# **2020 IEEE Fifth International Conference on Data Science in Cyberspace (DSC 2020)**

Hong Kong 27 – 29 July 2020



IEEE Catalog Number: ISBN:

CFP20E91-POD 978-1-7281-9559-9

## Copyright © 2020 by the Institute of Electrical and Electronics Engineers, Inc. All Rights Reserved

*Copyright and Reprint Permissions*: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

#### \*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.

IEEE Catalog Number:	CFP20E91-POD
ISBN (Print-On-Demand):	978-1-7281-9559-9
ISBN (Online):	978-1-7281-9558-2

#### Additional Copies of This Publication Are Available From:

Curran Associates, Inc 57 Morehouse Lane Red Hook, NY 12571 USA Phone: (845) 758-0400 Fax: (845) 758-2633 E-mail: curran@proceedings.com Web: www.proceedings.com



## 2020 IEEE Fifth International Conference on Data Science in Cyberspace (DSC) **DSC 2020**

### **Table of Contents**

Welcome Message from the General Chairs .xiv
Organizing Committee xv
Program Committee xvii

# 2020 IEEE Fifth International Conference on Data Science in Cyberspace (DSC)

#### **Session 1: Data Intensive Applications**

GeST: A Grid Embedding Based Spatio-Temporal Correlation Model for Crime Prediction .1..... Yiting Qian (Shanghai Jiao Tong University), Li Pan (Shanghai Jiao Tong University), Peng Wu (Shanghai Jiao Tong University), and Zhengmin Xia (Shanghai Jiao Tong University)

Temperature Prediction Modeling and Control Parameter Optimization Based on Data Driven .8..... Qingguang Liu (Guangxi University), Jielong Wei (Guangxi University), Sining Lei (Guangxi University), Qingbao Huang (Guangxi University; South China University of Technology; Key Laboratory of Big Data and Intelligent Robot, Ministry of Education), Mengqiao Zhang (Guangxi University), and Xiongbin Zhou (Alnan Aluminium Inc.; Alnan Aluminium Co. Ltd.)

Heterogenous Multi-source Fusion for Ship Trajectory Complement and Prediction with Sequence Modeling .15..... *Changmeng Zheng (South China University of Technology), Qi Peng (South* 

China University of Technology), and Xuemiao Xu (South China University of Technology)

#### Session 2: Social Networks

Tweet Stance Detection: A Two-Stage DC-BILSTM Model Based on Semantic Attention .22..... Yuanyu Yang (Beijing University of Posts and Telecommunications), Bin Wu (Beijing University of Posts and Telecommunications), Kai Zhao (Beijing University of Posts and Telecommunications), and Wenying Guo (Beijing University of Posts and Telecommunications)

Personality2vec: Network Representation Learning for Personality .30 Zhanming Guan (Beijing University of Posts and Telecommunications), Bin Wu (Beijing University of Posts and Telecommunications), Bai Wang (Beijing University of Posts and Telecommunications), and Hezi Liu (Beijing University of Posts and Telecommunications)
A Unified Information Diffusion Model for Social Networks .38 Xiangyi Kong (Guangzhou University), Zhaoquan Gu (Peng Cheng Laboratory, Guangzhou University), and Lihua Yin (Peng Cheng Laboratory, Guangzhou University)
Session 3: Cyberspace Security, Privacy and Trust I
Detecting DNS Tunnels Using Session Behavior and Random Forest Method .45 Yang Zhao (Sichuan University), Hongzhi Ye (Sichuan University), Lingzi Li (Sichuan University), Cheng Huang (Sichuan University), and Tao Zhang (The Third Research Institute of Minister of Public Security)
Which DGA Family does a Malicious Domain Name Belong To .53 Yunyi Zhang (Sun Yat-sen University; Cyberspace Security Research Center, Peng Cheng Laboratory), Yuelong Wu (Sun Yat-sen University), and Shuyuan Jin (Sun Yat-sen University; Cyberspace Security Research Center, Peng Cheng Laboratory)
An APT Attack Analysis Framework Based on Self-Define Rules and Mapreduce .61 Yulu Qi (National University of Defense Technology), Rong Jiang (National University of Defense Technology), Yan Jia (National University of Defense Technology), and Aiping Li (National University of Defense Technology)
A Review of APT Attack Detection Methods and Defense Strategies .67 Kai Xing (National University of Defense Technology), Aiping Li (National University of Defense Technology), Rong Jiang (National University of Defense Technology), and Yan Jia (National University of Defense Technology)
Unsupervised Euclidean Distance Attack on Network Embedding .71 Shanqing Yu (Zhejiang University of Technology), Jun Zheng (Zhejiang University of Technology), Jinyin Chen (Zhejiang University of Technology), Qi Xuan (Zhejiang University of Technology), and Qingpeng Zhang (City University of Hong Kong)

## Session 4: Knowledge Discovery

A Transformer-Based Model for Sentence-Level Chinese Mandarin Lipreading .78..... Ma Shihui (Shanghai Jiaotong Unniversity), Shilin Wang (Shanghai Jiaotong Unniversity), and Xiang Lin (Shanghai Jiaotong Unniversity)

An Advanced BERT-Based Decomposition Method for Joint Extraction of Entities and Relations.82 Changhai Wang (National University of Defense Technology), Aiping Li (National University of Defense Technology), Hongkui Tu (National University of Defense Technology), Ye Wang (National University of Defense Technology), Chenchen Li (National University of Defense Technology), and Xiaojuan Zhao (National University of Defense Technology)
Deep Learning for Social Network Information Cascade Analysis: A Survey .89 Luqun Gao (National University of Defense), Bin Zhou (National University of Defense), Yan Jia (National University of Defense), Hongkui Tu (National University of Defense Technology), Ye Wang (National University of Defense), Chenguang Chen (National University of Defense), Haiyang Wang (National University of Defense Technology), and Hongwu Zhuang (National University of Defense Technology)
Incorporating Entity Type Information into Knowledge Representation Learning .98 Wenyu Huang (South China University of Technology), Guohua Wang (South China University of Technology/Key Laboratory of Big Data and Intelligent Robot), Huakui Zhang (South China University of Technology), and Feng Chen (South China University of Technology)
Context-Aware Event Type Identification Based on Context Fusion and Joint Learning .105 Zuowei Zhang (Hohai University) and Yan Tang (Hohai University)

#### Session 5: Cyberspace Security, Privacy and Trust II

Secure Data Dissemination Among Multiple Base Stations in High-Speed Railway Network .113... Zhongbai Jiang (China Information Technology Security Evaluation Center), Yanwei Sun (China Information Technology Security Evaluation Center), Lei Shi (China Information Technology Security Evaluation Center), Weihua Hu (China Information Technology Security Evaluation Center), and Zhaohui Liu (China Information Technology Security Evaluation Center) StateConsisIV: A Privacy-Preserving Integrity Verification Method for Cloud Components Based on a Novel State Consistency Feature .120. Peiru Fan (China Industrial Control Systems Cyber Emergency Response Team), Chonghua Wang (China Industrial Control Systems Cyber Emergency Response Team), Jun Li (China Industrial Control Systems Cyber Emergency Response Team), Bo Zhao (Key Laboratory of Aerospace Information Security and Trusted Computing, School of Cyber Science and Engineering, Wuhan University), and Zhaoxu Ji (Key Laboratory of Aerospace Information Security and Trusted Computing, School of Cyber Science and Engineering, Wuhan University) SecureMLDebugger: A Privacy-Preserving Machine Learning Debugging Tool .127.....

Peiyi Han (Beijing University of Posts and Telecommunications), ChaoZheng Wan (Harbin Institute of Technology, China), Chuanyi Liu (Harbin Institute of Technology, Cyberspace Security Research Center Peng Cheng Laboratory, China), Shaoming Duan (Harbin Institute of Technology, China), Hezhong Pan (Beijing University of Posts and Telecommunications), and Pengshuai Luo (Harbin Institute of Technology, China)

#### Session 6: Machine Learning

A Survey of Depth Estimation Based on Computer Vision .135 Liu Yang (National University of Defense Technology, China), Jie Jiang (National University of Defense Technology, China), Jiahao Sun (National University of Defense Technology, China), Liang Bai (National University of Defense Technology, China), and Qi Wang (University of Electronic Science and Technology of China)
Anobeat: Anomaly Detection for Electrocardiography Beat Signals .142 Yingzi Ou (Beijing Institute of Technology), Xin Li (Beijing Institute of Technology), Zhenyu Guo (Beijing Institute of Technology), and Yizhuo Wang (Beijing Institute of Technology)
Deep Learning-Based Quantitative Steganalysis to Detect Motion Vector Embedding of HEVC Videos .150 Xiongbo Huang (South China University of Technology), Yongjian Hu (South China University of Technology), Yufei Wang (Sino-Singapore International Joint Research Institute), Beibei Liu (South China University of Technology), and Shuowei Liu (South China University of Technology)

#### Session 7: Sentiment Analysis in Cyberspace

A Joint Model for Aspect-Category Sentiment Analysis with TextGCN and Bi-GRU .156..... Ying Yang (Beijing University of Posts and Telecommunications), Bin Wu (Beijing University of Posts and Telecommunications), Lianwei Li (Beijing University of Posts and Telecommunications), and Shuyang Wang (Beijing University of Posts and Telecommunications) Word Level Domain-Diversity Attention Based LSTM Model for Sentiment Classification .164..... Haoliang Zhang (University of Chinese Academy of Sciences, Institute of Information Engineering CAS), Hongbo Xu (Institute of Information Engineering, CAS), Jinqiao Shi (Beijing University of Posts and Telecommunications), Tingwen Liu (Institute of Information Engineering CAS), and Chun Liao (Institute of Information Engineering CAS) Multi-task Learning Network for Document-Level and Multi-aspect Sentiment Classification .171. Zhou Wang (Hohai University) and Jing Cao (Hohai University) Real-Time Event Detection and Tracking in Microblog via Text Chain and Sentiment Time Series .178..... Bingxu Piao (Beijing University of Posts and Telecommunications, Beijing, China), Xu Wu (Beijing University of Posts and Telecommunications, Beijing, China), Jingchen Wu (Beijing University of Posts and Telecommunications, Beijing, China), and Xiaqing Xie (Beijing University of Posts and Telecommunications, Beijing, China) A Unified Labeling Model for Open-Domain Aspect-Based Sentiment Analysis .186..... Qian Ji (Shanghai Jiao Tong University), Xiang Lin (Shanghai Jiao Tong University), Yinghua Ma (Shanghai Jiao Tong University), Gongshen Liu (Shanghai Jiao Tong University), and Shilin Wang (Shanghai Jiao Tong

University)

#### Session 8: Data Mining and IR

Robust Text Clustering with Graph and Textual Adversarial Learning .190 Yongming Liang (Beijing University of Posts and Telecommunications), Tian Tian (Beijing University of Posts and Telecommunications), Kaifu Jin (Beijing University of Posts and Telecommunications), Xiaoyu Yang (Beijing University of Posts and Telecommunications), Yuefei Lv (Beijing University of Posts and Telecommunications), and Xi Zhang (Beijing University of Posts and Telecommunications)
GPU-BTM: A Topic Model for Short Text using Auxiliary Information .198 Yibing Guo (Harbin Institute of Technology, China), Yutao Huang (Harbin Institute of Technology, China), Ye Ding (Dongguan University of Technology, China), Shuhan Qi (Harbin Institute of Technology, China), Xuan Wang (Harbin Institute of Technology, China), and Qing Liao (Harbin Institute of Technology; Peng Cheng Laboratory, China)
Longitudinal Analysis of Cyber-Related Articles .206 Mohammad Al Boni (CyberCube Analytics Inc.) and Trishala Neeraj (CyberCube Analytics Inc.)
A Low-Dimensional Representation Learning Method for Text Classification and Clustering .214 Xiang Wang (National University of Defense Technology, China), Yunfan Liao (Beijing University of Posts and Telecommunications), Junxing Zhu (National University of Defense Technology, China), Bin Zhou (National University of Defense Technology, China), and Yan Jia (National University of Defense Technology, China)
Graph Convolutional Network for Visual Question Answering Based on Fine-Grained Question Representation 218 Ze Hu (Guangxi University), Jielong Wei (Guangxi University), Qingbao Huang (Guangxi University; South China University of Technology), Hanyu Liang (Guangxi University), Xingmao Zhang (Guangxi Arts University), and Qingguang Liu (Guangxi University)

#### Workshops

#### **Big Data and Business Analytics (BDBA 2020)**

Research on Rumor Propagation Simulation Based on Behavior-Attribute .225..... Hailiang Chen (National University of Defense Technology, China), Bin Chen (National University of Defense Technology, China), Chuan Ai (National University of Defense Technology, China), Mengna Zhu (National University of Defense Technology, China), Kaisheng Lai (Jinan University), and Lingnan He (Sun Yat-sen University)

On Improving the Learning of Long-Term Historical Information for Tasks with Partial

Observability 232

Xinwen Wang (Beijing Institute of Technology), Xin Li (Beijing Institute of Technology), and Linjing Lai (Beijing Institute of Technology)

Adversarial Examples for Chinese Text Classification 238 Yushun Xie (Guangzhou University), Zhaoquan Gu (Guangzhou University), Bin Zhu (Guangzhou University), Le Wang (Guangzhou University), Weihong Han (Guangzhou University), and Lihua Yin (Guangzhou University)
<ul> <li>BLHNN: A Novel Charge Prediction Model Based on Bi-Attention LSTM-CNN Hybrid Neural Network .246</li> <li>Jia Guo (Beijing University of Posts and Telecommunications), Bin Wu (Beijing University of Posts and Telecommunications), and Pengpeng Zhou (Beijing University of Posts and Telecommunications)</li> </ul>
Big Data Mining for Cyberspace (BDMC 2020)
A Token Level Multi-target Stance Detection Dataset .253 Tianpeng Ye (Shanghai Jiao Tong University), Yinghua Ma (Shanghai Jiao Tong University), Xiang Lin (Shanghai Jiao Tong University), and Jianhua Li (Shanghai Jiao Tong University)
Deepfake Detection with Clustering-Based Embedding Regularization .257 Kui Zhu (Beijing University of Posts and Telecommunications), Bin Wu (Beijing University of Posts and Telecommunications), and Bai Wang (Beijing University of Posts and Telecommunications)
An Efficient Parallel Stochastic Gradient Descent for Matrix Factorization on GPUS .265 Xing Tianyu (Beijing University of Posts and Telecommunications), Wu Bin (Beijing University of Posts and Telecommunications), and Wang Bai (Beijing University of Posts and Telecommunications)
Image-Based Encrypted Traffic Classification with Convolution Neural Networks .27.1 Yanjie He (Xi'an Jiaotong University) and Wei Li (Xi'an Jiaotong University)

## Mobile Ubiquitous Systems and Technologies (MUST 2020)

Refining Co-Operative Competition of Robocup Soccer with Reinforcement Learning .279 Zhengqiao Wang (Zhengzhou University), Yufan Zeng (University of Liverpool), Yue Yuan (Zhengzhou University), and Yibo Guo (Zhengzhou University)
Join-Based Social Ridesharing 284
Yu Han (ZhengZhou University), Yifei Li (ZhengZhou University),
QingShun Wu (ZhengZhou University), Ji Wan (Beihang University), and
Yafei Li (ZhengZhou University)

A Data Traceability Method to Improve Data Quality in a Big Data Environment .290..... *Guobao Zhang (Hohai University)* 

# Multi-dimensional Data Association and inTelligent Analysis (MDATA 2020)

Knowledge Fusion and Spatiotemporal Data Cleaning: A Review .295 Huchen Zhou (Cyberspace Institute of Advance Technology, Guangzhou University), Mohan Li (Cyberspace Institute of Advance Technology, Guangzhou University), and Zhaoquan Gu (Pengcheng Laboratory)
Automatic Classification of Matching Rules in Pattern Matching .302. Yunyi Tang (Cyberspace Institute of Advanced Technology, Guangzhou University, China), Le Wang (Cyberspace Institute of Advanced Technology, Guangzhou University, China; PCL Research Center of Networks and Communications, Peng Cheng Laboratory, China), Xiaolong Chen (Cyberspace Institute of Advanced Technology, Guangzhou University, China), Zhaoquan Gu (Cyberspace Institute of Advanced Technology, Guangzhou University, China; PCL Research Center of Networks and Communications, Peng Cheng Laboratory, China), Lihua Yin (Cyberspace Institute of Advanced Technology, Guangzhou University, China; PCL Research Center of Networks and Communications, Peng Cheng Laboratory, China), and Xin Yi (Aerospace Control Center Beijing, China)
Chinese Open Relation Extraction with Pointer-Generator Networks .307 Ziheng Cheng (Beijing University of Posts and Telecommunications), Xu Wu (Beijing University of Posts and Telecommunications), Xiaqing Xie (Beijing University of Posts and Telecommunications), and JingChen Wu (Beijing University of Posts and Telecommunications)
A Survey on Approaches and Applications of Knowledge Representation Learning .312 Chenchen Li (National University of Defense Technology, China), Aiping Li (National University of Defense Technology, China), Ye Wang (National University of Defense Technology, China), Hongkui Tu (National University of Defense Technology, China), and Yichen Song (National University of Defense Technology, China)
Contextual Gated Graph Convolutional Networks for Social Unrest Events Prediction .320 Haiyang Wang (National University of Defense Technology, China), Bin Zhou (National University of Defense Technology, China), Zhipin Gu (National University of Defense Technology, China), and Yan Jia (National University of Defense Technology, China)
A Knowledge Graph Embedding Method Based on Neural Network .326 Chenchen Li (National University of Defense Technology, China), Aiping Li (National University of Defense Technology, China), Hongkui Tu (National University of Defense Technology, China), Ye Wang (National University of Defense Technology, China), and Changhai Wang (National University of Defense Technology, China)

Seeds Optimization for Entity Alignment in Knowledge Graph Embedding .333..... Xiaolong Chen (Cyberspace Institute of Advanced Technology, Guangzhou University), Le Wang (Cyberspace Institute of Advanced Technology, Guangzhou University and PCL Research Center of Networks and Communications, Peng Cheng Laboratory), Yunyi Tang (Cyberspace Institute of Advanced Technology, Guangzhou University), Weihong Han (Cyberspace Institute of Advanced Technology, Guangzhou University and PCL Research Center of Networks and Communications, Peng Cheng Laboratory), and Zhaoquan Gu (Cyberspace Institute of Advanced Technology, Guangzhou University and PCL Research Center of Networks and Communications, Peng Cheng Laboratory)

#### Multi-source Network Fusion and Analysis (MSNFA 2020)

A Study of Bitcoin De-Anonymization: Graph and Multidimensional Data Analysi	s .339
Xingyu Lv (Guangzhou University), Ye Zhong (Guangzhou University), and	
Qingfeng Tan (Guangzhou University)	

Two-Stage Encoding Extractive Summarization .346..... Wenying Guo (Beijing University of Posts and Telecommunications), Bin Wu (Beijing University of Posts and Telecommunications), Bai Wang (Beijing University of Posts and Telecommunications), and Yuanyu Yang (Beijing University of Posts and Telecommunications)

A Parallel Algorithm for Graph Transaction Based Frequent Subgraph Mining .351..... Fengcai Qiao (National University of Defense Technology, China), Yuanfa Zhang (Naval Research Academy), Jinsheng Deng (National University of Defense Technology, China), Zhaoyun Ding (National University of Defense Technology, China), and Aiping Li (National University of Defense Technology, China)

Sampling Topic Representative Users by Integrating Node Degree and Edge Weight .356..... Jiangwen Wang (Inner Mongolia University) and Zhijie Ban (Inner Mongolia University)

#### Vulnerability Analysis and Adversarial Learning (VAAL 2020)

An Anomaly Detection Method for System Logs Using Venn-Abers Predictors .362..... Lanlan Pan (Civil Aviation University of China), Chunbo Liu (Civil Aviation University of China), Zhaojun Gu (Civil Aviation University of China), Zhi Wang (Nankai University, China), and Yitong Ren (Civil Aviation University of China)

The Class Overlap Model for System Log Anomaly Detection Based on Ensemble Learning .369.... Yitong Ren (Civil Aviation University of China), Zhaojun Gu (Civil Aviation University of China), Lanlan Pan (Civil Aviation University of China), and Chunbo Liu (Civil Aviation University of China) DQ-MOTAG: Deep Reinforcement Learning-Based Moving Target Defense Against DDoS Attacks ..... 375

Author Index 401