



Special issue on advances in data intelligence and modelling

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This special issue is based on the best papers selected from the 11th International Conference on Ambient Systems, Networks and Technologies (ANT-2020) and its allied events, which were held on April 6–9, 2020, in Warsaw, Poland. The conference attracted a large number of scientific papers that contributed to the state-of-the-art in the ambient systems, networks and technologies. All the papers selected for this special issue have been extended significantly from their original versions and underwent two rounds of rigorous peer-review process. Based on the reviewers' feedback, as well as the evaluations of the Guest Editors, ten papers were selected for this special issue from 15 invited submissions. The accepted papers augment ambient systems by uncovering interesting methodologies related to data intelligence, recommender systems, queue modeling, predictive systems, smart cities, COVID-19 data management, and route optimization simulation and modeling.

The first paper by Wageeh et al. is entitled “YOLO Fish Detection with Euclidean Tracking in Fish Farms”. The activities of managing fish farms, like fishponds surveillance, are one of the tough and costly fish farmers' missions. Generally, these activities are done manually, wasting time and money for fish farmers. A method is introduced in this paper which improves fish detection and fish trajectories where the water conditions is challenging. Image Enhancement algorithm is used at first to improve unclear images. Object Detection algorithm is then used on the enhanced

images to detect fish. In the end, features like fish count and trajectories are extracted from the coordinates of the detected objects. Our method aims for better fish tracking and detection over fishponds in fish farms.

The second paper by Narman et al. is entitled “An Enhanced Ride Sharing Model Based on Human Characteristics, Machine Learning Recommender System, and User Threshold Time”. In this paper the authors have carried out an extensive simulation and measured the efficiency of the matching model while comparing the results with and without machine learning algorithms. The authors have used real-time New York City Cab traffic data with real-traffic conditions by using Google Maps APIs. Results indicate that the proposed model is feasible and efficient as the number of riders increases while maintaining threshold time for riders. Our proposed model and obtained results will help service providers to increase the usage of carpooling, and implicitly preserve natural resources and improve environmental conditions. An essential part of the transportation domain in smart cities is to share vehicles. Sharing vehicles is an impeccable solution to issues like vehicle congestion, pollution, and the rapid consumption of fuel. Even though carpooling has several benefits, currently, the usage is significantly low due to social barriers, long rider waiting time, and unfair pricing models. Considering these issues, the authors have designed an enhanced vehicle-sharing model with two matching layers. The first layer matches riders based on similar characteristics, and the second layer provides matching options to riders and drivers to restrict the waiting time by using personalized threshold time. At the end of trips, feedback is collected from users according to five characteristics. Then, the two main characteristics that are the most important to riders are determined based on the collected feedback. The characteristics and classifiers are fed to our machine-learning classification module.

The third paper by Nguyen et al. is entitled “nQSV-Net: A Novel Queuing Search Variant for Global Space Search and Workload Modeling”. This paper proposed research that goes through two steps: (1) using meta-heuristic optimization for global space search; (2) applying the proposed optimization

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to multivariate workload modeling and prediction. In the first step, the interest is paid towards the improvement of the Queuing Search optimization by the space-walk combination of Levy-flight trajectory to improve population diversity and Opposition-based learning to speed up the convergence process. To evaluate the solution's effectiveness, the authors compared it with six well-known optimization algorithms using CEC 2014 benchmark functions. The achieved experiment results show the significant effect of the nQSV designs in avoiding local optima and speed up the convergence process. In the second step, to prove the feasibility of solving real problems, the authors apply nQSV to train a neural network to model multiple variables of distributed workload simultaneously. The model is called nQSV-Net as the whole. The gained outcomes from extensive experiments with three real datasets show the accuracy and stability of nQSV-Net as a problem-solving solution in the domain.

The fourth paper by Mathias et al. is entitled "*A Framework for Monitoring Multiple Databases in Industries using OPC UA*". This paper proposed an information distribution scheme related to databases using Open Platform Communication Unified Architecture (OPC UA) servers to clients when multiple databases are involved in a factory. The aim is for external, but relevant clients, to be able to monitor this information mesh independent of explicit access to user schemas. A methodology to dispense data from, as well as check changes in databases using SQL queries and events is outlined and implemented using OPC UA servers. The structure can be used as a remote viewing application for multiple databases in one address space of a UA server.

The fifth paper by Handrich et al. is entitled "*Simultaneous Prediction of Valence/Arousal and Emotion Categories and its Application in an HRC Scenario*". The authors described the problem of facial expression analysis. The proposed approach predicts both basic emotion and valence/arousal values as a continuous measure for the emotional state. Experimental results including cross-database evaluation on the AffectNet, Aff-Wild, and AFEW dataset shows that the approach predicts emotion categories and valence/arousal values with high accuracies and that the simultaneous learning of discrete categories and continuous values improves the prediction of both. In addition, the authors used their approach to measure the emotional states of users in a Human-Robot-Collaboration scenario (HRC), show how these emotional states are affected by multiple difficulties that arise for the test subjects, and examine how different feedback mechanisms counteract negative emotions users experience while interacting with a robot system.

The sixth paper by Basmi et al. is entitled "*Distributed and scalable platform architecture for smart cities complex events data collection: COVID19 Pandemic use case*". For decades, numerous names have been given to boost an urban city: digital city, green city, smart cities and the list goes on.

They are all accompanied with ideas and propositions to enrich citizen's life quality, by employing latest information technology to improve environment's sustainability, through better energy usage, targeting problems affecting infrastructure costs, automation and efficient human resources distribution. Consequently, cities governors provide plans and conceive laws so society including individuals and organizations collaborate in a cycle of providers and consumers to make steps ahead toward smartification of the city in which they all operate. Consequently, hundreds of cities around the world are living example of what a smart city could be resembling in terms of information technology advancement and everyday usage. Each application or to be general system serve and exist for a specific purpose, using mobile applications and small sensors together to cooperate and deliver a value imposing a huge economic and social value and significant source of data. However, most of these applications are tied to specific domains and solely designed to solve predefined problems. Thus, for a decision maker point of view, decisions' the cost becomes high to correlate multiple data flow in different shapes. As a solution, in this paper the authors propose a system that is based on abstracting city events of different backgrounds—social, urban and natural, they chose to call them complex space time events.

The seventh paper is Farrag et al. is entitled "*STIMF: A Smart Traffic Incident Management Framework*". This paper proposed STIMF: A Smart Traffic Incident Management Framework to reduce the burden on traffic incident operators by assisting them in selecting the most appropriate response strategy when an incident occurs. STIMF includes two software systems: (a) a simulation environment used to evaluate traffic incident management strategies and (b) a fuzzy-logic inference system that allows the traffic operator to get prompt recommendations on the best response strategies based on the current context and conditions. Moreover, the STIMF framework also describes the process of preparing and building the simulation environment.

The eighth paper by Knapen, L. and Holmgren, J. is entitled "*Optimal bicycle trip impediments resolution by data fusion*". A set of GPS traces and a set of notifications of problematic situations (spots identified by GPS records) have been collected independently by two groups of bicyclists. The data collection periods did not coincide but overlapped and none was contained in the other one. The aim of our work is to use both datasets to determine an optimal action plan for problem solving given a limited budget. First, problematic locations are clustered. Each cluster corresponds to an impediment which is associated with trips using a distance function. The aim is to find out which impediments to solve under a given budget constraint in order to maximize the number of impediment-free trips. Thereto the trip set is partitioned by matching each trip with the largest set of its affecting impediments. Solving all impediments in such a set

induces a cost and makes the associated part of trips impediment free. A branch-and-bound optimizer is presented and evaluated. The clustering parameters affect the set of impediments and the extent of each of them. In order to evaluate the sensitivity of the result to the clustering parameters a technique is proposed to consistently estimate the impediment resolution cost.

The ninth paper by Buijs et al. is entitled “*Using Neural Nets to Predict Transportation Mode Choice: Amsterdam Network Change Analysis*”. Mode choice analysis can help in assessment of changes in traveler behavior that occurred after the opening of the new metro line. As it is known that artificial neural nets excel at complex classification problems, this paper aims to investigate an approach where the traveler’s transportation mode is predicted through a neural net, trained on choice sets and user specific attributes inferred from the data. The method shows promising results. It is shown that such models perform better when it is asked to predict the choice of mode for trips which take place on the same underlying transportation network as the data with which the model is trained. This difference in performance is observed to be especially high for trips from and to certain areas that were impacted by the introduction of the North South line.

The tenth paper by Kampen et al. is entitled “*Understanding the relation between travel duration and station choice behavior of cyclists in the metropolitan region of*

Amsterdam”. In this paper the authors investigated factors that influence departure station choice on combined bicycle-train and bicycle-metro trips in the Netherlands. Data from a mobile app was used to track an individual his travel behavior over the years 2018 and 2019. A discrete choice model was estimated to see whether people prefer to travel to park their bicycle at the station with the shortest travel duration or one of the stations further away. The final results show that people often park their bicycle at either the station with the shortest travel duration or the second shortest. Furthermore, the results show significant results for using trip characteristics and close to significant results for socioeconomic variable.

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