Main Topic

Data and Knowledge for Medical Decision Support
Aims and Scope

The *International Journal for Biomedicine and Healthcare* is an online journal publishing submissions in English or Czech languages. The journal aims to inform the readers about the latest developments in the field of biomedicine and healthcare, focusing on multidisciplinary approaches, new methods, results and innovations. It will publish short format papers reporting about advances in a special field of biomedicine and healthcare, abstracts of conference submissions, case-studies, essays and articles that explore how science, education and policy are shaping the world and vice versa, editorial commentary, opinions from experts, information on projects, new equipment and innovations.

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## Contents

**7 Editorial**  
Zvárová J.

**Assistive Diagnostic Technologies for Medical Decision Support**

8 Medical Decision Support System for COPD and Asthma Screening  
Pendzhurov I., Mihova P., Vinarova J.

8 Tempolenses with Variable Magnification for Sonic Representation of Medical Data. Application for Cardiac Signals  

9 Computational Cognitive Modeling for the Diagnosis of Specific Language Impairment  
Oliva J., Serrano J.I., del Castillo M.D., Iglesias A.

9 Integration of Characteristic Values with Symbolization in Knee Movement Analysis  
Turčin I., Ergović V., Lacković M.

10 How Turing and Wolf Influenced my Decision Support Systems  
Richards B.

10 Objectification of a Choice of a Spa Treatment Plan for Arthritis of the Hip Joint  
Och F., Medonos J., Hanzliček P., Valenta Z., Dvorák V., Zvárová J.

**Knowledge Discovery in Biomedical Databases for Decision Support**

11 Breast Cancer Size Determination Using Automated Data Algorithms  

11 Interest Propagation for Knowledge Extraction and Representation  
Mulas F., del Fabbro E., Zupan B., Bellazzi R.

12 The Choice Impact of Soft Analysis Tools in Genes Selection Methods  
Kaissi O., Moussa A., Ghacham A., Vannier B.

12 Analysis of Neurosurgery Data Using Statistical and Data Mining Methods  
Berka P., Vrabec M.

**Knowledge Management**

13 Supporting Drug Prescription through Autocompletions  
Ehrler F., Lovis Ch.

13 Sharing and Reusing Multimedia Multilingual Educational Resources in Medicine  
Zdrahal Z., Knoth P., Mulholland P., Collins T.

14 Measuring Technology’s Effects on Healthcare Processes  
Turkeli S., Tulin Kayhan F., Kaya H., Dirican C.

14 Terminology-driven Radiological Information Extraction from Clinical Narratives in Multilingual Corpora  
Pivetti S., Giacomini M.

15 Adverse Drug Event Prevention in Neonatal: A Rule-based Approach  
Lazou K., Farini M., Kouktias V., Drossou V., Maglaveras N., Bassiliades N.

15 Design of Database Structure for Development of Medical Domain Ontologies  
Maximov D., Samsonova A., Konev A., Karas S.

16 Implementation of Production Inference Based on Ontological Model of Knowledge Representation  
Maximov D., Samsonova A., Konev A., Karas S.

16 Graphical Modeling and Query Language for Analyzing Clinical Processes  
Barzdins J., Rencis E., Sostaks A.
Formalization of Knowledge, Ontologies, Clinical Guidelines and Standards of Health Care

17 Comparing the Use of SNOMED CT and ICD10 for Coding Clinical Conditions to Implement Laboratory Guidelines
Yasini M., Ebrahiminia V., Duclos C., Venot A., Lamy J.-B.

17 A Novel Way of Integrating Rule Based Knowledge into a Web Ontology Language Framework
Gamberger D., Krstačić G., Jović A.

18 Structured Knowledge Acquisition for Defining Guideline-compliant Pathways
Heiden K., Böckmann B.

18 Implementing Healthcare Information Security: Standards Can Help
Orel A., Bernik I.

19 Towards Sustainable Management of Disease Terminological Continuity Using Knowledge Based and Generative Approaches
Belhadj I., Jacquelinet Ch.

19 An Ontological Treatment of Clinical Prediction Rules Implementing the Alvarado Score
Corrigan D., Taweel A., Fahey T., Arvanitis T., Delaney B.

20 Utilization of Ontology Look-up Services in Information Retrieval for Biomedical Literature
Vishnyakova D., Pasche E., Lovis Ch., Ruch P.

20 DIOS – Database of Formalized Chemotherapeutic Regimens
Klimes D., Smid R., Kubasek M., Vyzula R., Dusek L.

21 Model-Based Derivation of Context-Sensitive Change Operations for the Adaption of Clinical Pathways
Houta S.

21 Knowledge Representation and Management Enabling Intelligent Interoperability – Principles and Standards
Blobel B.

22 Risk Assessment Prediction of Hypertension and its Associated Diseases – An Ontology Driven Model
Sherman P.C., Vinu P.V., Krishnan R., Takroni Y.

22 FMECA Analysis of a Home Care service
Faiella G., Troianello D., Fiore R., Rutoli G., Romano M., Bifulco P., Cesarelli M.

23 Linked Data and Czech e-Health
Kozák J., Necáský M., Pokorný J.

23 Catalogue of Clinical Practice Guidelines as a Web Service Component for Decision Support Systems
Zvolský M., Veselý A.

24 Simultaneously Authoring and Modelling Clinical Practice Guidelines: A Case Study in the Therapeutic Management of Type 2 Diabetes in France
Bouaud J., Falcoff H., Séroussi B.

Intelligent Interoperability and Telemedicine

25 Design and Implementation of the Standards-Based Personal Intelligent Self Management System (PICS)

25 Interoperability Evaluation Case Study: An Obstetrics-Gynecology Department and Related Information Systems
Vida M., Stoicu-Tivadar L., Blobel B., Bernad E.

26 Simple Use Case Evaluation Method Determining an EHR Integration Platform Design
Krsička D., Šárek M.

26 Proposal of a Multi-Layer Data Model
Huptych M., Lhotska L.

27 Home Care and Domotic Zigbee Network for Telemedicine Applications
D’Addio G., Cimmino P., de Matteis E., Arpaia P.

27 Design and Implementation of a Telemedicine Service for the ECG Reporting in an University Hospital
Perrone A., Faiella G., Persico M., Romano M., Bifulco P., Cesarelli M.
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>A Conceptual Framework for Automating the Operational and Strategic Decision-making Process in the Health Care Delivery System</td>
<td>Ruohonен T., Ennejmy M.</td>
</tr>
<tr>
<td>28</td>
<td>Stochastic Models for Low Level DNA Mixtures</td>
<td>Slovák D., Zvárová J.</td>
</tr>
<tr>
<td>29</td>
<td>Physicians Perceptions of an Educational Support System Integrated into an Electronic Health Record</td>
<td>Borbolla D., Gorman P., del Fiol G., Mohan V., Hersh W., Otero C., Luna D., Gonzalez F., de Quiros B.</td>
</tr>
<tr>
<td>31</td>
<td>A Proposed Novel Method for CHD Screening by Fetal Heart Murmur Detection using Phonocardiography</td>
<td>Kovács F., Fodor G., Hosszú G.</td>
</tr>
<tr>
<td>33</td>
<td>Electronic Patient-Oriented System of Medical Care Quality “EPOS-MCQ”</td>
<td>Lugovkina T., Richards B., Tutikova N., Nurieve A.</td>
</tr>
<tr>
<td>33</td>
<td>Clinical Business Intelligence Solution</td>
<td>Mahar K., Farok M., Bakry W.M.</td>
</tr>
<tr>
<td>34</td>
<td>Development of a National SNOMED CT Based Medication Decision Support System</td>
<td>Greibe K.</td>
</tr>
<tr>
<td>35</td>
<td>Redesign of Hospital Information System to Support the New Model of Italian Hospitals Based on the Intensity of Care</td>
<td>Faiella G., Laperuta R., Carissimi G., Fratini A., Romano M., Bifulco P., Cesarelli M.</td>
</tr>
<tr>
<td>35</td>
<td>Decision Support System for Implantology</td>
<td>Polášková A., Dostálková T., Feberová J.</td>
</tr>
<tr>
<td>36</td>
<td>Impact of the Use of an Electronic Template on Clinicians Adherence to Follow Guidelines for Diabetes Care with a Randomized Trial</td>
<td>Mundra V., Yaghoubian S., Nguyen V., Sider D., Muniz J., Villabona C.V.</td>
</tr>
<tr>
<td>37</td>
<td>Differences in Diagnostic Accuracy in Encounter Orientated Compared with Problem Orientated (POMR) Medical Records. Diabetes as an Exemplar</td>
<td>Sadek K., Khunti K., de Lusignan S.</td>
</tr>
<tr>
<td>38</td>
<td>Risk Perception &amp; Environmental Risk Management in Public Health Protection</td>
<td>Bencko V., Quinn J.M., Zvárová J.</td>
</tr>
<tr>
<td>39</td>
<td>Clinical Case Player for Data-Driven Education Based on Real Severe Sepsis Cases</td>
<td>Schwarz D., Harazim H., Štourač P.</td>
</tr>
<tr>
<td>39</td>
<td>Knowledge Gap and E-course on Statins</td>
<td>Ivanusa M., Klinar I., Kern J.</td>
</tr>
</tbody>
</table>

**Data and Knowledge Management for Decision Support in Forensic Medical Disciplines**

**eHealth Decision Support Systems for GPs, Clinicians, Nurses, Health Care Managers and Patients**

**Education and Training for Decision Support**
40 Education for Medical Decision Support at EuroMISE Centre
   Martinková P., Zvára K., Dostálová T., Zvárová J.

41 Telemedicine System for Education in Wireless Medical Data Acquisition and Decision Making
   Balogh J., Provazník I.

Evaluation of Decision Support Systems

42 Handling Intra-Cluster Correlation When Analyzing the Effects of Decision Support on Health Care Process Measures
   Peek N., Goud R., de Keizer N.

42 Developing and Evaluating Intelligent Decision Support Models in Ventilation Management
   Tzavaras A., Weller P.R., Spyropoulos B.

43 Automatic System Testing of a Decision Support System for Insulin Dosing Using Google Android
   Spat S., Höll B., Petritsch G., Schaupp L., Beck P., Pieber T.R.

43 Attitudes and Experience of Dutch General Practitioners Regarding Computerized Clinical Decision Support
   Medlock S., Eslami S., Askari M., Brower H.J., van Weert H.C., de Rooij S.E., Abu-Hanna A.

44 Analyzing the "CareGap": Assessing Gaps in Adherence to Clinical Guidelines in Adult Soft Tissue Sarcoma
   Waks Z., Goldbraich E., Farkash A., Torresani M., Bertulli R., Restifo N., Locatelli P., Casali P., Carmeli B.

Diagnostic, Therapeutic and Prognostic Decision Support

45 Personalized Medicine and the Need for Decision Support Systems
   Denecke K., Spreckelsen C.

45 Entropy Driven Decision Tree Building for Decision Support in Gastroenterology
   Bertolini S., Maoli A., Rauch G., Giacomini M.

46 Prognostic Decision Support Using Symbolic Dynamics in CTG Monitoring
   Cesarelli M., Romano M., Bifulco P., Improta G., d’Addio G.

46 System for Selection of Relevant Information for Decision Support
   Kalina J., Seidl L., Zvara K., Grünfeldová H., Slovák D., Zvárová J.

47 New Nonalcoholic Steatohepatitis Diagnosis Model-Related Personalized Medicine
   Douali N., Abdennour M., Zucker J.D., Jaulent M.Ch.

47 Diagnostic Decision Support of Heart rate Turbulence in Sleep Apnea Syndrome
   d’Addio G., de Felice A., Balzano G., Zotti R., Iannotti P., Bifulco P., Cesarelli M.

48 Changes of the Optic Nerve in the OCT Image and Correlation with MRI Image of Brain and Visual Pathways
   Vesela Florova Z., Obenberger J., Lestak J., Výborny P., Meluzinova E.

49 Computer-Assisted Evaluation of Videokymographic Data

49 Nuchal Translucency Quality Review Using Exponentially Weighted Moving Average Chart
   Hynek M., Steskal D., Zvárová J.

50 CoPlot Visualization of Predictive Model for Postoperative Vomiting in Patients Undergoing General Anesthesia for
   Laparoscopic Gynecological Surgery
   Sonicki Z., Šimurina T., Kern J., Ivančković D.

50 Dental Electronic Health Record Evaluation

51 Designing Prognostic Models by Reinforcing Linear Separation
   Bobrowski L.

51 The Medicolegal Certification of Medical Fitness to Work: Necessity of Standardization
   Tuček M.

52 In-Hospital Death Prediction in Patients with Acute Coronary Syndrome
   Monhart Z., Reissigova J., Zvarova J., Grünfeldova H., Jansky P., Vojacek P., Widimsky P.

Other Topics

53 Elderly People Activity Classification Based on Accelerometer
   Muzny M., Hana K., Seidl L., Melecky R.
53 A Comparison of English and French Approaches to Providing Patients Access to Summary Care Records
de Lusignan S., Seroussi B.

54 Global Quality Indicators for Primary Care Electronic Patient Records
de Clercq E., Moreels S., van Cesteren V., Bossuyt N., Goderis G.

54 People and Organizational Issues that Surround the Implementation of Health Information Systems
Zayim N., Bozkurt S., Samur M.K.

55 Vision for the Future of OMICs Data in Electronic Health Records
Hermosilla-Gimeno I., Lopez-Campos G., Lopez-Alonso V., Saarela M.

55 Comparing Security Awareness Between Medical and Technical Students
Solic K., Hercigonja-Szekeres M., Nenadic K., Ilakovac V.

56 Behavioural Biometrics in Biomedicine
Schlenker A., Šárek M.

56 Why We Do It Different from OpenEHR
Niggemann J.

57 Applying Medical Knowledge in Data Mining
Rauch J., Tomečková M.

57 What Constitutes Healthy Nutrition? Factor Analysis of Data Collected in a Food Frequency Questionnaire
Fister K., Kern J.

58 New Perspectives and Methodological Challenges in Medical Decision Making
Moisil I.I., Bera L.G.

58 Attendance Data of an Online CME Course
Mazzoleni M.Ch., Rognoni C., Lanza A., Bisio S.

59 History of Medical Informatics in Europe
Mihalas G., Zvarova J., Kulikowski C.

59 Accelerometer Based Features Assessment for a Real Time Activity Recognition
Muzny M., Muzik J.

60 Air Quality Early Warning To Prevent Breathing Difficulty
Havlík J.

61 Building Platform for Optimization of Medical Education
Komenda M.

61 Behavioural Biometrics for Application in Biomedicine
Schlenker A., Šárek M.

62 Modeling Cost-Effectiveness of Screening: Autoimmune Thyroid Disorders After Spontaneous Abortion
Bartáková J., Potluková E., Rogalewicz V., Fait T., Schöndorfová D., Telička Z., Jiskra J.

63 Analysis of Low Level DNA Mixtures
Slovak D., Zvárová J.

63 Dental Medicine Sign Language Corpus for Decision Support Systems in Health Care for Deaf People
Chiriac I.A.

64 Matching Medical Websites to Medical Guidelines through Clinical Vocabularies in View of Website Quality Assessment
Rak D., Svátek V.

65 Shrinkage Approach for Gene Expression Data Analysis
Haman J., Valenta Z., Kalina J.

65 Genotype-Phenotype Relationship in Czech Patients Diagnosed with Collagenous Forms of Osteogenesis Imperfecta
Šormová L., van Hul W., Fiałkowski I., Mazura I., Mazurová S., Mařík I., Mortier G.

66 The Design of an Interactive Web Portal for Support of Telemonitoring Utilization in Diabetes Management
Oulická M., Muzik J.

66 Sharing Knowledge and Cooperation on Pharmacoeconomical Research Projects in the Hospital Environment
Telička Z., Jiskra J., Svačina Š.
67 Legal Aspects of Protecting Medical Data by Data Surveillance
Dostál O., Šárek M.

67 Public Health in War and Disaster: Duty of Care and Best Practices in Medicine
Quinn J.M., Bencko V.

68 HL7 EHR System Functional Model Use Case Integration Assessment
Krsička D., Šárek M.

68 Attitudes and Experience of Dutch General Practitioners Regarding Computerized Clinical Decision Support
Medlock S., Eslami S.,Askari M., Brouwer H.J., van Weert H.C., de Rooij S.E., Abu-Hanna A.

Vida M., Stoicu-Tivadar L., Blobel B., Bernad E.

Janousova E., Pavlik T., Mayer J., Dusek L.

70 Data and Knowledge in Distributed Medical Applications
Şerban A., Şerban C., Stoicu-Tivadar L.

70 Introduction to Ontology-Based Knowledge Representation of Data Protocols
Seidl L., Hanzlíček P.

71 Matching Czech Medical Texts to Codes
Zvára K.

71 Hybrid Architecture for Web-Based Simulators of Human Physiology
Kulhánek T., Šilar J., Privitzer P., Kofránek J.

72 Simulation Applications in Medical Education
Privitzer P., Šilar J., Kulhánek T., Mateják M., Kofránek J.

Workshop – Decision Support and Decision Making Enabled by Personal Portable Devices

73 Decision Support and Decision Making Enabled by Personal Portable Devices
Lhotska L., Cheshire P., Pharow P.

73 Human Factors in Design and Development of Personal Portable Devices
Lhotska L., Pharow P., Cheshire P.

74 Possibilities of Personal Health Status Monitoring
Havlík J., Dvořák J., Parák J., Pokorný M., Lhotská L., Panýrek P.

74 AsTeRICS
Drajsajtl T., Struk P., Bednárová A.

Workshop – Using Information to Improve the Quality of Care in Type 2 Diabetes in Primary Care

75 Dietary Menu Generation Using Harmony Rules in Tele-Care
Vassányi I., Kósá I., Pintér B., Nemes M., Mák E., Kozmann Gy.

76 Prevalence and Characteristics in Coding, Classification and Diagnosis of Diabetes in Primary Care
Seidu S., Davies M.J., Mostafa S., de Lusignan S., Khunti K.

77 Pharmacoeconomy of Diabetes Mellitus and its Implications for Organization and Quality of the Care in the Czech Republic
Horák P., Kvapil M.

77 Concept of Knowledge-Based Self-Management Pathways for the Empowerment of Diabetes Patients
Schmuhl H., Demski H., Lamprinos I., Dogac A., Ploessnig M., Hildebrand C.

78 A Collaborative Approach to Care Coordination: Maccabi Case Study
Kubu P., Kaye R., Waksman M., Blatt M.N., Corrigan T.

78 Technologies Supporting Care for Diabetes in Primary Care in the Czech Republic
Svagina S., Karen I., Mucha C., Hendl J.

79 Errors in the Coding of Diabetes in Electronic Records Implications for Care de Lusignan S., Khunti K.
EFMI STC 2013: Data and Knowledge for Medical Decision Support

Jana Zvárová
Editor in Chief

With this first issue of the volume 2013 the readers get the abstracts of submissions presented at the Thirteenth EFMI Special Topic Conference held in Prague, Czech Republic, from 17-19 April 2013. The EFMI STC 2013 (www.stc2013.org) is Europe’s leading forum for presenting results of current scientific work focusing on the special topic Data and knowledge for medical decision support. The EFMI STC 2013 was organized by the European Federation for Medical Informatics (EFMI) in cooperation with the Society of Biomedical Engineering and Medical Informatics of the Czech Medical Society J.E. Purkyne. Nearly thirty years after the conference Computer-aided medical decision making held in Prague 1985 [1] this conference showed many new developments of methods and systems focused on medical decision support.

The conference Data and knowledge for medical decision support was running in two parallel sessions and was enriched by several workshops. All submissions with abstracts are published in this issue and assigned to groups according to the topics of the conference and topics of workshops. Topics of the conference were:

- Assistive diagnostic technologies for medical decision support
- Knowledge discovery in biomedical databases for decision support
- Knowledge management
- Formalization of knowledge, ontologies, clinical guidelines and standards of health care
- Intelligent interoperability and telemedicine
- Data and knowledge management for decision support in forensic medical disciplines
- eHealth decision support systems for GPs, clinicians, nurses, health care managers and patients
- Education and training for decision support
- Evaluation of decision support systems
- Diagnostic, therapeutic and prognostic decision support

More detail information about submissions can be found in the conference proceedings (including all full papers) published by the IOS Press [2]. Selected posters and short communications will be rewritten and published as original articles in the European Journal for Biomedical Informatics (www.ejbi.org) an official journal of EFMI. Medical decision support is an important constituent in different eHealth applications. Most of the developed decision support systems can be more or less easily integrated into clinical information systems both as part of those systems connected through standardized interfaces or as services to be remotely accessed.

References


Medical Decision Support System for COPD and Asthma Screening

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Abstract

Medical Information System is set of technologies and methods for planned gathering, processing, analysis, archiving and dissemination of medical data and information. The presented medical decision support system for asthma and chronic obstructive pulmonary disease screening is designed for the needs of Center for screening and early diagnosis of bronco-obstructive diseases in "Hospital - Svoge" LTD within a project of Ministry of Economy, Energy and financed by the Japanese government to support structural reforms in Bulgaria. This article describes the development and implementation of that specialized software.

Keywords

E-Health, medical information system, asthma, chronic obstructive pulmonary disease

Tempolenses with Variable Magnification for Sonic Representation of Medical Data. Application for Cardiac Signals

George Mihalas¹, Sorin Paralescu², Minodora Andor¹, Dan Lighezan¹, Nicoleta Mîrlea¹, Danina Muntean¹, Mircea Hancu¹, Adrian Neagu¹, Monica Neagu¹, Anca Tudor¹, Ovidiu Fira-Mladinescu¹, Adrian Neagu¹, Monica Neagu¹, Anca Tudor¹, Ovidiu Fira-Mladinescu¹
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Abstract

The purpose of this study was to develop the tools and the methodology for a systematic analysis of usefulness of adding sonic representation of data, supplementary to visualization. This paper is mainly dedicated various temporal lenses, including the newly developed lenses with variable magnification, proposed as a tool for a better perception of short events combined with a compression of irrelevant intervals. Sonification procedures are also briefly presented. The programs were tested using various cardiac signals: ECG and heart rate HR both in humans and in rats (experimental data). The results, represented by the sound files, were uploaded in an accessible library, which contains both sonic and visual representation of the signals.

Keywords

Tempolens, variable magnification, sonification, HR analysis, ECG
Computational Cognitive Modeling for the Diagnosis of Specific Language Impairment

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Abstract

Specific Language Impairment (SLI), as many other cognitive deficits, is difficult to diagnose given its heterogeneous profile and its overlap with other impairments. Existing techniques are based on different criteria using behavioral variables on different tasks. In this paper we propose a methodology for the diagnosis of SLI that uses computational cognitive modeling in order to capture the internal mechanisms of the normal and impaired brain. We show that machine learning techniques that use the information of these models perform better than those that only use behavioral variables.

Keywords
Language impairment, machine learning, automatic diagnosis, computational cognitive modeling

Integration of Characteristic Values with Symbolization in Knee Movement Analysis

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Abstract

This paper proposes a method that combines two different ways of signal interpretation for gait analysis. Features points in gait cycle are extracted and then enhanced with approximation of the curve for individual gait values in different gait phases. Such an approach enables better classification of human gait that is not only based on typical values such as maximum flexion or extension of a knee, hip, etc, but it also includes shape similarity based on symbolization that is easily utilized in clustering. This study involved 20 subjects divided in 3 groups from which 12 healthy, 8 with an ACL (Anterior Cruciate Ligament) deficit. Subjects with ACL problems were recorded before and after surgery. Focus is on kinematics data that were obtained using BTS Elite system with 8 cameras.

Keywords
Symbolization, gait features, clustering, knee joints
How Turing and Wolf Influenced my Decision Support Systems

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Abstract

Decision Support Systems (DSS) have a vital role to play in today's scenario for Patient Care. They can embody a vast knowledge not normally found in one individual where diagnosis and treatment are involved. This paper highlights the training in minute details and precise mathematics needed in a successful DSS and indicates how such attention-to-detail was instilled into the writer as a result of working with Alan Turing and Emil Wolf who have both since achieved world-wide recognition in their own fields as a result of international publicity by the current writer. The article discusses four Decision Support Systems written by the present writer all of which have been shown to improve patient treatment and care, and which are of such complexity that, without their use, patient care would fall short of optimum. The Systems considered are those for Intensive Care Units, Cardiovascular Surgery, a Programmed Investigation Unit, and Diagnosis of Congenital Abnormalities. All these Systems have performed better than the human alternatives and have shown their value in the improvement of patient care.

Keywords

Decision support systems, intensive care units, cardiovascular surgery

Objectification of a Choice of a Spa Treatment Plan for Arthritis of the Hip Joint

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Abstract

For the treatment of hip arthritis diagnosis there different treatment plans are at use in spa facilities. In this paper we study the objectification of the choice of a spa treatment plan.

Keywords

Decision-support, spa treatment, hip arthritis, statistical analysis
Breast Cancer Size Determination Using Automated Data Algorithms

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Abstract

The TNM Classification of Malignant Tumor (TNM) in breast cancer is one of the most important prognostic factors. However, the complexity of the classification, the existence of different versions over time, and the variability of the source used to obtain data, makes the manual collection of the staging from unstructured free text be variable and imprecise. The aim of this project is to develop a tool based on artificial intelligence that allows the collection of tumor size (T) staging data for breast cancer automatically, saving time and reducing the variability. Our approach, based on two steps, starts with the detection and extraction of tumor’s size characteristics in free text, using a simple natural language processor. Secondly, based on the data extracted, we applied different data mining algorithms for the T classification such as the J48 classifier tree, LADtree, and NaiveBayes. In addition, a non-data mining based classification algorithm was also applied. Then, the pathologic T stage was obtained from the pathology report. The non-data mining based algorithm had the highest percentage of correctly classified cases (96%) and the J48 algorithm achieved a high percentage of correctly classified cases (93%) and also allowed changes, what is needed when guidelines are updated.

Keywords

TNM staging, breast cancer, data mining, classification tree, tumor size, natural language processing

Interest Propagation for Knowledge Extraction and Representation

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Abstract

Due to the increasing number of available biomedical data repositories, providing a comprehensive and intuitive access to information is still a demanding task for Information Retrieval systems. In this work we present an interactive data exploration system that retrieves relevant information by propagating the user’s interest within a network. The developed techniques have been applied to two different retrieval tasks useful for biomedical research: the prioritization of proteins related to a disease of interest and the search of publications in the literature. The method relies on a network of biomedical entities, scoring of entities of interest by the user, and score propagation. The assessment of the relevance of the retrieved information confirmed a high accuracy of the presented algorithms for both the domains considered.

Keywords

Knowledge extraction, database management, information retrieval
The Choice Impact of Soft Analysis Tools in Genes Selection Methods

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Abstract

In the analysis of experiments that involves the high density of oligonucleotide chips, it is important to generate list of genes or ‘targets’ from the genome wide data set that contains a lot of information. Gene selection is a process that seeks to identify the most significant genes which reveal large expression changes between the baseline experiments and the conditions. Even though, several algorithms like T-test and other derived statistical algorithms were used for that selection process, the suitable P-value Cutoff remains difficult to choose. However, the reproducitvity of results and their impact on the genes and/or experiments classification, while using different soft tools remain a subject of discussion. In this work, we use two Affymetrix data sets, when we look for identifying list of genes under SAM and T-test-BH algorithms with FDR control running under R/Bioconductor project and Bioinformatics ToolBox of Mathworks. The list of selected genes changes significantly when using the two algorithms under both R/Bioconductor project and Bioinformatics ToolBox of Mathworks.

Keywords

Gene selection, Microarrays soft analysis

Analysis of Neurosurgery Data Using Statistical and Data Mining Methods

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Abstract

The data concerning the outcomes of surgical clipping and endovascular treatment in acute aneurysmal subarachnoid hemorrhage (SAH) patients have been analyzed to reveal relations between subjective neuropsychological assessments, measurable characteristics of the patient and the disease, and the type of treatment the patient had undergone one year before. We build upon results of previous analyses where have been found that the differences in neuropsychological assessment of the patients treated by either coiling or clipping was small and slightly in favor of surgical group. Using this data, we compare the “classical” statistical and data mining approach. While statistics offers techniques based on contingency tables, where the compared variables have to be manually selected, data mining methods like association rules, decision rules or decision trees offer the possibility to generate and evaluate a number of more complex hypotheses about the hidden relationships. We used SAS JMP to perform the statistical analysis. Our original LISp-Miner system based on the GUHA method was used for the data mining experiments.

Keywords

Aneurysmal subarachnoid hemorrhage, association rules, LISp-Miner
Supporting Drug Prescription through Autocompletions

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Abstract

Computerized prescription is a central component in modern clinical information systems. It allows scheduling drugs delivery, exams and other types of care. It is thought to be a useful tool for the reduction of medication errors and for the improvement of medication logistics. Whereas the success of the computerized prescription depends on the unambiguous selection of the manipulated concepts, there is a strong variability between the preferred terms of clinicians of different backgrounds. Moreover, users sometimes want to use synonyms or don’t know the exact spelling of the term. This makes the search for desired procedure name through large size vocabularies time-consuming for users. In order to facilitate the prescriptions process, we have built a tool that proposes the most likely terms based on the first letters inputted by the user. The tool helps selecting the most appropriate term by ranking the possible results in a clever manner. Experimental evaluation shows promising results and indicates the tool ease the terminology manipulations.

Keywords

Automatic completion, CPOE, decision support

Sharing and Reusing Multimedia Multilingual Educational Resources in Medicine

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Abstract

The paper describes the Eurogene portal for sharing and reusing multilingual multimedia educational resources in human genetics. The content is annotated using concepts of two ontologies and a topic hierarchy. The ontology annotation is used to guide search and for calculating semantically similar content. Educational resources can be aggregated into learning packages. The system is in routine use since 2009.

Keywords

Ontology, multimedia, multilingual educational resources, learning package
Measuring Technology’s Effects on Healthcare Processes

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³ Bakirköy Training and Research Hospital, Clinic of Otorhinolaryngology, Istanbul, Turkey

Abstract

This paper is about how a new technology affects business processes and determining performance measures that can be used to assess the technology’s effects on business processes. In literature, there are several papers which deal with evaluation of business process improvement (BPI) techniques. To evaluate the BPI techniques cost, flexibility, time, quality, customer and staff dimensions are used. Processes in healthcare are very complex, people from more than 50 different professions work together collaboratively. We use cost, flexibility, time and quality dimensions for reducing the complexity of healthcare. Through analysis of literature on robotic surgery and deeper interview with surgery team we have identified measures that we use to examine the effects of technology on healthcare processes dimensions. For quality, time and cost generally numerical measures are identified, by using hospital clinical information system surgery data are gathered to analyze the values of measures. Flexibility dimension’s measures are not easy to calculate, such as “vision quality”, “haptic awareness”. In the conclusion part, writing process of this paper will analyze and evaluate in the sense of data- information-knowledge-wisdom.

Keywords

Robotic surgery, process, technology, business process improvement, knowledge management

Terminology-driven Radiological Information Extraction from Clinical Narratives in Multilingual Corpora

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Abstract

The great majority of Information Extraction tools can be applied to English texts only as the syntactic algorithms are tailored for this language. Moreover, the rare multilingual applications present in literature are not appropriate for real time applications. With the objective of providing non-English languages with tools that are necessary in modern medical information processing, this paper presents a real time IE system that aims at tagging medical corpora available in some non-English languages with UMLS concepts. The NLP application has been evaluated in respect to both accuracy in extraction and execution times performances on a subset of a corpus of 450,000 textual radiological reports written in the Italian language. The Automatic Terms Recognition results were found to be superior to those observed in similar non-English focused studies. The tool achieves a throughput of 26K bytes of text per second.

Keywords

Biomedical ontology, information extraction, non-English text mining, unstructured clinical narrative, automatic indexing
Adverse Drug Event Prevention in Neonatal: A Rule-based Approach

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Abstract

Adverse drug events (ADE) in a neonatal unit can be of great importance due to the underlying nature and the special characteristics of the patients. This paper presents our work on the development of a knowledge base (KB) for supporting the identification and prevention of ADEs. First, a literature review was conducted to identify ADEs observed through the use of the most commonly-used drugs in a specific neonatal unit. Then, the acquired knowledge was encoded according to an ontological data model developed for the representation of the specific facts for the neonatal unit. Finally, a rule-based prototype consisting of 164 rules was implemented in order to represent and simulate the inference procedure about preventing ADEs.

Keywords

Adverse drug event (ADE), knowledge base, rules, neonatal unit

Design of Database Structure for Development of Medical Domain Ontologies

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Abstract

Any domain can be represented as a set of interrelated elements. The basic unit of this structure is an object with the following parameters: value type, description, area, weight, tag or label. All objects are interconnected by links with the following parameters: direction, strength, type. The database was created that allows to describe objects, to specify their properties, and to link them.

Keywords

Ontology, knowledge base, database
Implementation of Production Inference Based on Ontological Model of Knowledge Representation

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Abstract

In order to represent any areas of knowledge in form of ontology, a program complex was worked out; knowledge is represented by the set of interrelated elements. The basic item of ontology is an object with certain parameters (area of use, type of value). The links between the objects are characterized by force, type and direction. The production inference was organized on the base of this model. Parameters of link (types “antecedent”, “consequent”, and “value”) are used for this. Production rules are formed from these elements of knowledge for conclusion obtaining.

Keywords
Ontology, network model, production model

Graphical Modeling and Query Language for Analyzing Clinical Processes

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Abstract

We propose a new modeling language (as a profile of UML Class diagrams) that captures all the useful features from various UML diagrams and can be used in modeling of the hospitals. Based on the modeling language, we have developed an easy-to-perceive graphical query language, which allows the physicians to retrieve directly from the various hospital databases information they need to better understand the flow of clinical processes.

Keywords
Hospital, modeling, modeling languages, query languages
Comparing the Use of SNOMED CT and ICD10 for Coding Clinical Conditions to Implement Laboratory Guidelines

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Abstract

Laboratory medicine is responsible for an important part of hospital expenditure. Providing appropriate decision support to laboratory test requesters at the point of care is one of the main incentives for implementing laboratory guidelines, which can improve medical care. Laboratory guidelines developed by local experts in the Parisian region and two national guidelines for dyslipidemia were analysed to extract test ordering recommendations. Clinical conditions which can be a trigger to order or not to order laboratory tests were extracted and mapped with ICD10 and SNOMED CT: 43.1% of clinical conditions were matched by ICD10 whereas SNOMED CT covered 80.1% of these conditions. For the non mapped conditions, the main problem was found to be the ambiguity of the terms used in the guidelines. Ordinal characteristics of some clinical conditions and using terms more specific than SNOMED CT were other causes of mapping failure. Applying consistent and explicit concepts in the development of guidelines would lead to better implementation. By resolving the guideline ambiguity, SNOMED CT is a good choice and covers almost all of the clinical conditions in laboratory guidelines which are needed to implement in a Clinical Decision Support System.

Keywords

Guideline implementation, clinical decision support system, laboratory guideline, SNOMED CT, ICD10

A Novel Way of Integrating Rule Based Knowledge into a Web Ontology Language Framework

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Abstract

Web ontology language (OWL), used in combination with the Protégé visual interface, is a modern standard for development and maintenance of ontologies and a powerful tool for knowledge presentation. In this work, we describe a novel possibility to use OWL also for the conceptualization of knowledge presented by a set of rules. In this approach, rules are represented as a hierarchy of actionable classes with necessary and sufficient conditions defined by the description logic formalism. The advantages are that: the set of the rules is not an unordered set anymore, the concepts defined in descriptive ontologies can be used directly in the bodies of rules, and Protégé presents an intuitive tool for editing the set of rules. Standard ontology reasoning processes are not applicable in this framework, but experiments conducted on the rule sets have demonstrated that the reasoning problems can be successfully solved.

Keywords

Rules, knowledge, ontologies, decision support
Structured Knowledge Acquisition for Defining Guideline-compliant Pathways

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Abstract

Healthcare providers are facing an enormous cost pressure, wherefore the assurance of an efficient care on a high level of quality is of decisive importance. Clinical guidelines and clinical pathways have been established for that purpose. Clinical guidelines offer abstract recommendations for diagnostic and therapeutic issues, while clinical pathways are a road map of patient management. The consideration of clinical guidelines during pathway development is highly recommended. But the transfer of evident knowledge (clinical guidelines) to care processes (clinical pathways) is not straightforward due to different information contents and semantical constructs. This article proposes a model-driven approach in conjunction with a developed knowledge acquisition tool to improve the development of guideline-compliant pathways.

Keywords

Knowledge acquisition, clinical guidelines, clinical pathways, metamodeling, Health Level 7

Implementing Healthcare Information Security

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Abstract

Using widely spread common approaches to systems security in health dedicated controlled environments, a level of awareness, confidence and acceptance of relevant standardisation is evaluated. Patients’ information is sensitive, so putting appropriate organisational techniques as well as modern technology in place to secure health information is of paramount importance. Mobile devices are becoming the top priorities in advanced information security planning with healthcare environments being no exception. There are less and less application areas in healthcare without having a need for a mobile functionality which represents an even greater information security challenge. This is also true in emergency treatments, rehabilitation and homecare just to mention a few areas outside hospital controlled environments. Unfortunately quite often traditional unsecured communications principles are still in routine use for communicating sensitive health related information. The security awareness level with users, patients and care professionals is not high enough so potential threats and risks may not be addressed and the respective information security management is therefore weak. Standards like ISO/IEC 27000 ISMS family, the ISO/IEC 27799 information security guidelines in health are often not well known, but together with legislation principles such as HIPAA, they can help.

Keywords

Information security, healthcare information standards, healthcare information security standards, ISO standards, HIPAA
Towards Sustainable Management of Disease Terminological Continuity Using Knowledge Based and Generative Approaches

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Abstract

This work proposes and implements a method for terminological continuity management using a generative approach. Two versions of diseases terminologies were generated starting from two evolving knowledge models. The generation method was implemented using “Prolog CG” supporting Conceptual Graphs formalism and logic inference features. A set of specific terms coming from both generated versions were analyzed. Using specialization feature, we inferred all the possible “is-a” relations between terms (conceptual hierarchy). Visual inspection of this hierarchy shows that for each two terms, one can provide an interpretable shared super term. Generative terminologies are, indeed, an efficient mean to manage disease terminological continuity over time.

Keywords
Terminologies, disease, continuity, knowledge representation

An Ontological Treatment of Clinical Prediction Rules Implementing the Alvarado Score

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Abstract

A lack of acceptance has hindered the widespread adoption and implementation of clinical prediction rules (CPRs). The use of clinical decision support systems (CDSSs) has been advocated as one way of facilitating a broader dissemination and validation of CPRs. This requires computable models of clinical evidence based on open standards rather than closed proprietary content. The on-going TRANSFoRm project has developed ontological models of CPRs suitable for providing CPR based decision support. This paper presents a description of the design and implementation of the ontology model for CPRs that has been proposed. The conceptual validity of the ontology is discussed using the example of a specific CPR in the form of the Alvarado Score for acute appendicitis. We demonstrate how the model is used to query the structure of this particular rule, providing a computable representation suitable for CPRs in general.

Keywords
Clinical prediction rules, ontology, clinical decision support
Utilization of Ontology Look-up Services in Information Retrieval for Biomedical Literature

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Abstract

With the vast amount of biomedical data we face the necessity to improve information retrieval processes in biomedical domain. The use of biomedical ontologies facilitated the combination of various data sources (e.g. scientific literature, clinical data repository) by increasing the quality of information retrieval and reducing the maintenance efforts. In this context, we developed Ontology Look-up services (OLS), based on NEWT and MeSH vocabularies. Our services were involved in some information retrieval tasks such as gene/disease normalization. The implementation of OLS services significantly accelerated the extraction of particular biomedical facts by structuring and enriching the data context. The results of precision in normalization tasks were boosted on about 20%.

Keywords
Ontology, information retrieval, literature curation

DIOS – Database of Formalized Chemotherapeutic Regimens

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Abstract

Chemotherapeutic regimens (CHR) and their administration are routine practice in contemporary oncology. The development of a structured, electronic database of standard CHR can help the faster propagation of information about new CHR and at the same time enable assessment of their adherence in clinical practice. The goal was to develop a standardized way to describe a regimen using XML, fill the database with currently available regimens and develop tools to assess the adherence of the treatment to chosen regimen, compare the dose-intensity and recognize the regimen from existing data on drug administration. The data are being inserted in cooperation with expert oncologists and the database currently contains about 260 CHRs. Such system can be used to enhance decision support systems and interoperability of HIS. The database and tools are available online on the internet.

Keywords
Cancer chemotherapy protocols, antineoplastic combined chemotherapy regimens, XML, clinical database
Model-Based Derivation of Context-Sensitive Change Operations for the Adaption of Clinical Pathways

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Abstract

To increase the acceptance of clinical pathways, it is necessary to ensure that workflow management systems provide methods for adapting the clinical pathways to individual needs of the patient. Variants encapsulate context information as well as change operations and are proposed context-sensitive to the user in order to adapt the clinical pathway to the actual treatment situation. This article presents a model-based approach for derivation of context-sensitive change operations (variants) for the adaption of clinical pathways using existing health standards.

Keywords
Clinical pathways, knowledge discovery, context mining, Health Level 7, workflow management

Knowledge Representation and Management Enabling Intelligent Interoperability – Principles and Standards

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Abstract

Based on the paradigm changes for health, health services and underlying technologies as well as the need for at best comprehensive and increasingly automated interoperability, the paper addresses the challenge of knowledge representation and management for medical decision support. After introducing related definitions, a system-theoretical, architecture-centric approach to decision support systems (DSSs) and appropriate ways for representing them using systems of ontologies is given. Finally, existing and emerging knowledge representation and management standards have been presented. The paper focuses on the knowledge representation and management part of DSSs, excluding the reasoning part from the considerations.

Keywords
Knowledge representation, decision support systems, artificial intelligence, system theory, architecture, ontologies, standards
Risk Assessment Prediction of Hypertension and its Associated Diseases – An Ontology Driven Model

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Abstract

This research paper presents an intelligent system to predict the risk assessment of hypertension in three main related areas like diabetes, cardiovascular problems, and kidney disorders. The system is targeted on patients in Sultanate of Oman. Currently there is no specific system in the domain of hypertension or its associated diseases in the Sultanate. Also currently available medical systems in Oman do not employ an intelligent approach; they are just using database-oriented methodologies. They are not flexible and adaptable to complex requirements and processes and lack intelligence. We propose a system with ontologies as knowledge base (medical knowledge base), patient medical profile to be stored in a semantic way and an inference mechanism to extract data in the decision making process. Ontology is among the most powerful tools to encode medical knowledge formally. Since the knowledge base is constructed through ontology, it can be easily reused and extended in a variety of different problems. The proposed system which is an interactive decision support system (DSS) is a partial replacement of traditional database oriented system which is not capable of finding out patient risk analysis in an intelligent way.

Keywords

Knowledgebase, clinical decision support system, ontology, semantic web, inference engine

FMECA Analysis of a Home Care service

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Abstract

Failure Mode, Effect and Criticality Analysis (FMECA) is one of the most widely used tool to improve performance of a system. We applied a FMECA methodology to a Home Care service provided by the Service of Biotechnologies in Naples. In order to identify precisely all failure modes, the Home Care is studied like a process and decomposed in three main sub-processes. The FMECA method was then applied to each sub-process and it resulted in a detailed collection of corrective actions functional to manage all the dangerous activities identified. This collection could be assembled in policy statements documentations, useful to identify the interventions to adequate the room and the whole house and save operational costs.

Keywords

Home care, risk management, FMECA
Linked Data and Czech e-Health

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Abstract

In this paper we propose healthcare data architecture based on the principles of Linked Data. We briefly explain the Linked Data principles and current state of healthcare data publishing in the Czech Republic. We show how public and experts could benefit from the proposed architecture.

Keywords
Linked data, RDF, e-Health, data architecture

Catalogue of Clinical Practice Guidelines

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Abstract

Catalogue of Clinical practice guidelines (CPG) is a web application since 2007 collects records of clinical practice guideline documents published in the Czech language on the Internet. It currently contains 562 documents of 72 professional medical associations. Each record contains identification of the document, including involved medical associations and authors, codes for MeSH and ICD-10, web link referring to the document, date of creation, expected date of termination, and other parameters. Each document record is accompanied by links to the latest relevant PubMed articles. All web links are periodically automatically checked. The latest version of the application we enhanced the record by input and output conditions (coded by National laboratory items classification, ATC groups and ICD-10 codes). In addition to the original web portal with enhanced services for registered users, it was created a new web service interface. This interface allows us to input parameters via URI and dynamically generates an XML file with information about the document in a standardized format. It contains reference to the full text, list of professional associations, authors, date of validity and possibly other key parameters of the CPG document. Our system can manage a huge list of CPG documents and make the selection of the proper document depending on input parameters. The result can be delivered online to web user of automatic system for decision support. When available we can also formalized process model of the document in XML format. Our web application is available at http://neo.euromise.cz/kkdp.

Keywords
Clinical practice guideline, internet, international classification of diseases, MeSH headings, clinical decision support systems
Simultaneously Authoring and Modelling Clinical Practice Guidelines: A Case Study in the Therapeutic Management of Type 2 Diabetes in France

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Abstract

By providing patient-specific advice, clinical decision support systems (CDSSs) are expected to promote the implementation of clinical practice guidelines (CPGs) to improve the quality of care. However, produced as texts, often incomplete and ambiguous, CPGs are difficult to translate into the formal knowledge bases (KBs) of CDSSs. The French National Authority for Health (HAS) decided to update CPGs on the management of type 2 diabetes. This work illustrates the simultaneous development of the text and its formal counterpart in a CDSS named RecosDiab. CPGs were elaborated by a working group according to the guideline development methodology. Textual recommendations were graded, either as evidence-based when evidence existed or as consensus-based when acknowledge by the working group. Knowledge modelling was performed following the steps of deabstraction, disambiguation, and verification of completeness. This last step generated clinical situations not explicitly mentioned in the text and were graded as expert-based. The resulting KB provides therapeutic advice for 805 clinical situations, among which 2 are graded as evidence-based, 37 are consensus-based, and 766 are expert-based. However, because of the amount of expert-based propositions, the HAS did not endorse the system.

Keywords

Practice guidelines as topic, evidence-based medicine, guideline formalisation, clinical decision support systems, type 2 diabetes mellitus
Design and Implementation of the Standards-Based Personal Intelligent Self Management System (PICS)

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Abstract

Against the background of demographic change and a diminishing care workforce there is a growing need for personalized decision support. The aim of this paper is to describe the design and implementation of the standards-based personal intelligent care systems (PICS). PICS makes consistent use of internationally accepted standards such as the Health Level 7 (HL7) Arden syntax for the representation of the decision logic, HL7 Clinical Document Architecture for information representation and is based on a open-source service-oriented architecture framework and a business process management system. Its functionality is exemplified for the application scenario of a patient suffering from congestive heart failure. Several vital signs sensors provide data for the decision support system, and a number of flexible communication channels are available for interaction with patient or caregiver. PICS is a standards-based, open and flexible system enabling personalized decision support. Further development will include the implementation of components on small computers and sensor nodes.

Keywords

Arden syntax, decision support, personalized care, smart home, home care

Interoperability Evaluation Case Study: An Obstetrics-Gynecology Department and Related Information Systems

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Abstract

The paper presents the steps and metrics for evaluating the interoperability of an Obstetrics-Gynecology Department Information System applied on Bega Clinic Timisoara regarding its readiness for interoperability in relation with similar systems. The developed OGD IS was modeled starting from the Generic Component Model and sends information to other medical units using the HL7 Clinical Document Architecture and Continuity of Care Document standards. The data for evaluation are real, collected between 2009 and 2010 from Bega Clinic Timisoara. The results were relatively good for the investigated data and structure.

Keywords

Obstetrics-gynecology department information system, HL7 CDA, GCM, quality, evaluation
Simple Use Case Evaluation Method Determining an EHR Integration Platform Design

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Abstract

Integration platform is a basic technical tool realizing an interoperable Electronic Health Record (EHR). Our goal is to couple the knowledge about interoperability, the functions required for an EHR system and the formalized best practices for an integration platform. Evaluation method has been developed and existence possibility of the expressible dependencies between EHR use cases and logic of integration platform has been tested on the HL7 Functional Model. A dependency has been identified and it is also discussed in this article.

Keywords

Interoperability, electronic health record, healthcare information system, integration platform, integration pattern, HL7 functional model

Proposal of a Multi-Layer Data Model

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Abstract

The aim of the paper is to describe a data model for medical domain that allows storing and representing signal data type, which is more and more frequently used. It is not sufficient to store measured signals in separate files but this data must be stored in structured way as other patient data enabling easier access and satisfying requirements of semantic interoperability.

Keywords

Signal, data model, interoperability
Home Care and Domotic Zigbee Network for Telemedicine Applications

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Abstract

A wireless home care monitoring and domotic system for elderly and disable people has been developed. The architecture is based on a local measurement board, automatically acquiring data from commercial noninvasive home medical devices and environmental sensors, connected to a remote main server and updating a medical records’ database. A web-based application allows medical doctors and caregivers to consult the records and interact with the system. The domotic subsystem consists of wireline sensors distributed in the patient’s home for environmental checking. The biomedical measurement subsystem consists of a wireless zigbee network of electrocardiograph, blood pressure, spirometry, oxymetry, blood glucose, and body composition medical devices. The system constantly identifies a current green/yellow/red patient’s status, automatically forwarding related warnings via sms to doctors and caregivers. In the framework of the EU-funded research project Padiamond, a system prototype has been tested on case study of six moderate-to-severe Chronic Obstructive Pulmonary Disease (COPD) subjects with very interesting performance, flexibility and usability, close both to patients and physicians requirements, suggesting further applications to different medical fields.

Keywords

Telemedicine, remote monitoring, wireless sensor networks, ZigBee

Design and Implementation of a Telemedicine Service for the ECG Reporting in an University Hospital

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Abstract

In this work, we present a tele-electrocardiography remote system for ECG reporting that has been implemented at the Federico II University Hospital in Naples. The new telemedicine system has modified the organization of the ECG service avoiding the movement of professional staff among the hospital buildings. According to the new organization, the ECG data are now acquired directly in the hospital department where the patient is hospitalized and after the acquisition are sent, via intranet, to the Central Advisory Service of Cardiology for the reporting activities, it is not necessary an internal mail system for the ECG delivery. In order to demonstrate the goodness of the new service and organization, we established a set of indicators. The indicators reveal that the new organization guarantees economic advantages, an evident simplifications of the staff activities (communication and logistics) and the reduction of the speed of reporting.

Keywords

Telemedicine, ECG, medical reporting, HCTA
A Conceptual Framework for Automating the Operational and Strategic Decision-making Process in the Health Care Delivery System

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Abstract

Making reliable and justified operational and strategic decisions is a really challenging task in the health care domain. So far, the decisions have been made based on the experience of managers and staff, or they are evaluated with traditional methods, using inadequate data. As a result of this kind of decision-making process, attempts to improve operations usually have failed or led to only local improvements. Health care organizations have a lot of operational data, in addition to clinical data, which is the key element for making reliable and justified decisions. However, it is progressively problematic to access it and make usage of it. In this paper we discuss about the possibilities how to exploit operational data in the most efficient way in the decision-making process. We’ll share our future visions and propose a conceptual framework for automating the decision-making process.

Keywords

Simulation, process mining, health care, process redesigning

Stochastic Models for Low Level DNA Mixtures

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Abstract

The increasing sensitivity of forensic analysis methods allows to investigate less and less amount of biological material. For samples of low quality or quantity, there are stochastic events that require intensive statistical analysis. There are several models how to calculate the probability of a given set of alleles. The two models proposed by Kelly et al. ⁴ extend so far the most widely used model by the possibility of dropout and peak heights of individual alleles. As we found out, the first model is incorrect, while the second model highly improves the possibility of DNA mixture analysis. However, this model also overestimates the probabilities calculated unless the possibility of determining the dropout probability is added to the model.

Keywords

Forensic DNA interpretation, low level samples, allele peak heights, dropout probability
Physicians Perceptions of an Educational Support System
Integrated into an Electronic Health Record

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Abstract

The purpose of this study is to determine the perceptions by physicians of an educational system integrated into an electronic health record (EHR). Traditional approaches to continuous medical education (CME) have not shown improvement in patient health care outcomes. Hospital Italiano de Buenos Aires (HIBA) has implemented a system that embeds information pearls into the EHR, providing learning opportunities that are integrated into the patient care process. This study explores the acceptability and general perceptions of the system by physicians when they are in the consulting room. We interviewed 12 physicians after one or two weeks of using this CME system and we performed a thematic analysis of these interviews. The themes that emerged were use and ease of use of the system; value physicians gave to the system; educational impact on physicians; respect for the individual learning styles; content available in the system; and barriers that were present or absent for using the CME system. We found that the integrated CME system developed at HIBA was well accepted and perceived as useful and easy to use. Future work will involve modifications to the system interface, expansion of the content offered and further evaluation.

Keywords
Electronic health record, decision support system, continuous professional development, information pearl
Rule-based Healthcare-associated Bloodstream Infection Classification and Surveillance System

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Abstract

Healthcare-associated infections (HAIs) are a major patient safety issue. These adverse events add to the burden of resource use, promote resistance to antibiotics, and contribute to patient deaths and disability. A rule-based HAI classification and surveillance system was developed for automatic integration, analysis, and interpretation of HAIs and related pathogens. Rule-based classification system was design and implement to facilitate healthcare-associated bloodstream infection (HABSI) surveillance. Electronic medical records from a 2200-bed teaching hospital in Taiwan were classified according to predefined criteria of HABSI. The detailed information in each HABSI was presented systematically to support infection control personnel decision. The accuracy of HABSI classification was 0.94, and the square of the sample correlation coefficient was 0.99.

Keywords

Healthcare-associated infection, surveillance, infection control, information systems, Web-based services
Concept of Knowledge-Based Self-Management Pathways for the Empowerment of Diabetes Patients

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Abstract

The concept of a modular and standards-based patient empowerment framework to support the self-management of diabetes is outlined in this work. Beside an overview of the overall system architecture, the integration approach on a technical and semantical level is shown. Highlighted are the differences of the two pilot applications that will be implemented in Germany and Turkey utilizing the commonly designed core services.

Keywords

Patient empowerment, self-management, pathways, decision support, medical records, diabetes, semantic integration

A Proposed Novel Method for CHD Screening by Fetal Heart Murmur Detection using Phonocardiography

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Abstract

The paper presents a novel screening method to indicate congenital heart diseases (CHD) which otherwise would remain undetected because of their low level. Therefore, not belonging to the high-risk population, they are omitted from the regular fetal monitoring with ultrasound echocardiography. Based on the fact that CHDs are morphological defects of the heart causing turbulent blood flow, this turbulence appears as a murmur, which can be detected by phonocardiography (PCG). The proposed method applies measurements on the maternal abdomen and from the recorded sound signal a sophisticated processing determines the fetal heart murmur. The paper describes the problems and the additional advantages of the PCG method including the possibility of measurements at home and its combination with the prescribed regular cardiotocographic (CTG) monitoring. The proposed screening process implemented on a telemedicine system provides an enhanced safety against hidden cardiac diseases.

Keywords

Cardiac murmurs, fetal phonocardiography, screening of CHDs, telemedicine system
Designing e-Health Services for Enhanced Pharmaceutical care Provision: Opportunities and Challenges

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Abstract

Primary Healthcare (PHC) reforms are presently addressing chronic-disease management. It is also of importance to science and society to understand how eHealth services could be developed and used to address the challenges of health systems bottlenecks mostly regarding services integration like community pharmacies within PHC. Method: Focusing on the two initial steps of Design Science Research methodology (DSRM), a mixed methods approach was used with an online survey to collect data on pharmaceutical services and use of Information Technologies (IT) in community pharmacy, followed by an exploratory observational time and business processes study, using the shadowing method. Results: All pharmacies use IT for medicine dispensing, but only 40% use it for enhanced pharmaceutical services provision. Pharmacists spend 50% of their time in patients’ interactions, 38% on administrative tasks, but still having an average of 38.4 minutes of idle time. Conclusion: The current state of IT usage in Portuguese community pharmacies is mainly focused on medicine dispensing. Patterns of used time reflect a need to internal reorganization of pharmacies in order to enable eHealth pharmaceutical services provision.

Keywords

Integrated disease management, enhanced pharmaceutical services, innovation, eHealth business service models, DSRM
Electronic Patient-Oriented System of Medical Care Quality

“EPOS-MCQ”

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Abstract

“EPOS-MCQ” is the program product for decision support at the moments of drugs and medical interventions prescribing, planning the tactics of patients’ treatment. The methodology of Clinical Events systematization and rational “quantization” of information was created by clinicians as well as the Quality Patterns Rules were described and formalized for decision-support. This methodology showed the technological and psychological applicability of this new clinical approach for operative evaluation of Clinical Situations by the staff. Additional coding of different characteristics of Clinical Situations at the decision-making moments was used. The Quality Patterns Rules were included into the electronic knowledge-base. The real prescriptions and medical interventions were gathered in database. The monitoring of real Clinical Events and evaluation of the compliance to the Quality Patterns allowed to improve the Medical Care Quality. There was halving in Mortality among the adult patients with pneumonia.

Keywords

Decision-support systems, formalized quality protocols, improved patient care

Clinical Business Intelligence Solution

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Abstract

The rapid growth of information technologies has brought immense opportunities for patient data sharing, development and dissemination of clinical information system knowledge and analysis across distributed, heterogeneous healthcare data sources. The Paper proposes a Methodology to achieve business intelligence Model for the heterogeneous and not fully automated clinical system to eliminate the crucial set of obstacles faced by knowledge workers as well as the executives to analyze, monitor and manage the clinical system information. The existence of data discrepancies and deviations, The diversity and separation of the information in different forms and locations, the lack of unification of data models across different systems, the enormous increase of transactional data, with no valuable information, the lack of consistency in information extraction and reporting for decision making and the weak integration between demographic, medical encounters and drug usage domains.

Keywords

Clinical data warehouse, data integration, data warehousing, data design, heterogeneous, data warehouse architecture
Healthcare Systems Analysis through the Workflow Management approach. A case study: Hypertension Center Model

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Abstract

The increasing attention to the efficiency and the efficacy of the quality of care is leading the Healthcare Organizations to focus on the workflow management approach to monitor and to rationalize their activities. We are going to describe in this poster the workflow analysis performed in a particular Hypertension center located in Naples.

Keywords

Workflow management systems, health technology assessment, business process management, healthcare process analysis, WoPeD

Development of a National SNOMED CT Based Medication Decision Support System

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Abstract

Physicians often lack the time to familiarize themselves with the details of particular allergies or other drug restrictions. CDS, based on a structured terminology as SNOMED CT (SCT), can help physicians get an overview, by automatically alerting important allergy, interacting, risk and max dose information. Using SCT rather than local terminologies or the ATC classification, will resolve, among others, known problems with combination drugs as it becomes possible to warn against all active ingredients in a preparation.

Keywords

SNOMED CT, medication, decision support, allergy
Redesign of Hospital Information System to Support the New Model of Italian Hospitals Based on the Intensity of Care

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Abstract

The Italian National Health Care is facing a redesign phase characterized by a new organizational model applied to hospitals, called “lean thinking model”. The re-organized hospitals are defined “Hospital organized according to the Intensity of Care”. According to the modification of hospital organization, also the information system has to be adapted. This work aims to describe the re-engineering of the Hospital Information System (HIS) currently utilized in the hospital of Porretta Terme, one of the first Italian hospitals that has introduced the new model. The evaluation of the functionalities of the pre-existing HIS of Porretta Terme, the platform called “AR-EAS” developed by Engineering, led to the conclusion that this System was not appropriate to manage the new organizational model. The platform were reengineered and aligned to the new requirements. In conclusion, we can assert that our redesign brought two advantageous results, firstly we introduced new features to increase the coherence with the new hospital organization. Secondly, it was possible to set up a set of indicators. They have demonstrated that the new organization led to the better reuse of beds and the allocation of the staff was more efficient with the consequent reduction of wastage.

Keywords

Lean thinking, software engineering, intensity of care, medical informatics

Decision Support System for Implantology

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Abstract

Implantology is rapidly developing interdisciplinary field providing enormous amounts of data to be classified, evaluated and interpreted. The analysis of clinical data remains a big challenge, because each new system has specific requirements. The aim of study was to prepare specific tool for treatment planning. Decision support system is built on Expert system. It is interactive software which provides clinical recommendations and treatment planning. Expert systems are knowledge-based computer programs designed to provide assistance in diagnosis and treatment planning. These systems are used for health care (dentistry, medicine, pharmacy etc.). The application contained the medical history analysis to obtaining information useful in formulating a diagnosis and providing implant insertion and prosthetic reconstruction to the patient; the diagnostic examination of dental implant procedure; implant positioning diagnosis - 3-D measurement; diagnostic information for treatment planning; treatment plan in the form of objective measurement of implant placement that helps surgeon and prosthetodontics. The decision algorithm implemented by programming language was used. Core of program was an expert knowledge programming like a decision tree. The analysis of the decision-making process for implant treatment in general practice was prepared and analyzed.

Keywords

Computer program, decision support system, dentistry, expert system, implantology
Impact of the Use of an Electronic Template on Clinicians Adherence to Follow Guidelines for Diabetes Care with a Randomized Trial

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Abstract

Introduction: Diabetes mellitus (DM) was the seventh leading cause of death in 2006. The number of patients is expected to double by 2050. Simple non-adherence to follow guidelines by physicians is a significant source of morbidity and mortality. Our goal was to study the impact of an electronic template on adherence to follow ADA guidelines for diabetes care by general internists.

Methods: We designed an electronic template based on the eight point ADA guidelines for management of diabetes type 2 including: glycosylated hemoglobin (HgbA1c) assessment, blood pressure (BP) control, lipid control, smoking cessation counseling, diabetic foot exams, pneumococcal vaccination (PCV), renal assessment and annual retina exam. A pre-intervention control group was randomly selected independent of age and sex variable from existing patients database. The template was used by physicians for 6 months. Same patients were not followed in the control and intervention group.

Results: Our intervention group consisted of 212 subjects; they were compared with a control group of 154. Significant improvements were detected in HbA1c testing (57.5% vs. 94.1%; p<0.001), BP control/intervention done (53.3% vs. 89.1%; p<0.001), low-density lipoprotein (LDL) control/intervention done (65.6% vs. 90.0%; p<0.001), compliance with diabetic foot exams (88.3% vs. 99.1%; p=0.001), compliance with annual eye exams (38.3% vs. 94.8%; p<0.001). Non-significant improvements were detected in smoking cessation counseling (97.3% vs 100%; p=0.578), micro-albuminuria (92.8% to 92.9%; p=0.72). No pre intervention data on PCV was available, so no comparisons were done.

Conclusion: Utilization of a template in the EMR showed a significant improvement in diabetes care including HbA1c assessment, BP control, LDL control, feet examination, and annual eye examination. Use of templates in the EMR systems showed increased adherence to guidelines by physicians, this might extrapolate to other chronic diseases.

Keywords

Diabetes mellitus type II, electronic reminder, electronic medical record, ADA guidelines, randomized clinical trial
Differences in Diagnostic Accuracy in Encounter Orientated Compared with Problem Orientated (POMR) Medical Records. Diabetes as an Exemplar

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Abstract

\textbf{Background:} We developed an algorithm that detected errors in diagnosis, classification or coding to support the introduction of a new practical classification of diabetes. We noted that the more problem oriented primary care electronic patient record (EPR) system had less variation in the range of codes used and therefore developed a new POMR sensitive algorithm.

\textbf{Objective:} To compare existing algorithms used to detect coding errors with a new POMR tailored algorithm to detect errors in diabetes coding.

\textbf{Method:} We used data from The Health Improvement Network database (N= 2,466,364) of whom 4.08\% (n=100,513) had diabetes. We recalibrated algorithms designed to look for contradictions in coding to take account of POMR systems; which are less likely to have multiple similar codes recorded. We explored the different proportions of people with a classifiable diagnosis of type 1 or type 2 diabetes with unclassifiable diabetes. We compared characteristics of these groups in terms of age, gender, BMI, glycaemic control and therapy.

\textbf{Results:} We found the proportion of people with classifiable types of diabetes to be: using POMR, T1DM prevalence was 0.31\% (7,750/2,466,364) with T2DM prevalence rates of 3.65\% (89,990/2,466,364); this compared to EOMR T1DM of 0.377\% (9,267/2,466,364); for T2DM 3.22\% (79,420/2,466,364). EOMR data had higher levels of unclassified diabetic patients compared with POMR 11\% (11439) vs 2\% (2380), respectively. Differences were also noted in RBS levels between POMR (11.1±5.76) and EOMR (6.91±1.2).

\textbf{Conclusion:} Variation in coding variability between POMR and EOMR has been demonstrated through difference in both prevalence and treatment outcomes for patients with diabetes. This has highlighted the need for system specific algorithms, which not only highlight errors but help maintain good data quality. Previous work has consistently demonstrated that improvement in data quality results in better clinical care for patients.

\textbf{Keywords}

Diabetes, medical record, classification
Project I-COP – Architecture of Software Tool for Decision Support in Oncology

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Abstract

This article briefly describes the development of I-COP tool, which is designed to promote education and decision making of clinical oncologists and is based on real data from medical facilities, which are processed, stored in database, analyzed and finally displayed in an interactive software application. Used data sources are shortly described in individual sections together with the functionality of developed tools. The final goal of this project is to provide support for work and education within each involved partner center. Clinical oncologists are therefore supposed to be the authors and users at the same time.

Keywords

I-COP, data processing, data mining, oncology, data analyses, medical education, National Cancer Registry, insurance companies reports

Risk Perception & Environmental Risk Management in Public Health Protection

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Abstract

When evaluating perception of environmental risks, psychosocial and psychosomatic factors may be of fundamental importance. This is the case in particular where our knowledge of the true health consequences of exposure to given factor is incomplete or its action is within the range of values where we do not anticipate the measurable biological effect. This applies not only in the case of the indoor environment related complains but also to that of non-ionizing electromagnetic radiation and electro-ionic microclimate. A serious consequence found in the syndrome of mass hysteria is the fact that due to differently motivated disinformation, part of the population can suffer from some psychosomatic symptoms. Those imply objective suffering and deterioration quality of life for those affected.

Keywords

Risk perception, environmental risks assessment, psychosomatic aspects, psychosocial aspects of risk, health an illness, scientific and social models, public health
Clinical Case Player for Data-Driven Education Based on Real Severe Sepsis Cases

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Abstract

The EPOSS/SEPSIS-Q project has been running in the Czech Republic since 2011. The key activity of this project includes a research database in which data about patients with severe sepsis and septic shock are inserted retrospectively. An advanced IT infrastructure has been developed enabling utilization of data from everyday clinical practice for innovation of clinical teaching.

Keywords

Clinical education, e-learning, clinical cases, severe sepsis

The Management of Personal Support for University Students with Disabilities: A Quantitative Analysis through the Workflow Approach

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Abstract

In Public Services, the Goods and Services Providers are progressively increasing their focus on the workflow analysis, in order to design safe and flexible processes and to improve their effectiveness. This paper describes a quantitative analysis - based on the Petri Nets theory - performed through the Woped simulator. The experimental test - site is the Sinapsi Center of the University Federico II of Naples.

Keywords

Workflow management systems, quantitative simulation, healthcare process analysis, WoPeD
Knowledge Gap and E-course on Statins

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Abstract

Aim: The objective of this article includes examining the knowledge of e-course participants on the use of statins in clinical practice.

Methods: The e-test was composed of 50 multiple choices questions. E-test results were compared between the family physicians (FP) and other specialist groups. The questions with the least number of correct answers were identified and all questions were divided into three groups: difficult (a correct answer obtained in <60% of examinees), medium-difficult (in 60 to <70%) and easy (all other questions). For each participants, the correct answer percentage was calculated in relation to the respective group of questions.

Results: 441 candidates completed the e-test; 412 (93.4%) from Croatia; 217 (52.7%) from larger cities and 262 (59.4%) were FP. A total of 420 (95.2%) participants completed the test successfully with no difference in the number of correct answers between FPs and other specialists. FPs provided fewer correct answers to medium-difficult (p=0.006) and to difficult questions (p=0.016) concerning more recent insights into statins.

Conclusions: In questions concerning more recent insights into statins, FPs obtained worse results than other participants, especially in more recent scientific and professional insights, pointing to the need for shorter but more frequent educational programs.

Keywords

Education, continuing, family practice, specialization, internet, information dissemination, hydroxymethylglutaryl CoA reductase inhibitors

Education for Medical Decision Support at EuroMISE Centre

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Abstract

This work describes e-learning tools and approaches used in education and training for medical informatics, statistics and epidemiology offered by the EuroMISE Center of the Charles University and Academy of Sciences of the Czech Republic. Many of the courses cover decision-support topics and are based on different decision-support information technologies.

Keywords

Education, decision support, knowledge evaluation, e-learning
Telemedicine System for Education in Wireless Medical Data Acquisition and Decision Making

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Abstract

This paper deals with implementation of telemedicine technology into educational and research activities of biomedical students and training of medical staff. New laboratory infrastructure was built at the Department of Biomedical Engineering of Brno University of Technology, which includes wireless data acquisition devices using Bluetooth interface for measurement of basic medical markers. An effective client-server solution was used for processing and analysis of acquired data. The system provides open access on software and hardware level including transfer protocols, database solution and signal processing.

Keywords

Telemedicine, bluetooth application, medical data acquisition, education
Handling Intra-Cluster Correlation When Analyzing the Effects of Decision Support on Health Care Process Measures

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Abstract

The clinical worksite constitutes a naturally clustered environment, posing challenges in the statistical analysis of quality improvement interventions such as computerised decision support. Ignoring clustering in the analysis may lead to biased effect estimates, underestimating the variance and hence type I errors. This paper presents a secondary analysis on data from a previously published, cluster randomised trial in cardiac rehabilitation. We compared six different statistical analysis methods (weighted and unweighted t-test; adjusted $\chi^2$ test; normal and multilevel logistic regression analysis; and generalized estimation equations). There were considerable differences in both point estimates and p-values derived by the methods, and differences were larger with increasing intra-cluster correlation.

Keywords

Statistical methods, health care quality assessment, computerised decision support

Developing and Evaluating Intelligent Decision Support Models in Ventilation Management

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Abstract

Ventilation management is the ongoing process of adapting ventilator settings to mechanically ventilated patient needs. The present paper develops and evaluates two different mechanical ventilation Decision Support (DS) models utilizing evolution of Fuzzy systems and Adaptive Neuro-Fuzzy Inference Systems. Seventy hours of real patient data were collected and categorized into three lung pathology groups. Sixty percent of the recorded data sets were used for the development of hybrid DS model. Evaluation of the developed lung pathology specific systems was performed first against the 40% of the remaining data sets in terms of statistical disagreement between DS model’s suggestions and clinical decisions on ventilator settings, and second as a percentage of DS model suggestions lying within clinical disagreement standard deviation. Results suggest that ANFIS exhibited superior performance over evolved Fuzzy DS models.

Keywords

Ventilation management, clinical decision support systems, fuzzy logic, genetic algorithms, adaptive neuro-fuzzy inference systems
Automatic System Testing of a Decision Support System for Insulin Dosing Using Google Android

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Abstract

Hyperglycaemia in hospitalised patients is a common and costly health care problem. The GlucoTab system is a mobile workflow and decision support system, aiming to facilitate efficient and safe glycaemic control of non-critically ill patients. Being a medical device, the GlucoTab requires extensive and reproducible testing. A framework for high-volume, reproducible and automated system testing of the GlucoTab system was set up applying several Open Source tools for test automation and system time handling. The REACTION insulin titration protocol was investigated in a paper-based clinical trial (PBCT). In order to validate the GlucoTab system, data from this trial was used for simulation and system tests. In total, 1190 decision support action points were identified and simulated. Four data points (0.3%) resulted in a GlucoTab system error caused by a defective implementation. In 144 data points (12.1%), calculation errors of physicians and nurses in the PBCT were detected. The test framework was able to verify manual calculation of insulin doses and detect relatively many user errors and workflow anomalies in the PBCT data. This shows the high potential of the electronic decision support application to improve safety of implementation of an insulin titration protocol and workflow management system in clinical wards.

Keywords

Diabetes, decision support system, automatic testing, Google Android, simulation

Attitudes and Experience of Dutch General Practitioners Regarding Computerized Clinical Decision Support

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Abstract

Dutch general practices have a high adoption rate for computerized patient records and clinical decision support. We sought to measure the attitudes and experience of Dutch general practitioners towards clinical decision support. Methods: A preliminary survey was created based on questions from published surveys, modified with the results of interviews. The final web-based survey was administered to 43 general practitioners in a practice area where a decision support implementation is planned. Results: Thirty general practitioners (70%) completed the survey. Most felt that decision support is a good idea (23/30), although fewer reported positive experience with decision support (10/30). Participants were supportive of rules and guidelines, but commonly had the sense that there were too many alerts. Conclusion: Dutch clinicians are positive about decision support, but future efforts should try to reduce the perception of overload, for example by ensuring that alerts are relevant and choosing less interruptive forms of notification for less severe alerts.

Keywords

Decision support, clinician perceptions, implementation
Analyzing the "CareGap": Assessing Gaps in Adherence to Clinical Guidelines in Adult Soft Tissue Sarcoma

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Abstract

Clinical decision support systems (CDSSs) are gaining popularity as tools that assist physicians in optimizing medical care. These systems typically comply with evidence-based medicine and are designed with input from domain experts. Nonetheless, deviations from CDSS recommendations are abundant across a broad spectrum of disorders, raising the question as to why this phenomenon exists. Here, we analyze this gap in adherence to a clinical guidelines-based CDSS by examining the physician treatment decisions for 1329 adult soft tissue sarcoma patients in northern Italy using patient-specific parameters. Dubbing this analysis "CareGap", we find that deviations correlate strongly with certain disease features such as local versus metastatic clinical presentation. We also notice that deviations from the guideline-based CDSS suggestions occur more frequently for patients with shorter survival time. Such observations can direct physicians’ attention to distinct patient cohorts that are prone to higher deviation levels from clinical practice guidelines. This illustrates the value of CareGap analysis in assessing quality of care for subsets of patients within a larger pathology.

Keywords

Clinical decision support, clinical practice guidelines, evidence-based medicine, soft tissue sarcoma, cancer treatment
Personalized Medicine and the Need for Decision Support Systems

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Abstract

Advances in genomics and human genetics have enabled a more detailed understanding of the impact of genetics in a disease and its treatment. In addition to a patients' clinical signs and symptoms, physicians can now or in near future consider genetic data for their diagnosis and treatment decisions. This new information source based on genome and gene expression analysis makes clinical decision processes even more complex. Beyond, behavioral and environmental aspects should also be considered in order to realize personalized medicine. Given these additional information sources, the need for support in decision making is increasing. In this paper, we introduce a vision how knowledge-based systems or decision support systems can help to realize personalized medicine and we explore the upcoming challenges for clinical decision support in that context.

Keywords
Personalized medicine, decision support system, knowledge based system

Entropy Driven Decision Tree Building for Decision Support in Gastroenterology

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Abstract

Gastroesophageal reflux disease is a serious clinical problem, which can significantly impair health-related quality of life, thus having global implications for patients. The first step for a doctor is the clinical classification of the patients, divided into classes after being subjected to endoscopic examinations to control if there are lesions of the esophageal mucosa, and if present, the severity of these lesions. 269 patients were taken into consideration (4 healthy patients, 219 with non erosive reflux disease, 21 with erosive reflux disease, 15 with complicated erosive reflux disease, 10 with Barrett’s disease). A set of values taken from gastroscopy, ph-metry and manometry tests were considered and a decision tree was made to classify every patient. Entropy and information gain were calculated for each node to create the most possible simple tree. The resulting tree presents some paths including a significant number of persons; the values that build these paths can be considered characteristic of each class of patient. This method can be a basis to develop a diagnostic decision support for a training doctor starting from a set of characteristics, specific to a class of patient.

Keywords
Gastroesophageal reflux, decision tree, entropy, information gain, decision support
Prognostic Decision Support Using Symbolic Dynamics in CTG Monitoring

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Abstract

Foetal heart rate variability is one of the most important parameters to monitor foetal wellbeing. Linear parameters, widely employed to study foetal heart variability, have shown some limitations in highlighting dynamics potentially relevant. During the last decades, therefore, nonlinear analysis methods have gained a growing interest to analyze the chaotic nature of cardiac activity. Parameters derived by techniques investigating nonlinear can be included in computerized systems of cardiotocographic monitoring. In this work, we described an application of symbolic dynamics to analyze foetal heart rate variability in healthy foetuses and a concise index, introduced for its classification in antepartum CTG monitoring. The introduced index demonstrated to be capable to highlight differences in heart rate variability and resulted correlated with the Apgar score at birth, in particular, higher variability indexes values are associated to early greater vitality at birth. These preliminary results confirm that SD can be a helpful tool in CTG monitoring, supporting medical decisions in order to assure the maximum well-being of newborns.

Keywords

Foetal health monitoring, symbolic dynamics, computerized cardiotocography, foetal health prognostic decision support

System for Selection of Relevant Information for Decision Support

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Abstract

We implemented a prototype of a decision support system called SIR which has a form of a web-based classification service for diagnostic decision support. The system has the ability to select the most relevant variables and to learn a classification rule, which is guaranteed to be suitable also for high-dimensional measurements. The classification system can be useful for clinicians in primary care to support their decision-making tasks with relevant information extracted from any available clinical study. The implemented prototype was tested on a sample of patients in a cardiological study and performs an information extraction from a high-dimensional set containing both clinical and gene expression data.

Keywords

Decision support system, web-service, information extraction, high-dimension, gene expressions
New Nonalcoholic Steatohepatitis Diagnosis Model-Related Personalized Medicine

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³ IRD, UMI 209, UMMISCO, IRD France Nord, Bondy, France

Abstract

Non-alcoholic fatty liver disease (NAFLD) is a recently recognized entity related to modern lifestyle and with expanded clinical importance because of the rising incidence of obesity and diabetes. NAFLD is a clinical syndrome, and pathologically characterized by diffuse macrovesicular fatty change in the hepatocytes. NAFLD includes simple nonalcoholic fatty liver disease, nonalcoholic steatohepatitis (NASH) and hepatic cirrhosis. NASH is a disease evolving under the influence of various stimuli still poorly understood, but where insulin resistance prominently. In this paper we present new diagnosis model to predicate NASH.

Keywords
Non-alcoholic fatty liver disease, liver disease, clinical decision support system, knowledge representation, artificial intelligence, fuzzy logics

Diagnostic Decision Support of Heart rate Turbulence in Sleep Apnea Syndrome

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Abstract

Obstructive sleep apnea syndrome (OSAS) is characterized by repeated upper-airway obstruction during sleep. It is diagnosed by polysomnographic studies, scoring OSAS severity by an apneas/hypopneas index associated to worse prognosis, mainly for an increased cardiovascular morbidity. Cardiac autonomic impairments involved in the development of cardiovascular disease in OSAS can be assessed by heart rate turbulence (HRT) analysis and aim of the paper is to show the increased medical decision support by HRT evaluation in OSAS patients. HRT has been assessed in 274 polysomnographic recordings of mild-to-severe OSAS patients and an overall cardiorespiratory risk scoring (CRRIS) index has been proposed on the base of both OSAS severity and HRT assessment. Results showed that, while the only polysomnographic analysis would have equally ranked OSAS patients within their mild-to-severe classification, CRRIS index allows to identify a 19% of severe-OSAS patients at very high risk of sudden cardiac death, a 13% of moderate-OSAS patients with a risk level comparable to those of severe, and a 17% of mild-OSAS patients with evidence of an autonomic impairment. CRRIS index, detecting patients at greater probability of worsening could give to the physician a very useful medical decision support in the follow up of this particular chronic disease.

Keywords
Diagnostic decision support, heart rate turbulence, sleep-apnea
Changes of the Optic Nerve in the OCT Image and Correlation with MRI Image of Brain and Visual Pathways

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Abstract

Objective: We will demonstrate the case report of a patient with relapsing remitting (RR) form of multiple sclerosis.

Multiple sclerosis (MS), also known as "disseminated sclerosis" or "encephalomyelitis disseminata", is an inflammatory disease in which the fatty myelin sheaths around the axons of the brain and spinal cord are damaged, leading to demyelination and scarring as well as a broad spectrum of signs and symptoms. Disease onset usually occurs in young adults, and it is more common in women.

We want to present the practical benefits of synthesis imaging methods in radiology and ophthalmology - especially OCT RTVue analysis and MRI tractography in assessing visual pathway.

Methods and Results: Case report of a patient with diagnosis of RR form of MS, in lactation phase after second birth. She is after 3 episodes of retrobulbar neuritis with nonspecific clinical picture of suspected acute attack (vertigo, lesion of vision). MR confirmed remission with the typical image of demyelinisation of MS, without progression the last few months before the examination. OCT RTVue analysis showed loss of ganglion cells and RNFL especially in right eye.

Conclusion: Results of MR and OCT RTVue complement each other well as complementary secondary imaging methods for diagnostic and non-invasive monitoring of visual pathway changes.

Keywords

Multiple sclerosis, radiology, ophthalmology
Computer-Assisted Evaluation of Videokymographic Data

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Abstract

Videokymography is a novel medical imaging method used in laryngology and phoniatrics for observation and diagnosis of vocal fold vibrations. The amount and the quality of the data hamper manual feature extraction. A computer-assisted extraction could facilitate the diagnostic process. The proposed solution offers a software tool for data enhancement and extraction of typical characteristics of vocal folds vibrations designed by experts. The proposed methodology is based on digital image processing methods, namely image denoising, image segmentation, and object detection. Such approach enables to reflect specific features of videokymographic images and extracted vocal fold parameters. We have tested the proposed solutions on a representative set of videokymographic data. The comparison of the achieved results with the visually detected features proved the method applicability. The algorithms were implemented into the VKFD (videokymography feature detection) software.

Keywords

Videokymography, image processing, computer-assisted evaluation

Nuchal Translucency Quality Review Using Exponentially Weighted Moving Average Chart

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Abstract

Objectives: To design an exponentially weighted moving average (EWMA) chart for nuchal translucency (NT) quality review and assess its performance compared to cumulative sum (CUSUM) chart.

Methods: Optimal $\lambda$ for EWMA chart was selected using simulation. Twenty series of 2000 random measurements were generated and the ability to detect the shift and subsequent normalisation for various $\lambda$ was assessed. The performance of EWMA chart was compared to previously described CUSUM model using the real dataset of fetal NT measurements over a two-year period.

Results: Optimal $\lambda$ of 0.02 was selected having the same ability to detect undesired shift in a process and with lower probability of false alarm being raised compared to CUSUM. A set of 7575 NT measurements were used for constructing EWMA and CUSUM charts. EWMA model showed close agreement with CUSUM but with the advantage of ability to indicate promptly the rectification of the process to in-control thus being more appropriate for long-term prospective as well as retrospective NT quality review. Moreover, it showed a lower chance to raise false alarm compared to CUSUM.

Keywords

Nuchal translucency, exponentially weighted moving average, control chart, cumulative sum, ultrasound
CoPlot Visualization of Predictive Model for Postoperative Vomiting in Patients Undergoing General Anesthesia for Laparoscopic Gynecological Surgery

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Abstract

The aim of this paper was to propose predictive model for postoperative vomiting in patients undergoing general anesthesia for laparoscopic gynecological surgery at general hospital Zadar, Croatia. Model was developed based on risk factors data for POV in a group of 374 women by CoPlot visualization technique.

Keywords

Data visualization, postoperative vomiting, predictive model

Dental Electronic Health Record Evaluation

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Abstract

This contribution is focused on the comparison of ease of use of three means of keeping the patients data in the field of dentistry: the classical paper WHO dental card, a lifetime dental EHR controlled by keyboard and a lifetime dental EHR controlled by voice. The EuroMISE Centre developed a pilot EHR application called MUDR (Multimedia Distributed Electronic Health Record). The study compares the elapsed time necessary to update/enter the information about the patient’s dental status using the above mentioned three methods. The EHR software has been extended to support controlling by means of a human voice. The hands-free operation of the software brings revolutionary benefits into the field of dentistry.

Keywords

Dentistry, medical documentation, electronic health record
Designing Prognostic Models by Reinforcing Linear Separation

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Abstract

Variety of prognostic models can be designed on the basis of learning sets by using the principle of linear separability. The degree of linear separability of two learning sets can be evaluated on the basis of the minimal value of the perceptron criterion function, which belongs to a larger family of the convex and piecewise linear (CPL) criterion functions. Parameters constituting the minimal value of a given CPL criterion function can define particular prognostic model. Prognostic models have been designed this way, for example, on the basis of genetic data sets.

Keywords

Linear prognostic models, CPL criterion function, feature selection

The Medicolegal Certification of Medical Fitness to Work: Necessity of Standardization

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Abstract

Czech Republic Act No 373/2011 Dig., on specific health services defines Occupational Health Service (OHS). One of the crucial medicolegal activity of OHS providers is the certification of medical fitness to work issued by examining physician and based on knowledge of working conditions/ health risks of work and on results of occupational medical examinations. There are different written or electronic forms of certification of medical fitness to work that should be unified and standardized for practical needs of OHS providers and employers.

Keywords

Occupational health services, medical fitness, certification, standardization
In-Hospital Death Prediction in Patients with Acute Coronary Syndrome

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Abstract

The aim of our work was to assess which factors predict in-hospital death in patients with acute MI admitted primarily to non-percutaneous coronary intervention (PCI) hospitals in the Czech Republic. The analysed data originated from ALERT-CZ (Acute coronary syndromes – Longitudinal Evaluation of Real-life Treatment in non-PCI hospitals in the Czech Republic) registry (1.7.2008 to 30.6.2011). Predictors of in-hospital death were identified using a multilevel logistic regression. Higher age, heart failure, lower systolic blood pressure, elevated heart rate, elevated creatinin were significant negative predictors of in-hospital death. Patients with diagnosis of NSTEMI/unstable angina had significantly lower odds of in-hospital death than patients with diagnosis of myocardial infarction. Administration of not all recommended drugs (aspirin, clopidogrel, heparin/fondaparinux, statin,beta-blocker) within the first 24 hours significantly increased odds of in-hospital death of patients with acute coronary syndromes.

Keywords

Acute coronary syndrome, in-hospital death, prediction, multilevel logistic regression, non-PCI hospital
Elderly People Activity Classification Based on Accelerometer

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Abstract

In this paper, we summarize aspects of integration and utilization of an accelerometer device in the SeniorInspect system. Moreover, we propose several additional activity classification, which also utilizes accelerometer device. These types of activities are focused on the support of seniors to live a free and safe life in their home environment. We aim to evaluate these activity types with respect to the accelerometer sensor placement.

Keywords

Accelerometer, position evaluation, SeniorInspect, activity recognition, pedometry, fall detection

A Comparison of English and French Approaches to Providing Patients Access to Summary Care Records

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Abstract

Online access to records is part of the process of empowering patients. National health services in both France and England have introduced systems to provide online access to summary health data. The English system was called the “Summary Care Record (SCR),” made accessible to patients through “HealthSpace.” The French system Dossier Médical Personnel (DMP) is a patient controlled record clinicians enter data into. The objective was to compare the programmes and lessons from the introduction of patient access. We carried out a literature review. The English system has been progressively de-scoped, with HealthSpace due to close in 2013, only 0.01% of the population signing up for “advanced accounts.” The French system slowly grows as more documents are added; though only 0.31% of the population have opened a DMP. The English SCR has an opt-out consent model, whereas the French DMP is patient controlled opt-in consent model. The SCR sits within an NHS intranet while the DMP sits on the Internet. Both systems have costs of around 200million Euro. Providing patients online access to their medical records is potentially empowering. However, the English HealthSpace and SCR have failed to deliver and are due to be withdrawn as methods of providing patients online access. The French system is still in operation but much criticised for its high costs and low uptake. The design of these systems does not appear to have met patients’ needs or been readily integrated into physicians workflow.

Keywords

Records as topic, patient care, health records, personal
Global Quality Indicators for Primary Care Electronic Patient Records

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Abstract

Electronic Patient Records can be interfaced with medical decision support systems and quality of care assessment tools. An easy way of measuring the quality of EPR data is therefore essential. This study identified a number of global quality indicators (tracers) that could be easily calculated and validated them by correlating them with the Sensitivity and Positive Predictive Value (PPV) of data extracted from the EPR. Sensitivity and PPV of automatically extracted data were calculated using a gold standard constructed using answers to questions GPs were asked at the end of each contact with a patient. These properties were measured for extracted diagnoses, drug prescriptions, and certain parameters. Tracers were defined as drug-disease pairs (e.g. insulin-diabetes) with the assumption that if the patient is taking the drug, then the patient is suffering from the disease. Four tracers were identified that could be used for the ResoPrim primary care research database, which includes data from 43 practices, 10,307 patients, and 13,372 contacts. Moderately positive correlations were found between the 4 tracers and between the tracers and the sensitivity of automatically extracted diagnoses. For some purposes, these results may support the potential use of tracers for monitoring the quality of information systems such as EPRs.

Keywords

Computerised patient record, primary healthcare, data collection, evaluation study

People and Organizational Issues that Surround the Implementation of Health Information Systems: A Literature Review

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Abstract

Recent studies on the evaluation of information technology used in today’s modern health care environment often refer to the failures of health information systems (HIS) systems. There are a number of major issues that cause problems to occur in the design, implementation, evaluation process, as well as other factors. Moreover, throughout the many studies so far conducted, in the success of health information technology the human factor has, in addition to technical issues, also been shown to be an important component. In this study, it is aimed to review and summarize recent studies on human and organizational issues related to HIS.

Keywords

Organization, change management, review
Vision for the Future of OMICs Data in Electronic Health Records

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Abstract

The EU funded INBIOMEDvision Project (http://www.inbiomedvision.eu/) organized and coordinated several events where experts from different disciplines got together to discuss topics relevant to Biomedical Informatics challenges and shared their ideas and views about integrative knowledge management for healthcare and research. The role that the integration of omics data in Electronic Health Records may have in the advancement of personalised medicine and the challenges that Biomedical Informatics faces to help make personalised medicine a reality were highlighted during these meetings.

Keywords

Biomedical informatics, personalised medicine, electronic health record, OMICs data

Comparing Security Awareness Between Medical and Technical Students

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Abstract

The information security should be important issue regarding information systems used in healthcare. As human factor has significant influence on security, aim of this study is to compare level of security awareness among students with medical and technical background. The novel evaluation method based on the ontology knowledge base and the enhanced Evidential Reasoning algorithm was used for overall evaluation analysis and for detailed comparison analysis. Medical students got lower overall grade than technical students, but higher grade when comparing to referent “minimally secure” level of awareness. However, both groups of students got relatively low overall grade of awareness and need additional education in order to raise their awareness regarding security issues.

Keywords

Information security, user’s awareness, ontology knowledge database, evidential reasoning
Behavioural Biometrics in Biomedicine

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\textsuperscript{3} CESNET z.s.p.o., Prague, Czech Republic

Abstract

The goal of this work is to suggest an improved authentication method for biomedicine based on analysis of currently used behavioural biometric methods. A brief definition of identification, authentication and biometric characteristics is provided. The main part of the work focuses on keystroke dynamics, its advantages, disadvantages and applications in biomedicine. Keystroke dynamics is then proposed as an interesting behavioural biometric characteristic for use in computer security not being widely used so far. The result of the work will be a new set of methods, which allows optimal multifactor authentication method regarding its comfort, cost and reliability. The purpose of this paper is to focus on the available information about keystroke dynamics.

Keywords

Biometrics, behavioural biometrics, keystroke dynamics, mouse dynamics

Why We Do It Different from OpenEHR

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Abstract

Decision support needs structured patient data to work with. At CompuGroup, we are building a system of clinical data types for use in the electronic patient record of hospital information systems and practice information systems. These data types are comparable to openEHRs archetypes. However, our approach differs from the one taken by openEHR in several aspects: We employ a two-layer, multi-hierarchical approach rather than a strict hierarchy, we separate measurement action and result in a different way, and we use explicit relations.

Keywords

OpenEHR, archetype, separation of concerns
Applying Medical Knowledge in Data Mining

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Abstract

First experiments concerning dealing with domain knowledge in data mining in medical data are presented. The data mining procedure 4ft-Miner dealing with association rules - couples of general Boolean attributes is used. Formalized items of medical knowledge are used. Each such item of knowledge is projected onto set of association rules, which can be considered as its consequences. This set of association rules is then used to filter out uninteresting association rules.

Keywords

Data mining, association rules, domain knowledge, GUHA method, logic of association rules

What Constitutes Healthy Nutrition? Factor Analysis of Data Collected in a Food Frequency Questionnaire

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Abstract

We used exploratory factor analysis to define a healthy and unhealthy nutritional pattern, based on data from a food frequency questionnaire. The healthy pattern is rich in fruits, various kinds of vegetables (except for potatoes), legumes, and preferring freshly squeezed juices over sodas, whereas the unhealthy pattern is consistent with frequent consumption of sugar, bread, potatoes, cured meats and sweets, little use of fruits and vegetables, and preference of vegetable oil over olive oil. Each participant was assigned a score, indicating the extent to which they followed each nutritional pattern. The unhealthy nutrition score showed an association with abdominal obesity - the key risk factor for cardiovascular disease and type 2 diabetes - both cross sectionally and five years later.

Keywords

Factor analysis, nutrition, food frequency questionnaire, abdominal obesity, cardiovascular disease, type 2 diabetes

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New Perspectives and Methodological Challenges in Medical Decision Making

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Abstract

The development of different kind of applications that support medical decision making is undergoing dramatic changes due to technological progresses in ITC. Our contribution is outlining some of the most important approaches that are thought to change the way tools and technologies for healthcare are developed (cyber physical systems, some approaches borrowed from different disciplines as chaos/complexity and bounded rationality). We are also reporting the results of a snapshot study of how the patients and the physicians are facing these newcomers.

Keywords

Cyber physical systems, chaos, complexity science, bounded rationality, medical decision making

Attendance Data of an Online CME Course

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Abstract

The present paper is aimed at understanding if and how healthcare professionals have attended an e-learning CME course about theory and practice of clinical trials, with the goal of understanding the potentiality of online education in a large research and care delivery Institution. In particular we have analysed: Attitude to course completion; Attitude to exploit the “learning from mistakes” and “learning without time constraints” opportunities offered by the online educational model. The results show good participation of the healthcare staff, very low drop out percentages, but a suboptimal usage of the e-learning course.

Keywords

E-learning, CME, evaluation
**History of Medical Informatics in Europe**

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**Abstract**

The panel intends to collect data, opinions and views for a systematic and multiaxial approach for a comprehensive presentation of "History of Medical Informatics", treating both general (global) characteristics, but emphasizing the particular features for Europe. The topic is not only a subject of large interest but also of a great importance in preparing a detailed material for celebration of forty years of medical informatics in Europe. The panel comprises a list of topics, trying to cover all major aspects to be discussed. Proposals of staging the major periods of medical informatics history are also discussed.

**Keywords**

Medical informatics, health informatics, e-health history, medical informatics education, EFMI, IMIA

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**Accelerometer Based Features Assessment for a Real Time Activity Recognition**

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**Abstract**

In this work, we consider the problem of recognizing particular human activities on a basis of wrist mounted accelerometer data. The information gain is therefore evaluated for each of proposed features in the time domain. As we suppose a real time data processing, the computational requirements are also estimated. Results of the work are used to set up a classification scheme in a low-power embedded environment.

**Keywords**

Activity recognition, accelerometer, weka, feature information gain, feature computational time
Abstract

Present style of living, reach in stress, office and home air setting and more frequent diagnosed breath difficulties cause a new attitude to managing our free time or working activities. Better planning of where we spend our vacation or awareness of in which air conditions we spend tens of hours at home or in office require an existence of air quality data and their accessibility at mobile or home terminals.

We present an air quality system solution ensuring full supply chain composing of - common air quality parameters detection, wireless sensor network management, data transmission towards an aggregator, connectivity with remote database, using web services for data interpretation and user availability. Secure sharing of air quality data within cloud services assists the patient effective prevention of staying on places negatively affecting breathing.

The system reflects the need of strong support of the persons suffering by any breath difficulties or cardiovascular troubles as well as elderly or children. It makes their life better ensuring both they have online data on request where they are and to fetch data of sites where they plan to go.

The innovative idea is to provide patients with a means by which they can access air quality data on time on site. We can expect big demand for user friendly applications on the market, which will advance life comfort and activity planning.

Our concept integrates available technologies like IC sensors, wireless modules, micro PC, internet services and databases. Using all those technologies together we come up with user friendly system allowing user to monitor ambient air quality. The simple user skills to handle mobile devices, like smart phone, are only required.

Keywords

Style of living, breathing difficulty, air quality
Building Platform for Optimization of Medical Education

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Abstract

In the contribution the original decision support system for organization of medical curriculum will be described. All existing solutions that have been published are focused on the building curriculum only from a certain perspective. However, there still does not exist an interactive web-oriented system that would cover all elements connected with global curriculum optimization, including a detailed parametric description down to the level of learning units and outcomes. The aim of the work is to create a new platform, which provides clear information intended to help to understand curriculum structure and to help to make decisions related to curriculum construction. The fundamental principles of the new approach and used technologies are reported here.

Keywords

Decision support system, medical curriculum, outcome-based approach, nature language processing, data visualization

Behavioural Biometrics for Application in Biomedicine

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Abstract

The goal of this work is to suggest an improved authentication method for biomedicine based on analysis of currently used behavioural biometric methods. A brief definition of identification, authentication and biometric characteristics is provided. The main part of the work focuses on keystroke dynamics, its advantages, disadvantages and applications in biomedicine. Keystroke dynamics is then proposed as an interesting behavioural biometric characteristic for use in computer security not being widely used so far. The result of the work will be a new set of methods, which allows optimal multifactor authentication method regarding its comfort, cost and reliability. The purpose of this paper is to focus on the available information about keystroke dynamics.

Keywords

Biometrics, behavioural biometrics, keystroke dynamics, mouse dynamics
Modeling Cost-Effectiveness of Screening: Autoimmune Thyroid Disorders After Spontaneous Abortion

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Abstract

Introduction: Healthcare costs rise sharply and the solution appears to be simple: screening and prevention. But how cost-effective is screening and does it really save money? Women with autoimmune thyroid disorders (AITD) may have increased rates of infertility, spontaneous abortions (SpA) and perinatal death. Cost-effectiveness analyses of screening for AITD in women after SpA are still lacking.

Objective: To assess the suitability of systematic screening for thyroid disease in women after SpA in the Czech Republic – from the perspective of women’s reproductive health. Methods: In years 2008–2012 thyroid ultrasound, serum concentrations of thyroid stimulatory hormone (TSH), antibodies to thyroid peroxidase (TPOAb) and free thyroxine (FT4) were systematically investigated in all women after SpA in term of project of General University Hospital in Prague. Overall, 297 women after SpA in the 7th -12th gestational weeks were included and followed (median time 3 years). Forty-six women were lost to follow-up. Levothyroxine treatment was in 77 women with hypothyroidism/AITD (group Treated, median age 31 years); 61 women with subclinical hypothyroidism or euthyroid AITD left untreated (group Untreated, median age 30 years) and 113 women without signs of thyroid disease served as Controls (median age 30 years).

Results: For the base case analysis, the economic model showed that treatment was associated with an increased rate of successfully completed next pregnancy (increment of 5 newborns/100 women; compared with Untreated group) and leads to savings of 22028.56 EUR/100 women. Total costs per successfully completed pregnancy were 1154.64 EUR in controls, 1175.26 EUR in the treated, and 2058.80 EUR in the untreated women with AITD. The analysis was most sensitive to the number of women undergoing assisted reproduction and probability of improvement of women’s infertility by levothyroxine treatment. Additional scenarios in which therapy does not prevented cases of increased women’s ability to conceive, the systematic screening does not remain even cost-effective.

Conclusion: Our results suggest that systematic screening and treatment of subclinical hypothyroidism and euthyroid AITD in women after SpA could be a strategy that improve women’s reproductive health and save money relative to current practice. However, more studies whether levothyroxine treatment exerts beneficial effects on women’s fertility need to be done.

Keywords

Autoimmune thyroid disorders, spontaneous abortion, screening, cost-effectiveness analysis, antibodies to thyroid peroxidase
Analysis of Low Level DNA Mixtures

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Abstract

The increasing sensitivity of forensic analysis methods allows to investigate less and less amount of biological material. For samples of low quality or quantity, there are stochastic events that require intensive statistical analysis. There are several models how to calculate the probability of a given set of alleles. The two models proposed by Kelly et al. [1] extend so far the most widely used model by the possibility of dropout and peak heights of individual alleles. As we found out, the first model is incorrect, while the second model highly improves the possibility of DNA mixture analysis. However, this model also overestimates the probabilities calculated unless the possibility of determining the dropout probability is added to the model.

Keywords

Forensic DNA interpretation, low level samples, allele peak heights, dropout probability

Dental Medicine Sign Language Corpus for Decision Support Systems in Health Care for Deaf People

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Abstract

In order to build a Decision Support System in Health Care for Deaf People the first step of the process is to build a corpus of keywords and keyphrases, from the medical domain this system is intended to be used and translate them in deaf signs. The content of the corpus must be very carefully selected in accord with the aim of the future designed system. This corpus can be built as a database or as a dictionary. It can be integrated later, for example, in decision making support for the agreement of the treatment for the deaf patient. The system can “explain” in their “language” what the treatment involves and what the options of the patient are. The corpus can be also integrated in an educational decision support system for the education and practice of the deaf students or even in a expert system for the deaf doctors in the aid of choosing the optimal treatment. The corpus can be built in video technology using video recording of the signs or with animated avatar technology. My paper describes the phases of building such a corpus with the video technology and some options and possibilities of creating decision support systems for deaf people. This article is part of my PhD work supported by a grant from Sectoral Operational Programme Human Resources Development (SOP HRD), 2007-2013, contract no. 9/01.11.2010.

Keywords

Decision support system, e-health, health care, deaf signs
Matching Medical Websites to Medical Guidelines through Clinical Vocabularies in View of Website Quality Assessment

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Abstract

Modern technology offers a wide array of possibilities to publish almost any content freely on the Internet. Because of the importance and delicacy of medical information, the quality of such texts provided to general public seems to be a serious issue nowadays. Unfortunately the only feasible way to approve the adequacy of the medical information content is human verification today. Best practices in medicine are systematically captured by medical guidelines (MGLs), which are provided by renowned medical societies and based on results of Evidence-Based Medicine (EBM).

We propose a simple approach to exploiting MGL content as ‘gold standard’ for the assessment of content quality in medical web sites (WS). It is based on the idea that the information content or at least the scope of a medical text is reflected in the domain terminology used. We discuss a possible use of this approach in semiautomatic human-based quality verification and various aspects related to its application.

Concept candidates discovered in a MGL and in the tested web pages are matched to UMLS, yielding sets of used medical terms and corresponding concepts. Several aggregation techniques for MGLs were proposed. In a small case study, MGL and WS documents were analyzed for overall similarity at term and concept level.

The method was applied on a selected medical topic employing relevant MGLs and 100 WS. All the analyzed web pages fell into five distinct categories (corresponding to the target audience). Aggregations for the MGLs were proposed and tested. The average cosine similarity to MGL across all tested WS reached 0.72 whereas the average similarity calculated per each category varied up to 6.6% against the overall number.

The research done is the first step towards automated evaluation of medical web page content on the basis of MGLs as the quality standard. We describe further tasks which would improve the outputs of the comparison and the possibility of its widespread application.

Keywords

Information quality assessment, clinical vocabularies, unified medical language system (UMLS), evidence-based medicine (EBM), medical guidelines (MGL)
Shrinkage Approach for Gene Expression Data Analysis

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Abstract

“Shrinkage” approach is a novel approach for statistical inference in the context of gene expression data. Typically, this kind of data has very large number of genes (variables) and very small number of expression levels for each gene (observations). If we want to use classical estimate of covariance matrix which plays important role in classification algorithms we fail. This is the point where “shrinkage” approach is useful.

Keywords

Shrinkage estimation, covariance matrix, high dimensional data, gene expression

Genotype-Phenotype Relationship in Czech Patients Diagnosed with Collagenous Forms of Osteogenesis Imperfecta

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Abstract

Osteogenesis imperfecta is a heritable disorder of connective tissue, especially of bones. About 90\% of affected patients have causative mutation in one of the two genes (COL1A1, COL1A2), both coding collagen type I. The effects of these mutations result in mild to lethal phenotype regard on type and position of the change. Typical clinical outcome of the disease is high frequency of fractures due to low bone mineral density, bluish sclera or dentino-genesis imperfecta. We analysed in this study COL1A1 gene coding sequence in DNA samples from Czech OI patients affected by collagenous forms of the disease. Identified mutations are situated in both coding and noncoding sequences of the gene and result in nonsense, missense, frame shift or silent defects in alpha1(I) chain encoded by the studied gene. The aim of this research is to found possible genotype-phenotype relationship which could help to improve the treatment quality.

Keywords

Osteogenesis imperfecta, collagen type I, COL1A1, COL1A2, mutation, phenotype-genotype correlation
The Design of an Interactive Web Portal for Support of Telemonitoring Utilization in Diabetes Management

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Abstract

Number of diabetes patients is increasing every year. Diabetes is very often accompanied by comorbidities. However patients do not use all possibilities to stabilize their disease. Many articles, literature, statistics, meta-analyses, surveys of current websites and applications for optimizing the dose of insulin and improve the health of the patient have been investigated in order to get the overall overview about the issue. The output from this work gives information for design of an interactive web portal which includes telemonitoring with the prediction of blood glucose and insulin dose optimization.

Keywords

Diabetes, telemonitoring, web portal, application

Sharing Knowledge and Cooperation on Pharmacoeconomical Research Projects in the Hospital Enviroment

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Abstract

Clinicians from various departments work on multiple research projects and often there is a necessary cooperation between various groups of clinicians and researches. Current systems in the hospital do not allow managing research projects or active cooperation on creating guidelines electronically. In this paper, we are presenting an implementation of a wiki-based system which helps researches in collecting data, managing projects and publishing information in regulated environment.

Keywords

Wiki, regulated environment, guidelines
Legal Aspects of Protecting Medical Data by Data Surveillance

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Abstract

For the protection of the medical data and also for the surveillance over their employees the medical facilities might wish to use such tools as a surveillance of data traffic on their networks. Possible implementation of data surveillance however requires balancing of interests of three parties. Firstly, the medical facilities themselves, secondly, their employees, and thirdly, the patients. In relation to the to the workers that are employees of the medical facilities the rules of the Labour Code will apply, for others the Civil Code regulation would apply. The administrative law regulation applies at the same time also, with the Protection of Personal Data Act strengthening position of both employees and patients, while the specific regulation of health records concerns itself mainly with rights of the patients.

Keywords

Data protection, data surveillance, legal framework

Public Health in War and Disaster: Duty of Care and Best Practices in Medicine

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Abstract

Introduction: Conflict, disaster, humanitarian intervention and a global increase in natural resource extraction place an unprecedented burden and strain on best practices and healthcare delivery in remote medicine.

Methods: Qualitative review of healthcare delivery in remote medicine. Fragile nation-states, regional geopolitical, social and political change, healthcare staff migration and ever pervasive private industry impacts on society all contribute to the rising liability of Duty of Care of nation-states in remote healthcare and medicines’ delivery.

Results: The responsibility to protect access to the very basic of healthcare and health security of citizens and employees is of major concern but remains elusive to a core understanding or accepted description for nation-states and private enterprise; duty of care is poorly understood and not uniformly applied across countries.

Discussion: This paper defines duty of care in the remote medical setting, compares the similarities and differences of a responsibility to protect for that of the nation-state and multinational organizations operating globally and finally, attempts to draw very practical applications for remote medical practitioners to ensure best outcomes for patients.

Summary: Duty of Care and responsibility to protect are emerging concepts in medicine that will affect the practitioner, clinician, policy makers and key stakeholders in healthcare; acceptance and understanding will help decision making in the clinical and policy-based space.

Keywords

Health security, war and disaster medicine, development medicine
HL7 EHR System Functional Model Use Case Integration Assessment

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Abstract

Integration platform is a basic technical tool realizing an interoperable Electronic Health Record (EHR). Our goal is to couple the knowledge about interoperability, the functions required for an EHR system and the formalized best practices for an integration platform. Evaluation method has been developed and existence possibility of the expressible dependencies between EHR use cases and logic of integration platform has been tested on the HL7 Functional Model. A dependency has been identified and it is also discussed in this article.

Keywords

Interoperability, electronic health record, healthcare information system, integration platform, integration pattern, HL7 functional model

Attitudes and Experience of Dutch General Practitioners Regarding Computerized Clinical Decision Support

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Abstract

Dutch general practices have a high adoption rate for computerized patient records and clinical decision support. We sought to measure the attitudes and experience of Dutch general practitioners towards clinical decision support. Methods: A preliminary survey was created based on questions from published surveys, modified with the results of interviews. The final web-based survey was administered to 43 general practitioners in a practice area where a decision support implementation is planned. Results: Thirty general practitioners (70%) completed the survey. Most felt that decision support is a good idea (23/30), although fewer reported positive experience with decision support (10/30). Participants were supportive of rules and guidelines, but commonly had the sense that there were too many alerts. Conclusion: Dutch clinicians are positive about decision support, but future efforts should try to reduce the perception of overload, for example by ensuring that alerts are relevant and choosing less interruptive forms of notification for less severe alerts.

Keywords

Decision support, clinician perceptions, implementation

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Abstract

The paper presents the steps followed for creating a complex Obstetrics-Gynecology Department Information System according to Generic Component Model. The developed OGD IS was modeled starting from the Generic Component Model and using for communication the HL7 Clinical Document Architecture and the Continuity of Care Document standards. The evaluation was done using real life data, collected between 2009 and 2010 from Bega Clinic Timisoara. Finally, the interoperability between Obstetrics-Gynecology Department Information System and other medical units was evaluated using 3 metrics. The results were relatively good for the investigated data and structure.

Keywords

Model, obstetrics-gynecology department information system, HL7 CDA, GCM, quality, evaluation


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Abstract

Commonly used survival measures, the leukaemia-free survival and the cumulative incidence, become inappropriate for outcome assessment in patients with chronic myeloid leukaemia as they are unable to cope with multiple disease remissions that can be achieved in time. So, the current survival measures, namely the current cumulative incidence (CCI) of leukaemia-free patients and the current leukaemia-free survival (CLFS), can be used instead to account for multiple relapses and leukemia-free periods during the treatment course. Both measures are available for public use in the currentSurvival package for R.

Keywords

Current survival, CCI, CLFS, chronic myeloid leukaemia
Data and Knowledge in Distributed Medical Applications

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Abstract

Background: Having a software capable to collect, process and diagnose data from the patients in an automatically way, based on information, symptoms and investigations is one of current challenges for researchers and medical science. The purpose of current study is to design a cloud-based medical application to improve patient safety, quality of care and organizational efficiency.

Material and methods: The first step will start from a medical based approach which covers many different diseases to diagnosis, differentiated on most important pathologies. The second step will consist of collecting traditional and new data from patients using online questionnaires. After the patient introduces all the data, the application will formulate a presumptive diagnosis and will direct patients to a list of physicians. A questionnaire will dynamically ask questions about the interface, and functionality improvements. Based on the answers, the functionality of the system and the interface will be improved considering the real needs expressed by the end-users.

Conclusion: The application we propose will involve the computer support in the diagnosis of different diseases and an accurate automatic differential diagnostic system and is intended to be a useful tool for patients, physicians and healthcare providers.

Keywords
Cloud-based application, patients, physicians, healthcare providers, automatic diagnostic system

Introduction to Ontology-Based Knowledge Representation of Data Protocols

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Abstract

In ancient times programmers were pure scientists. To ease the task of programmers, several architecture approaches were introduced on engineering part of their job. Thus programmers now have an easy life just focusing on appointed real world problem. Even with great tools we see lots of IT projects not reaching user satisfaction. This is usually due to misunderstanding user roles, their needs, business logic of the segment etc. – all a real world issues. In general some knowledge and wisdom about real world has probably not been taken or understood. The knowledge can be presented to computers in several ways; we focus on Ontology Based representation of Data Protocols. This will ease implementation of application interfaces as well as data protocol gateways.

Keywords
Ontology, data protocol, DASTA, HL7, knowledge representation
Matching Czech Medical Texts to Codes

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Abstract

Background: Free-form narrative reports include patient’s history, family history, diagnoses, medications and other information concerning patient’s health status. Extracting such information would open it up for other uses like automatic reminders, book-keeping or to prepare short summaries like epSOS PS.

Objective: The aim of this paper is to summarize preliminary results of using statistical methods with expert assistance.

Methods: Expert assistance by a physician, statistical NLP methods.

Conclusions: Expert assistance and assisted learning seems necessary.

Keywords

Narrative reports, NLP, information extraction

Hybrid Architecture for Web-Based Simulators of Human Physiology

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Abstract

This work summarizes technology of web simulators with focus on the simulation performed on server and visualization performed on client. This hybrid architecture allows to perform long term simulation and to run demanding application on the server or remote capacity e.g. within computational grid. Additionally see and control the simulation on mobile devices with limited computation capabilities. The result is a growing set of models of human physiology published as simulation application, especially a large scale physiological model Hummod.

Keywords

Modeling, simulator, human physiology, REST
Simulation Applications in Medical Education

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Abstract

Simulation applications are effective tools in medical education. They can explain the function of individual physiological systems in a very visual and interactive way. Development of simulation applications requires cooperation of many domain experts. Teachers design intended educational scenarios, physiological modellers create simulation models, computer graphic designers designs visual appearance and programmers assemble all components together into one application. Each domain expert has their specific development tools. These tools produce different outputs that are not easily composable into one application. To resolve this problem a special integration tools and frameworks are needed.

Keywords

Education, medicine, physiology, simulation, WEB, domain expert, frameworks, software development
Decision Support and Decision Making Enabled by Personal Portable Devices

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Abstract

This paper offers an introduction to some of the most important technical, semantic, ethical, and privacy-related challenges that may occur when introducing Personal Portable Devices (PPD) to exploit their capability to collect and record personal health data into processes of recommendations, decision support, and decision making in health care and welfare. It addresses aspects such as the Medical Device Directive (MDD), devices that are compliant with MDD, and those that are not. Regardless whether being MDD-compliant or not, each class of devices may have its own benefits and weaknesses in terms of enabling health-related decisions. But it is not only devices that are involved in decision support and decision making – it is the human being, too. This paper addresses the technological aspects and a second paper, also submitted to this conference, addresses the various dimensions of what is usually called the human factor.

Keywords

Personal portable devices, decision support, decision making, EFMI

Human Factors in Design and Development of Personal Portable Devices

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Abstract

This paper is an introduction into some of the most important human factor, ethical, and privacy-related challenges that may occur when introducing Personal Portable Devices (PPD) to exploit their capability to collect and record personal health data for use in processes of recommendations, decision support, and decision making in health care and welfare. It addresses non-technical aspects such as human centered design, motivation of potential users, ethical and legal issues. Regardless whether being MDD-compliant or not, each class of devices may have its own benefits and weaknesses in terms of enabling health-related decisions. This paper complements another technology-based paper that is also submitted to this conference.

Keywords

Personal portable devices, decision support, human factor, EFMI
Possibilities of Personal Health Status Monitoring

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Abstract

The paper deals with possibilities of personal health status monitoring. The overview of basic principles and outline of significant advantages and disadvantages of the methods are presented at the paper. There are a lot of possibilities how to monitor the patient using wireless technologies and how to initialize the appropriate action in the life threatening situations. The main aim of these solutions is to safe the elderly and impaired people in the daily life, and especially, to enable the possibility to stay in their natural environment (home, family, ...) instead of to institutionalize them. Two solutions for monitoring and providing better life are presented in more details.

The specific solution for monitoring vital signs and classifying of urgent states using telemedical system – the Intelligent Primer Nurse application – is presented in detail. The smart system combining the telemedical approach and home TV computer – Home Brain system – is also briefly presented. Finally, the short discussion of possibilities and modern approach is in the conclusion of the paper.

Keywords

Telemonitoring, telemedicine, vital signs monitoring, assistive technologies

AsTeRICS

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Abstract

AsTeRICS - “The Assistive Technology Rapid Integration Construction Set” is a construction set for assistive technologies which can be adapted to the motor abilities of end-users.

AsTeRICS allows access to different devices such as PCs, cell phones and smart home devices, with all of them integrated in a platform adapted as much as possible to each user.

People with motor disabilities in the upper limbs, with no cognitive impairment, no perceptual limitations (neither visual nor auditory) and with basic skills in using technologies such as PCs, cell phones, electronic agendas, etc. have available a flexible and adaptable technology which enables them to access the Human-Machine-Interfaces (HMI) on the standard desktop and beyond.

AsTeRICS provides graphical model design tools, a middleware and hardware support for the creation of tailored AT-solutions involving bioelectric signal acquisition, Brain-/Neural Computer Interfaces, Computer-Vision techniques and standardized actuator and device controls. Novel, end-user ready solutions can be created and adapted via a graphical editor without additional programming efforts. The AsTeRICS open-source framework provides resources for utilization and extension of the system to developers and researchers.

AsTeRICS was developed by the AsTeRICS project [1] and was partially funded by EC.

Keywords

AsTeRICS, AT, assistive technologies, user driven AT, ambient assisted living, motor disability, BCI, brain-computer interface, computer vision, model based design, biosignal acquisition
Dietary Menu Generation Using Harmony Rules in Tele-Care

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Abstract

An important task of personalized lifestyle counseling is dietary menu planning and analysis. The paper describes the architecture and results produced by an automated dietary menu generator MemGene, applied now in a diabetes home monitoring project. Our solution is intended to support, not to substitute the human dietary expert.

Computer-aided menu planning is a traditionally hard problem since it is characterized by i) a very large search space and ii) hard-to-formalize expert dietary knowledge on the harmony assessment of a menu. For the first problem i.e. search satisfying numerical constraints, we apply multi-level, multi-objective genetic algorithms that calculate the fitness of candidate solutions using personalized target values of various nutrients. The objectives for the menu planning process are obtained from personal medical data, entered manually or measured by sensors of the tele-care system. Another source of information is the aim of the patient like “losing weight” and the user’s daily dietary log (essentially a smart phone application) which can be analyzed for food composition and completeness. Then we apply general nutritional guidelines to compute the personalized numerical constraints at different levels. An example constraint is the daily minimum, optimum and maximum value for carbohydrate content.

For the assessment of harmony, we defined dietary concept sets, and use a simple mechanism for enforcing harmony rules over them. The rules are used to score candidate solutions e.g. a daily menu, and the score is combined with the numerical fitness of the solutions at different levels (dish, meal, daily menu). Rules assign a positive or negative score to a co-occurrence pattern of two or more sets. Positive scores mean recommended patterns, like “muesli and any drink for breakfast”; and are used during menu generation, while negative scores mean detrimental combinations, like “beer and water-melon in the same meal”, and are used for the assessment of the user’s log.

The MenuGene system is currently applied in a clinical trial, in which it will support the nutritional logging, analysis and blood sugar management of patients with diabetes.

Keywords

Dietary menu planning, genetic algorithms, nutrition counselling
Prevalence and Characteristics in Coding, Classification and Diagnosis of Diabetes in Primary Care

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Abstract

Introduction: Approximately 366 million people worldwide live with diabetes and this figure is expected to rise. Among the correct diagnosis, there will be errors in the diagnosis, classification and coding, resulting adverse health and financial implications.

Aim: To determine the prevalence and characteristics of diagnostic errors in people with diabetes managed in primary care settings.

Methods: We conducted a cross-sectional study in 9 general practices in Leicester, UK, from May - August 2011, using a validated electronic tool-kit. Searches identified cases with potential errors which were manually checked for accuracy.

Results: There were 54,088 patients and 2,434 (4.5%) diagnosed with diabetes. Out of 316 people identified with potential errors with the toolkit, 180 (57%) had confirmed errors after manually reviewing the records, resulting in an error prevalence of 7.4%. Correctly coded people on registers had significantly greater HbA1c reductions. There were no significant differences between patients with and without errors in their HbA1C, BMI, age and size of practice. There was also no significant association of the errors with pay-for-performance initiatives however those patients not on disease register had worse glycaemic control.

Conclusion: A high prevalence of diabetic diagnostic errors was confirmed using medication, biochemical and demographic data. Larger studies are needed to more accurately assess the scale of this problem. Automation of these processes might be possible, which would allow searches to be even more user friendly.

Keywords

Misdiagnosis, misclassification, miscoding, tool-kit
Pharmacoeconomy of Diabetes Mellitus and its Implications for Organization and Quality of the Care

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Abstract

Organization of the care (orchestration of education, prevention, detection of patients, their treatment, cooperation between primary care physicians, specialists, academic centers, payers and public health authorities) is important factor for success, cost effectiveness and quality of the care for large scale chronic diseases such as diabetes mellitus. Data of General Health Insurance Company and state Institute of Health Information and Statistics show remarkable potential of improvements in organization of care to increase its quality and profit for patients and also potential to control of monies spend for the treatment. 6% increase in real incidence rate of diabetes mellitus patients since 2002 was observed as well as 23% (2003-2009) decrease in mortality rate (50% decrease between 1980 to 2009). Data also show not only higher average expenses for treatment of patients with diabetes mellitus compared to average expenses incurred for treatments of all other diagnoses, but also a crucial relationship of costs with presence or absence of diabetes mellitus complications. It is understood, that compliance of patients to the treatment, improvements in organization of care, state of the art pharmacotherapy can significantly contribute to delay in occurrence and severity of the complications, quality of the life of the patients and control of medical health insurance costs.

Keywords

Diabetes mellitus, pharmacoeconomy, quality of the care, organization of the care

Concept of Knowledge-Based Self-Management Pathways for the Empowerment of Diabetes Patients

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Abstract

The concept of a modular and standards-based patient empowerment framework to support the self-management of diabetes is outlined in this work. Beside an overview of the overall system architecture, the integration approach on a technical and semantical level is shown. Highlighted are the differences of the two pilot applications that will be implemented in Germany and Turkey utilizing the commonly designed core services.

Keywords

Patient empowerment, self-management, pathways, decision support, medical records, diabetes, semantic integration
A Collaborative Approach to Care Coordination

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Abstract

Cost pressures, new payment models, and demographic trends are creating a global economic crisis as health systems struggle to care for an aging population of sicker patients. Funds available for healthcare are constrained, and they’re being wasted by inefficient, uncoordinated healthcare services. Reflecting the importance of collaboration in caring for patients with chronic conditions, nearly 80 percent of the scoring criteria for the National Committee for Quality Assurance’s (NCQA) Recognition Program for Physician Practice Connections (PPC) Patient-Centered Medical Home (PCMH) relate to information sharing and teamwork. New payment models are forcing delivery networks to share the risks and potential cost savings of caring for these patients. By imposing direct or indirect financial consequences, these models incentivize organizations to emphasize prevention, deliver care in the lowest-cost appropriate setting, and reduce readmissions, Emergency Department (ED) visits, acute-care admissions, and bed days of care. Maccabi’s core belief is that all IT investments are business investments that should support strategic priorities and deliver a sustainable advantage to the organization. Among other clinical benefits of collaborative approach to care coordination in Maccabi implementation of Health IT tools supporting care coordination resulted in 13% increase in the number of diabetic patients who had a regular HbA1c and 8% increase in the number of diabetic patients whose HbA1c results indicated that the disease was stable.

Keywords

Care coordination, collaborative approach, payment models

Technologies Supporting Care for Diabetes in Primary Care in the Czech Republic

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Abstract

Introduction: Care for diabetes was till 2009 in Czech Republic concentrated by diabetologists. Starting January 1st, 2010 care for uncomplicated diabetic patients can be provided by G.P.

Aim: To describe technologies used by GPs in diabetes care.

Methods: Two information systems are mostly used in Czech Republic in GP offices- Medicus and PCdoktor. Special modules are use to support the care for diabetic patients. Several devices for testing of blood glucose and Hb A1c are used in the office. These devices can be on line connected to the information systems. The system is used for visit planning in different types of patients, for writing reports and for summarizing data for insurance offices.

Results: Patients and GPs are very satisfied with the organization and technical support of patients care for diabetics. There are especially satisfied with coding for the insurance office. The system is of course criticized by diabetologists who are having less patients. The new organization of care is more complex now including not only HbA1c but also lipid and blood pressure.

Conclusion: Technical support for diabetes care enabled complex care for diabetic patient even in the critical situation when the number of diabetic patients is extremely increasing.

Keywords

Diabetes mellitus, information systems, GP Office
Errors in the Coding of Diabetes in Electronic Records
Implications for Care

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Abstract

\textbf{Introduction:} Errors in the classification and coding of diabetes lead to patients potentially failing to be recalled for treatment, clinicians involved in their care not getting prompt or reminders, and the patients themselves receiving the wrong educational programme, and treatment.

\textbf{Aim:} To describe the process of identify and classification of diagnostic errors in people with diabetes managed in primary care settings.

\textbf{Methods:} We explored the extent to which codes for diabetes in computer systems could be mapped to the WHO classification for diabetes; we next developed a taxonomy of errors: misclassification, miscoding, and misdiagnosis. We developed manual algorithms and machine processable algorithms to sort them. Finally we recognised that needed different types of sort process for more strictly problem orientated medical record (POMR) systems.

\textbf{Results:} We report how many codes commonly used in diabetes can either be directly, possibly, or have no clear mapping with the WHO classification of diabetes. We used hand and automated searches to detect errors in clinical coding and developed self-audit tools that could be used to identify cases with coding errors. We found 40\% and 60\% of these in two separate evaluations to be clinically significant. Finally, we have demonstrated different search strategies are needed for POMR systems compared with those which are episode orientated as the former have less coding variation.

\textbf{Conclusion:} Coding errors in diabetes, and other conditions, are clinically significant and informaticians could take a major role in correcting them.

\textbf{Keywords}\n
Diabetes mellitus, medical record systems, computerized