CIT. Journal of Computing and Information Technology, Vol. 31, No. 4, December 2023, i–ii
doi: 10.20532/cit.2023.1005831

Editorial

The December 2023 (Vol. 31, No. 4) issue of *CIT. Journal of Computing and Information Technology* brings four papers from the areas of cooperative networks, network security, and natural language processing.

The first paper in this issue, titled *Distributed Computing Optimization in Unmanned Aerial Vehicle Swarm Cooperative Networks*, deals with the management and control challenges of unmanned aerial vehicle (UAV) swarm cooperative networks in dynamic environments. The authors of the paper, Xinghua Zhang, Wangchun Luo, Fu Zhang, Zhibin Shi, and Hongyi Liu propose a model to predict network flow and a novel distributed control algorithm. This algorithm, based on multi-agent technology and finite-time distributed control law under spatial-temporal constraints enhances operational efficiency, control precision, and collaborative stability of UAVs. Comparative analysis with deep Q-network, graph isomorphism networks, and graph attention networks shows that the proposed algorithm outperforms the existing methods in simulation time, collaborative control, and computational efficiency, making it a significant advancement for real-time coordination of large-scale UAV networks.

In the paper, titled *An Intrusion Detection Model Based on Extra Trees Algorithm with Dimensionality Reduction and Oversampling*, the authors Li Yin and Yijun Chen deal with a common network security issue – intrusion detection. Namely, with the increasing complexity and scale of campus information systems, ensuring network security has become critical. Therefore, the authors inspect traditional machine learning issues in intrusion detection, such as high feature dimensions, overfitting, and data imbalance. They propose a model that uses linear discriminant analysis for dimension reduction, oversampling with SMOTE for dataset balancing, and the extra trees (extremely randomized trees) classification algorithm for constructing the model. Experimental results, which include comparison of the proposed model with random forest and support vector machine on the well-known NSL-KDD dataset, show that the proposed model significantly improves the accuracy and efficiency of network intrusion detection in practical applications.

A limitation of traditional network security methods is their reliance on predefined rules, which leads to struggle against sophisticated attacks. Novel methods integrate data analysis and machine learning for improved network anomaly detection. In the paper titled *Enhanced Network Security Protection through Data Analysis and Machine Learning: An Application of GraphSAGE for Anomaly Detection and Operational Intelligence*, the author Yujing Lu focusses on enhancing the GraphSAGE model for an improved network anomaly detection. New sampling, aggregation, and loss functions are proposed based on including the path information, which was not considered in the original GraphSAGE model. Additionally, the research introduces a model for rapid and accurate network anomaly root cause analysis and a decision support system for adaptive protection strategies. The experiments conducted on three different networks show significant improvements in anomaly detection compared to GraphGAGE and decision tree models. These achieved advancements aim to enhance cybersecurity defense capabilities and operational efficiency, offering significant practical value for maintaining stable and secure network operations.

In the last paper of the issue, titled *Efficient Sentence Representation Learning via Knowledge Distillation with Maximum Coding Rate Reduction*, the authors Domagoj Ševerdija, Tomislav Prusina, Luka Borozan, and Domagoj Matijević deal with the topic of effectiveness of pre-trained large language models for sentence representation in natural language inference. This study highlights the performance gap between pre-trained large language models and smaller models due to hardware constraints. To address this, the study explores the knowledge distillation of Sentence-BERT model by introducing a projection layer on top of the model's encoder that uses the maximum coding rate reduction loss function, which was originally designed for general purpose manifold clustering. The experiments show that the distilled model, with reduced complexity and smaller sentence embeddings, achieves comparable performance to larger models on semantic retrieval, semantic textual similarity, and sentence classification downstream tasks. This approach offers a practical solution for deploying efficient sentence representations on resource-limited devices without sacrificing performance.

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