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GUEST EDITORIAL

Special issue on trends & advances to mine intelligence from ambient data

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Ambient data is generated from a collective of smart devices, connected environments and pervasive platforms, so well-integrated and finely tuned that we no longer think about connecting, syncing, or controlling. The techniques and hardware involved in the development of Ambient Intelligence Systems are under a state of continuous evolution. This allows to develop hardware adapted systems and to deal with situations that were not approachable in different case studies. The use of new protocols, wireless sensor networks and IoT devices has allowed to incorporate new sources of ambient information; these can be processed thanks to the improvements in computing capacities and the reduced costs of the different devices. As a result, there is an increase in the use cases to which new trends and techniques in ambient analytics to obtaining ambient intelligence can be applied.

This Special Issue focuses on the use of new trends in WSN, IoT, embedded systems and devices that incorporate Artificial Intelligence techniques or Distributed Artificial Intelligence (multi-agent systems, virtual organizations, classifiers, neural networks, Bayesian networks, etc.) for conducting ambient analytics. All the papers selected for this special issue have underwent two rounds of rigorous peer-review process. Based on the reviewers' feedback, as well as the evaluations of the Guest Co-editors, 18 papers were selected for this special issue.

One of the papers is by Lafontaine et al. [1] entitled "*An open vibration and pressure platform for fall prevention with a reinforcement learning agent*". The authors of this paper propose an inexpensive open vibration platform equipped with pressure sensors. The platform is built from easily available electronic components to be used as a tool by physiotherapists in order to help them in their evaluation of the postural control of individuals at risk of postural imbalance. The platform has been built to be easily reproducible by the scientific community. Moreover, the computer code necessary to make it work is fully open source and can be used in any non-commercial applications. A first version of the platform was tested with 7 healthy human participants. A simple reinforcement learning agent was deployed and tested to automatically calibrate the vibration motors for optimal stimulation. The agent exploited computer vision to capture the data from a force platform commercially available and use it as ground truth. Also, a second version of the platform was built and presented. That version is have been validated clinically with both healthy and impaired human participants.

Another paper is by Wang et al. [2] entitled "*Revealing the hidden features in traffic prediction via entity embedding*". This paper provides a NN-based model to predict traffic flow of a bike-sharing system in Suzhou, China. The model only uses external and discrete variables like weather, places of interest (POIs), and holiday periods. The authors applied both entities embedding and one-hot encoding for the data preprocessing of these variables. The results show that (1) Entity embedding can effectively increase the continuity of categorical variables and slightly improve the prediction efficiency for the NN model; and (2) The hidden relationship in variables can be identified through visual analysis, and the

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trained embedding vectors can also be used in traffic-related tasks.

Another paper is by Beg et al. [3] entitled "*UAV-enabled intelligent traffic policing and emergency response handling system for the smart city*". The authors investigate the shortcomings of traffic policing and emergency response handling systems; propose an intelligent, autonomous UAV-enabled solution; and describe the system in a simulated environment. Several scenarios of traffic monitoring and policing system are considered in the simulation: traffic light violations and accident detection, mobile speeding traps and automated notification, congestion detection and traffic rerouting, flagged stolen vehicles/pending arrest warrants and vehicle tracking using UAVs, and autonomous emergency response handling systems.

Another paper is by Outay et al. [4] entitled "*Estimating ambient visibility in the presence of fog: a deep convolutional neural network approach*" where a novel approach to estimate visibility range under foggy weather conditions is proposed which is based on "learned features". More precisely, the authors use AlexNet deep convolutional neural network (DCNN), trained with raw image data, for feature extraction and a support vector machine (SVM) for visibility range estimation. The quantitative analysis showed that the proposed approach is very promising in estimating the visibility range with very good accuracy. The proposed solution can pave the way towards intelligent driveway assistance systems to enhance awareness of driving weather conditions and hence mitigate the safety risks emanating from fog-induced low visibility conditions.

Another paper is by Koch et al. [5] entitled "*Path complexity and bicyclist route choice set quality assessment*". This research work aims to study how the concept of route complexity can help generate and analyze plausible choice sets in the demand modeling process. The complexity of a given path in a graph is the minimum number of shortest paths that is required to specify that path. Complexity is a path attribute which could potentially be considered to be important for route choice in a similar way. The complexity was determined for a large set of observed routes and for routes in the generated choice sets for the corresponding origin-destination pairs. The respective distributions are shown to be significantly different so that the choice sets do not reflect the traveler preferences, this is in line with classical choice set quality indicators. The authors also investigate often used choice set quality methods and formulate measures that are less sensitive to small differences between routes that can be argued to be insignificant or irrelevant.

Another paper is by Afridi et al. [6] entitled "*Triggers and connection-making for serendipity via user interface in recommender systems*". In this paper the authors examine transparency in recommender systems. The authors introduce a new user interface design for recommender system in academia and new study methods and approaches and studies a large group of users who are using this recommender system. The user interface components such as bubble messages on recommender system mechanism, user controls on manipulating the recommender system outcomes and showing authors work addition to recommendation. Repeated measure design of research was used to study serendipity and task load among users for Google Scholar and JabRef related work user interface (User interface developed for Experiment). Subjective evaluation of user interface was done along with NASA-Task Load Index for workload measurement. Further sentiment analysis was conducted for validations of findings. This study finds that serendipitous recommendations and user satisfaction is facilitated via transparency in recommender systems. Furthermore, the authors found that transparency enhances interactivity for users who are looking for novel and useful recommendations related to their work. This work contributes to human computer interaction studies of recommender systems and reviews the leading literature on transparency, serendipity, and recommender systems in learning environments.

Another paper is by Ahmed et al. [7] entitled "*Examining queue-jumping phenomenon in heterogeneous traffic stream at signalized intersection using UAV-based data*". This research is aims at exploring the queue-jumping phenomenon of motorbikes at signalized intersections and its impact on the saturation flow rate, travel time, and delay. The study of within green time flow dynamics shows that the flow of traffic within green time is not uniform. Surprisingly, the results indicate that the traffic flow for the first few seconds of the green time is significantly higher than the remaining period of green time, which shows a contradiction to the fact that traffic flow for the first few seconds is lower due to accelerating vehicles. Mode-wise traffic counted per second shows that this anomaly is attributed to the presence of motorbikes in front of the queue. Consequently, the outputs of simulation results obtained from calibrated Vissim show that the simulated travel time for motorbikes is significantly lower than the field-observed travel times even though the average simulated traffic flow matches accurately with the field-observed traffic flow. The findings of this research highlight the need to incorporate the queue-jumping behavior of motorbikes in the microsimulation packages to enhance their capability to model heterogeneous and undisciplined traffic.

Another paper is by El Barachi et al. [8] entitled "*A location-based ubiquitous crowdsourcing approach for the emergency supply of oxygen cylinders*". The authors of this paper present a location-based ubiquitous crowdsourcing solution to enable chronic obstructive pulmonary diseases (COPD) patients to request an emergency supply of oxygen cylinders. At the heart of the solution is a trusted platform that acts as a mediator for the ambient social interaction among a virtual and socially engaged community of requestors and

suppliers. The geo-temporal data generated by this social interaction can be analyzed to uncover meaningful ambient environmental patterns. The proposed approach also uses image processing and computer vision techniques to help validate crowd responses.

Another paper is by Lee et al. [9] entitled "*GAN-based imbalanced data intrusion detection system"*. The purpose of this study is to solve data imbalance by using the Generative Adversarial Networks (GAN) model, which is an unsupervised learning method of deep learning which generates new virtual data similar to the existing data. It also proposed a model that would be classified as Random Forest to identify detection performance after addressing data imbalances based on a GAN. The results of the experiment showed that the performance of the model proposed in this paper was better than the model classified without addressing the imbalance of data. In addition, it was found that the performance of the model proposed in this paper was excellent when compared with other models that were previously used widely for the data imbalance problem.

Another paper is by Hosni et al. [10] entitled "*A novel technique for automated concealed face detection in surveillance videos*". In this paper the authors present a novel technique for concealed face detection based on complexion detection to challenge a concealed face assumption. The proposed algorithm first determines the existence of a human being in the surveillance scene. Head and shoulder contour will be detected. The face will be clustered to cluster patches. Then determination of presence or absent of human skin will be determined. The authors proposed a hybrid approach that combines normalized RGB (rgb) and the YCbCr space color. This technique is tested on two datasets; the first one contains 650 images of skin patches. The second dataset contains 800 face images. The algorithm achieves an average detection rate of 97.51% for concealed faces. Also, it achieved a run time comparable with existing state-of-the-art concealed face detection systems that run in real time.

Another paper is by Alhajyaseen et al. [11] entitled "*Travelers' preferences regarding autonomous mobility in the State of Qatar*". This study focused on investigating travel preferences regarding autonomous mobility (in the form of privately owned AV (PAV) and shared AV (SAV) (such as on-demand taxi service). As a case study, the State of Qatar is studied and analyzed. A stated preference survey was designed and executed in a web-based questionnaire platform. Overall, data from $n = 315$ respondents were analyzed, and travel mode choice behavior was modeled using a logit model for the examination of travelers' preferences. The results indicate that there exists a reluctance to prefer PAV and SAV, over a regular car (NC) while public transport (PT) is the least preferred mode. The comfort level that a vehicle can offer is found to be one of the most important factors for Qatari residents. Students and unemployed individuals have shown an inclination towards SAV while full-time employed individuals have shown a higher preference for PAVs. These results are helpful for government agencies and AVs marketing companies to develop plans and policies in line with travelers' preferences.

Another paper is by Lesani et al. [12] entitled "*Smart home resident identification based on behavioral patterns using ambient sensors*". In this paper, the authors present a novel approach to identify the smart home residents. The different behavioral patterns of smart home's inhabitants are exploited to distinguish the residents. The variation of a specific individual behavior in smart homes is a significant challenge. The authors introduce different features that are useful to handle this problem. Moreover, they introduce an innovative strategy which considers the Bag of Sensor Events and Bayesian networks. In the Bag of Sensor Events approach, the frequency of each sensor event occurrence is considered, regardless of the order of sensor events. The efficiency of the Bag of sensor Events approach is compared to the Sequence of Sensor Events. The realized experiments confirm that the Bag of Sensor Events approach outperformed the previous approaches. When the smart homes residents are people who repeat their daily activities frequently, applying the Bag of Sensor Events on Activity Based Window Frame features, which considers the performed daily activities, would identify them more accurately. In contrast, in cases where residents perform their activities in different ways, considering the Time Based Window Frame leads to higher accuracy in distinguishing residents. In this approach, the features are created by considering the constant time intervals. The F-measure of the proposed approach on the Twor2009, Tulum2009, and Tulum2010 datasets is 96%, 100%, and 99%, respectively, which improves the results of the previous researches which consider behavioral patterns to identify smart home residents.

Another paper is by Farrag et al. [13] entitled "*Toward the improvement of traffic incident management systems using Car2X technologies*". The aim of this paper is to develop a smart TIM system which is based on Car2X communications and which aims at improving both traffic safety, commuters' mobility, and gas emissions. To assess the effectiveness of the proposed solution, the authors use the following measures: stops delay, stops all, vehicle delay, travel time, gas emissions, and fuel consumption. This paper also outlines the use of a developed simulation platform (which was developed based on VISSIM and Python) to quantify the benefits of using Car2X communications. Simulations have been run on Muscat Expressway in the Sultanate of Oman. Results are promising and include (1) the travel time decreased by 6%; (2) the average stop delay and vehicle stops were reduced by at least 9% and 27% respectively; and (3) there is a total

decrease in fuel consumption and carbon monoxide emissions by approximately 16%.

Another paper is by Nemer et al. [14] entitled "*Performance evaluation of range-free localization algorithms for wireless sensor networks*". In this paper the authors survey the different range-free localization techniques and discuss some of the localization-based applications where the location of the SNs is vital and sensitive. The authors describe five localization algorithms: Centroid, Amorphous, approximate point in triangle, DV-Hop and DV-HopMax. These algorithms have been simulated using MATLAB based on different setups and topologies. The authors also compare localization algorithms based on different performance metrics showing their pros and cons such as localization accuracy and energy consumption.

Another paper is by Adnan et al. [15] entitled "*Integrated agent-based microsimulation framework for examining impacts of mobility-oriented policies*". This paper presents an approach where individual schedules, derived from a lighter version of an activity-based model, are fed into a Multi-Agent Transport Simulation (MATSIM) framework. Simulations are performed for two European cities i.e. Hasselt (Belgium) and Bologna (Italy). After calibrating the modeling framework against aggregate traffic counts for the base case, the impacts of a few traffic management policies (restricting car access, increase in bus frequency) are examined. The results indicate that restricting car access is more effective in terms of reducing traffic from the network and also shifting car drivers/passengers to other modes of travel. The enhancement of bus infrastructure in relation to increase in frequency caused shifting of bicyclist towards public transport, which is an undesirable result of the policy if the objective is to improve sustainability and environment.

Another paper is by Shaker et al. [16] entitled "*Facilitating hikers' mobility in protected areas through smartphone app: a case of the Hoge Kempen National Park, Belgium*". This paper presents a digital tool that provides valuable information for both the visitors and the managers of protected areas. The app provides assistance to users to generate, access, and record hiking routes within the protected area. A route planner was created to generate user-specific alternative routes taking into account the user's preferences in terms of distance, preferred landscape, level of accessibility, etc. The app also provides the users with basic information on the park, including captivating points, typical flora, and fauna. Moreover, visitors and park management can communicate with each other through exchanging messages and suggestions. The pilot validation test performed with 20 participants and real-time test from 68 park visitors revealed that all the functionality of the app is in order and the app enhances the mobility experience of the user within Hoge Kempen National Park. Furthermore, regular use of the app from users will generate rich data that is valuable for visitor management purposes, for example, the number of trips per day, the average duration of visits and popular segments.

Another paper is by Adnan et al. [17] entitled "*Estimation of travel time distributions for urban roads using GPS trajectories of vehicles: a case of Athens, Greece*". This study presents the detailed investigation of travel time distribution in different spatiotemporal settings. The study considered four different types of urban roads and six time intervals along with consideration of weekdays and weekends. The empirical investigation employed Kruskal-Wallis, Chi-square, and Kolmogorov-Smirnov tests to fit travel time data into seven unimodal statistical distributions that are found in the literature to describe travel time distribution. It is found that lognormal distribution outperformed other distribution, and all of the considered categories of travel time data are well-fitted to this distribution. Additionally, parameters of lognormal distribution for different categories of travel time data are not significantly different from each other, which led to the conclusion that travel time distribution is roughly independent of space and time, which is in agreement with a few earlier studies that are limited in their scope especially in relation with availability of data. With this important finding, this study estimate values of travel time variability for different classes of individuals employing a standard approach that requires time of day independent standardized distribution of travel time. It is estimated that for Athens population value of travel time variability is approximately half of the value of travel time.

Another paper is by Mbarek et al. [18] entitled "*MBS: Multilevel Blockchain System for IoT*". In this paper, the authors propose to secure the IoT platform with a multilevel blockchain system (MBS) where the speed and flexibility of blockchain transactions are enforced by mobile agents which are migrating throughout the IoT network. The simulations of the proposed solution through the Hyperledger Fabric are showing relevant results in terms of response time and energy consumption.

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