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CITS 19

The 2019 International Conference on Computational Intelligence, Information Technology and Systems Research

Lublin University of Technology

June 13-15, 2019

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Abstracts

Characterizing Twitter Users in Stance Detection Systems: the Case of the Vaccination Topic in Italy

13 June
9:00 am

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Nowadays Twitter, as one of the most popular social media, represents a valuable source of information about the users' opinion towards social and political issues. The development of a protocol for mining useful information from data available on the social platform may increase the reliability of monitoring systems in charge of tracking the public opinion, and make them smart and low-cost alternatives to traditional polling and survey techniques.

In this work, we focus on monitoring the stance towards the vaccination topic in Italy. Specifically, we rely on a collected dataset of tweets regarding the vaccination topic in Italy, containing information about each tweet and its author, along with a label indicating positive, negative or neutral opinions towards the topic. The labels have been estimated with an ad-hoc stance classification model, embedded into an intelligent system for stance detection.

Our previous analysis considered the overall volume of tweets, but did not take into account the diversity of users' behavior. In order to have a sharper picture of the public opinion expressed on the social media, we shift the focus of our analysis onto users. We first tell apart verified and unverified users, assuming that the first group contains accounts of public interest while the second is better representative of the general public. Then, a preliminary statistical analysis help us characterize the trend of the target topic over time, and the prevailing opinion in different regions of the country.

This work represents a first step towards an intelligent system for a fine-grained analysis of public opinion from Twitter data. With regard to the vaccination topic, monitoring the community opinion may be of primary importance for Public Healthcare Organizations in order to promote awareness campaigns and proper countermeasures aimed at fighting outbreaks of eradicated diseases.

AI at Dawn - Opportunities and Challenges

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Since the concept of Turing machine has been first proposed in 1936, the capability of machines to perform intelligent tasks went on growing exponentially. Artificial Intelligence (AI), as an essential accelerator, pursues the target of making machines as intelligent as human beings. It has already reformed how we live, work, learning, discover and communicate. In this talk, I will review our recent progress on AI by introducing some representative advancements from algorithms to applications, and illustrate the stairs for its realization from perceiving to learning, reasoning and behaving. To push AI from the narrow to the general, many challenges lie ahead. I will bring some examples out into the open, and shed lights on our future target. Today, we teach machines how to be intelligent as ourselves. Tomorrow, they will be our partners to step into our daily life.

Database Queries with Fuzzy Linguistic Quantifiers: Dealing with Data Quality Using the OWA (Ordered Weighted Averaging) Operators

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We discuss database queries with fuzzy linguistic quantifiers, exemplified by „find all records satisfying most of important conditions on attributes" originally introduced by Kacprzyk and Ziółkowski (1986), and Kacprzyk, Ziółkowski and Zadrożny (1989). We assume that the fuzzy linguistic quantifier driven aggregation of partial satisfactions proceeds by using the OWA (ordered weighted averaging) operators. We further develop a new approach by Kacprzyk and Zadrożny (2015) for taking into data of various quality (in a general sense, for instance veracity) by using some calculus of the OWA operators with an additional weighting vector. More specifically, we present a further extension of the above mentioned aggregation with the OWAs with additional weights for dealing with data quality by employing a richer class of operators exemplified by the induced OWAs, the generalized OWAs, the probabilistic OWAs, the distance based OWAs, etc. Moreover, we indicate that this approach can also be used for the so called compound bipolar queries, introduced by Kacprzyk and Zadrożny (2013), which combine the bipolar queries and queries with linguistic quantifiers.

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Procedures for Outliers Detection, Clustering, and Classification Based on Nonparametric Methodology

13 June
11:30 am

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In the practice of data analysis some problems for many-sided research are caused by the methodological variety of specific algorithms, often leading to laborious interpretations and time-consuming studies. This paper presents the concept of methodically unified procedures, based on kernel estimators, for three fundamental

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tasks: outlier detection, clustering, and classification. Their clear interpretation facilitates the applications and potential individual modifications. The investigated procedures are distribution-free, enabling analysis and exploration of data with any distributions, also when elements are grouped in several separated parts. The results obtained depend not only on the values of particular attributes, but above all on the complex relationships between them. The material constitutes the summary of the investigations described in the publications [1-6].

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Contributing to Spatial Planning and Policy Debates Through the Reverse Clustering Approach

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Poland features three-tier administrative system (provinces, counties, municipalities) with a developed self-governmental structure, reaching from the bottom up to the provincial level, where it coexists with the central administration. The relatively complex resulting setting entails a number of issues to be resolved regarding policy or structures, or both. A particular case is constituted by the effective management and planning for the metropolitan areas. There are a dozen or so such areas in Poland, where a single urban unit, being the formal town, is surrounded by the units that are often formally rural, but, in fact, constitute the suburbs or otherwise

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belong to the functional urban zone. This gives rise to the concepts of bringing the respective units together under a joint management and/or planning scheme, or of changing appropriately the boundaries of the units involved. Some of such concepts lead to lively debates and controversies.

The paper shows the application of the reverse clustering approach to this kind of debate. The reverse clustering consists in finding, for a given set of objects (units), indexed I, $I \in I = 1, \ldots, n$, the data set, describing them, $X = \{x_i\}$, $I = 1, \ldots, n$, and a partition of the set of units, P_A, such a partition, produced on the basis of X by some clustering procedure, P_B, that is possibly the closest to P_A.

In the case here considered the units are municipalities, described by a set of characteristics that refer to their socio-economic and resource aspects (including those that define their place along the urban-rural axis). The initial partition, P_A, is given by either the formal assignment of the municipalities to the three categories, "urban", "rural" and "urban-rural" (the latter being formed mostly by a very small town, surrounded by a rural municipality), or by some planning-related concepts of classifying the units for definite policy or strategic purposes (or for outright change of unit boundaries, including mergers).

The partitions P_B, obtained from the reverse clustering, while being possibly similar to P_A, may indicate the divergent instances, which call for attention, or the alternative aspects of the partitions sought. A couple of concrete illustrations are provided along with interpretations, pertaining to the essential socio-economic aspects of the situations considered.

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On the Convergence of the Method of Alternating Projections for Multivariate Symmetric Eigenvalue Problem

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The method of alternating projections for multivariate symmetric eigenvalue problem relies on the solution of some small inhomogeneous symmetric problems at every iteration. The rate of local convergence for the maximum solution of the problem is analyzed. The method is quadraticly convergent on some linear subspace Q and is sublinearly convergent on the compliment of this subspace. Since the solution of the problem belongs to the subspace Q the practical convergence of the method is superlinear. Numerical experiments indicate practical usefulness of the method. The choice of the starting point has minimal influence on the number of iterations.

A Study of Graphical Approaches to Fuzzy Analytic Hierarchy Process

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Saaty's Analytic Hierarchy Process (AHP) is widely used in many decision-making problems such as a choice of alternatives, prioritization, or ranking. Despite being a valuable tool based on pairwise comparisons of a set of alternatives, the method is strongly connected with a numeric or linguistic descriptors of the preferences. This could form a limitation for the users who do not feel comfortable with numbers or words strictly related with the articulation of the meaning of preference, i.e., with a predefined scale. Therefore, in this study, we develop an AHP approach based on a simple graphic interface. The results and their consistency as well as stability of the method are examined. Moreover, we look at the specificity of the method when experts do not provide answers to all questions. Finally, we analyze four variants of non-linear transforms which are used to minimize the inconsistency ratio of the AHP process.

The Concept of a Supply Chain Management System Using Intermodal Transport: A Case Study

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In this paper we present an outline of the supply chain management model using intermodal transport. The starting point is cooperation with a large logistics company using various forms of transport. The work presents assumptions of the model, which, thanks to the use of real data from the transport management systems used by the company so far, will be able to use a wide range of factors affecting the cost and transport time. The aim of the planned model is the optimization of costs and transport time as well as reducing the impact on the natural environment.

A Neuro-Fuzzy Framework for Spam Filtering: A Basic Concept and Preliminary Experiments

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In this study, we propose a neuro-fuzzy framework for spam filtering. Since spammers are introducing more and more sophisticated methods, we must improve anti-spam techniques continually. Relations amongst fea- tures indicating spam may be nonlinear as well as boundaries between spam and regular emails could be blurry. Therefore, we propose the concept of a complex neuro-fuzzy system for spam filtering, in which a neural part models nonlinearity of features, and a fuzzy part models un- certain boundary between spam and regular emails. The simplified ap- plication of this idea is validated in an empirical case study. The novelty of this study relies on incorporating techniques modelling nonlinearity and uncertainty in one framework for spam filtering.

Virtual Reality for Cross-Cultural Education – A Case Study

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In the modern world, through the intensification of migration phenomena related to economic factors, security and education, we are dealing with the development of multicultural and multinational environments. In such societies, cross-cultural competence turn out to be very useful. A better understanding of foreign culture enables faster assimilation in business structures as well as during tourist stays. Researchers are still looking for ways to improve education in this area. The authors describe the idea of using virtual reality technologies for this purpose. In their opinion, the immersive nature of this technology can be used to strengthen the educational process.

The article describes the process of creating a virtual reality cultural game. The authors also present the results of pilot studies, conducted on a group of students of different nationalities: Poles, Turks, Georgians, Slovenians, Slovak, and Ukrainians.

Analysis of Human Brain Responses to Visual and Audio Stimuli Based on EEG Evoked Potentials

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The aim of the paper is to perform comparative analysis of the human responses to visual and auditory stimuli. The human brain response latencies were measured and compared. The analysis was based on nineteen EEG electrodes. The presented case study is a preliminary study conducted to assess the measurement and analysis procedure, perform a preliminary selection of parameters and verify the hardware configuration. The paper verifies the hypothesis that the human response to visual stimuli is faster than to audio stimuli.

The experiment was divided into two parts examining, correspondingly, the reaction to two types of stimuli: visual and auditory. The tool, called PsyTask was used in the experiment. Both parts included the following stages: pictorial description of the task to be solved by an examined person and the sequence of unordered trials. As for visual part, a single trial included the demonstration of white background with one of five birds, whereas a single trial of the auditory part contained a record of separate birdsong. The number of trials was set to 828 repetitions for both parts. As for the first part, the break between the trials was 100 ms long, while for the second part the break was 1000 ms long. The trials were assessed in accordance with Go/Nogo paradigm.

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Regarding the first part of the experiment, the following situation was concerned as a Go trial: the examined person clicked a left mouse button after the recognition of an owl in the presented picture, whereas a trial was considered as Nogo in case when the examined person did not click the left mouse button upon recognition of the demonstrated picture or when the left mouse button was clicked after false recognition.

During the data acquisition it was observed that multiple factors, e.g. eye-blinking, eyeball movement, etc., can cause artefacts in the EEG record. As the result of the experiment, the numbers of correct and false reactions to stimuli were collected, the reaction times were measured as well. Another result was the observation that the said stimuli caused the activation of occipital and parietal lobes. The answer for the question placed in the abstract was obtained: shorter reaction times correspond to visual stimuli.

Digital Reproduction of the 3D Geometry of a Pitcher from Afrasiab

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The availability of 3D scanning devices allows to perform the process of digitising a growing number of diverse museum artefacts. After properly conducted processing of the acquired point cloud, we get a photorealistic digital copy that can be presented in many ways. With regard to objects from archaeological excavations, the vast majority are artefacts that are more or less damaged or only partially preserved. Their state of preservation, specialised archaeological knowledge and the use of appropriate computer 3D technologies allow their complete digital reconstruction.

The present work concerns the development of alternative methods and algorithms of conduct, the selection of programs and tools to recreate the surface of the outer and inner side wall and the bottom of a 12th century pitcher from the Afrasiab excavations in Uzbekistan.

Chest X-Ray Watermarking Based on Automatic ROI Detection

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Medical images carry crucial information for diagnosis and future treatment. Because of this, it is essential to ensure their high quality and authenticity. This makes it impossible to interfere with medically important data by compression or watermarking. Medically important data are a part of the image that is important from the diagnostic point of view. This part of the image is also called region of interest (ROI). The rest of the image is called region of non-interest (RONI). RONI can be affected without interfering diagnosis. There are two possibilities of determining the ROI. In one of them the diagnostician marks a part of the image by hand. The other possibility is to use an automatic algorithm of ROI detection. The paper presents a novelty chest X-ray image watermarking method including automatic ROI detection scheme based on shade thresholding.

Technology and Iconography of the Romanesque Door of Płock

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The doors for the cathedral in Płock were ordered by bishop Alexander of Malonne in 12th century and cast in bronze by master Riquin and his assistant Waismuth in Magdeburg between 1152 and 1154. They consist of 46 panels fixed on a wooden background. Presently they are placed on the western facade of the Orthodox Church of God's Wisdom in Veliky Novgorod (USSR). There have been a lot of doubts and inconsistences as to the iconographic program of the work (as the order of the panels was changed during the course of centuries

The monument of art was described and analyzed by many researchers and art historians; F. Adelung, J. Lelewel, the bishop of Płock Wincenty Popiel exiled to Novogrod in 1868, M. Gębarowicz.

Newer research works, made in the 20th century analyze the affiliations with similar bronze doors in Verona (A. Goldschmidt), Augsburg (W. Sauerländer), and state that the doors were ordered for Płock and were really placed there. Their origin is described as the artistic tradition of the 11th century and their prototype as Early Christian and Byzantine doors (Hermann Fillitz and Georg Zarnecki).

Other researchers (U. Götz, U. Mende) analyze in detail the contents of particular panels.

The aim of K. Askanas' work was to present the history of the monument of art which was taken to Novgorod by Lithuanians in 13th century as a war trophy and hung in the sobor of God's Wisdom.

Further research of the question of the Doors of Płock led to their replication based on the original Novgorod version and placing the copy in the Płock Cathedral.

Nonparametric Density Estimation for Human Motion Tracking

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In today's world, human tracking has truly emerged as a vivid research area. Human motion tracking relates to the task of analyzing the movement of a person over time, using the data obtained by a motion capture device. In sports, the results obtained via an motion capture system enable the clear identification of the degree of training of the subjects studied, their technique and level of movement efficiency. Herein, this is done on the basis of the analysis of parameter changes measured in the successive phases of physical activity.

Indoor rowing is a sports discipline developed in the academic environment. Water rowers off season use ergometers to maintain the correct body condition. Biomechanical parameters and the movement effectiveness and efficiency of rowers' legs and hands were widely researched.

In this study motion capture system (Vicon, Oxford Metrics Ltd., UK) was used to register three-dimensional movement of rowers. The study was performed on the Concept II Indoor Rower ergometer. Participants were asked to row 500 meters on the ergometer with the maximal speed. The used biomechanical model Plug-in Gait calculated a number of different parameters, including angles, moments and forces in the joints of a subject.

The main aim of the study is to construct a mathematical model which in the best possible way allows the analysis of personal movement over time and makes possible, a comparison of the rowing techniques of professional and non-professional rowers. Here, the sample population was a group of ten non-rowers and a professional rower. The modeling was performed using a mathematical method applying the fitting of a nonparametric regression function for analyzing the speed and accuracy of rowing technique. The method presented here, an effective transparent tool for modeling motion tracking, is based on the theory of statistical kernel estimators. The approach is universal, and it can be used in parameter regression analysis where arbitrary assumptions concerning the form of regression function are not recommended.

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Adjusting the Type of Neural Networks to Evaluate Children's Gait

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Contemporary, artificial neural networks are an excellent tool to classify patterns. Depending on the knowledge about dependencies between input and output data, different neural structures are used. The aim of the paper is to select the neural network structure, parameters and learning method to distinguish the gait of healthy children and those with disorders. The input vector to the neural network is: step length, step velocity, step duration, step width, step cadence, the maximal height of heel and toe during the step and average ankle angle. These items were generated from three-dimensional data recorded using motion capture system (Vicon, Oxford Metrics Ltd., UK) and the biomechanical model Plug-in Gait. The children were walking along straight 2.5 m path.

Possessing the data describing the children's walk is a condition insufficient to be able to clearly assign a specific patient to groups of people characterized by a correct or incorrect walk. It is also desirable to separate individual groups. In other words, it should be shown that it is possible to extract a set of parameters from the data sets that will allow for an unambiguous classification of the children's gait. During the research, 1608 sets of samples suitable for classification and derived from both children with walking defects and healthy children were obtained. Feedforward neural networks as well as Support Vector Machine were tested as a classifier. The separability of the collected data using the tSNE method was also shown.

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Multi-Objective Optimization with the Whale Optimization Algorithm

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Optimization is a task of finding the best configuration of input variables, measuring the quality of solutions through the objective function which is calculated over these variables. As such optimization problems could be formulated for a variety of fields related to science and engineering. Most real-world problems however, require reaching multiple, often conflicting, objectives. For such tasks a methodology of multi-objective optimization offers a broad range of algorithms, with plethora of heuristic techniques being made available. The paper studies the application of the recently introduced nature-inspired algorithm mimicking the behavior of whales – namely Whale Optimization Algorithm – in the task of multi-objective optimization. Along with algorithm's description its performance is being evaluated over a set of benchmark instances and compared with the one of well-known Particle Swarm Optimization procedure. It is concluded that the application of introduced technique brings promising outcomes. The discussion of obtained results is followed by areas of possible improvements and plans for further research.

An Algorithm to Reconstruct Long Lived Particles in LHCb CERN Experiment

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Main goal of the LHCb experiment (Large Hadron Colider beauty) at the European Organization for Nuclear Research in Geneva is to perform precise measurements of CP-symmetry in a high energy environment, violation of which is the main source of matter-antimatter asymmetry in the Universe. Effective algorithms used to analyze huge amounts of data generated in the LHCb detection systems are essential to such research. This paper will discuss the status of development of algorithm that is going to be used in LHCb high performance analysis framework to reconstruct long lived particles. The algorithm will use entirely new approach in comparison to one used so far. New procedure will consist of fast reconstruction algorithm that is in state of constant evolution during entire LHCb data collection process. Adaptation of algorithm will make use of fuzzy analysis and nonparametric estimation.

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Soil Structure Analysis Using 3D Reconstructed Model from CT Images

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15 June
10:10 am

Recent advances in computed tomography and digital image processing algorithms provide technologically advanced measurement tools for studying the internal structures of soil aggregates. Once scanned, the computed tomography information allows the non-destructive visualization of slices, arbitrary sectional views and pseudo-color representations. The image processing operations applied for 2D images are used successfully for characterizing the pore volume distribution and in quantifying the differences in structures of the porous material.

In this paper, we proposed a novel algorithm for 3D soil reconstruction with the use of CT images. Herein, volumes are created from 2D images by rendering the pixels of which the threshold is in the desired range. At this stage, the Otsu method is applied. The triangle meshes described by a set of vertices become the iso-surfaces and volumes. The marching cubes algorithm is applied to the image volumes to construct the meshes. With the use of the steps described above, it thus becomes possible to reconstruct the soil structure into 3D images.

The article presents a survey on this 3D reconstruction approach and draws conclusions for analysing the pore volume distribution and total porosity. Moreover, a number of scientists have reported that studies of pore volume distribution are useful as a general method for defining the soil structure. The presented methodology is illustrated with a number of soil aggregates which differ in terms of soil fertilization. This method is expected to be more useful than classical methods, where arbitrary assumptions concerning the shape of pores are required.

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Search Space Reduction on Metaheuristics Performance

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15 June
11:00 am

The topic of this paper are follow up researches on utilizing previously noticed fact, that weights sets generated for an artificial neural netrork (ANN) by selected metaheuristics (evolutionary algorithm - EA - and firefly algorithm - FA) tends to have multiple local optima in unbounded search domain, that have been shown to vary in terms of weights values in significant way. The discussion on the impact of search space reduction (SSR) and a way to properly utilize it is provided.

Determination of Ceramic Tile Colors Surface Areas on the Medieval Sher-Dor Madrasah Mosaic in Samarkand – Problems and Solutions

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15 June
11:25 am

The seventeenth-century medieval Sher-Dor madrasah mosaic is a tourist gem and a visiting card to the city of Samarkand, and even to all of Uzbekistan. The mosaic consists of unregulated ceramic tiles in eight colors on an area of over 100 square meters.

The mosaic was renovated in the 1960s by reconstructing on the basis of old engravings and small original remains. Due to the bad current state of the mosaic, another renovation of this type is being prepared. One of the tasks of renovation works is to order the right amount of tiles, specially made for this purpose.

The article presents the problems of the task of determining the surface area of tiles in each of the defined colors. After reviewing the possible methods, the classification algorithm used and its implementation were presented. The operating parameters of the developed software as well as the method of optical control of the classification results are also presented.

The software created allowed to classify colors on over 70% of the mosaic surface. The remaining part were welds, empty spots after the discarded tiles, the heterogeneity of the color of the tiles, the steel mesh protecting the mosaic and the elements of its fixing

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