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Poster



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RADIOMIC FEATURES ANALYSIS IN PET IMAGES FOR HEAD AND NECK CANCER

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Positron emission tomography (PET) image has been used routinely in oncology for tumor diagnosis, staging and assessment of treatment response. However, the information extracted from image-based features for diagnosis is still under development during the past decade. In recent years, radiomics texture analysis has been used in medical imaging to obtain quantitative data through automated and reproducible analysis, reflecting the characteristics of the tumor, providing additional clinical diagnostic information. In this study, we analyzed 80 head and neck cancer and extracted image features from four metabolic volumes (MTV2.5, MTV3.0, MTV40% and MTV50%) of PET images. The features include shapes, intensity-based, grey level co-occurrence, size zone, length, neighborhood grey-tone difference etc.. ANOVA and Kruskal-Wallis test was used to assess the differences of image texture features in different groups of patients. Receiver-operating characteristic analysis was used to find out the optimal cutoff point of overall survival (OS) and primary, relapse free survival (PRFS) with different image features. The results showed that 16 image texture features had significant differences in early tumor stage (T1, T2) and lately tumor stage (T3, T4). We found 5 and 2 image textural features had ability to predict the tumor response and recurrence, respectively. The histogram entropy is the one predictor of OS and PRFS of head and neck cancer patients. We found that image textural features provide predictive and prognostic information on tumor staging, tumor response, recurrence, and can be a prognosticator for OS and PRFS in head and neck cancer in PET images.

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COPING WITH NEW TECHNOLOGIES FOR INTEGRATED ASSISTANCE: EVALUATION OF THE ADHERENCE TO THE BEYONDSYLOS PROJECT

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The project “Beyond Silos”, launched in 2014, and expected to run until January 2017 involves several European countries, among which there is Bulgaria. The project is aimed at spreading ICT-enabled, health and social care for older people by developing integrated services, such as Telecare and telehealth, household support, etc. However, the array of health, social care and housing services and their procedures can be confusing particularly for elderly people. Individuals who agreed to join the project may refuse to continue to follow it: consequently, loss of adherence could increase their situation of frailty. In Bulgaria, 118 individuals, signaled by social services and their GPs, were suitable for inclusion in the project. After two months, 18 patients showed a low compliance and decided to leave the assistance program. Among the reasons to justify their decision, together with the aggravation of disease, there was the difficulty to cope with the technology. This brief communication examines the reasons for reduced adherence: information has been collected through questionnaires directed to patients and their carers. The results of the analysis may help in developing an effective model of integrated care.

Biography

Slaveyko Djambazov graduated medicine (2001), healthcare management (2007) and MBA (2010). He has been a serial entrepreneur for the last 16 years and has been teaching and doing research and publishing in the field of health economics and health technology assessment for the last 6 years.

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Accepted Abstracts



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ACCURACY OF DIAGNOSIS AND TREATMENT PLANS IN TELEDERMATOLOGY: A PILOT STUDY

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Limited mobility, high costs of transportation and specialized care, make it very difficult to get specialized care services for the elderly, especially those living in nursing homes, particularly in the field of skin diseases. In this study, we evaluate the accuracy of diagnostic and treatment plan in teledermatology compared to in-person examination. The population of this quasi-experimental study, consisted of 280 elderly people living in Kahrizak Charity Foundation in Tehran. The exclusion criteria included: emergency skin conditions and genital skin lesions. All participants should have signed a consent form. No sampling was done since there were few qualified individuals ($n = 46$) finally, 37 patients participated in the study. In order to calculate the accuracy of diagnosis and treatment planning, simple statistical methods were used. The participants with skin diseases, consisted of 37 elderly patients (aged 62 to 89), 22 of whom were men. The accuracy of diagnosis and treatment planning for patients provided by teledermatology compared to those of in-person examination were, 86% and 84%, respectively. The result shows that teledermatology can be considered as a solution to overcome these barriers and improve access to specialized skin care services and the elderly can benefit from teledermatology in nursing homes and have better access to specialized services and avoid unnecessary trips to dermatology clinics.

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APPLICATIONS OF ARTIFICIAL NEURAL NETWORKS FOR MEDICAL DIAGNOSTICS AND PROGNOSTICS

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In the medical field, diagnostic and prognostic remain the most important step to identify disease type and thereby define the adequate treatment before reaching catastrophic and fatal states. However, clinical symptoms and syndromes are not sufficient to detect some diseases. Consequently, the definition of new advanced techniques for medical diagnostics and prognostics are becoming of great interest to assist specialists in clinical researches and hence to ensure safety for millions of people. Artificial neural networks (ANNs) are inspired by the way that the brain performs computations: they are classified as one of the best and most used soft computing techniques. In this context, two innovative methods for early-stage Alzheimer's disease diagnosis and blood glucose level prediction of Type 1 diabetes prediction and other cancer image analysis will be presented, as well as the result interpretation and some case studies. The aim of this work is to show the great assistance provided by these advanced techniques to the medical staff where the big data are processed through a trained ANNs leading accurate statistics leading suitable diagnostic decision making.

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TMJSIM - AID SIMULATOR AT DIAGNOSIS, PRE-SURGICAL PLANNING AND MONITORING OF BUCOMAXILOFACIAL TREATMENT

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Medical simulators have been helping to teach therapeutic and diagnostic procedures as well as the representation of medical concepts and in the process of decision of health professionals. Use of jaw motion simulators in dentistry, education, orthodontic adjustment of occlusions, or in the pre-operative planning of craniofacial surgery can be extremely useful, improving diagnosis and postoperative treatment. This article presents TMJsim, a simulator of mandibular motion constructed from real data coming from Computed Tomography and Magnetic Resonance images. A virtual joint model which composes the simulator receives points captured from the lower incisor point motion. Contribution of each muscle in temporomandibular movement is approached from the Hill actuators model and the concept of curves of insertion. Virtual Articulator is replacing mechanical articulators currently used with many advantages: more accurate simulation of motion, inclusion of new parameters such as muscle strength and it shows graphics for motion curve analysis.

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MEDICAL INFORMATICS IN THE ERA OF TRENDY DATA DISCIPLINES

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Historically, medical/health informatics have emerged from the desire to use digital resources in order to make healthcare systems more efficient and to make improvements to the health of individuals and of the population. Many industries, including health, have seen huge increases in the volume and variety of data available to them in recent years. In response, new disciplines have arisen to take full advantage of these new data resources. While there is a partial overlap between the scope of medical informatics and trendy disciplines such as big data, data mining, data science, and machine learning, it is natural to ask where medical informatics stands in this era. In this talk, we review the distinctive roles that each data discipline has played in current accomplishments in medical informatics. As the increase in magnitude and richness of health data often translates to evolving needs, we discuss the need to develop smarter tools that make full use of the health-related data. We also outline what the next chapter of innovations should contain for data disciplines to thrive as medical informatics application domain grows.

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REVIEW OF INTENSITY-BASED AND GEOMETRY-BASED REGISTRATION TECHNIQUES, APPLIED ON 3D CONE-BEAM CT DATA

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In numerous medical applications, precise spatial alignment of Computed Tomography (CT) images is a strong requirement. Alignment is achieved by applying digital image processing techniques known as image registration. Typically, registration considers the intensities or color of all data points (image pixels), thus dramatically increasing processing time, especially in large data sets, such as CT volumes. Alternative approaches consider only a selected set of key-points from the examined data sets. Those key-points can be fully described using various geometrical characteristics, instead of their color information, thus forming unique geometrical descriptors. The geometrical descriptors can be used for allocating corresponding points between two compared data sets, which in turn can be used for aligning them. This study focuses on the comparison of several geometry-based, descriptor-oriented registration techniques, as well as conventional, exhaustive, intensity-based methods for aligning three-dimensional (3D) Cone-beam CT (CBCT) data pairs. Specifically, three general image registration frameworks were examined: (a) a geometry-based methodology featuring three distinct geometrical descriptors, (b) an intensity-based methodology using three different similarity metrics and (c) the Iterative Closest Point algorithm. All methodologies and their derivatives were applied for a total of thirty 3D CBCT data pairs with both known and unknown initial spatial differences. The results were assessed both qualitatively and quantitatively and it was concluded that the featured geometry-based registration framework performed similarly to the examined exhaustive registration techniques, by achieving significantly improved processing time.

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KNOWLEDGE ENGINEERING PARADIGMS IN THE INTELLIGENT MEDICAL KNOWLEDGE-BASED SYSTEMS

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Knowledge engineering paradigms (KEPs) deal with the development of intelligent systems in which reasoning and knowledge play a pivotal role. On the other side intelligent health Informatics and medical knowledge-based systems is an important area that is at the intersection of artificial intelligence (AI), information science, computer science, data science, social science, behavioral science, life sciences and health care. In this paper, we focus our discussion around some of KEPs for developing the intelligent ehealth and medical knowledge-based systems. In addition, the paper presents some examples of the developed systems by the author and his colleagues at Artificial intelligence and Knowledge Engineering Research Labs, Ain Shams University, Cairo, Egypt.

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EFFECTIVE FACTORS IN ACCEPTANCE OF SMART PHONES BY PHYSICIANS: APPLICATION OF STRUCTURAL EQUATION MODELING IN THE LARGEST UNIVERSITY IN THE SOUTH OF IRAN

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The present study aimed to determine the attitudes towards and effective factors in acceptance of smart phones by physicians of Shiraz University of Medical Sciences, the largest University of Medical Sciences in the south of Iran. This cross-sectional study was performed using Structural Equation Modeling (SEM) in 2015. The study participants included 200 physicians working in the hospitals of Shiraz University of Medical Sciences selected through two-stage stratified sampling, but 185 participants completed the study. The study data were collected using a researcher-made questionnaire completed through a 5-point Likert scale. The validity of the questionnaire was confirmed by a panel of experts, its construct validity of confirmatory factor analysis, and its reliability by Cronbach's alpha of 0.802. All data analyses were performed using SPSS (version 22) and LISREL (version 8.8) software programs. The results showed that most of the physicians had a desirable attitude towards using smart phones. Besides, the results of SEM indicated a significant relationship between attitude and compatibility, observability, personal experience, Optional use, and perceived usefulness. Moreover, some important fitness indices revealed appropriate fitness of the study model ($p=0.26$, $X^2/df=1.35$, $RMR=0.070$, $GFI=0.77$, $AGFI=0.71$, $NNFI=0.93$, $CFI=0.94$). Thus, compatibility, observability, personal experience, Optional use, and perceived usefulness were effective in the physician's attitude towards using smart phones. By preparation of the required infrastructures, policymakers in the field of health technology can enhance the utilization of smart phones in hospitals.

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SPECTROPHOTOMETRIC DATA IN THE INTERACTIONS BETWEEN HUMAN IMMUNODEFICIENCY VIRUS (HIV) AND BLOOD CELLS TREATED WITH ANTIRETROVIRAL DRUGS

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A synergy between engineers and biological researchers may obviously be needed so as to achieve a more reliable research result. The spectrophotometric data on the interactions between the Human immunodeficiency virus (HIV) and blood cells treated with antiretroviral drug were collected to be used to show the effects of antiretroviral drugs on the absorbent characteristics of HIV infected and uninfected blood. The methodology involved the serial dilution of the five different antiretroviral drugs (two HAART/FDC and three single drugs) and the subsequent incubation with the blood samples collected from ten HIV infected persons that had not yet commenced treatment with the antiretroviral drugs, ten HIV infected persons that had already commenced treatment with the antiretroviral drugs and ten HIV negative persons, for the absorbance measurements using a digital Ultraviolet Visible MetaSpecAE1405031Pro Spectrophotometer. The peak absorbance data for various interacting systems were measured. These were used to show that the antiretroviral drug has the effect of increasing the peak absorbance values of both the infected and uninfected blood components, i.e., the drugs are made able to increase the light absorption capacity of the blood cells. The use of the findings of this work in drug design by pharmaceutical industries may be expected to yield good results.

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GLOBAL E-HEALTH FOR COLLABORATIONS IN BIOINFORMATICS: NEW MODELS FOR ELECTRONIC HEALTHCARE DELIVERY AND NEW COLLABORATION PLATFORMS FOR GLOBAL BIOMEDICAL RESEARCH

Yuri Quintana*

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Changes in global disease trends and demographics are creating unprecedented challenges to the delivery of health care and biomedical research worldwide. New technologies have allowed us to collect large amounts of data, but making that information useful for clinical care and global research remains a challenge. This talk will present some innovations in big-data translational platforms for biomedical research. Opportunities for the use of mobile health apps, wearable technologies, and big data applications will be discussed. New e-health systems will be discussed for connecting patients, families and professionals in the areas of maternal health care, senior care, and oncology. Challenges in establishing e-health networks in developed and developing countries will be examined.

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ECARE: NEW MODELS FOR HEALTH SERVICES AND COLLABORATION AMONG PATIENTS, FAMILIES AND PROFESSIONALS

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People-centered health care focuses on seeking an active role for the patient and also to strengthen all other members of the health team, including families. By promoting greater opportunity for patients, it is possible to have better health outcomes, quality of life, and optimal return on investment in the health system. To carry out this new model, we need not only new technologies but also a change in the way the way we communicate and collaborate with patients and families. This talk will present some innovations and electronic health systems to connect patients, families and professionals. The talk will describe an e-health system for maternal health and pediatrics. A description will be provided by a system called InfoSAGE that provides education and communication for coordinated care for the elderly in assisted living homes. Opportunities for the use of mobile health applications, portable diagnostic technologies, and big data applications will be discussed. The challenges to establishing people-centered e-health systems will be discussed.

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NATIONAL HEALTHCARE SAFETY NETWORK (NHSN) – INFORMATICS SOLUTION FOR HOSPITAL-ACQUIRED INFECTIONS

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As Program Manager for the Centers for Disease Control and Prevention (CDC) for surveillance applications to include the following: BioSense –syndromic surveillance of the; FluTool –surveillance application used by CDC to report weekly incidence of flu in the Morbidity and Mortality Weekly Report (MMWR); PHIN Vocabulary Access and Distribution System (VADS) – standardized vocabularies to Public Health partners; PHIN Messaging (MS) – standard secure messages HL-7 transport; National Healthcare, Safety Network (NHSN) – healthcare-associated infection tracking; and International Healthcare Safety Network (IHSN) – healthcare associated infection tracking to the Ministry of National Guard Health Affairs. In 2011, as project manager for the Ministry of Health, Kingdom of Saudi Arabia managed Public Health Informatics; infectious disease surveillance; infection control and implementation of surveillance/informatics requirements for the National Laboratory. While many health care informatics applications are superior in their use of scientific and epidemiological properties, they don't gather sufficient data on infectious/chronic diseases and HAIs in the local environment. Many in health care advocate top-down approaches to gaining this information But, instead of fixing problems in data validation and costs, focus has changed from data gathering technique improvement to accreditation and training in the hopes of improvement of healthcare related outcomes. Using mobile technology, the approach necessary especially for the Middle East and North Africa (MENA) towards this problem is to utilize methods and protocols already in place; automate local processes to roll up locally, regionally and nationally and to expand on these local informatics solutions to eventual input to centralized systems (i.e., Big Data). One such system is the National Healthcare Safety Network (NHSN) implemented for the Ministry of Health, Kingdom of Saudi Arabia. This presentation will be both a justification and a demonstration as to how and why this system works.

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AUGMENTED REALITY AND HOSPITALIZED NEWBORN SAFETY

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At the hospital care of a newborn, the iatrogenic risk may be related to the specific side effects of drugs, but also to errors during preparation (dilution error, calculation error, error due to a combination of two incompatible products from a physico-chemical point of view) and/or during the administration of products (dose error, administration of a non-prescription medication) committed by the nursing staff. These errors are common and constitute a real concern of medical teams. The steps of preparation and drug administration are particularly at risk. The majority of administration errors is related to the human factor¹. They are associated with increased stress among nurses. These errors can have consequences for the patient, professionals, health institutions and health insurance. Many studies have proposed and evaluated measures to limit the occurrence of these errors. The research is now shifting focus towards multimodal approaches integrating traceability of operations². However, these measures struggle to be integrated into daily clinical practice. Hence, the introduction of new technologies in the health care system must be considered. To avoid these errors, we propose to design and develop an innovative decision support system based on the technology of Augmented Reality, built into intelligent glasses freeing the user's hands. This system ensures traceability, usability, dynamism, security and transparency for better management of patient medical care. The application implemented on the augmented reality glasses have been tested by 7 nurses. Most of them estimate that the glasses enable them to gain time and to reduce the mistakes while preparing drugs.

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ANTIBIOTIC STEWARDSHIP OPERATIONALIZED: EMR-FACILITATED IV TO PO CONVERSIONS

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Background: Antibiotic Stewardship is a crucial imperative, yet all-too-often elusive to operationalize. Intravenous (IV) therapy for hospitalized patients is common practice, particularly for patients sufficiently ill to require hospitalization. However, medications providing oral (PO) bioavailability alternatives allow for therapeutic IV to PO conversions for reduce cost-per-case and length of stay (LOS), and improved stewardship. Evidence shows that appropriate conversions from IV to PO have decreased LOS by 1.53 days with average medication-related cost-per-case \$15,149 savings.

Methods: Physicians, pharmacists and IT-professionals teamed to define bioavailability alternative antibiotics appropriate for IV to PO conversions, and then designed optimal within-EMR computations triggering alerts recommending conversions. Pharmaceutically-pertinent guidance indicated 12 appropriate antibiotics. Pre-versus-post prospective study of patterns contrasted a 12-month baseline versus month-to-month post-implementation.

Results: Post-implementation from baseline 85%-to-15% IV-versus-PO mix (all $p < 0.001$):

- 68%-to-32% mix within 4 months, sustained for 6 additional
- 11.4% decreased IV-associated infections
- 36.8% decreased LOS due to earlier discharges with PO management.
- 6.8% lower cost-per-case, with 14.1% less IV costs, 42.5% more in PO costs.
- Thus \$3,300 lower cost-per-antibiotic-case per discharge.

Conclusions: Antibiotic stewardship, and other medication-related undertakings, can be made more tangible and manageably operationalized through EMR-enabled strategies like IV to PO conversions. A 6.8% reduced cost-per-case totaled over \$30,000 in the first 4 months in this organization. Shortened loss also mean improved facility capacity without bricks-and-mortar, and sooner patient capability for self-management.

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ELECTRONIC PATIENT RECORD (EPR) SYSTEM IN SOUTH AFRICA: RESULTS OF A PILOT STUDY

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Patient health records contain sensitive information for which an electronic patient record (EPR) system can safely secure and transmit amongst clinicians for use in improving health delivery. Clinician's use behaviour of these systems is under scrutiny to assess their attributes towards health technology. South Africa (SA) clinicians responded to a pilot study survey to assess their understanding of EPR, what attributes are important towards technology use and more importantly streamlining the survey for a larger study. Descriptive statistics using mean scores were used because of the small sample size of 11 clinicians who completed the survey. Nine (9) constructs comprising 62 items were used and a Cronbach alpha score of 0.883 was obtained. Limitations and discussions conclude the study.

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META-ANALYSIS OF CONTINUOUS IMPROVEMENT EFFICACY: VERSUS PAPER AND COMPARATIVE EMRS

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Introduction: Since the IOM's "To Err Is Human", and other indicting publications, continuous improvement methodologies have become commonplace throughout healthcare. Quantified successes include improvements in clinical outcomes, efficiency, satisfactions and cost-per-case. Also noteworthy, proliferation near-ubiquity of EMRs, promising improved outcomes beyond code-capture and info-storage alone. However, all EMR vendors have not provided rigorous proof of EMRs enabling impactful continuous improvement beyond paper-alone, or comparatively versus other EMR designs. Are there EMR characteristics for comparatively greater continuous improvement capabilities?

Methods: Meta-analysis included 16 matched organisations: Four for three contrasting EMR designs/approaches, four paper-based non-EMR. Data included 6-month pre-EMR baselines versus 24-month post-implementation. All organizations leveraged interchangeable high-value methodologies (6-Sigma, Lean). Catheter associated urinary tract infections (CAUTIs) represented the only undertaking universal in the 16. One statistician with SPSS and SAS did all analyses.

Results & Interpretations:

Comparative gains versus baselines (each $p < 0.001$):

- Non-EMR achieved 5.3% improvement by 6-months, 8.2% by 24.
- Compliance-focused, non-programmable EMRs: 4.9% 6-months, 29.1% 24, plateauing by 20-months.
- Somewhat-programmable EMRs: 17.2% 6-months, 56.4% 24, no plateauing.
- Locally programmable/adaptable EMR: 29% 6-months, 87.2% 24, no limitations for improvement thereafter: no plateauing.

Conclusions & Discussion: EMRs are superior to paper-based alone for continuous improvement. EMR characteristics determine the magnitude and speed of continuous improvement, as well as apparent long term limitations (i.e. plateauing). Some EMRs resulted in 10-times the improvement versus other EMRs, and never plateaued. Key EMR characteristics determine efficacy and magnitude of continuous improvements. Review of those characteristics is crucial to considering optimal design and capabilities for healthcare organizations.

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XACML-BASED SECURITY DESIGN PATTERNS FOR CLINICAL RESEARCH

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As web-based applications and services grow in size and complexity, traditional access control solutions based on the preliminary identification of users become inadequate for enforcing access control. This is the case in a clinical research environment where web service applications are often distributed and contain sensitive information. The increasing challenges to achieve specific information security goal such as fine-grained authorisation, confidentiality, integrity and non-repudiation may result in security vulnerabilities if not addressed. However, by applying best practice solutions, we demonstrate the use of security design patterns to describe reusable solutions to recurring security issues in clinical research. In this paper, we focus on the composition of clinical access control policies to enhance the authorisation flow of the AndroPhenome project at the University of Birmingham. The work exploits the extensible Access Control Markup Language (XACML) syntax to define the clinical security policies. To eliminate or mitigate the consequences of security vulnerabilities associated with access control, the constructs of the XACML policy elements including combining algorithms and obligations are used to deliver specific security features through a policy enforcement point (PEP) and policy decision point (PDP).

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DYNAMIC FUNCTIONAL CONNECTIVITY BASED CLASSIFICATION OF PARTICIPANTS FROM FUNCTIONAL MRI DATA

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A dynamic sliding-window-based method, named dynamic functional connectivity (DFC), which assesses temporal dynamics of functional connectivity among different brain networks, was recently developed and it has gained attention (Sakoglu et al, MAGMA Journal, 2010). DFC provides more information than the static FC method and DFC-based features can lead to better classification of brain diseases or conditions when compared with static FC-based features. The method can be applied to FMRI time courses of a voxel or a region-of-interest, as well as it can be combined with powerful data-driven techniques such as independent component analysis (ICA). In this talk, analysis and classification results from FMRI data on addiction, based on DFC features, will be presented.

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A CLINICAL DECISION SUPPORT PLATFORM BASED ON ONTOLOGIES AND CASE-BASED REASONING FOR ANTIBIOTICS PRESCRIPTION IMPLEMENTED BY A MULTI-AGENT SYSTEM

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This study describes the construction and optimizes the sensitivity specificity of a decision support (DS) platform for identifying a potential infectious disease, according to a patient's self-description of their disease state. A pilot domain ontology was constructed that pertain to clinical stages and their corresponding information components. The DS platform cooperates with ontology to use an estimate of the likelihood of achieving maximum benefit in each disease case to form empirical therapy recommendations and data on the sensitivity of the disease organism to antibiotics. If the disease severity is not too high, the DS platform screens for an appropriate therapy and proposes an antibiotic therapy specifically adapted to the patient, taking into account the indications, contraindications, side-effects, drug-drug interactions between proposed therapy and already prescribed medication and the route of administration of the therapy. Aiming to avoid drug-use risks as much as possible and screening for some antibiotic application protocols that are not in accordance with current medical theory, the DS platform uses case-based reasoning (CBR) to search for similar medical cases within the database and presents the references to the patient as justifiable evidence. The proposed DS platform supports NLP queries. Patients can obtain therapy suggestions by inquiring about a current clinical case. By combining a DS platform based on the therapeutic knowledge base, a diagnostic model of infectious disease, and a CBR approach via subtractive design, and also avoiding drug-use risks as much as possible, categorization of possible infectious disease diagnoses are suggested.

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