Guest Editorial Preface

Special Issue on AI-Powered Anomaly Detection for Distributed Systems and the Pervasive Edge Computing

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In some real applications, it is impractical to collect all classes from limited samples, such as distributed system. For supervised learning, we need to deduce whether a test sample is from a known class or an unknown class by learning a model from a training set which consists of several known classes. The samples from unknown class are termed as anomalies or novelties. The anomalies or novelties widely exist in many real applications, such as illegal intrusion in internet of services, irregular visiting in edge computing, and abnormal events in Internet of Things to name just a few. Detecting anomalies or novelties is a challenge task in the community of machine learning. AI-Power makes identify anomalies or novelties automatically. Additionally, the massive data derived from lots of IoT devices and applications (e.g., smart grid, healthcare, smart building, and smart distributed systems) would be inevitably corrupted by noises which can be seen as the anomalies for normal data. The corrupted data would make the performance of edge computing degrade. Therefore, anomaly detection is crucial for edge computing and distributed system, which can reduce the impact of noises.

This special issue is expected to spur further research and development of anomaly detection and to provide a unique opportunity to allow researchers in several domains of computing area to contribute to anomaly detection and its applications in the Internet of Things and distributed systems. The six papers in this special issue cover the theme of this special issue.

The first article, "Edge Computing-Induced Caching Strategy for National Traditional Sports Video Resources by Considering Unusual Items," by Wenwen Pan, Bei Liu, and Zhiliang Song, proposes to utilize the ant colony-stimulated annealing algorithm as the caching strategy to improve the hit rate of cache items in edge computing. Their caching strategy can increase the hit rate whilst reduce the delay time.

The second article, "Fatigue and Abnormal State Detection by Using EMG Signal During Football Training," by Chunhai Cui, Enqian Xin, Meili Qu, and Shuai Jiang, proposes a framework to analyse the surface electromyography (EMG) signals and monitor the fatigue state during football training. In the framework, the noises in EMG are removed and extracted six features, then the extracted features are used to train a one-class support vector machine to monitor training state. The experimental results show that the framework can recognize most of the fatigue states during training.

The third article, "Abnormal Financial Transaction Detection via AI-Technology," by Zhuo Wang, proposes to utilize weighted one-class support vector machine to monitor abnormal transactions

during time series financial data which are represented by several statistical variables. The proposed method can effectively detect the suspicious transactions during daily life.

The fourth article, "On Detecting Abnormal Access for Online Ideological and Political Education," by Yuzhu Yang, proposes a data stream-based network intrusion detection method to monitor and manage online education visiting. First, a knowledge library is constructed by normal visiting mode and abnormal visiting mode. Second, the dissimilarity between data point and data cluster is used to measure the similarity between normal mode and abnormal mode. Lastly, the knowledge library is updated to reflect the changes of network in online education system by re-clustering. The proposed method is evaluated on a real dataset.

The fifth article, "Recognizing the Style of Artistic Painting via Information Entropy for Smart City Construction," by Xiaojie Du and Wenhao Wang, proposes a framework to help smart library management by using an intelligent paintings recognition method. First, they utilize the information entropy to represent the paintings. Then, the information entropy features are used to train an oracle to recognize the painting style. The framework can effectively recognize the painting style.

The six article, "Teaching Management and Monitoring Abnormal Network Behaviors Under COVID-19," by Yao Li and Ping Luo, proposes an anomaly detection method by using data flow to mine high frequency events for monitoring abnormal and burst access during online education. First, the data flow in traffic network is described as a special structure which is used to establish an efficient high frequent event detection algorithm. Second, the network traffic flow is reduced to make it become possible to monitor large-scale concurrent network visiting. The effectiveness of the abnormal network behaviour detection method is verified through the experiment on a real network environment for online education.

In conclusion, the article presented in this special issue demonstrates fruitful research in the field of anomaly detection, edge computing, and distributed online systems. We wish to thank both the authors and the reviewers for their hard work in helping us assemble this Special Issue, and would also like to express our sincere gratitude to the Editor-in-Chief, Prof. Nik Bessis, for providing this opportunity and lots of guidance throughout the process.

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