applied sciences

MDPI

Editorial

Actionable Pattern-Driven Analytics and Prediction

Jerry Chun-Wei Lin [1,*] and Chun-Hao Chen [2]

[1] Department of Computer Science, Electrical Engineering and Mathematical Sciences, Western Norway University of Applied Sciences, Inndalsveien 28, 5063 Bergen, Norway
[2] Department of Information and Finance Management, National Taipei University of Technology, Taipei 10608, Taiwan; chchen@ntut.edu.tw
* Correspondence: jerrylin@ieee.org

1. Introduction

Pattern-driven analytics and mining has received a lot of attention in the last two decades, because information discovered in data can be used to support decision and strategy making. In addition to traditional methods for mining interesting patterns, several machine learning and optimization methods have been proposed in artificial intelligence to find interesting patterns and retrieve that information in a reasonable time, or in a big data environment. The purpose of this "Actionable Pattern-Driven Analytics and Prediction" Special Issue is to compile recent research efforts dedicated to studying and discovering actionable knowledge in realistic situations and enterprise applications. The number of selected/accepted papers for publication is 11, and their main contributions are described below.

2. Contributions

The first paper [1] proposes a driver behavior analysis system using one spatial stream ConvNet to extract the spatial features and one temporal stream ConvNet to capture the driver's motion information. The two-dimensional (2D) ConvNet is used to construct the spatial and temporal ConvNet streams, and they were pre-trained by the large-scale ImageNet. In order to integrate different modalities, the feature-level fusion methodology was applied, and a fusion network was designed to integrate the spatial and temporal features for further classification. Moreover, a self-compiled dataset of 10 actions in the vehicle was established. Results showed that the proposed system can increase the accuracy rate by nearly 30% compared to the two-stream CNN model with a score-level fusion.

The second paper [2] proposes an integrated deep network consisting of a detection and identification module for person search. In real situations, person search is a very challenging problem because of the large appearance variation caused by occlusion, background clutter, pose variations, etc., and most existing works take cropped pedestrian images either from manual labelling or a perfect detection assumption. Thus, a framework for the practical surveillance scenarios in which the scene images are captured is designed. Additionally, the detection module based on the Faster R-CNN is used to detect persons in a scene image. For identifying and extracting discriminative features, a multi-class CNN network is trained with the auto-detected bounding boxes from the detection module instead of the manually cropped data. The distance metric is then learned from the discriminative features output by the identification module. According to the experimental results of the test performed in the scene images, the multi-class CNN network for the identification module can provide a 62.7% accuracy rate, which is higher than that for the two-class CNN network.

The third paper [3] focuses on the ontology-based tourist knowledge representation and recommendation method. The designed model is used to search for popular attractions from the online travel reviews (OTR) content and construct a tourist knowledge structure for these travelers. When the tourists do not need to know the keywords of the popular

Citation: Lin, J.C.-W.; Chen, C.-H. Actionable Pattern-Driven Analytics and Prediction. *Appl. Sci.* **2021**, *11*, 7529. https://doi.org/10.3390/app11167529

Received: 22 February 2021
Accepted: 16 August 2021
Published: 17 August 2021

attraction name, they only need to acquire their current location; the ORT content will then recommend the next attraction to the traveler, which helps the traveler make the correct travel decision. The evaluation result showed that the method proposed in this study can help travelers to quickly make travel decisions and is better than the traditional searching methods.

The fourth paper [4] builds an effective system, called the personality-driven course decision assistant, to help students determine the courses they should select by mining and filtering learners' personality patterns. For learner pattern mining, the relationships between the students' learning results and the referred personalities are discovered to provide the learners with valuable information before learning commences. For filtering learner personality patterns, students with similar personality patterns are filtered to predict the potential learning results. Through the actual system, a number of subjective and objective evaluations were conducted, and the evaluation results reveal that the proposed system is highly effective and reliable.

The fifth paper [5] proposes an electric energy consumption prediction model utilizing the combination of convolutional neural network (CNN) and bi-directional long short-term memory (Bi-LSTM), which is named the EECP-CBL model, to predict electric energy consumption. In this framework, two CNNs in the first module extract the important information from several variables in the individual household electric power consumption (IHEPC) dataset. Then, the Bi-LSTM module with two Bi-LSTM layers uses the above information as well as the trends of time series in two directions, including the forward and backward states, to make predictions. The obtained values in the Bi-LSTM module is passed to the last module that consists of two fully connected layers for finally predicting the electric energy consumption in the future. The experimental results indicate that the designed framework outperforms the state-of-the-art approaches in terms of several performance metrics for electric energy consumption prediction on several variations of the IHEPC dataset in real-time, short-term, medium-term, and long-term timespans.

The sixth paper [6] proposes a deep-learning-based defective bean inspection scheme (DL-DBIS), together with a generative-adversarial network (GAN)-structured automated labeled data augmentation method (GALDAM) for enhancing the proposed scheme, so that the automation degree of bean removal with robotic arms can be further improved for coffee industries. The proposed scheme is aimed at providing an effective model to a deep-learning-based object detection module for accurately identifying defects among dense beans. The proposed GALDAM can be used to greatly reduce labor costs because data labeling is the most labor-intensive work in this type of solution. Testing results of a case study reveal that the proposed scheme can efficiently and effectively generate models for identifying defective beans with accuracy and precision values up to 80%.

The seventh paper [7] proposes a model to forecast the foreign exchange rate. It incorporates event sentiments to accurately predict the exchange rate. Moreover, as the currency market is heavily dependent upon highly volatile factors such as gold and crude oil prices, these sensitive factors for exchange rate forecasting is then considered. The study also shows the importance of incorporating the investor sentiment of local and foreign macro-level events for accurate forecasting of the exchange rate. The results show that this deep-learning-based model is a better predictor of foreign currency exchange rate in comparison with the statistical techniques normally employed for prediction. It also presents evidence that the exchange rate of all three countries is more exposed to events happening in the US.

The eighth paper [8] proposes a proactive content-loading algorithm for improving per-user personalized preferences using multinomial softmax classification. The proposed UAS technique predicts a partial video skip due to long-time viewing by the user. This prediction prevents unnecessary network usage and guarantees maximum continuity by minimizing the video interruption and delay. Based on experimental results, the proposed algorithm has a personalized per-user content waiting time that is significantly lower than that of competing algorithms.

The ninth paper [9] proposes a big data analytics framework (named the multiple item support frequent patterns (MISFP)-growth algorithm) that uses Hadoop-based parallel computing to achieve high-efficiency mining of itemsets with multiple item supports (MIS). To facilitate decision makers in setting MIS, the authors also proposed the concept of classification of item (COI), which classifies items of higher homogeneity into the same class, by which the items inherit class support as their item support. The experimental results show an approximately 38% reduction in the execution time on parallel architectures. Furthermore, according to the experimental results, the enhanced performance of the proposed algorithm indicates that it could have big data analytics applications.

The tenth paper [10] proposes a method that can rapidly mine frequent patterns under varying network bandwidths. This fast distributed mining in changing network bandwidth (FDCNB)-mining method is based on the effective structure for distributed computing environments. Additionally, the authors added a monitor node to observe variable network bandwidths in cloud or distributed computing environments, which is beneficial for the kernel node to select the optimal computing node. Through empirical evaluation, the proposed method is shown to deliver excellent performance in terms of execution efficiency and load balancing.

The eleventh paper [11] proposes a hybrid CSA (HCSA) to minimize the makespans of PFSPs. First, to make the CSA suitable for solving the PFSP, the smallest position value rule is applied to convert continuous numbers into job sequences. The HCSA then uses a Nawaz–Enscore–Ham (NEH) technique to create a population with the required levels of quality and diversity. A local search is designed to enhance the quality of the solutions and avoid premature convergence. In addition, a simulated annealing approach enhances the local search of a method based on a variable neighborhood search. The tests indicate that the performance of the proposed HCSA is significantly superior to that of other algorithms.

Funding: This special issue is partially supported by Western Norway University of Applied Sciences, Bergen, Norway.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Chen, J.-C.; Lee, C.-Y.; Huang, P.-Y.; Lin, C.-R. Driver Behavior Analysis via Two-Stream Deep Convolutional Neural Network. *Appl. Sci.* **2020**, *10*, 1908. [CrossRef]
2. Chen, J.-C.; Wu, C.-F.; Chen, C.-H.; Lin, C.-R. Person Search via Deep Integrated Networks. *Appl. Sci.* **2020**, *10*, 188. [CrossRef]
3. Pai, M.-Y.; Wang, D.-C.; Hsu, T.-H.; Lin, G.-Y.; Chen, C.-C. On Ontology-Based Tourist Knowledge Representation and Recommendation. *Appl. Sci.* **2019**, *9*, 5097. [CrossRef]
4. Su, J.-H.; Liao, Y.-W.; Chen, L.-N. An Intelligent Course Decision Assistant by Mining and Filtering Learners' Personality Patterns. *Appl. Sci.* **2019**, *9*, 4665. [CrossRef]
5. Le, T.; Vo, M.T.; Vo, B.; Hwang, E.; Rho, S.; Baik, S.W. Improving Electric Energy Consumption Prediction Using CNN and Bi-LSTM. *Appl. Sci.* **2019**, *9*, 4237. [CrossRef]
6. Chou, Y.-C.; Kuo, C.-J.; Chen, T.-T.; Horng, G.-J.; Pai, M.-Y.; Wu, M.-E.; Lin, Y.-C.; Hung, M.-H.; Su, W.-T.; Chen, Y.-C.; et al. Deep-Learning-Based Defective Bean Inspection with GAN-Structured Automated Labeled Data Augmentation in Coffee Industry. *Appl. Sci.* **2019**, *9*, 4166. [CrossRef]
7. Yasir, M.; Durrani, M.Y.; Afzal, S.; Maqsood, M.; Aadil, F.; Mehmood, I.; Rho, S. An Intelligent Event-Sentiment-Based Daily Foreign Exchange Rate Forecasting System. *Appl. Sci.* **2019**, *9*, 2980. [CrossRef]
8. Kim, K.; Kwon, D.; Kim, J.; Mohaisen, A. Personalized Online Live Video Streaming Using Softmax-Based Multinomial Classification. *Appl. Sci.* **2019**, *9*, 2297. [CrossRef]
9. Wang, C.-S.; Chang, J.-Y. MISFP-Growth: Hadoop-Based Frequent Pattern Mining with Multiple Item Support. *Appl. Sci.* **2019**, *9*, 2075. [CrossRef]
10. Lin, C.-C.; Li, W.-C.; Chen, J.-C.; Chung, W.-Y.; Chung, S.-H.; Lin, K.W. A Distributed Algorithm for Fast Mining Frequent Patterns in Limited and Varying Network Bandwidth Environments. *Appl. Sci.* **2019**, *9*, 1859. [CrossRef]
11. Huang, K.-W.; Girsang, A.S.; Wu, Z.-X.; Chuang, Y.-W. A Hybrid Crow Search Algorithm for Solving Permutation Flow Shop Scheduling Problems. *Appl. Sci.* **2019**, *9*, 1353. [CrossRef]