

# **2021 IEEE International Conference on Data Mining (ICDM 2021)**

**Virtual Conference  
7-10 December 2021**

**Pages 1-786**



**IEEE Catalog Number: CFP21278-POD**  
**ISBN: 978-1-6654-2399-1**

**Copyright © 2021 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:	CFP21278-POD
ISBN (Print-On-Demand):	978-1-6654-2399-1
ISBN (Online):	978-1-6654-2398-4
ISSN:	1550-4786

**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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# 2021 IEEE International Conference on Data Mining (ICDM) **ICDM 2021**

## Table of Contents

Message from the ICDM 2021 General Chairs .....	xxviii
Message from the ICDM 2021 Program Chairs .....	xxx
Organizing Committee .....	xxxii
Area Chairs and Program Committee .....	xxxiv
External Reviewers .....	xliv
Keynotes .....	xlviii

## Regular Papers

Gated Information Bottleneck for Generalization in Sequential Environments .....	1
<i>Francesco Alesiani (NEC Laboratories Europe), Shujian Yu (UiT - The Arctic University of Norway; Xi'an Jiaotong University), and Xi Yu (University of Florida)</i>	
Partial Differential Equation Driven Dynamic Graph Networks for Predicting Stream Water Temperature .....	11
<i>Tianshu Bao (Vanderbilt University, USA), Xiaowei Jia (University of Pittsburgh, USA), Jacob Zwart (U.S. Geological Survey, USA), Jeffrey Sadler (U.S. Geological Survey, USA), Alison Appling (U.S. Geological Survey, USA), Samantha Oliver (U.S. Geological Survey, USA), and Taylor T. Johnson (Vanderbilt University, USA)</i>	
A Linear Primal-Dual Multi-instance SVM for Big Data Classifications .....	21
<i>Lodewijk Brand (Colorado School of Mines, USA), Lauren Baker (Colorado School of Mines, USA), Carla Ellefsen (Colorado School of Mines, USA), Jackson Sargent (University of Michigan, Ann Arbor, USA), and Hua Wang (Colorado School of Mines, USA)</i>	
Spatially and Robustly Hybrid Mixture Regression Model for Inference of Spatial Dependence.....	31
<i>Wennan Chang (Purdue University), Pengtao Dang (Purdue University), Changlin Wan (Purdue University), Xiaoyu Lu (Indiana University, USA), Yue Fang (Department of Biostatistics, Indiana University), Tong Zhao (Amazon), Yong Zang (Indiana University, USA), Bo Li (Peking University, China), Chi Zhang (Purdue University), and Sha Cao (Indiana University, USA)</i>	

Differentially Private String Sanitization for Frequency-Based Mining Tasks .....	41
<i>Huiping Chen (King’s College London, United Kingdom), Changyu Dong (Newcastle University, United Kingdom), Liyue Fan (University of North Carolina at Charlotte, USA), Grigorios Loukides (King’s College London, United Kingdom), Solon P Pissis (CWI, The Netherlands; Vrije Universiteit, The Netherlands; ERABLE Team, France), and Leen Stougie (CWI, The Netherlands; Vrije Universiteit, The Netherlands; ERABLE Team, France)</i>	
Learning Transferable User Representations with Sequential Behaviors via Contrastive Pre-Training .....	51
<i>Mingyue Cheng (University of Science and Technology of China), Fajie Yuan (Westlake University, China), Qi Liu (University of Science and Technology of China), Xin Xin (Shandong University, China), and Enhong Chen (University of Science and Technology of China)</i>	
Highly Scalable and Provably Accurate Classification in Poincaré Balls .....	61
<i>Eli Chien (University of Illinois Urbana-Champaign, USA), Chao Pan (University of Illinois Urbana-Champaign, USA), Puoya Tabaghi (University of Illinois Urbana-Champaign, USA), and Olgica Milenkovic (University of Illinois Urbana-Champaign, USA)</i>	
Topic-Noise Models: Modeling Topic and Noise Distributions in Social Media Post Collections .....	71
<i>Rob Churchill (Georgetown University, USA) and Lisa Singh (Georgetown University, USA)</i>	
TRIO: Task-Agnostic Dataset Representation Optimized for Automatic Algorithm Selection .....	81
<i>Noy Cohen-Shapira (Ben-Gurion University of the Negev, Israel) and Lior Rokach (Ben-Gurion University of the Negev, Israel)</i>	
Hypergraph Ego-Networks and Their Temporal Evolution .....	91
<i>Cazamere Comrie (Cornell University) and Jon Kleinberg (Cornell University)</i>	
MetaGB: A Gradient Boosting Framework for Efficient Task Adaptive Meta Learning .....	101
<i>Manqing Dong (University of New South Wales), Lina Yao (University of New South Wales), Xianzhi Wang (University of Technology Sydney), Xiwei Xu (Data61, CSIRO), and Liming Zhu (Data61, CSIRO)</i>	
ACE-HGNN: Adaptive Curvature Exploration Hyperbolic Graph Neural Network .....	111
<i>Xingcheng Fu (Beihang University, China), Jianxin Li (Beihang University, China), Jia Wu (Macquarie University, Australia), Qingyun Sun (Beihang University, China), Cheng Ji (Beihang University, China), Senzhang Wang (Central South University, China), Jiajun Tan (Beihang University, China), Hao Peng (Beihang University, China), and Philip S. Yu (University of Illinois at Chicago, USA)</i>	
Dictionary Pair-Based Data-Free Fast Deep Neural Network Compression .....	121
<i>Yangcheng Gao (Hefei University of Technology, China), Zhao Zhang (Hefei University of Technology, China), Haijun Zhang (Harbin Institute of Technology (Shenzhen), Xili University Town, China), Mingbo Zhao (City University of Hong Kong), Yi Yang (University of Technology Sydney, Australia), and Meng Wang (Hefei University of Technology, China)</i>	

GNES: Learning to Explain Graph Neural Networks .....	131
<i>Yuyang Gao (Emory University, USA), Tong Sun (George Mason University, USA), Rishab Bhatt (Emory University, USA), Dazhou Yu (Emory University, USA), Sungsoo Hong (George Mason University, USA), and Liang Zhao (Emory University, USA)</i>	
Graph Transfer Learning .....	141
<i>Andrey Gritsenko (Northeastern University, USA), Yuan Guo (Northeastern University, USA), Kimia Shayestehfard (Northeastern University, USA), Armin Moharrer (Northeastern University, USA), Jennifer Dy (Northeastern University, USA), and Stratis Ioannidis (Northeastern University, USA)</i>	
Finding Age Path of Self-Paced Learning .....	151
<i>Bin Gu (Mohamed bin Zayed University of Artificial Intelligence, UAE), Zhou Zhai (Nanjing University of Information Science &amp; Technology, China), Xiang Li (University of Western Ontario, Canada), and Heng Huang (University of Pittsburgh, USA)</i>	
Continual Learning for Multivariate Time Series Tasks with Variable Input Dimensions .....	161
<i>Vibhor Gupta (TCS Research, India), Jyoti Narwariya (TCS Research, India), Pankaj Malhotra (TCS Research, India), Lovekesh Vig (TCS Research, India), and Gautam Shroff (TCS Research, India)</i>	
LAGA: Lagged AllReduce with Gradient Accumulation for Minimal Idle Time .....	171
<i>Ido Hakimi (Technion - Israel Institute of Technology, Israel), Rotem Zamir Aviv (Technion - Israel Institute of Technology, Israel), Kfir Y. Levy (Technion - Israel Institute of Technology, Israel), and Assaf Schuster (Technion - Israel Institute of Technology, Israel)</i>	
Online Learning in Variable Feature Spaces with Mixed Data .....	181
<i>Yi He (Old Dominion University), Jiaxian Dong (Guangzhou University), Bo-Jian Hou (Cornell University), Yu Wang (Guangzhou University), and Fei Wang (Cornell University)</i>	
Conversion Prediction with Delayed Feedback: A Multi-task Learning Approach .....	191
<i>Yilin Hou (Alibaba Group, China), Guangming Zhao (Alibaba Group, China), Chuanren Liu (The University of Tennessee, USA), Zhonglin Zu (Alibaba Group, China), and Xiaoliang Zhu (Alibaba Group, China)</i>	
Flexible, Robust, Scalable Semi-Supervised Learning via Reliability Propagation .....	200
<i>Chen Huang (University of Electronic Science and Technology of China; SiChuan University, China), Liangxu Pan (University of Electronic Science and Technology of China), Qinli Yang (University of Electronic Science and Technology of China), Hongliang Wang (University of Electronic Science and Technology of China; Kth Royal Institute of Technology), and Junming Shao (University of Electronic Science and Technology of China)</i>	
Group-Level Cognitive Diagnosis: A Multi-task Learning Perspective .....	210
<i>Jie Huang (University of Science and Technology of China), Qi Liu (University of Science and Technology of China), Fei Wang (University of Science and Technology of China), Zhenya Huang (University of Science and Technology of China), Songtao Fang (University of Science and Technology of China), Runze Wu (NetEase Fuxi AI Lab, China), Enhong Chen (University of Science and Technology of China), Yu Su (iFLYTEK Research, China), and Shijin Wang (IFLYTEK, China)</i>	

STAN: Adversarial Network for Cross-Domain Question Difficulty Prediction .....	220
<i>Ye Huang (University of Science and Technology of China), Wei Huang (University of Science and Technology of China), Shiwei Tong (University of Science and Technology of China), Zhenya Huang (University of Science and Technology of China), Qi Liu (University of Science and Technology of China), Enhong Chen (University of Science and Technology of China), Jianhui Ma (University of Science and Technology of China), Liang Wan (University of Science and Technology of China), and Shijin Wang (iFLYTEK Research, China)</i>	
Climate Modeling with Neural Diffusion Equations .....	230
<i>Jeehyun Hwang (Yonsei University, South Korea), Jeongwhan Choi (Yonsei University, South Korea), Hwangyong Choi (Yonsei University, South Korea), Kookjin Lee (Arizona State University, USA), Dongeun Lee (Texas A&amp;M University - Commerce, USA), and Noseong Park (Yonsei University, South Korea)</i>	
Risk-Aware Temporal Cascade Reconstruction to Detect Asymptomatic Cases .....	240
<i>Hankyu Jang (The University of Iowa, USA), Shreyas Pai (The University of Iowa, USA), Bijaya Adhikari (The University of Iowa, USA), and Sriram V. Pemmaraju (The University of Iowa, USA)</i>	
Attentive Neural Controlled Differential Equations for Time-Series Classification and Forecasting .....	250
<i>Sheo Yon Jhin (Yonsei University, South Korea), Heejoo Shin (Yonsei University, South Korea), Seoyoung Hong (Yonsei University, South Korea), Minju Jo (Yonsei University, South Korea), Solhee Park (Yonsei University, South Korea), Noseong Park (Yonsei University, South Korea), Seungbeom Lee (Socar Co. Ltd., South Korea), Hwiyoung Maeng (Socar Co. Ltd., South Korea), and Seungmin Jeon (Socar Co. Ltd., South Korea)</i>	
Hypergraph Convolutional Network for Group Recommendation .....	260
<i>Renqi Jia (University of Chinese Academy of Sciences, China; Institute of Information Engineering, Chinese Academy of Sciences, China), Xiaofei Zhou (University of Chinese Academy of Sciences, China; Institute of Information Engineering, Chinese Academy of Sciences, China), Linhua Dong (University of Chinese Academy of Sciences, China; Institute of Information Engineering, Chinese Academy of Sciences, China), and Shirui Pan (Monash University, Australia)</i>	
Physics-Guided Machine Learning from Simulation Data: An Application in Modeling Lake and River Systems .....	270
<i>Xiaowei Jia (University of Pittsburgh), Yiqun Xie (University of Maryland), Sheng Li (University of Georgia), Shengyu Chen (University of Pittsburgh), Jacob Zwart (U.S. Geological Survey), Jeffrey Sadler (U.S. Geological Survey), Alison Appling (U.S. Geological Survey), Samantha Oliver (U.S. Geological Survey), and Jordan Read (U.S. Geological Survey)</i>	
Crowdsourcing with Self-Paced Workers .....	280
<i>Xiangping Kang (Shandong University, China), Guoxian Yu (Shandong University, China), Carlotta Domeniconi (George Mason University, USA), Jun Wang (Shandong University, China), Wei Guo (Shandong University, China), Yazhou Ren (University of Elec. Sci. and Tech. of China, China), and Lizhen Cui (Shandong University, China)</i>	

MASCOT: A Quantization Framework for Efficient Matrix Factorization in Recommender Systems.....	290
<i>Yunyong Ko (Hanyang University, Republic of Korea), Jae-Seo Yu (Hanyang University, Republic of Korea), Hong-Kyun Bae (Hanyang University, Republic of Korea), Yongjun Park (Hanyang University, Republic of Korea), Dongwon Lee (The Pennsylvania State University, University Park, USA), and Sang-Wook Kim (Hanyang University, Republic of Korea)</i>	
Anomaly Detection with Prototype-Guided Discriminative Latent Embeddings .....	300
<i>Yuandu Lai (Tianjin University, China), Yahong Han (Tianjin University, China), and Yaowei Wang (PengCheng Laboratory, China)</i>	
THyMe+: Temporal Hypergraph Motifs and Fast Algorithms for Exact Counting .....	310
<i>Geon Lee (KAIST, South Korea) and Kijung Shin (KAIST, South Korea)</i>	
BaT: Beat-Aligned Transformer for Electrocardiogram Classification .....	320
<i>Xiaoyu Li (Xi'an Jiaotong University, China; The First Affiliated Hospital of Xi'an Jiaotong University, China), Chen Li (Xi'an Jiaotong University, China), Yuhua Wei (Xi'an Jiaotong University, China), Yuyao Sun (Ping An Healthcare Technology, China), Jishang Wei (HP Labs, USA), Xiang Li (Ping An Healthcare Technology, China), and Buyue Qian (The First Affiliated Hospital of Xi'an Jiaotong University, China)</i>	
Mcore: Multi-agent Collaborative Learning for Knowledge-Graph-Enhanced Recommendation ....	330
<i>Xujia Li (The Hong Kong University of Science and Technology), Yanyan Shen (Shanghai Jiao Tong University), and Lei Chen (The Hong Kong University of Science and Technology)</i>	
Towards Interpretability and Personalization: A Predictive Framework for Clinical Time-Series Analysis .....	340
<i>Yang Li (Xi'an Jiaotong University, China), Xianli Zhang (Xi'an Jiaotong University, China), Buyue Qian (The First Affiliated Hospital of Xi'an Jiaotong University, China), Zeyu Gao (Xi'an Jiaotong University, China), Chong Guan (Tencent Jarvis Lab, China), Yefeng Zheng (Tencent Jarvis Lab, China), Hansen Zheng (Xi'an Jiaotong University, China), Fenglang Wu (The First Affiliated Hospital of Xi'an Jiaotong University, China), and Chen Li (Xi'an Jiaotong University, China)</i>	
Preference-Aware Group Task Assignment in Spatial Crowdsourcing: A Mutual Information-Based Approach .....	350
<i>Yunchuan Li (University of Electronic Science and Technology of China, China), Yan Zhao (Aalborg University, Denmark), and Kai Zheng (University of Electronic Science and Technology of China, China)</i>	

Disentangled Deep Multivariate Hawkes Process for Learning Event Sequences .....	360
<i>Xixun Lin (Institute of Information Engineering, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China), Jiangxia Cao (Institute of Information Engineering, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China), Peng Zhang (Guangzhou University, China), Chuan Zhou (Academy of Mathematics and Systems Science, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China), Zhao Li (Alibaba Group, China), Jia Wu (Macquarie University, Australia), and Bin Wang (Xiaomi AI Lab, China)</i>	
SSDNet: State Space Decomposition Neural Network for Time Series Forecasting .....	370
<i>Yang Lin (The University of Sydney, Australia), Irena Koprinska (The University of Sydney, Australia), and Mashud Rana (CSIRO, Australia)</i>	
Deep Generation of Heterogeneous Networks .....	379
<i>Chen Ling (Emory University, USA), Carl Yang (Emory University, USA), and Liang Zhao (Emory University, USA)</i>	
Technological Knowledge Flow Forecasting Through A Hierarchical Interactive Graph Neural Network .....	389
<i>Huijie Liu (University of Science and Technology of China, China), Han Wu (University of Science and Technology of China, China), Le Zhang (University of Science and Technology of China, China), Runlong Yu (University of Science and Technology of China, China), Ye Liu (University of Science and Technology of China, China), Chunli Liu (Hefei University of Technology, China), Qi Liu (University of Science and Technology of China, China), and Enhong Chen (University of Science and Technology of China, China)</i>	
Efficient Reinforced Feature Selection via Early Stopping Traverse Strategy .....	399
<i>Kunpeng Liu (University of Central Florida, USA), Pengfei Wang (DAMO Academy, Alibaba Group, China), Dongjie Wang (University of Central Florida, USA), Wan Du (University of California Merced), Dapeng Wu (University of Florida, USA), and Yanjie Fu (University of Central Florida, USA)</i>	
Multi-objective Explanations of GNN Predictions .....	409
<i>Yifei Liu (BUPT, China), Chao Chen (Lehigh University, USA), Yazheng Liu (BUPT, China), Xi Zhang (BUPT, China), and Sihong Xie (Lehigh University, USA)</i>	
FGC-Stream: A Novel Joint Miner for Frequent Generators and Closed Itemsets in Data Streams .....	419
<i>Tomas Martin (Université du Québec à Montréal, Canada), Petko Valtchev (Université du Québec à Montréal, Canada), and Louis-Romain Roux (Ecole Polytechnique, Paris, France)</i>	
Multi-way Time Series Join on Multi-length Patterns .....	429
<i>Md Parvez Mollah (University of New Mexico, USA), Vinicius M. A. Souza (Pontifícia Universidade Católica do Paraná, Brazil), and Abdullah Mueen (University of New Mexico, USA)</i>	
Outlier-Robust Multi-view Subspace Clustering with Prior Constraints .....	439
<i>Mehrnaz Najafi (LinkedIn, USA), Lifang He (Lehigh University, USA), and Philip S. Yu (University of Illinois at Chicago, USA)</i>	



Label Dependent Attention Model for Disease Risk Prediction using Multimodal Electronic Health Records .....	449
<i>Shuai Niu (Hong Kong Baptist University, China), Qing Yin (Hong Kong Baptist University, China), Yunya Song (Hong Kong Baptist University, China), Yike Guo (Hong Kong Baptist University, China), and Xian Yang (Hong Kong Baptist University, China)</i>	
Cutting to the Chase with Warm-Start Contextual Bandits .....	459
<i>Bastian Oetomo (The University of Melbourne, Australia), R. Malinga Perera (The University of Melbourne, Australia), Renata Borovica-Gajic (The University of Melbourne, Australia), and Benjamin I. P. Rubinstein (The University of Melbourne, Australia)</i>	
Towards Generating Real-World Time Series Data .....	469
<i>Hengzhi Pei (University of Illinois at Urbana-Champaign, USA), Kan Ren (Microsoft Research Asia, China), Yuqing Yang (Microsoft Research Asia, China), Chang Liu (Microsoft Research Asia, China), Tao Qin (Microsoft Research Asia, China), and Dongsheng Li (Microsoft Research Asia, China)</i>	
GraphANGEL: Adaptive and Structure-Aware Sampling on Graph Neural Networks .....	479
<i>Jingshu Peng (The Hong Kong University of Science and Technology, China), Yanyan Shen (Shanghai Jiao Tong University, China), and Lei Chen (The Hong Kong University of Science and Technology, China)</i>	
Sequential Diagnosis Prediction with Transformer and Ontological Representation .....	489
<i>Xueping Peng (University of Technology Sydney, Australia), Guodong Long (University of Technology Sydney, Australia), Tao Shen (University of Technology Sydney, Australia), Sen Wang (The University of Queensland, Australia), and Jing Jiang (University of Technology Sydney, Australia)</i>	
Cardiac Complication Risk Profiling for Cancer Survivors via Multi-view Multi-task Learning .....	499
<i>Thai-Hoang Pham (The Ohio State University, USA), Changchang Yin (The Ohio State University, USA), Laxmi Mehta (The Ohio State University, USA), Xueru Zhang (The Ohio State University, USA), and Ping Zhang (The Ohio State University, USA)</i>	
Powered Hawkes-Dirichlet Process: Challenging Textual Clustering using a Flexible Temporal Prior .....	509
<i>Gaël Poux-Médard (Université de Lyon, France), Julien Velcin (Université de Lyon, France), and Sabine Loudcher (Université de Lyon, France)</i>	
Memory Augmented Multi-instance Contrastive Predictive Coding for Sequential Recommendation .....	519
<i>Ruihong Qiu (The University of Queensland), Zi Huang (The University of Queensland), and Hongzhi Yin (The University of Queensland)</i>	
Robust Low-Rank Deep Feature Recovery in CNNs: Toward Low Information Loss and Fast Convergence .....	529
<i>Jiahuan Ren (Hefei University of Technology, China), Zhao Zhang (Hefei University of Technology, China), Jicong Fan (The Chinese University of Hong Kong (Shenzhen), China), Haijun Zhang (Harbin Institute of Technology (Shenzhen), China), Mingliang Xu (Zhengzhou University, China), and Meng Wang (Hefei University of Technology, China)</i>	

Truth Discovery in Sequence Labels from Crowds .....	539
<i>Nasim Sabetpour (Iowa State University, USA), Adithya Kulkarni (Iowa State University, USA), Sihong Xie (Lehigh University, USA), and Qi Li (Iowa State University, USA)</i>	
Better Prevent than React: Deep Stratified Learning to Predict Hate Intensity of Twitter Reply Chains .....	549
<i>Dhruv Sahnan (IIIT-Delhi, India), Snehil Dahiya (IIIT-Delhi, India), Vasu Goel (IIIT-Delhi, India), Anil Bandhakavi (Logically, UK), and Tanmoy Chakraborty (IIIT-Delhi, India)</i>	
Fast Attributed Graph Embedding via Density of States .....	559
<i>Saurabh Sawlani (Carnegie Mellon University), Lingxiao Zhao (Carnegie Mellon University), and Leman Akoglu (Carnegie Mellon University)</i>	
PARWiS: Winner Determination from Active Pairwise Comparisons Under a Shoestring Budget ...	569
<i>Dev Yashpal Sheth (Indian Institute of Technology Madras, India) and Arun Rajkumar (Indian Institute of Technology Madras, India)</i>	
Attention-Based Feature Interaction for Efficient Online Knowledge Distillation .....	579
<i>Tongtong Su (Nankai University, China), Qiyu Liang (Nankai University, China), Jinsong Zhang (Nankai University, China), Zhaoyang Yu (Nankai University, China), Gang Wang (Nankai University, China), and Xiaoguang Liu (Nankai University, China)</i>	
Ultra Fast Warping Window Optimization for Dynamic Time Warping .....	589
<i>Chang Wei Tan (Monash University, Australia), Matthieu Herrmann (Monash University, Australia), and Geoffrey I. Webb (Monash University, Australia)</i>	
A Robust Algorithm to Unifying Offline Causal Inference and Online Multi-Armed Bandit Learning .....	599
<i>Qiao Tang (Chongqing University, China) and Hong Xie (Chongqing University, China)</i>	
Fast Computation of Distance-Generalized Cores using Sampling .....	609
<i>Nikolaj Tatti (University of Helsinki, Finland)</i>	
Isolation Kernel Density Estimation .....	619
<i>Kai Ming Ting (Nanjing University, China), Takashi Washio (Osaka University, Japan), Jonathan. R. Wells (Deakin University, Australia), and Hang Zhang (Nanjing University, China)</i>	
DCF: An Efficient and Robust Density-Based Clustering Method .....	629
<i>Joshua Tobin (Trinity College Dublin, Ireland) and Mimi Zhang (Trinity College Dublin, Ireland)</i>	
CASPITA: Mining Statistically Significant Paths in Time Series Data from an Unknown Network .....	639
<i>Andrea Tonon (University of Padova, Italy) and Fabio Vandin (University of Padova, Italy)</i>	
Precise Bayes Classifier: Summary of Results .....	649
<i>Amin Vahedian (University of Wisconsin-Whitewater, USA) and Xun Zhou (The University of Iowa, USA)</i>	

USTEP: Unfixed Search Tree for Efficient Log Parsing .....	659
<i>Arthur Vervaeet (3DS OUTSCALE / ISEP, France), Raja Chiky (ISEP - Institut Supérieur d'Électronique de Paris, France), and Mar Callau-Zori (3DS OUTSCALE, France)</i>	
Deep Reinforced Attention Regression for Partial Sketch Based Image Retrieval .....	669
<i>Dingrong Wang (Rochester Institute of Technology, USA), Hitesh Sapkota (Rochester Institute of Technology, USA), Xumin Liu (Rochester Institute of Technology, USA), and Qi Yu (Rochester Institute of Technology, USA)</i>	
Deep Human-Guided Conditional Variational Generative Modeling for Automated Urban Planning... 679	
<i>Dongjie Wang (University of Central Florida, USA), Kunpeng Liu (University of Central Florida, USA), Pauline Johnson (University of Central Florida, USA), Leilei Sun (Beihang University, China), Bowen Du (University of Central Florida, USA), and Yanjie Fu (University of Central Florida, USA)</i>	
Combining Ranking and Point-Wise Losses for Training Deep Survival Analysis Models .....	689
<i>Lu Wang (University of Toronto, Canada), Yan Li (University of Toronto, Canada), and Mark Chignell (University of Toronto, Canada)</i>	
Global Convolutional Neural Processes .....	699
<i>Xuesong Wang (University of New South Wales), Lina Yao (University of New South Wales), Xianzhi Wang (University of Technology Sydney), Hye-Young Paik (University of New South Wales), and Sen Wang (University of Queensland)</i>	
Nonlinear Causal Structure Learning for Mixed Data .....	709
<i>Wenjuan Wei (NEC Labs China, China) and Lu Feng (NEC Labs China, China)</i>	
Learning to Reweight Samples with Offline Loss Sequence .....	719
<i>Yuhua Wei (Xi'an Jiaotong University, China), Chen Li (Xi'an Jiaotong University, China), Xiaoyu Li (Xi'an Jiaotong University, China), Jishang Wei (HP Labs, USA), and Buyue Qian (The First Affiliated Hospital of Xi'an Jiaotong University, China)</i>	
PRGAN: Personalized Recommendation with Conditional Generative Adversarial Networks .....	729
<i>Jing Wen (Sun Yat-sen University, China; Guangdong Province Key Laboratory of Computational Science, China; Ministry of Education, China), Bi-Yi Chen (Sun Yat-sen University, China; Guangdong Province Key Laboratory of Computational Science, China; Ministry of Education, China), Chang-Dong Wang (Sun Yat-sen University, China; Guangdong Province Key Laboratory of Computational Science, China; Ministry of Education, China), and Zhihong Tian (Guangzhou University, China)</i>	
A Regularized Wasserstein Framework for Graph Kernels .....	739
<i>Asiri Wijesinghe (Australian National University, Australia), Qing Wang (Australian National University, Australia), and Stephen Gould (Australian National University, Australia)</i>	

Impression Allocation and Policy Search in Display Advertising .....	749
<i>Di Wu (Alibaba Group), Cheng Chen (Alibaba Group), Xiujun Chen (Alibaba Group), Junwei Pan (Yahoo Research), Xun Yang (Alibaba Group), Qing Tan (Alibaba Group), Jian Xu (Alibaba Group), and Kuang-Chih Lee (Alibaba Group)</i>	
Expert Knowledge-Guided Length-Variant Hierarchical Label Generation for Proposal Classification .....	757
<i>Meng Xiao (Computer Network Information Center, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China), Ziyue Qiao (Computer Network Information Center, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China), Yanjie Fu (University of Central Florida, USA), Yi Du (Computer Network Information Center, Chinese Academy of Sciences, China), Pengyang Wang (University of Macau, China), and Yuanchun Zhou (Computer Network Information Center, Chinese Academy of Sciences, China)</i>	
A Statistically-Guided Deep Network Transformation and Moderation Framework for Data with Spatial Heterogeneity .....	767
<i>Yiqun Xie (University of Maryland), Erhu He (University of Pittsburgh), Xiaowei Jia (University of Pittsburgh), Han Bao (University of Iowa), Xun Zhou (University of Iowa), Rahul Ghosh (University of Minnesota), and Praveen Ravirathinam (University of Minnesota)</i>	
Predictive Modeling of Clinical Events with Mutual Enhancement Between Longitudinal Patient Records and Medical Knowledge Graph .....	777
<i>Xiao Xu (Ping An Health Technology), Xian Xu (Ping An Health Technology), Yuyao Sun (Ping An Health Technology), Xiaoshuang Liu (Ping An Health Technology), Xiang Li (Ping An Health Technology), Guotong Xie (Ping An Technology (Shenzhen) Co. Ltd.), and Fei Wang (Cornell University)</i>	
Hyper Meta-Path Contrastive Learning for Multi-behavior Recommendation .....	787
<i>Haoran Yang (University of Technology Sydney, Australia), Hongxu Chen (University of Technology Sydney, Australia), Lin Li (Wuhan University of Technology, China; University of Technology Sydney, Australia), Philip S. Yu (University of Illinois at Chicago, U.S.A), and Guandong Xu (University of Technology, Australia)</i>	
Graph-Based Adversarial Online Kernel Learning with Adaptive Embedding .....	797
<i>Peng Yang (Baidu Research, USA), Xiaoyun Li (Baidu Research, USA), and Ping Li (Baidu Research, USA)</i>	
Structure-Aware Stabilization of Adversarial Robustness with Massive Contrastive Adversaries .....	807
<i>Shuo Yang (The University of Sydney, Australia), Zeyu Feng (The University of Sydney, Australia), Pei Du (AntGroup, China), Bo Du (Wuhan University, China), and Chang Xu (The University of Sydney, Australia)</i>	
Space Meets Time: Local Spacetime Neural Network for Traffic Flow Forecasting .....	817
<i>Song Yang (The University of Auckland, New Zealand), Jiamou Liu (The University of Auckland, New Zealand), and Kaiqi Zhao (The University of Auckland, New Zealand)</i>	

Accurate Graph-Based PU Learning Without Class Prior .....	827
<i>Jaemin Yoo (Seoul National University, South Korea), Junghun Kim (Seoul National University, South Korea), Hoyoung Yoon (Seoul National University, South Korea), Geonsoo Kim (NCSOFT, South Korea), Changwon Jang (NCSOFT, South Korea), and U Kang (Seoul National University, South Korea)</i>	
AS-GCN: Adaptive Semantic Architecture of Graph Convolutional Networks for Text-Rich Networks .....	837
<i>Zhizhi Yu (Tianjin University, China), Di Jin (Tianjin University, China), Ziyang Liu (Tsinghua University, China), Dongxiao He (Tianjin University, China), Xiao Wang (Beijing University of Posts and Telecommunications, China), Hanghang Tong (University of Illinois at Urbana-Champaign, USA), and Jiawei Han (University of Illinois at Urbana-Champaign, USA)</i>	
Physics Interpretable Shallow-Deep Neural Networks for Physical System Identification with Unobservability .....	847
<i>Jingyi Yuan (Arizona State University, USA) and Yang Weng (Arizona State University, USA)</i>	
SCEHR: Supervised Contrastive Learning for Clinical Risk Prediction using Electronic Health Records .....	857
<i>Chengxi Zang (Population Health Sciences, Weill Cornell Medicine, USA) and Fei Wang (Population Health Sciences, Weill Cornell Medicine, USA)</i>	
FRAUDRE: Fraud Detection Dual-Resistant to Graph Inconsistency and Imbalance .....	867
<i>Ge Zhang (Macquarie University, Australia), Jia Wu (Macquarie University, Australia), Jian Yang (Macquarie University, Australia), Amin Beheshti (Macquarie University, Australia), Shan Xue (Macquarie University, Australia), Chuan Zhou (Chinese Academy of Sciences, China), and Quan Z. Sheng (Macquarie University, Australia)</i>	
Robustifying DARTS by Eliminating Information Bypass Leakage via Explicit Sparse Regularization .....	877
<i>Jiuling Zhang (University of Chinese Academy of Sciences, China) and Zhiming Ding (Institute of Software Chinese Academy of Sciences, China)</i>	
Fair Decision-Making Under Uncertainty .....	886
<i>Wenbin Zhang (Carnegie Mellon University, USA) and Jeremy C. Weiss (Carnegie Mellon University, USA)</i>	
AutoEmb: Automated Embedding Dimensionality Search in Streaming Recommendations .....	896
<i>Xiangyu Zhao (City University of Hong Kong, Hong Kong), Haochen Liu (Michigan State University, USA), Wenqi Fan (The Hong Kong Polytechnic University, Hong Kong), Hui Liu (Michigan State University, USA), Jiliang Tang (Michigan State University, USA), Chong Wang (ByteDance, USA), Ming Chen (ByteDance, USA), Xudong Zheng (ByteDance, China), Xiaobing Liu (ByteDance, China), and Xiwang Yang (ByteDance, China)</i>	
DAC-ML: Domain Adaptable Continuous Meta-Learning for Urban Dynamics Prediction .....	906
<i>Xin Zhang (Worcester Polytechnic Institute), Yanhua Li (Worcester Polytechnic Institute), Xun Zhou (University of Iowa), Oren Mangoubi (Worcester Polytechnic Institute), Ziming Zhang (Worcester Polytechnic Institute), Vincent Filardi (Worcester Polytechnic Institute), and Jun Luo (Lenovo Group Limited)</i>	

GANBLR: A Tabular Data Generation Model .....	916
<i>Yishuo Zhang (Deakin University, Australia), Nayyar A. Zaidi (Deakin University, Australia), Jiahui Zhou (Xian Shiyou University), and Gang Li (Deakin University, Australia)</i>	
Few-Shot Partial Multi-label Learning .....	926
<i>Yunfeng Zhao (Shandong University, China), Guoxian Yu (Shandong University, China), Lei Liu (Shandong University, China), Zhongmin Yan (Shandong University, China), Carlotta Domeniconi (George Mason University, USA), and Lizhen Cui (Shandong University, China)</i>	
Discriminative Additive Scale Loss for Deep Imbalanced Classification and Embedding .....	936
<i>Zhao Zhang (Hefei University of Technology, China), Weiming Jiang (AI team, Shanghai Shizhuang Information Technology Co., Ltd, China), Yang Wang (Hefei University of Technology, China), Qiaolin Ye (Nanjing Forestry University, China), Mingbo Zhao (Donghua University, China), Mingliang Xu (Zhengzhou University, China), and Meng Wang (Hefei University of Technology, China)</i>	
Triplet Deep Subspace Clustering via Self-Supervised Data Augmentation .....	946
<i>Zhao Zhang (Hefei University of Technology, China), Xianzhen Li (Soochow University, China), Haijun Zhang (Harbin Institute of Technology (Shenzhen), China), Yi Yang (University of Technology Sydney, Australia), Shuicheng Yan (Sea AI Lab (SAIL) &amp; National University of Singapore, Singapore), and Meng Wang (Hefei University of Technology, China)</i>	
Temporal Clustering with External Memory Network for Disease Progression Modeling .....	956
<i>Zicong Zhang (The Ohio State University, USA), Changchang Yin (The Ohio State University, USA), and Ping Zhang (The Ohio State University, USA)</i>	
Deep Incremental RNN for Learning Sequential Data: A Lyapunov Stable Dynamical System .....	966
<i>Ziming Zhang (Worcester Polytechnic Institute, USA), Guojun Wu (Worcester Polytechnic Institute, USA), Yanhua Li (Worcester Polytechnic Institute, USA), Yun Yue (Worcester Polytechnic Institute, USA), and Xun Zhou (University of Iowa, USA)</i>	

## Short Papers

PIETS: Parallelised Irregularity Encoders for Forecasting with Heterogeneous Time-Series .....	976
<i>Futoon M. Abushaqra (RMIT University, Australia), Hao Xue (RMIT University, Australia), Yongli Ren (RMIT University, Australia), and Flora D. Salim (RMIT University, Australia)</i>	
TEST-GCN: Topologically Enhanced Spatial-Temporal Graph Convolutional Networks for Traffic Forecasting .....	982
<i>Muhammad Afif Ali (Grab-NUS AI Lab, Singapore), Suriya Venkatesan (GrabTaxi Holdings, Singapore), Victor Liang (GrabTaxi Holdings, Singapore), and Hannes Kruppa (GrabTaxi Holdings, Singapore)</i>	
DIVINIA: Rare Object Localization and Search in Overhead Imagery .....	988
<i>Jonathan Amazon (Novateur Research Solutions, USA), Khurram Shafique (Novateur Research Solutions, USA), Zeeshan Rasheed (Novateur Research Solutions, USA), and Aaron Reite (NGA, USA)</i>	

Cold Item Integration in Deep Hybrid Recommenders via Tunable Stochastic Gates .....	994
<i>Oren Barkan (The Open University; Microsoft), Roy Hirsch (Tel Aviv University; Microsoft), Ori Katz (Technion; Microsoft), Avi Caciularu (Bar-Ilan University), Jonathan Weill (Microsoft), and Noam Koenigstein (Tel Aviv University; Microsoft)</i>	
LOGIC: Probabilistic Machine Learning for Time Series Classification .....	1000
<i>Fabian Berns (University of Muenster, Germany), Jan David Huewel (University of Muenster, Germany), and Christian Beecks (University of Muenster, Germany)</i>	
K-Means for Evolving Data Streams .....	1006
<i>Arkaitz Bidaurrezaga (Basque Center for Applied Mathematics, Spain), Aritz Pérez (Basque Center for Applied Mathematics, Spain), and Marco Capó (Basque Center for Applied Mathematics, Spain)</i>	
Generating Explanations for Recommendation Systems via Injective VAE .....	1012
<i>ZeRui Cai (East China Normal University, China)</i>	
Self-Learn to Explain Siamese Networks Robustly .....	1018
<i>Chao Chen (Lehigh University, USA), Yifan Shen (BUPT, China), Guixiang Ma (University of Illinois at Chicago, USA), Xiangnan Kong (WPI, USA), Srinivas Rangarajan (Lehigh University, USA), Xi Zhang (BUPT, China), and Sihong Xie (Lehigh University, USA)</i>	
Heterogeneous Stream-Reservoir Graph Networks with Data Assimilation .....	1024
<i>Shengyu Chen (University of Pittsburgh), Alison Appling (U.S. Geological Survey), Samantha Oliver (U.S. Geological Survey), Hayley Corson-Dosch (U.S. Geological Survey), Jordan Read (U.S. Geological Survey), Jeffrey Sadler (U.S. Geological Survey), Jacob Zwart (U.S. Geological Survey), and Xiaowei Jia (University of Pittsburgh)</i>	
Improving Deep Forest by Exploiting High-Order Interactions .....	1030
<i>Yi-He Chen (Nanjing University, China), Shen-Huan Lyu (Nanjing University, China), and Yuan Jiang (Nanjing University, China)</i>	
Promoting Fairness Through Hyperparameter Optimization .....	1036
<i>Andre F. Cruz (Feedzai), Pedro Saleiro (Feedzai), Catarina Belem (Feedzai), Carlos Soares (Fraunhofer AICOS and LIACC, Faculdade de Engenharia, Universidade do Porto), and Pedro Bizarro (Feedzai)</i>	
Temporal Multi-view Graph Convolutional Networks for Citywide Traffic Volume Inference .....	1042
<i>Shaojie Dai (Ocean University of China, China), Jinshuai Wang (Ocean University of China, China), Chao Huang (The University of Hong Kong, China), Yanwei Yu (Ocean University of China, China), and Junyu Dong (Ocean University of China, China)</i>	
Gain-Some-Lose-Some: Reliable Quantification Under General Dataset Shift .....	1048
<i>Benjamin Denham (Auckland University of Technology, New Zealand), Edmund M-K Lai (Auckland University of Technology, New Zealand), Roopak Sinha (Auckland University of Technology, New Zealand), and M. Asif Naeem (National University of Computer &amp; Emerging Sciences, Pakistan)</i>	

Fair Graph Auto-Encoder for Unbiased Graph Representations with Wasserstein Distance .....	1054
<i>Wei Fan (University of Central Florida, USA), Kunpeng Liu (University of Central Florida, USA), Rui Xie (University of Central Florida, USA), Hao Liu (The Hong Kong University of Science and Technology, Hong Kong), Hui Xiong (Rutgers University, USA), and Yanjie Fu (University of Central Florida, USA)</i>	
GCN-SE: Attention as Explainability for Node Classification in Dynamic Graphs .....	1060
<i>Yucai Fan (Carnegie Mellon University, USA), Yuhang Yao (Carnegie Mellon University, USA), and Carlee Joe-Wong (Carnegie Mellon University, USA)</i>	
Heterogeneous Graph Neural Architecture Search .....	1066
<i>Yang Gao (Institute of Information Engineering, China; University of Chinese Academy of Sciences, China), Peng Zhang (Guangzhou University, China), Zhao Li (Alibaba Group, China), Chuan Zhou (Academy of Mathematics and Systems Science, China; University of Chinese Academy of Sciences, China), Yongchao Liu (Ant Group, China), and Yue Hu (Institute of Information Engineering, China; University of Chinese Academy of Sciences, China)</i>	
Attacking Similarity-Based Sign Prediction .....	1072
<i>Michal Tomasz Godziszewski (Univeristy of Warsaw), Tomasz Pawel Michalak (University of Warsaw), Marcin Waniek (NYU Abu Dhabi), Talal Rahwan (NYU Abu Dhabi), Kai Zhou (Hong Kong Polytechnic University), and Yulin Zhu (Hong Kong Polytechnic University)</i>	
Recurrent Neural Networks Meet Context-Free Grammar: Two Birds with One Stone .....	1078
<i>Hui Guan (University of Massachusetts, Amherst, USA), Umang Chaudhary (University of Massachusetts, Amherst, USA), Yuanchao Xu (North Carolina State University, USA), Lin Ning (North Carolina State University, USA), Lijun Zhang (University of Massachusetts, Amherst, USA), and Xipeng Shen (North Carolina State University, USA)</i>	
PaGAN: Generative Adversarial Network for Patent Understanding .....	1084
<i>Guillaume Guarino (ICUBE, France), Ahmed Samet (ICUBE, France), Amir Nafi (ICUBE, France), and Denis Cavallucci (ICUBE, France)</i>	
Federated Principal Component Analysis for Genome-Wide Association Studies .....	1090
<i>Anne Hartebrodt (University of Southern Denmark, Denmark), Reza Nasirigerdeh (Technical University of Munich, Germany), David B. Blumenthal (Friedrich-Alexander University Erlangen-Nürnberg, Germany; Joint senior), and Richard Röttger (University of Southern Denmark, Denmark; Joint senior)</i>	



Thin Semantics Enhancement via High-Frequency Priori Rule for Thin Structures Segmentation...	1096
<i>Yuting He (Southeast University, China), Rongjun Ge (Southeast University, China), Jiasong Wu (Southeast University, China; Centre de Recherche en Information Biomedicale Sino-Francais), Jean-Louis Coatrieux (Univ Rennes, Inserm, France; Centre de Recherche en Information Biomedicale Sino-Francais), Huazhong Shu (Southeast University, China; Centre de Recherche en Information Biomedicale Sino-Francais), Yang Chen (Southeast University, China; Centre de Recherche en Information Biomedicale Sino-Francais), Guanyu Yang (Southeast University, China; Centre de Recherche en Information Biomedicale Sino-Francais), and Shuo Li (University of Western Ontario, Canada)</i>	
Source Inference Attacks in Federated Learning .....	1102
<i>Hongsheng Hu (University of Auckland, New Zealand), Zoran Salcic (University of Auckland, New Zealand), Lichao Sun (Lehigh University, USA), Gillian Dobbie (University of Auckland, New Zealand), and Xuyun Zhang (Macquarie University, Australia)</i>	
MC-RGCN: A Multi-channel Recurrent Graph Convolutional Network to Learn High-Order Social Relations for Diffusion Prediction .....	1108
<i>Ningbo Huang (State Key Laboratory of Mathematical Engineering and Advanced Computing, China), Gang Zhou (State Key Laboratory of Mathematical Engineering and Advanced Computing, China), Mengli Zhang (State Key Laboratory of Mathematical Engineering and Advanced Computing, China), and Meng Zhang (State Key Laboratory of Mathematical Engineering and Advanced Computing, China)</i>	
Trajectory WaveNet: A Trajectory-Based Model for Traffic Forecasting .....	1114
<i>Bo Hui (Auburn University), Da Yan (University of Alabama at Birmingham), Haiquan Chen (California State University, Sacramento), and Wei-Shinn Ku (Auburn University)</i>	
Spikelet: An Adaptive Symbolic Approximation for Finding Higher-Level Structure in Time Series .....	1120
<i>Makoto Imamura (Tokai University, Japan) and Takaaki Nakamura (Mitsubishi Electric Corporation, Japan)</i>	
Bi-Level Attention Graph Neural Networks .....	1126
<i>Roshni Iyer (University of California, Los Angeles), Wei Wang (University of California, Los Angeles), and Yizhou Sun (University of California, Los Angeles)</i>	
SCALP — Supervised Contrastive Learning for Cardiopulmonary Disease Classification and Localization in Chest X-Rays using Patient Metadata .....	1132
<i>Ajay Jaiswal (The University of Texas at Austin, USA), Tianhao Li (The University of Texas at Austin, USA), Cyprian Zander (MIS, Germany), Yan Han (The University of Texas at Austin, USA), Justin F. Rousseau (The University of Texas at Austin, USA), Yifan Peng (Weill Cornell Medicine, USA), and Ying Ding (The University of Texas at Austin, USA)</i>	
Heterogeneous Graph Neural Network with Distance Encoding .....	1138
<i>Houye Ji (Beijing University of Posts and Telecommunications, China), Cheng Yang (Beijing University of Posts and Telecommunications, China), Chuan Shi (Beijing University of Posts and Telecommunications, China), and Pan Li (Purdue University, United States)</i>	

An Effective and Robust Framework by Modeling Correlations of Multiplex Network Embedding .....	1144
<i>Pengfei Jiao (Tianjin University, China), Ruili Lu (Tianjin University, China), Di Jin (Tianjin University, China), Yinghui Wang (Tianjin University, China), and Huaming Wu (Tianjin University, China)</i>	
Adversarial Learning of Balanced Triangles for Accurate Community Detection on Signed Networks .....	1150
<i>Yoonsuk Kang (Hanyang University, South Korea), Woncheol Lee (Hanyang University, South Korea), Yeon-Chang Lee (Hanyang University, South Korea), Kyungsik Han (Hanyang University, South Korea), and Sang-Wook Kim (Hanyang University, South Korea)</i>	
Addressing Exposure Bias in Uplift Modeling for Large-Scale Online Advertising .....	1156
<i>Wenwei Ke (Alibaba Group, China), Chuanren Liu (The University of Tennessee, USA), Xiangfu Shi (Alibaba Group, China), Yiqiao Dai (Alibaba Group, China), Philip S. Yu (University of Illinois at Chicago, USA), and Xiaoqiang Zhu (Alibaba Group, China)</i>	
ENGINE: Enhancing Neuroimaging and Genetic Information by Neural Embedding .....	1162
<i>Wonjun Ko (Korea University, Republic of Korea), Wonsik Jung (Korea University, Republic of Korea), Eunjin Jeon (Korea University, Republic of Korea), Ahmad Wisnu Mulyadi (Korea University, Republic of Korea), and Heung-Il Suk (Korea University, Republic of Korea)</i>	
Learning Personal Human Biases and Representations for Subjective Tasks in Natural Language Processing .....	1168
<i>Jan Kocoń (Wrocław University of Science and Technology, Poland), Marcin Gruza (Wrocław University of Science and Technology, Poland), Julita Bielaniewicz (Wrocław University of Science and Technology, Poland), Damian Grimling (Sentimenti Sp. z o.o., Poland), Kamil Kanclerz (Wrocław University of Science and Technology, Poland), Piotr Miłkowski (Wrocław University of Science and Technology, Poland), and Przemysław Kazienko (Wrocław University of Science and Technology, Poland)</i>	
Detecting and Mitigating Test-Time Failure Risks via Model-Agnostic Uncertainty Learning .....	1174
<i>Preethi Lahoti (Max Planck Institute for Informatics, Germany), Krishna Gummedi (Max Planck Institute for Software Systems, Germany), and Gerhard Weikum (Max Planck Institute for Informatics, Germany)</i>	
Learnable Structural Semantic Readout for Graph Classification .....	1180
<i>Dongha Lee (University of Illinois at Urbana-Champaign, United States), Su Kim (Pohang University of Science and Technology, Republic of Korea), Seonghyeon Lee (Pohang University of Science and Technology, Republic of Korea), Chanyoung Park (Korea Advanced Institute of Science and Technology, Republic of Korea), and Hwanjo Yu (Pohang University of Science and Technology, Republic of Korea)</i>	
Out-of-Category Document Identification using Target-Category Names as Weak Supervision ....	1186
<i>Dongha Lee (University of Illinois at Urbana-Champaign, USA), Dongmin Hyun (Pohang University of Science and Technology, Republic of Korea), Jiawei Han (University of Illinois at Urbana-Champaign, USA), and Hwanjo Yu (Pohang University of Science and Technology, Republic of Korea)</i>	

Robust BiPoly-Matching for Multi-granular Entities .....	1192
<i>Ween Jiann Lee (Singapore Management University), Maksim Tkachenko (Singapore Management University), and Hady W. Lauw (Singapore Management University)</i>	
StarGAT: Star-Shaped Hierarchical Graph Attentional Network for Heterogeneous Network Representation Learning .....	1198
<i>Wen-Zhi Li (Sun Yat-sen University, China; Guangdong Province Key Laboratory of Computational Science, China; Ministry of Education, China), Ling Huang (South China Agricultural University, China; Guangdong Provincial Key Laboratory of Public Finance and Taxation with Big Data Application, China), Chang-Dong Wang (Sun Yat-sen University, China; Guangdong Province Key Laboratory of Computational Science, China; Ministry of Education, China), and Yu-Xin Ye (Jilin University, China)</i>	
Adversarial Regularized Reconstruction for Anomaly Detection and Generation .....	1204
<i>Angelica Liguori (University of Calabria, Italy; National Research Council (ICAR-CNR), Italy), Giuseppe Manco (National Research Council (ICAR-CNR), Italy), Francesco Sergio Pisani (National Research Council (ICAR-CNR), Italy), and Ettore Ritacco (National Research Council (ICAR-CNR), Italy)</i>	
HyperTeNet: Hypergraph and Transformer-Based Neural Network for Personalized List Continuation .....	1210
<i>Vijaikumar M (Indian Institute of Science, India), Deepesh Hada (Indian Institute of Science, India), and Shirish Sheoade (Indian Institute of Science, India)</i>	
Communication Efficient Tensor Factorization for Decentralized Healthcare Networks .....	1216
<i>Jing Ma (Emory University, USA), Qiuchen Zhang (Emory University, USA), Jian Lou (Emory University, USA; Xidian University, China), Li Xiong (Emory University, USA), Sivasubramaniam Bhavani (Emory University, USA), and Joyce C. Ho (Emory University, USA)</i>	
An Ensemble of Naive Bayes Classifiers for Uncertain Categorical Data .....	1222
<i>Marcelo Rodrigues de Holanda Maia (Universidade Federal Fluminense, Brazil; Instituto Brasileiro de Geografia e Estatística, Brazil), Alexandre Plastino (Universidade Federal Fluminense, Brazil), and Alex A. Freitas (University of Kent, UK)</i>	
Accurately Quantifying Under Score Variability .....	1228
<i>Andre Maletzke (UNIOESTE, Brazil), Denis dos Reis (ICMC-USP, Brazil), Waqar Hassan (ICMC-USP, Brazil), and Gustavo Batista (CSE-UNSW, Australia)</i>	
Semi-Supervised Graph Attention Networks for Event Representation Learning .....	1234
<i>Joao Pedro Rodrigues Mattos (University of São Paulo, Brazil) and Ricardo M. Marcacini (University of São Paulo, Brazil)</i>	

Matrix Profile XXIII: Contrast Profile: A Novel Time Series Primitive that Allows Real World Classification .....	1240
<i>Ryan Mercer (University of California, Riverside, USA), Sara Alaei (University of California, Riverside, USA), Alireza Abdoli (University of California, Riverside, USA), Shailendra Singh (University of California, Riverside, USA), Amy Murillo (University of California, Riverside, USA), and Eamonn Keogh (University of California, Riverside, USA)</i>	
PhyFlow: Physics-Guided Deep Learning for Generating Interpretable 3D Flow Fields .....	1246
<i>Nikhil Muralidhar (Virginia Tech, USA), Jie Bu (Virginia Tech, USA), Ze Cao (Virginia Tech, USA), Neil Raj (Virginia Tech, USA), Naren Ramakrishnan (Virginia Tech, USA), Danesh Tafti (Virginia Tech, USA), and Anuj Karpatne (Virginia Tech, USA)</i>	
Exploring Reflective Limitation of Behavior Cloning in Autonomous Vehicles .....	1252
<i>Mohammad Hossein Nazeri (Institute for Advanced Studies in Basic Science, Iran) and Mahdi Bohlouli (Institute for Advanced Studies in Basic Science, Iran)</i>	
MetaEDL: Meta Evidential Learning for Uncertainty-Aware Cold-Start Recommendations .....	1258
<i>Krishna Prasad Neupane (Rochester Institute of Technology, USA), Ervine Zheng (Rochester Institute of Technology, USA), and Qi Yu (Rochester Institute of Technology, USA)</i>	
STING: Self-Attention Based Time-Series Imputation Networks using GAN .....	1264
<i>Eunkyu Oh (Samsung Research, Republic of Korea), Taehun Kim (Samsung Research, Republic of Korea), Yunhu Ji (Samsung Research, Republic of Korea), and Sushil Khyalia (Samsung Research, Republic of Korea)</i>	
Multi-classification Prediction of Alzheimer's Disease Based on Fusing Multi-modal Features .....	1270
<i>Qiao Pan (Donghua University, China), Ke Ding (Donghua University, China), and Dehua Chen (Donghua University, China)</i>	
A General Framework for Mining Concept-Drifting Data Streams with Evolvable Features .....	1276
<i>Jiaqi Peng (University of Electronic Science and Technology of China, China), Jinxia Guo (University of Electronic Science and Technology of China, China), Qinli Yang (University of Electronic Science and Technology of China, China), Jianyun Lu (University of Electronic Science and Technology of China, China), and Junming Shao (University of Electronic Science and Technology of China, China)</i>	
Density-Based Clustering for Adaptive Density Variation .....	1282
<i>Li Qian (Ludwig Maximilian University of Munich, Germany), Claudia Plant (University of Vienna, Austria), and Christian Böhm (Ludwig Maximilian University of Munich, Germany)</i>	
GQNAS: Graph Q Network for Neural Architecture Search .....	1288
<i>Yijian Qin (Tsinghua University, China; BNRist), Xin Wang (Tsinghua University; Pengcheng Laboratory, China), Peng Cui (Tsinghua University, China), and Wenwu Zhu (Tsinghua University; Pengcheng Laboratory, China)</i>	

Incomplete Multi-view Multi-label Active Learning .....	1294
<i>Chuanwei Qu (Southwest University, China; Shandong University, China), Kuangmeng Wang (Southwest University, China; Shandong University, China), Hong Zhang (Southwest University, China), Guoxian Yu (Shandong University, Jinan, China), and Carlotta Domeniconi (George Mason University, USA)</i>	
Causal Discovery with Flow-Based Conditional Density Estimation .....	1300
<i>Shaogang Ren (Baidu Research, USA), Haiyan Yin (Baidu Research, USA), Mingming Sun (Baidu Research, USA), and Ping Li (Baidu Research, USA)</i>	
Scalable Pareto Front Approximation for Deep Multi-objective Learning .....	1306
<i>Michael Ruchte (University of Freiburg, Germany) and Josif Grabocka (University of Freiburg, Germany)</i>	
Alternative Ruleset Discovery to Support Black-box Model Predictions .....	1312
<i>Yoichi Sasaki (NEC Corporation, Japan) and Yuzuru Okajima (NEC Corporation, Japan)</i>	
Practitioner-Centric Approach for Early Incident Detection using Crowdsourced Data for Emergency Services .....	1318
<i>Yasas Senarath (George Mason University, USA), Ayan Mukhopadhyay (Vanderbilt University, USA), Sayyed Mohsen Vazirizade (Vanderbilt University, USA), Hemant Purohit (George Mason University, USA), Saideep Nannapaneni (Wichita State University, USA), and Abhishek Dubey (Vanderbilt University, USA)</i>	
T <sup>3</sup> : Domain-Agnostic Neural Time-Series Narration .....	1324
<i>Mandar Sharma (Virginia Tech), John Brownstein (Harvard Medical School), and Naren Ramakrishnan (Virginia Tech)</i>	
Compressibility of Distributed Document Representations .....	1330
<i>Blaž Škrlj (Jožef Stefan Institute, Slovenia) and Matej Petković (Jožef Stefan Institute, Slovenia)</i>	
Multimodal N-Best List Rescoring with Weakly Supervised Pre-training in Hybrid Speech Recognition .....	1336
<i>Yuanfeng Song (The Hong Kong University of Science and Technology; WeBank Co., Ltd, China), Xiaoling Huang (WeBank Co., Ltd, China), Xuefang Zhao (WeBank Co., Ltd, China), Di Jiang (WeBank Co., Ltd, China), and Raymond Chi-Wing Wong (The Hong Kong University of Science and Technology, China)</i>	
Learning Dynamic User Interactions for Online Forum Commenting Prediction .....	1342
<i>Wu-Jiu Sun (Southeast University, China), Xiao Fan Liu (City University of Hong Kong, China), and Fei Shen (City University of Hong Kong, China)</i>	
Pest-YOLO: Deep Image Mining and Multi-feature Fusion for Real-Time Agriculture Pest Detection .....	1348
<i>Zhe Tang (Central South University, China), Zhengyun Chen (Central South University, China), Fang Qi (Central South University, China), Lingyan Zhang (Central South University, China), and Shuhong Chen (Guangzhou University, China)</i>	
PSANet - Subspace Attention for Personalized Compatibility .....	1354
<i>Meet Taraviya (Amazon), Anurag Beniwal (Amazon), Yen-liang Lin (Amazon), and Larry Davis (Amazon)</i>	

Streaming Dynamic Graph Neural Networks for Continuous-Time Temporal Graph Modeling ...	1361
<i>Sheng Tian (Ant Group, China), Tao Xiong (Congyun Inc, China), and Leilei Shi (Ant Group, China)</i>	
DhakaNet: Unstructured Vehicle Detection using Limited Computational Resources .....	1367
<i>Tarik Reza Toha (Bangladesh University of Engineering and Technology), Masfiqur Rahaman (Bangladesh University of Engineering and Technology), Saiful Islam Salim (Bangladesh University of Engineering and Technology), Mainul Hossain (Bangladesh University of Engineering and Technology), Arif Mohamin Sadri (University of Oklahoma, USA), and A. B. M. Alim Al Islam (Bangladesh University of Engineering and Technology)</i>	
Detecting Adversaries in Crowdsourcing .....	1373
<i>Panagiotis A. Traganitis (University of Minnesota, USA) and Georgios B. Giannakis (University of Minnesota, USA)</i>	
A Lookahead Algorithm for Robust Subspace Recovery .....	1379
<i>Guihong Wan (The University of Texas at Dallas, USA) and Haim Schweitzer (The University of Texas at Dallas, USA)</i>	
Dynamic Attributed Graph Prediction with Conditional Normalizing Flows .....	1385
<i>Daheng Wang (University of Notre Dame, USA), Tong Zhao (University of Notre Dame, USA), Nitesh V. Chawla (University of Notre Dame, USA), and Meng Jiang (University of Notre Dame, USA)</i>	
Aspect-Based Sentiment Classification via Reinforcement Learning .....	1391
<i>Lichen Wang (Northeastern University, USA), Bo Zong (NEC Laboratories America, USA), Yunyu Liu (Northeastern University, USA), Can Qin (Northeastern University, USA), Wei Cheng (NEC Laboratories America, USA), Wenchao Yu (NEC Laboratories America, USA), Xuchao Zhang (NEC Laboratories America, USA), Haifeng Chen (NEC Laboratories America, USA), and Yun Fu (Northeastern University, USA)</i>	
Exploring the Long Short-Term Dependencies to Infer Shot Influence in Badminton Matches .....	1397
<i>Wei-Yao Wang (National Yang Ming Chiao Tung University, Taiwan), Teng-Fong Chan (National Yang Ming Chiao Tung University, Taiwan), Hui-Kuo Yang (National Yang Ming Chiao Tung University, Taiwan), Chih-Chuan Wang (National Yang Ming Chiao Tung University, Taiwan), Yao-Chung Fan (National Chung Hsing University, Taiwan), and Wen-Chih Peng (National Yang Ming Chiao Tung University, Taiwan)</i>	
Constrained Non-Affine Alignment of Embeddings .....	1403
<i>Yuwei Wang (University of Utah, USA), Yan Zheng (Visa Research), Yanqing Peng (University of Utah, USA), Michael Yeh (Visa Research), Zhongfang Zhuang (Visa Research), Das Mahashweta (Visa Research), Bendre Mangesh (Visa Research), Feifei Li (University of Utah, USA), Wei Zhang (Visa Research), and Jeff M. Phillips (University of Utah, USA)</i>	
Summarizing User-Item Matrix by Group Utility Maximization .....	1409
<i>Yongjie Wang (Nanyang Technological University, Singapore), Ke Wang (Simon Fraser University, Canada), Cheng Long (Nanyang Technological University, Singapore), and Chunyan Miao (Nanyang Technological University, Singapore)</i>	

BioHanBERT: A Hanzi-Aware Pre-Trained Language Model for Chinese Biomedical Text Mining .....	1415
<i>Xiaosu Wang (Fudan University, China), Yun Xiong (Fudan University, China), Hao Niu (Fudan University, China), Jingwen Yue (Fudan University, China), Yangyong Zhu (Fudan University, China), and Philip S. Yu (University of Illinois at Chicago, USA)</i>	
Adapting Membership Inference Attacks to GNN for Graph Classification: Approaches and Implications .....	1421
<i>Bang Wu (Monash University, Australia), Xiangwen Yang (Monash University, Australia), Shirui Pan (Monash University, Australia), and Xingliang Yuan (Monash University, Australia)</i>	
Composition-Enhanced Graph Collaborative Filtering for Multi-Behavior Recommendation .....	1427
<i>Daqing Wu (Peking University, China; Damo Academy, Alibaba Group, China), Xiao Luo (Peking University, China; Damo Academy, Alibaba Group, China), Zeyu Ma (Harbin Institute of Technology, China), Chong Chen (Peking University, China; Damo Academy, Alibaba Group, China), Pengfei Wang (Alibaba Group, China), Minghua Deng (Peking University, China), and Jinwen Ma (Peking University, China)</i>	
Boosting Deep Ensemble Performance with Hierarchical Pruning .....	1433
<i>Yanzhao Wu (Georgia Institute of Technology, USA) and Ling Liu (Georgia Institute of Technology, USA)</i>	
Overfitting Avoidance in Tensor Train Factorization and Completion: Prior Analysis and Inference .....	1439
<i>Le Xu (The University of Hong Kong), Lei Cheng (Zhejiang University, China), Ngai Wong (The University of Hong Kong), and Yik-Chung Wu (The University of Hong Kong)</i>	
Towards Stochastic Neural Network via Feature Distribution Calibration .....	1445
<i>Hao Yang (National University of Defense Technology, China), Min Wang (National University of Defense Technology, China), Yun Zhou (National University of Defense Technology, China), and Yongxin Yang (University of Edinburgh, UK)</i>	
Zero-Shot Key Information Extraction from Mixed-Style Tables: Pre-training on Wikipedia .....	1451
<i>Qingping Yang (Institute of Computing Technology, CAS, China; University of Chinese Academy of Sciences, China), Yingpeng Hu (Institute of Computing Technology, CAS, China; University of Chinese Academy of Sciences, China), Rongyu Cao (Institute of Computing Technology, CAS, China; University of Chinese Academy of Sciences, China), Hongwei Li (P.A.I. Ltd., China), and Ping Luo (Institute of Computing Technology, CAS, China; University of Chinese Academy of Sciences, China; Peng Cheng Laboratory, China)</i>	
Limited-Memory Common-Directions Method with Subsampled Newton Directions for Large-Scale Linear Classification .....	1457
<i>Jui-Nan Yen (National Taiwan University) and Chih-Jen Lin (National Taiwan University)</i>	
Online Testing of Subgroup Treatment Effects Based on Value Difference .....	1463
<i>Miao Yu (North Carolina State University, USA), Wenbin Lu (North Carolina State University, USA), and Rui Song (North Carolina State University, USA)</i>	

Jointly Multi-similarity Loss for Deep Metric Learning .....	1469
<i>Li Zhang (Alibaba Group, Singapore), Shitian Shen (Alibaba Group, China), Lingxiao Li (Alibaba Group, China), Han Wang (Alibaba Group, China), Xueying Li (Alibaba Group, China), and Jun Lang (Alibaba Group, Singapore)</i>	
Adaptive Spatio-Temporal Convolutional Network for Traffic Prediction .....	1475
<i>Mingyang Zhang (Hong Kong University of Science and Technology, China), Yong Li (Tsinghua University, China), Funing Sun (Tencent Inc., China), Diansheng Guo (Tencent Inc., China), and Pan Hui (Hong Kong University of Science and Technology, China; University of Helsinki, Finland)</i>	
MERITS: Medication Recommendation for Chronic Disease with Irregular Time-Series .....	1481
<i>Shuai Zhang (Beihang University, China), Jianxin Li (Beihang University, China), Haoyi Zhou (Beihang University, China), Qishan Zhu (Beihang University, China), Shanghang Zhang (Beihang University, China), and Danding Wang (National University of Singapore, Singapore)</i>	
Generating Structural Node Representations via Higher-Order Features and Adversarial Learning .....	1487
<i>Wang Zhang (Tianjin University, China), Yang Yu (Tianjin University, China), Ting Pan (Tianjin University, China), Lin Pan (Tianjin University, China), Pengfei Jiao (Tianjin University, China), and Wenjun Wang (Tianjin University, China)</i>	
A Multi-view Confidence-Calibrated Framework for Fair and Stable Graph Representation Learning .....	1493
<i>Xu Zhang (Dalian University of Technology, China), Liang Zhang (Dongbei University of Finance and Economics, China), Bo Jin (Dalian University of Technology, China), and Xinjiang Lu (Business Intelligence Lab, Baidu Research, China)</i>	
Unified Fairness from Data to Learning Algorithm .....	1499
<i>Yanfu Zhang (University of Pittsburgh, USA), Lei Luo (University of Pittsburgh, USA), and Heng Huang (University of Pittsburgh, USA)</i>	
C <sup>3</sup> -GAN: Complex-Condition-Controlled Urban Traffic Estimation Through Generative Adversarial Networks .....	1505
<i>Yingxue Zhang (Worcester Polytechnic Institute), Yanhua Li (Worcester Polytechnic Institute), Xun Zhou (University of Iowa), Zhenming Liu (College of William &amp; Mary), and Jun Luo (Lenovo Group Limited)</i>	
LIFE: Learning Individual Features for Multivariate Time Series Prediction with Missing Values .....	1511
<i>Zhao-Yu Zhang (Nanjing University, China), Shao-Qun Zhang (Nanjing University, China), Yuan Jiang (Nanjing University, China), and Zhi-Hua Zhou (Nanjing University, China)</i>	
Graph Neighborhood Routing and Random Walk for Session-Based Recommendation .....	1517
<i>Zizhuo Zhang (Huazhong University of Science and Technology (HUST)) and Bang Wang (Huazhong University of Science and Technology (HUST))</i>	
AdaBoosting Clusters on Graph Neural Networks .....	1523
<i>Li Zheng (Peking University, China), Jun Gao (Peking University, China), Zhao Li (Alibaba Group, China), and Ji Zhang (Zhejiang Lab, China)</i>	



Topic-Attentive Encoder-Decoder with Pre-Trained Language Model for Keyphrase Generation ..	1529
<i>Cangqi Zhou (Nanjing University of Science and Technology, China), Jinling Shang (Chinese Academy of Sciences, China), Jing Zhang (Nanjing University of Science and Technology, China), Qianmu Li (Nanjing University of Science and Technology, China), and Dianming Hu (SenseDeal Intelligent Technology Co., Ltd., China)</i>	
Joint Scence Network and Attention-Guided for Image Captioning .....	1535
<i>Dongming Zhou (Guangxi Normal University, China), Jing Yang (Guangxi Normal University, China), Canlong Zhang (Guangxi Normal University, China), and Yanping Tang (Guilin University of Electronic Technology, China)</i>	
Multi-objective Distributional Reinforcement Learning for Large-Scale Order Dispatching .....	1541
<i>Fan Zhou (Shanghai University of Finance and Economics), Chenfan Lu (Shanghai University of Finance and Economics), Xiaocheng Tang (DiDi AI Labs), Fan Zhang (DiDi AI Labs), Zhiwei Qin (DiDi AI Labs), Jieping Ye (DiDi AI Labs), and Hongtu Zhu (DiDi AI Labs)</i>	
Self-Supervised Universal Domain Adaptation with Adaptive Memory Separation .....	1547
<i>Ronghang Zhu (University of Georgia, USA) and Sheng Li (University of Georgia, USA)</i>	
A New Multiple Instance Algorithm using Structural Information .....	1553
<i>Xiaoyan Zhu (Xi'an Jiaotong University, China), Ting Wang (Xi'an Jiaotong University, China), Jiayin Wang (Xi'an Jiaotong University, China), Ying Xu (Xi'an Jiaotong University, China), and Yuqian Liu (Xi'an Jiaotong University, China)</i>	
Operation-Level Progressive Differentiable Architecture Search .....	1559
<i>Xunyu Zhu (Institute of Information Engineering, CAS, China; University of Chinese Academy of Sciences, China), Jian Li (Institute of Information Engineering, CAS, China), Yong Liu (Renmin University of China, China), Jun Liao (China Unicom, China), and Weiping Wang (Institute of Information Engineering, CAS, China; University of Chinese Academy of Sciences, China)</i>	
SMATE: Semi-Supervised Spatio-Temporal Representation Learning on Multivariate Time Series.	1565
<i>Jingwei Zuo (DAVID Lab, University of Versailles, Université Paris-Saclay, Versailles, France), Karine Zeitouni (DAVID Lab, University of Versailles, Université Paris-Saclay, Versailles, France), and Yehia Taher (DAVID Lab, University of Versailles, Université Paris-Saclay, Versailles, France)</i>	

## Author Index