DMBD'2022

November 21 –24, 2022
Beijing, China

PROGRAM

The Seventh International Conference on Data Mining and Big Data

Organized by International Association of Swarm and Evolutionary Intelligence

IASEI

Welcome message from General Chair

We are warmly welcoming you from all over the world to attend the Seventh International Conference on Data Mining and Big Data (DMBD'2022) in Beijing of China.

The theme of DMBD'2022 is "FinTech". The DMBD'2022 provided an excellent opportunity and/or an academic forum for academics and practitioners to present and discuss the latest scientific results and methods, innovative ideas, and advantages in theories, technologies, and applications in data mining and big data, especially in FinTech. The technical program covered a number of topics in related areas. The DMBD'2022 is the seventh international gathering in the world for the academias and researchers working on most aspects of data mining and big data, following successful events in Guangzhou (DMBD'2021), Serbia (DMBD'2020) virtually, ChiangMai (DMBD'2019), Shanghai (DMBD'2018), Fukuoka (DMBD'2017), and Bali (DMBD'2016) which provided a high-level academic forum for participants to disseminate their new research findings and discuss emerging areas of research. It also created a stimulating environment for participants to interact and exchange information on future challenges and opportunities in the field of data mining and big data.

Due to the rapid overspreading of Omicron variant of COVID-19, even though the DMBD'2022 is planned to be held in a hybrid mode, after carefully evaluating most of announcements and policies regarding to pandemic control, and too much restrictions on traveling to and staying in Beijing, the DMBD'2022 organizing committee has made the decision that our DMBD'2022 will continue as scheduled on November 21-24, by being converted to a fully virtual conference. The DMBD'2022 technical team will be providing the ability for the authors with accepted papers to present their work through an interactive online platform or video replay. The presentations of accepted authors will be made available to all registered attendees online.

Beijing, China's sprawling capital, has history stretching back 3 millennia. Yet it's known as much for modern architecture as its ancient sites such as the grand Forbidden City complex, the imperial palace during the Ming and Qing dynasties. Nearby, the massive Tiananmen Square pedestrian plaza is the site of Mao Zedong's mausoleum and the National Museum of China, displaying a vast collection of cultural relics. The 2022 Winter Olympics was an international winter multi-sport event held between 4 and 20 February 2022 in Beijing, China, and surrounding areas with competition in selected events beginning 2 February 2022. Beijing was selected as host city in 2015 at the 128th IOC Session in Kuala Lumpur, Malaysia, marking its second time hosting the Olympics, and the last of three consecutive Olympics hosted in East Asia. Having previously hosted the 2008 Summer Olympics, Beijing became the first city to have hosted both the Summer and Winter Olympics.

The DMBD'2022 will definitely contribute a lot to the enhancement of the research horizons of our delegates in the field of data mining and big data. Certainly, we are sure that you will have a wonderful experience of attending the virtual conference during DMBD'2022. On behalf of the organizing and technical committees, I wish the DMBD'2022 will be a memorable event for you.

Sincerely yours!

General Chair of DMBD'2022
Ying Tan
Peking University, China

Welcome message from Programme Committee Chair

The Seventh International Conference on Data Mining and Big Data (DMBD'2022) is the seventh international gathering in the world for researchers working on all aspects of data mining and big data, following the successful and fruitful previous six events (ICSI-DMBD'2016-2020, DMBD'2021), which provided an excellent opportunity and/or an academic forum for academics and practitioners to present and discuss the latest scientific results and methods, innovative ideas, and advantages in theories, technologies, and applications in data mining and big data. In this year event, the DMBD'2022 will be held at Beijing of China, promoting transverse fusion, and stimulating innovation. The aim of this important event is to exhibit the state-of-the-art research and development in many aspects of data mining and big data from theoretical to practical researches.

The DMBD'2022 received 135 submissions and invited submissions from about hundreds of authors from all over the world. Each submission was reviewed by at least 2 reviewers, and on average 2.5 reviewers. Based on rigorous reviews by the Program Committee members and reviewers, 62 high-quality papers were selected for publication in this proceedings volume with an acceptance rate of 45.92%. The papers are organized into 14 cohesive sections covering major topics of swarm intelligence research and its development and applications.

On behalf of the Organizing Committee of DMBD'2022, we would like to express our sincere thanks to the International Association of Swarm and Evolutionary Intelligence (IASEI) (iasei.org), which is the premier international scholarly society devoted to advancing the theories, algorithms, real-world applications, and developments of swarm intelligence and evolutionary intelligence. We would also like to thank Peking University, Computational Intelligence Laboratory of Peking University, Southern University of Science and Technology, Advaned Institute of Big Data, Beijing, Key Lab of Information System Requirement and Science and Technology on Information Systems Engineering Laboratory for its technical co-sponsorships, as well as to our supporters of Research Reports on Computer Science (RRCS), IEEE Computational Intelligence Society, International Neural Network Society, World Federation on SoftComputing, City Brain Technical Committee, Chinese Institute of Command and Control (CICC), MDPI's Journals:Electronics and Entropy, Beijing Xinghui Hi-Tech Co.,Nanjing Kangbo iHealth Academy and Springer Nature.

We would also like to thank the members of the Advisory Committee for their guidance, the members of the International Program Committee and additional reviewers for reviewing the papers, and the members of the Publication Committee for checking the accepted papers in a short period of time. We are particularly grateful to the proceedings publisher Springer for publishing the proceedings in the prestigious series of Communications in Computer and Information Science. Moreover, we wish to express our heartfelt appreciation to the plenary speakers, session chairs, and student helpers. In addition, there are still many more colleagues, associates, friends, and supporters who helped us in immeasurable ways; we express our sincere gratitude to them all. Last but not the least, we would like to thank all the speakers, authors, and participants for their great contributions that made DMBD'2022 successful and all the hard work worthwhile.

Programme Committee Chair of DMBD'2022
Yuhui Shi
Southern University of Science and Technology, China

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Venue

The DMBD Organizing Committee decided to use Tencent Conference as the software for online conference. Countries and regions other than China can use VooV Meeting to participate. Room numbers for meetings are listed below.

Room Name	**TecentMeeting Room Number**	**Meeting URL**
Main Venue	974-4365-2998	https://meeting.tencent.com/dm/BqN1rZ8HHDoQ
Oral Room I	329-2373-9434	https://meeting.tencent.com/dm/nR5PoDynlHQA
Oral Room II	311-4695-3055	https://meeting.tencent.com/dm/ioh1kk7sqEah
Poster Room	914-7503-6149	https://meeting.tencent.com/dm/jxyUQKLI0tih

Conference Schedule

Date	*Time(GMT+8)*	*Events*	*Location*
November 21st	14:00 - 17:00	Conference Information Desk	Main Venue (online)
November 22nd	08:40 - 08:50	Opening Ceremony	Main Venue (online)
	08:50 - 09:50	Plenary Speech I	
	09:50 - 10:00	Photo Session & Tea/Coffee Break	
	10:00 - 11:00	Plenary Speech II	
	11:00 - 12:00	Plenary Speech III	
	12:00 - 13:00	Lunch Break	
	13:00 - 17:00	Parallel Sessions	Oral Room I (online) Oral Room II (online) Poster Room (online)
	17:00 - 18:00	Dinner Break	
	18:00 - 19:20	Parallel Sessions	Oral Room I (online) Oral Room II (online) Poster Room (online)
	19:30 - 20:00	Award Ceremony	Main Venue (online)

Plenary Speech I

Robot Skill Learning in Virtual-Real Scene and 3C Applications

Speaker: Prof. Fuchun Sun
Affiliation : Tsinghua University, China
Location: Main Venue
Time: November 22nd 08:50-09:50

Abstract

The robot AI is dominated by physical interaction in a closed-loop form. It not only emphasizes the perception and processing of simulated human brain information, but also emphasizes brain-body cooperation to solve the dynamic, interactive and adaptive problems of behavior learning in the dynamic scene. As the core of robot AI, skill learning for robot manipulations is a difficult and important issue in current research. In view of the problems that existing skill learning methods do not make use of the demonstration samples efficiently and cannot achieve efficient policy learning, and the imitation learning algorithm is sensitive to the teaching preference characteristics and the local manipulation space, this talk introduces the skill learning for robot manipulations in virtual-real scenes carrying out in our research team. By using digital twin technology, a virtual scene for robot manipulation is established where new tactile modeling, imitation learning and transfer learning approaches are proposed for skill learning. Furthermore, some enhancement approaches are also developed for skill's robustness and generalization ability in 3C applications. Finally, the future development of robot skill learning is prospected.

Biography

Dr. Fuchun Sun is a full professor of Department of Computer Science and Technology and President of Academic Committee of the Department, Tsinghua University, deputy director of State Key Lab. of Intelligent Technology & Systems, Beijing, China. He also serves as Vice president of China Artificial Intelligence Society and executive director of China Automation Society. His research interests include robotic perception and intelligent control. He has won the Champion of Autonoumous Grasp Challenges in IROS2016 and IROS 2019. Dr. Sun is the recipient of the excellent Doctoral Dissertation Prize of China in 2000 by MOE of China and the Choon-Gang Academic Award by Korea in 2003, and was recognized as a Distinguished Young Scholar in 2006 by the Natural Science Foundation of China. He served as an associated editor of IEEE Trans. on Neural Networks during 2006-2010, IEEE Trans. On Fuzzy Systems during 2011-2018, IEEE Trans. on Cognitive and Developement since 2018 and IEEE Trans. on Systems, Man and Cybernetics: Systems since 2015.

Plenary Speech II

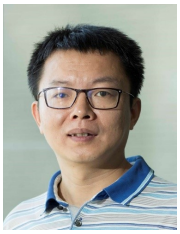
Distributed Machine Learning for Big Models

Speaker: Prof. Bin Cui
Affiliation : Peking University, China
Location: Main Venue
Time: November 22nd 10:00-11:00

Abstract

Machine/Deep learning (ML/DL) systems are important foundations for artificial intelligence and have attracted a lot of attention in academia and industry in recent years. The increasing scale of Deep Learning models and data brings severe challenges to existing systems, and distributed deep learning systems are becoming more and more important. As the intersection of ML/DL and systems, it is necessary to pay attention not only to the data characteristics, model structures, training methods, and optimization algorithms, but also to the execution problems in the computing, storage, communication, scheduling, and hardware of the system. In this talk, I will introduce the current development of "big models" and then share our efforts on the system optimizations for distributed training of big models, as well as the explorations of automated parallel training. Based on these efforts, I will also briefly present our open-sourced system – Hetu, a new distributed deep learning system for large-scale model training.

Biography



Bin Cui is a professor and Vice Dean in School of CS at Peking University. His research interests include database system, big data management and analytics, and ML system. He has regularly served in the Technical Program Committee of various international conferences including SIGMOD, VLDB and KDD, and is the Editor-in-Chief of Data Science and Engineering, also in the Editorial Board of Distributed and Parallel Databases, Journal of Computer Science and Technology, and SCIENCE CHINA Information Sciences, and was an associate editor of IEEE TKDE and VLDB Journal, and Trustee Board Member of VLDB Endowment. He is serving as Vice Chair of Technical Committee on Database (CCF). He was awarded Microsoft Young Professorship award (MSRA 2008), CCF Young Scientist award (2009), Second Prize of Natural Science Award of MOE China (2014), and appointed as Cheung Kong distinguished Professor by MOE China in 2016.

Plenary Speech III

Multimodal BCIs and Their Clinical Applications

Speaker: Prof. Yuanqing Li
Affiliation : South China University of Technology, China
Location: Main Venue
Time: November 22nd 11:00-12:00

Abstract

Despite rapid advances in the study of brain-computer interfaces (BCIs) in recent decades, two fundamental challenges, namely, improvement of target detection performance and multi-dimensional control, continue to be major barriers for further development and applications. In this paper, we review the recent progress in multimodal BCIs (also called hybrid BCIs), which may provide potential solutions for addressing these challenges. In particular, improved target detection can be achieved by developing multimodal BCIs that utilize multiple brain patterns, multimodal signals or multisensory stimuli. Furthermore, multi-dimensional object control can be accomplished by generating multiple control signals from different brain patterns or signal modalities. Here, we highlight several representative multimodal BCI systems by analyzing their paradigm designs, detection/control methods, and experimental results. Furthermore, we report several initial clinical applications of these multimodal BCI systems in two patient populations, i.e., patients with disorder of consciousness (DOC) and those with spinal cord injuries (SCIs). As an evolving research area, the study of multimodal BCIs is increasingly requiring more synergetic efforts from multiple disciplines for the exploration of the underlying brain mechanisms, the design of new effective paradigms and means of neurofeedback, and the expansion of the clinical applications of these systems.

Biography

Yuanqing Li received the B.S. degree in applied mathematics from Wuhan University, Wuhan, China, in 1988, the M.S. degree in applied mathematics from South China Normal University, Guangzhou, China, in 1994, and the Ph.D. degree in control theory and applications from the South China University of Technology, Guangzhou, in 1997. Since 1997, he has been with the South China University of Technology, where he became a Full Professor in 2004. From 2002 to 2004, he was with the Laboratory for Advanced Brain Signal Processing, RIKEN Brain Science Institute, Japan, as a Researcher. From 2004 to 2008, he was with the Laboratory for Neural Signal Processing, Institute for Infocomm Research, Singapore, as a Research Scientist. He was elevated to IEEE Fellow for his contributions to brain signal analysis and BCIs, 2016. He won State Natural Science Awards (second prize), China, 2009, Changjiang Professorship, Ministry of Education, China, 2012, Distinguished Young Scholar Award, National Natural Science Foundation of China (NSFC), 2008, and so on. He was elevated you to IEEE Fellow for contributions to brain signal analysis and brain computer interfaces, 2016. His research interests include blind signal processing, sparse representation, machine learning, brain–computer interface, EEG, and fMRI data analysis. He has published more than 100 papers in high level journals including Brain, Cerebral Cortex, NeuroImage, Human Brain Mapping, Journal of Neural Engineering, Neural Computation, Proceedings of the IEEE, IEEE Signal Processing Magazine, IEEE Trans. BME, IEEE Trans. IT, and EEE Trans. PAMI. He also has more than 30 publications in conferences including NIPS and WCCI. He has been serving as AE of several journals such as IEEE Trans. on Fuzzy Systems and IEEE Trans. on Human-Machine Systems.

Technical Program

November 22nd

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Date: November 22nd
Time: Session 3
Location: Poster Room

18:00-18:10	**A Novel Feature Selection Method Based on Adaptive Search Particle Swarm Optimization** *Qing-Hua Ling, Yi-Huai Wang, Fan-Yu Li , Fei Han*	P36
18:10-18:20	**Text-independent Speaker Identification Using a Single-scale SincNet-DCGAN Model** *Yanna Zhang, Guangcun Wei, Hang Min , Yunfei Xu*	P36
18:20-18:30	**Flow Prediction via Multi-view Spatial-temporal Graph Neural Network** *Shan Jiang, Qiang Wang, Chengjun Wang, Kun Liu, Shiqi Ning , Xinrun Xu*	P37
18:30-18:40	**RotatSAGE: A Scalable Knowledge Graph Embedding Model based on Translation Assumptions and Graph Neural Networks** *Yubin Ma, Yuxin Ding , Guangbin Wang*	P37
18:40-18:50	**Denoise Network Structure for User Alignment across Networks via Graph Structure Learning** *Li Liu, Chongyang Wang, Youmin Zhang, Ye Wang, Qun Liu , Guoyin Wang*	P37
18:50-19:00	**Novel Sentiment Analysis from Twitter for Stock Change Prediction** *Yang Cui, Yucen Jiang , Haisong Gu*	P37
19:00-19:10	**Multi-objective Optimization Technique for RSU Deployment** *Zecheng Kang, Dongyang Li, Weian Guo, Zhenyao Hua, Guangcao Liu , Yanfen Mao*	P38
19:10-19:20	**Study on the Prediction of Rice Noodle Raw Material Index Content by Deep Feature Fusion** *Zhiyu Tian, Kang Zhou, Wangyang Shen, Qing Zhao , Guangbin Li*	P38
19:20-19:30	**Multi-Cause Learning for Diagnosis Prediction** *Liping Wang, Qiang Liu, Huanhuan Ma, Shu Wu , Liang Wang*	P38

Abstracts

November 22nd—Session 1—Oral Room I

Non-Local Graph Aggregation for Diversified Stock Recommendation

Zhihan Yue , Ying Tan

Abstract. Stock prediction plays a key role in stock investments. Despite the promising achievements of existing solutions, there are still limitations. First, most methods focus on mining the local features from node neighbors, while ignoring non-local features in the stock market. Second, most existing works form the portfolio with the stocks with the highest predicted return, exposed to some risk factors that cause common price movements. To reduce the risk exposure, it is crucial to learn a diversified portfolio. To address the shortage of existing methods, this paper proposes a novel stock recommendation framework that enables both local and non-local feature learning for stock data. Different from the existing methods, the stocks are selected locally according to the ranks within each independent group. This strategy diversifies the recommended stocks effectively. Experimental results on multiple datasets from the U.S. and Chinese stock markets demonstrate the superiority of the proposed method over existing state-of-the-art methods.

The Framework of Hammer Credit Rating System for Enterprises in Capital Markets of China with International Standards

George Xianzhi Yuan, Hua He, Qilong Zhang, Yunpeng Zhou, Haiyang Liu , Chengxing Yan

Abstract. The goal of this paper is to discuss how we establish the "Hammer Credit System" by applying Gibbs sampling algorithm under the framework of bigdata approach to extract features in depicting proxy default (bad) samples or illegal behaviors by following the "five step principle". Our study shows that the Hamer Credit System is able to resolve three problems of the current credit rating market in China which rate: "1) the rating is falsely high; 2) the differentiation of credit rating grades is insufficient; and 3) the poor performance of predicting early warning and related issues"; and in addition the CAFÉ credit is supported by clearly defining the "BBB" as the basic investment level with annualized rate of default probability in accordance with international standards in the practice of financial industries, and the credit transition matrix for "AAA-A" to "CCCC" credit grades. JEL Classification: C53 C58 G21 G24 G32

A Novel Investment Strategy for Mixed Asset Allocation Based on Entropy-based Time Series Prediction

Xuemei Yao, Jiahui Long, Longyun Wang, Binglin Wang, Maidi Liu , Kewei Yang

Abstract. In recent years, the combinational investment of gold and Bitcoin has become a hot spot, and it is expected to achieve a balance between risk aversion and maximum income. Some existing methods lack of timeliness. Hence, this article proposes an Objective Empowerment Multi-Objective Programming Investment strategy based on ARIMA, which can increase the income obtained on the premise of minimizing investment risk. Firstly, the Autoregressive Integrated Moving Average (ARIMA) model is used to predict the price changes. Then, based on the forecast curve of prices, a Multi-Objective Nonlinear Programming model is adopted to find the optimal transaction strategy. This method achieves to maximize the cumulative income and chooses the strategy of investment by identifying different market trends. According to the precise data indicators of the US Gold Market and the Bitcoin Market from 2016-2021, this article introduces the Entropy Weight method to evaluate the adopted strategy of the previous period, so as to timely adjust the next investment strategy. Finally, through the sensitivity test, it is found that the method proposed in this article is robust.

Prediction of Postoperative Survival Level of Esophageal Cancer Patients Based on Kaplan-Meier(K-M) Survival Analysis and Gray Wolf Optimization (GWO)-BP Model

Enhao Liang, Yanfeng Wang, Lidong Wang, Xueke Zhao , Changkai Sun

Abstract. Esophageal squamous cell carcinoma (ESCC) is a global safety problem, especially the low 5-year survival rate of patients after surgery, and their healthy life after surgery is directly threatened. Kaplan-Meier(K-M) survival analysis is used to screen the blood indexes of patients with ESCC. The gray wolf algorithm (GWO) is introduced to optimize the weight threshold of back-propagation (BP) neural network, and a prediction model based on K-M-GWO-BP is established. According to the influencing factors of postoperative survival, the postoperative survival level of patients is predicted. K-M survival analysis is used to analyze the relevant risk factors, the redundant variables are eliminated, and the whole structure of the neural network is simplified. The initial weight of BP neural network is optimized by GWO. Conclusions: BP neural network model, PSO-BP, GA-BP, SSA-BP, GWO-BP, K-M-BP, K-M-PSO-BP, K-MGA-BP, KM-SSA-BP and K-M-GWO-BP are compared, the prediction accuracy of K-MGWO-BP neural network model is the best.

An Improved Multi-Source Spatiotemporal Data Fusion Model based on the Nearest Neighbor Grids for PM2.5 Concentration Interpolation and Prediction

Xiaoxia Zhang, Junjia Hu, Pengcheng Zhou , Guoyin Wang

Abstract. The acquisition of PM2.5 concentration mainly relies on small and provincial control air quality monitoring stations, respectively. The distribution of provincial control stations (PCSs) is sparse as its high cost, conversely the distribution of small stations is relatively dense and spread over the whole space as the relatively low cost, thus the observations of small stations can be employed to predict that of PCSs. Based on this considerations, in this paper, we propose a novel multi-source spatiotemporal data fusion method via the nearest neighbor grids, named MSF-NNG, to interpolate and predict PM2.5 concentration of PCSs by utilizing those data of small stations. Firstly, we divide the city into 1km×1km grids, and then Cressman interpolation method is employed to fill the missing ones with the observations of small stations, wherein the observations include PM2.5 concentrations, humidity, temperature and wind speed. Secondly, it needs to find the neighbors of a PCS based on its grid partitions. Thirdly, MSF-NNG is proposed to interpolate and predict the PM2.5 concentrations of PCS by fusing the information of PM2.5 concentrations, humidity, temperature and wind speed of the corresponding neighbor grids. Finally, comparison experiments are conducted on several data sets, the results show MSF-NNG method with obvious advantages in interpolation and prediction for PM2.5 concentrations over fourteen and twelve algorithms, respectively.

GAP: Goal-Aware Prediction with Hierarchical Interactive Representation for Vehicle Trajectory

Ding Li, Qichao Zhang, Shuai Lu, Yifeng Pan , Dongbin Zhao

Abstract. Predicting the future trajectories of surrounding vehicles plays a vital role in ensuring the safety of autonomous driving. It is extremely challenging for the pure imitation method due to the high degree of multimodality and uncertainty in the future. In fact, when driving in most traffic scenarios, vehicles should obey some traffic rules such as "vehicles follow the lane and do not collide with each other". Inspired by this, this paper proposes a goal-aware prediction (GAP) framework to predict the multimodal trajectories, where goals are chosen in the lanes with hierarchical interactive representation and a multi-task loss. Based on the graph-based vectorized input, a novel hierarchical interactive representation module is first designed to obtain the fine-grained goal features, which progressively models interactions between goal-to-goal, goal-tolane, and lane-to-agent, corresponding to the individual, local and global levels, respectively. Then, an auxiliary collision loss is developed to take into account learning from demonstration and injecting common sense of collision avoidance, and is served as a part of the multi-task loss to guide the generation of multimodal plausible trajectories. In the end, the proposed method is verified on the Baidu In-house Cut-in dataset, which includes more than 370K interactive scenarios collected in the real road testing. The comparative results demonstrate the superior performance of our proposed GAP model than the mainstream prediction methods.

November 22nd—Session 1—Oral Room II

Blockchain-based Integrity Auditing with Secure Deduplication in Cloud Storage

Yuhua Wang, Xin Tang, Yiteng Zhou, Xiguang Chen , Yudan Zhu

Abstract. Public auditing technology has currently been proposed to ensure the integrity of the cloud data and reduce users' overheads, which, enables users to hire a third-party auditor (TPA) for cloud data auditing. However, most existing public auditing schemes are exposed to security problems of not completely reliable TPAs, easily manipulated challenge messages, and the convenience for external adversaries to launch side-channel attacks based on audit parameters. Additionally, a large number of redundant integrity tags caused by the auditing mechanism increase the storage burden of cloud servers, and reduce the searching and auditing efficiency. Hence, aiming to solve the concern of data security and storage efficiency in cloud storage, this paper proposes a blockchain-based cloud storage integrity auditing with secure deduplication (BIAD). We distribute a random file key between different users by employing the ciphertext-policy attribute encryption (CP-ABE), and conduct secure public auditing through the blockchain combined with a bloom filter-based random challenge generation method. In particular, by applying the random key to encrypt ciphertext and integrity tags, the existence and ownership privacy of the requested file in the auditing process can be protected. The security analysis and experimental results demonstrate that compared with the state-of-the arts, the proposed scheme achieves public auditing and deduplication in a secure and lightweight way.

Secure Cross-User Fuzzy Deduplication for Images in Cloud Storage

Xiaomei Liu, Xin Tang, Luchao Jin, Xiong Chen, Ziji Zhou , Shuai Zhang

Abstract. In cloud storage, existing image fuzzy deduplication technology often adopts a cloud-based deduplication method, which, although it improves the image's deduplication efficiency, ignores the client's communication overhead. Therefore, to further reduce the bandwidth consumption caused by redundant image uploading, researchers use similar images to extract the same features and employ image features as encryption keys to achieve cross-user deduplication. Although this approach reduces the communication overhead, it increases the risk of side-channel attacks and threatens the image's privacy. Thus, this paper proposes a cross-user deduplication scheme based on image content decomposition to solve the privacy concern. Specifically, by acquiring the image's frequency characteristics, the base data representing the image's main contents and the deviation data representing the image's details are decomposed from the image. Then, we use the cross-user deduplication method for the base data deduplication and the cloud side deduplication method for the deviation data deduplication. The implementation demonstrates that the developed scheme improves the deduplication efficiency under the premise of effectively resisting side-channel attacks.

Ontology-based metadata model design of data governance system

Hong Yan, Jing Wang , Yu Zhou

Abstract. Data as an important asset, its governance problem gradually highlighted. Metadata as an important data technology means of data governance, its model is of great significance for sharing, exchanging, understanding, discovering, and interoperating data. This paper based on the ontology method, integrates various metadata models and proposes a metadata model system for the data governance lifecycle to promoting the construction of cross-domain data sharing space.

Research Hotspots, Emerging Trend and Front of Fraud Detection Rearch: A Scientometric Analysis (1984 - 2021)

Zeng Li, Yang Li , Zili Li

Abstract. This paper conducted a comprehensive scientometric review of Fraud Detection between 1984 and 2021 to depict the landscapes, research hotspots, and emerging trends in this field. Besides scientific outputs evaluation using statistical analysis and comparative analysis, scientometric methods such as co-occurrence analysis, cocitation analysis, and coupling analysis were used to analyze the knowledge structure of Fraud detection. Results showed that Fraud Detection research went up significantly in the past two decades, in addition to conventional scientometric results,

Problems with Regression-line in Data-mining Applications and A Better Alternate Linear-model

Sukhamay Kundu

Abstra t. The regression-line for a set of data-points pi = (xi , yi), 1 ⩽i ⩽N and N ¿ 2, la ks the rotation-property in the sense that if ea h pi is rotated by an angle θ around the origin then the regression-line does not rotate by the same angle θ ex ept for the spe ial ase when all pi 's are ollinear. This makes the regression-line unsuitable as a linear model of a set of data points for appli ations in data mining and ma hine learning. We present an alternative linear model that has the rotation property. In many ways, the new model is also more appealing intuitively as we show with examples. The same omputation of the new linear model takes the O(N) time as that for the regression-line.

Research on Hot Spot Mining Technology for Network Public Opinion

Chengxin Xie, Yuxuan Han, Yingxue Mu , Xiumei Wen

Abstract. The research on network public opinion has attracted more and more attention. To accurately find the hot spots in online public opinion data and analyze their heat, this paper studies the hot spot mining work of Weibo public opinion data. Considering the defects of the traditional K-means++ clustering algorithm in the initial point optimization, the Word2Vec model proposes a hot spot discovery improvement algorithm for the network public opinion data WPKmeans++ (Word to vector Penalty factor K-means++). The algorithm introduces the penalty factor to make up for the problem that K-means++ is applied to the scattered text data of hot topics that are affected by outlier points, reduces the invalid coverage of the initial clustering center of the text clustering algorithm, and verifies the accuracy and efficiency of the final clustering results through the analysis of comparative experiments. The original dataset is preprocessed using Chinese word segmentation and removal of stopping words, and the text modeling of the preprocessed result set is carried out by a word embedding model. Finally, the Weibo public opinion data set was used as the corpus.

November 22nd—Session 1—Poster Room

Name Disambiguation Based on Entity Relationship Graph in Big Data

Gengsong Li, Hongmei Li, Yu Pan, Xiang Li, Yi Liu, Qibin Zheng , Xingchun Diao

Abstract. Aiming at the problem of insufficient utilization of author information and low accuracy of the existing name disambiguation methods, a name disambiguation method based on commonly used author information entity relationship graph is proposed. The entity relationship graph is constructed according to the information of the co-authors and the authors' affiliated institutions, years of birth, gender and degrees, and the edges in the graph is divided into two categories: the vertices in the first type edges are the authors, and the vertices in the second type edges must include any one of the affiliated institution, year of birth, gender and degree. The connection strength of two authors with the same name in the graph is calculated by following steps: first, the length of the paths is limited; second, the first type edges and the second type edges are searched respectively in the graph; then, the connection strengths of different types of paths are calculated and normalized according to the number and the length of paths, and weighted summed to obtain the connection strength between two authors; finally, the obtained connection strength is compared with the threshold to realize name disambiguation. The experimental results show that the proposed method has higher accuracy than baselines.

Ontology-based Combat Force Modeling and Its Intelligent Planning Using Genetic Algorithm

Zhenya Li, Shaoqiu Zheng, Cunyang Song, Wei Wang , Xiaojun Yang

Abstract. Modern warfare is under high-tech conditions, and joint operations of various services and arms have become the main combat form. It is necessary to make full use of the existing weapons and equipment of multiple services and arms, and display the overall combat effectiveness of the global joint force through mixed clusters. The effectively modeling of combat forces and intelligent planning by the task are core problems. In this paper, we proposed to use ontology technology to model the combat force, which defining the basic entity attributes, force relationships, and behaviors capabilities of combat forces from multiple dimensions. Then, the combat tasks framework is modeled by the vector and presented, thus the task oriented combat force planning is transferred into an optimization problems. On this basis, the genetic algorithm is proposed to get the "demand-capability" mapping matrix, which can quickly return the recommended combat force by different task.

Research on Multi-channel Retrieve Mechanism Based on Heuristic

Shiqi Ning, Kun Liu, Chengjun Wang, Shan Jiang , Qiang Wang

Abstract. Search system is a crucial component in information systems, that is to retrieve the relevant documents by the specific query. There are many search retrieve algorithms, almost all focus on a specific domain of retrieve algorithms, such as text matching, tag matching, semantic matching. However, in a real search system, the purpose of the retrieve module is to find the documents related to the specified query as fully as possible, so it requires that the search system should contain multiple forms of retrieve capability. In this paper, we propose a multi-channel retrieve model, including text channel, semantic channel and intention channel. In text channels, we propose heuristic two-stage query rewrite model, which can generate more semantically rich queries. In semantic channel, we present a novel sample dynamic construction method, which saves the manual annotation cost, and can train the model more fully. Finally, a brief general implementation of the retrieve methods based on intention channel is presented. The results show that the retrieve method based on multi-channel can significantly improve the retrieve number and accuracy of documents, and business indicators such as click-through rate are also significantly improved.

PoetryBERT: Pre-Training with Sememe Knowledge for Classical Chinese Poetry

Jiaqi Zhao, Ting Bai, Yuting Wei , Bin Wu

Abstract. Classical Chinese poetry has a history of thousands of years and is a precious cultural heritage of humankind. Compared with the modern Chinese corpus, it is irrecoverable and specially organized, making it difficult to be learned by existing pre-trained language models. Besides, with the thousands of years of development, many words in classical Chinese poetry have changed their meanings or been out of use today, which further limiting the capability of existing pre-trained models to learn the semantics of classical Chinese poetry. To address these challenges, we construct a large-scale sememe knowledge graph of classical Chinese Poetry (SKG-Poetry), which connects the vocabularies in classical Chinese poetry and modern Chinese. By extracting the sememe knowledge from classical Chinese poetry, our model PoetryBERT not only enlarges the irrecoverable pre-training corpus but also enriches the semantics of the vocabularies in classical Chinese poetry, which enables PoetryBERT to be successfully used in downstream tasks. Specifically, we evaluate our model in two tasks in the field of Chinese classical poetry, which are poetry theme classification and poetrymodern Chinese translation. Extensive experiments are conducted on the two tasks to show the effectiveness of sememe knowledge based pre-training model.

Image hide with Invertible Network and Swin Transformer

Yuhuan Feng, Yunjie Liu, Hongjuan Wang, Jin Dong, Rujia Wang , Chunpeng Tian

Abstract. Image hiding is a way of hiding information by hiding a secret image in a carrier image in an imperceptible way and recovering it. How to effect better hiding of images in images is a problem that is still being studied. In this paper, we propose an invertible neural network based model using the Swin Transformer module to hide images. According to the properties of invertible neural networks, image hiding and revealing can be done by the same network of forward and backward processes. Since image hiding and recovery are forward and backward of the same network, sharing the same set of parameters, a lot of resources are saved accordingly. It is found that hiding secret information in wavelet domain can improve the concealment, so we transform the image to wavelet domain for hiding.

Modeling and Analysis of Combat System Confrontation Based on Large-scale Knowledge Graph Network

Rupeng Liang, Lizhi Ying, Kebo Deng, Huawei Zhu, Wei Ma , Shaoqiu Zheng

Abstract. Focusing on the confrontation analysis requirements of joint operation system of systems, this paper proposes an intelligent matching method of operational elements based on semantic features for typical large-scale combat system such as reconnaissance and fire strike, which can provide intelligent auxiliary support for rapid and dynamic reconfiguration of operational system of systems. On this basis, a general framework for system of systems confrontation modeling and combination analysis is built, which can support networked combat system mapping, flexible expansion of system of systems capabilities analysis, dynamic generation of systems knowledge graph and customization of system of systems. The framework provides quantitative evaluation of networked combat system capabilities, which can provide intelligent auxiliary support for commanders to rapidly build the combat system, dynamically analyze and accurately evaluate the confrontation effectiveness of the combat system.

A Classification Method for Imbalanced Data Based on Ant Lion Optimizer

Mengmeng Li, Yi Liu, Qibin Zheng, Xiang Li , Wei Qin

Abstract. Imbalanced data will bring difficulties in data processing, which is very common in data engineering. These data usually have sophisticated distributions. Different resampling methods are required for dealing with data with different distributions, while fixed ones are adopted traditionally. Therefore, to select appropriate resampling methods for data with such characteristics, we propose a novel classification method for Imbalanced Data based on Ant Lion Optimizer, called ALOID. It combines adaptive resampling strategies, feature selection, and ensemble classifiers. The adaptive resampling strategy refers to utilizing roulette wheel selection to choose the most suitable resampling method with a greater probability for each dataset according to the variable probabilities of resampling methods. Then a two-stage approach is further used in feature selection: preprocessing and enhancing. In addition, we adopt an ensemble classifier with dynamic weights. The variable probabilities of resampling methods, features, and the weights of base classifiers are coded in individual solutions. A large number of comprehensive experiments have been carried out in this paper. ALOID is compared with 8 state-of-the-art algorithms on 33 publicly available imbalanced datasets. Using K-nearest neighbor as the base classifier, we have found ALOID outperforms other methods in most cases, especially on high-dimensional imbalanced datasets. Experiment results demonstrate the performance advantage of ALOID over other comparable algorithms.

Multi-view Classification via Twin Projection Vector Machine with Application to EEG-based Driving Fatigue Detection

Xiaobo Chen , Yuxiang Gao

Abstract. Multi-view learning based on a variety of multiple hyperplane classification (MHC) models has shown promising performance for multi-view data classification in recent years. However, seeking for a single fitting hyperplane for each class might be insufficiently expressive for the datasets with complex feature distribution. Moreover, in the presence of outlier data, most approaches tend to produce degraded results due to the adverse impact of outliers. In this paper, we put forward a new multi-view MHC model termed as multiview twin projection vector machine (MvTPVM) which aims to seek for multiple projection vectors. Following the consensus principle, multi-view coregularization is introduced to constrain the projected features of two views. To further achieve robust multi-view classification, we propose a robust variant called RMvTPVM where the distance involved in this model is measured by L-norm. To solve the resulting model, an elegant iteration algorithm is further proposed. The experimental results on both standard UCI datasets and driving fatigue detection based on EEG signals verify the effectiveness of our models in multi-view classification.

An Interpretable Conditional Augmentation Classification Approach for Imbalanced EHRs Mortality Prediction

Tianhao Li, Najia Yin, Penghao Gao, Dengfeng Li , Wei Lu

Abstract. One of the most crucial tasks in the ICU is mortality prediction. The number of deceased patients is significantly lower than the number of survivors, and it is simple to over-identify the survivors. Additionally, the clinical use of present machine learning and deep learning models is challenging due to their lack of interpretability. To address the aforementioned issues, we innovatively propose the Interpretable Conditional Augmentation Classification (ICAC) method. By using CWGAN to create balanced samples, ICAC learns the distribution of minor samples. In order to make better clinical suggestions, the Shapley value is utilized to examine the marginal contribution of patient characteristics to the prediction model. We test the model on the latest released MIMIC-IV, and the experimental results show that the AUC index of our model is superior than that of the basic model. Our proposed method can successfully address the class imbalance issue in EHRs, clarify how features affect model outcomes, and offer useful recommendations for clinical practice.

CSHEM - A Compressed Sensing Based Secure Data Processing Method for Electrical Data

Wei Wu, Haipeng Peng , Lixiang Li

Abstract. Analyzing statistical features of electrical data is an important issue in the field of electrical data research, which often concerns collecting huge amounts of original data from various sources. Evidently, data compression and security issues are two key aspects of such process. However, a proportion of electrical data owners may agree to support electrical data analysis only when their private data are not disclosed to the public or even to the researchers. To address this problem, this paper proposes a secure data processing method named Compressed Sensing Homomorphic Encryption Method (CSHEM), which simultaneously achieves data compression and encryption. CSHEM also could allow researchers to reconstruct statistical analysis results of the original electrical data without requirements to possess these original data. We conduct experiments and simulations using real electrical data from over 100 households. The results show that the proposed method could realize data compression and encryption, and the reconstruction results could express the true statistical information of the original data.

Deep Structured Graph Clustering Network

Sun Li, Zihan Wang, Yong Li, Yang Yu, Wenbo Li, Hongliang Liu, Rong Song , Lei Zhu

Abstract. Shallow clustering methods adopt linear or simple nonlinear projections to reduce the feature dimensions, which may suffer from the weak representation capability. Contrastively, deep clustering methods have the advantages on representing the sample characteristics. However, most deep clustering models focus on preserving feature information of samples and ignore the important intrinsic structures of samples. Besides, large amounts of neural network parameters should be optimized in deep clustering models, but no proper semantic supervision can be used in the unsupervised clustering process. To alleviate these problems, in this paper, we propose a unified deep structured graph clustering network to guide the unsupervised deep clustering process with a theoretically ideal cluster structure. Specifically, we simultaneously learn the discriminative feature representation of samples, and the similarity graph of samples with well clustering structure by automatically assigning proper neighbors to each sample. Experiments on several public testing datasets demonstrate the effects of the proposed method.

Pose Sequence Model Using the Encoder-decoder Structure for 3d Pose Estimation

Jiwei Zhang, Lian Yang, Tianbo Ye, Wendong Wang , Ying Tan

Abstract. Human pose estimation is a hot research problem in computer vision, it has a certain application prospect in the automatic driving industry, security field, film and television industry, and specific action monitoring of special scenes. Because a 2D skeleton usually corresponds to multiple 3D skeletons, the mapping from 2D to 3D in the monocular video has inherent depth ambiguity and is ill-posed, which makes the research on the technology of 3D human pose estimation in monocular video challenging. In this paper, a Pose Sequence Model (PSM) for 3D human pose estimation in the monocular video is proposed, which combines the full convolution neural network based on extended convolution with the Long Short-Term Memory (LSTM) network. We make full use of convolution to extract spatial features and use LSTM to obtain temporal features. With this model, we can predict 3D human posture through 2D sequences. Compared with the previous work on classical data sets, our method has good detection results.

November 22nd—Session 2—Oral Room I

Heterogeneous Multi-unit Control with Curriculum Learning for Multi-agent Reinforcement Learning

Jiali Chen, Kai Jiang, Rupeng Liang, Jing Wang, Shaoqiu Zheng , Ying Tan

Abstract. Heterogeneous Multi-unit control is one of the most concerned topic in multi-agent system, which focuses on controlling agents of different type of functions. Methods that utilize parameter or replaybuffer sharing are able to address the problem of combinatorial explosion under isomorphism assumption, but may lead to divergence under heterogeneous setting. This work use curriculum learning to bypass the barrier of a needle in a haystack that is faced by either joint-action learner or independent learner. According to the experiment on heterogeneous force combat engagements, the independent learner outperforms the baseline learner by 10% of evaluation metrics with curriculum learning, which empirically shows that curriculum learning is able to discover a novel learning trajectory that is not followed by conventional multiagent learners.

Attentive Relational State Representation for Intelligent Joint Operation Simulation

Renlong Chen, Ling Ye, Shaoqiu Zheng, Yabin Wang, Peng Cui , Ying Tan

Abstract. In the multi-agent task, due to the constant changes in the location and state of each agent, the information considered by each agent when making decisions is also constantly changing. This makes it difficult to model cooperatively among agents. Previous methods mainly used average embedding to model feature aggregation. However, this aggregation has the problem of losing permutation invariance or excessive information loss. The feature aggregation method based on attentive relational state representation establishes an insensitive state representation to permutation and problem scale. In our experiments on Intelligent Joint Operation Simulation, experimental results show that attentive relational state representation improves the baseline performance.

Generating Adversarial Malware Examples for Black-Box Attacks Based on GAN

Weiwei Hu , Ying Tan

Abstract. Machine learning has been used to detect new malware in recent years, while malware authors have strong motivation to attack such algorithms. Malware authors usually have no access to the detailed structures and parameters of the machine learning models used by malware detection systems, and therefore they can only perform black-box attacks. This paper proposes a generative adversarial network (GAN) based algorithm named MalGAN to generate adversarial malware examples, which are able to bypass black-box machine learning based detection models. MalGAN uses a substitute detector to fit the black-box malware detection system. A generative network is trained to minimize the generated adversarial examples' malicious probabilities predicted by the substitute detector. The superiority of MalGAN over traditional gradient based adversarial example generation algorithms is that MalGAN is able to decrease the detection rate to nearly zero and make the retraining based defensive method against adversarial examples hard to work.

Accurate Decision-Making Method for Air Combat Pilots based on Data-Driven

Yiming Mao, Zhijie Xia, Qingwei Li, Jiafan He , Aiguo Fei

Abstract. The development of science and technology has constantly changed the air combat battlefield. At present, more and more researches focus on the optimization of air combat pilot Expert System(ES). The ES can be divided into two parts: tactical state decision-making and maneuver behavior decision-making. Although a lot of work had optimized the generation method of maneuver behavior decision-making, the tactical state decision-making still follows the original human rules. Based on a large number of tactical state decision-making sample data, this paper uses data-driven method to build a deep learning network. Experiments showed that this method can learn high-level decision empirical data and replace rule models, and can be applied to pilot's accurate tactical state decision-making in the future.

OLPGP: An optimized label propagation-based distributed graph partitioning algorithm

Haoqing Ren , Bin Wu

Abstract. One of the concepts that have attracted attention since entering the big data era is graph-structured data. Distributed systems for graph analysis are widely used to process large graphs. Graph partitioning is critical in parallel and distributed graph processing systems because it can balance the computational load and reduce communication load. An efficient graph partitioning algorithm can significantly improve the performance of large-scale graph data analysis and processing. In this paper, we propose a new Optimized Label Propagation-based distributed Graph Partitioning algorithm (OLPGP). OLPGP optimizes the label propagation algorithm and considers the differences between nodes. To improve computational efficiency, we implement OLPGP on the open-source distributed graph processing framework Spark GraphX. Conducted experiments on real-world networks indicate that OLPGP is scalable and achieves higher partition quality than the state-of-the-art label propagation-based graph partitioning algorithms.

November 22nd—Session 2—Oral Room II

DRGS: Low-Precision Full Quantization of Deep Neural Network with Dynamic Rounding and Gradient Scaling for Object Detection

Qiaojun Wu, Yuan Li, Song Chen , Yi Kang

Abstract. To improve the inference accuracy of neural networks, their size and complexity are growing rapidly, making the deployment of complex task models on mobile devices with efficient inference a major challenge for industry today. Low-precision quantization is one of the key methods to achieve efficient inference on complex networks, but previous works often quantize partial layers because severe accuracy degradation occurs when quantizing is applied to the entire network. In order to improve the stability and accuracy of low-precision quantization-finetuning, we propose a hardware-friendly low-precision full quantization method, called DRGS, which dynamically selects rounding mode for weights according to the direction of weight updates during the training forward and scales the corresponding gradient, finally completing the quantization of all layers of the complex network to achieve floating-freeinference. To validate the effectiveness of DRGS, we apply it to RetinaNet with full 4-bit quantization, and the result of the MS-COCO dataset shows that DRGS has a 2.1% improvement in mAP or at least 2X less quantization loss compared to the state of art implementation. This improvement is also significant even on the YOLO, an object detection model family known for run-time low latency and efficiency. In the latest version of YOLO-v5s, the 4-bit fully quantized network reaches mAP 33.4 which to our knowledge is the best mAP achieved at this category.

Emotion Recognition Based on Multi-scale Convolutional Neural Network

Zeen Wang

Abstract. The Convolutional neural network is one of the most mature models used in deep learning technology and have achieved a series of remarkable results in cross-domain research. It has become a hot research topic to apply Convolutional neural network (CNN) to emotion recognition based on EEG signals. Although many researchers have used experiments showing that CNNs have good results for emotion recognition, they ignore the individual differences of subjects and the time differences of the same subject. Then we propose the 1D multi-scale CNN in this paper that can effectively solve individual differences and temporal differences with optimal scale convolution, which solves restrictions of the results when classifying. The experiments on public DEAP dataset show that the 1D multi-scale CNN proposed outperforms other existing models.

Multiple Residual Quantization of Pruning

Yuee Zhou, Haidong Kang, Tian Zhang, Lianbo Ma , Tiejun Xing

Abstract. Model compression technology investigates the compression of deep neural networks by quantizing the full-precision weights of the network into low-bit ones, to achieve network acceleration. However, most of the existing quantization operations are calculated by simple thresholding operations, which will lead to serious precision loss. In this paper, we propose a new quantization framework combined with pruning, called Multiple Residual Quantization of Pruning(MRQP), to achieve higher precision quantization neural network(QNN). MRQP recursively performs quantization of the full-precision weights by combining the lowbit weights stem and residual parts many times, to minimize the error between the quantized weights and the full-precision weights, and to ensure higher precision quantization. At the same time, MRQP prunes some weights that have less impact on loss function to further reduce model size.

Research and Analysis of Video-Based Human Pose Estimation

Zheng Wang, Jing Sun, Qingxiao Xu , Kun Liu

Abstract. With the rapid development of computer vision and artificial intelligence, human pose estimation has become the subject of intense scholarly debate. In addition, ubiquitous video software and monitoring machines provide sufficient video data, and all kinds of key elements can be found in the visual information. However, due to different task subdivision scenarios as well as the confusing nature of the human actions, the scenario-oriented video detection techniques aim to establish standard libraries for distinct application scenarios, aggregating both original joint coordinates and composite features. In this paper, we present an innovative framework for detecting possible actions in various scenarios, table tennis training, pilot running planes and boot camp scenes, which covers vast range of social scenes. First, we call OpenPose for accurate and robust skeleton information. Then, manually constructed features of pose angles, relative displacements, moving pattern sequences and etc. are calculated. These informative features enlighten people of latent motion rules. Finally, we report how our framework is applied to realistic classification datasets. Through our work, an overall sketch for skeleton-based human pose estimation and a framework with practical application value is proposed, where people can gain a deep theoretical and practical understanding of a front field of computer vision.

Action Recognition for Solo-militant Based on ResNet and Rule Matching

Lijing Tong, Jinzhi Feng, Huiqun Zhao , Kun Liu

Abstract. To solve the problem of low accuracy of solo-militant action recognition under small sample data set, a new method of solo-militant behavior analysis based on ResNet and rule matching is proposed in this paper. The militant's action classification is done by 2 levels of classification. Firstly, the skeleton key points are extracted from the militant's combat video frames by OpenPose. Then, the first level classification of militant's action is performed by the ResNet deep learning network based on RGB images and combined with the skeleton key point rule set of militant's action. Next, the second level classification of militant's action is performed by the CNN network based on skeleton map and combined with the skeleton key point rule set. At last, the final classification of militant's action is output according to the 2 levels of classification. The experimental results show that the proposed method in this paper can achieve more effective recognition rate of solo-militant action under small sample data set.

November 22nd—Session 2—Poster Room

Supervised Prototypical Variational Autoencdoer for Shilling Attack Detection in Recommender Systems

Xinhao Wang, Huiju Zhao, Youquan Wang, Haicheng Tao , Jie Cao

Abstract. Collaborative filtering-based recommender systems are vulnerable to shilling attacks. How to detect shilling attacks has become a popular research direction. Some recent works have applied deep learning to the field of shilling attack detection. However, most of the existing deep learning-based shilling attack detection models are based on user-item scoring matrices, which do not apply manual scoring features well and cannot be used to detect cold-start shilling attackers. Thus, we propose a shilling attack detection algorithm based on Supervised Prototypical Variational Auto-Encoder (SP-VAE). Specially, SP-VAE can obtain a unified user-profile representation that can be easily used to down-stream applications of shilling attack detection classifiers. Then, the algorithm constructs the prototype representation of various shilling attacker, and a classifier is used to classify various shilling attack users and normal users. The experimental results show that our method consistently outperforms the traditional method in the case of cold-start profile of the shilling attack.

Therapeutic effects of corticosteroids for critical and severe COVID-19 patients

Yuhan Gao, Yaoqi Sun, Jinlan Bi, Shengying Wang, Jiyong Zhang , Mang Xiao

Abstract. The rapid spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection has led to an unprecedented public health, economic, and social crisis worldwide. Since no therapeutic treatment is yet available to effectively clear the virus and terminate transmission, supportive therapy is the primary clinical approach for coronavirus disease (COVID-19). The role of corticosteroids as one of the main means of anti-inflammatory adjuvants in the treatment of COVID-19 is controversial. Here, we retrospectively evaluated the therapeutic effects of corticosteroids by comparing clinical data of patients treated with or without a corticosteroids therapy at different severity levels. Kaplan-Meier curves shows that therapy with methylprednisolone and cortico-steroids increases the risk of death in patients with critical COVID19 pneumonia. For patients in the critical group, the risk of death was slightly higher in males receiving corticosteroids therapy, while hypertension and trauma history reduced the hazard ratio.

Knowledge Graph based Chicken Disease Diagnosis Question Answering System

Shushu Gu, Jing Wang, Shaoqiu Zheng, Yanling Pan, Guoxin Jiang, Wenwen Dai, Ziqi Cheng , Delong Chen

Abstract. With the rapid development of natural language processing technology and knowledge graph technology, knowledge graph based intelligent question answering systems are being increasingly applied in various fields and industries. In the poultry industry, it is of great importance for farmers to promptly obtain scientific information of poultry disease diagnosis and curing measurements, where knowledge graph based question answering systems can contribute richly. In this paper, we design and implement Knowledge Graph based Chicken Disease Diagnosis Question Answering System (CDD-QAS) via deep learning models. We build a knowledge graph for chicken disease diagnosis, which contains 28 common chicken diseases and their corresponding symptoms, prevention and curing measures. In the construction of intelligent question answering system, we use BERT-TextCNN to realize the task of intention recognition and use BiLSTM-CRF to realize the task of entity recognition. Experimental results show that our proposed system can achieve better performance than other models, and possess great interactivity and accuracy. The proposed system can make great contribution to poultry industry and sets a good example of applying knowledge graph and deep learning methods in building question answering system.

User's Permission Reasoning Method Based on Knowledge Graph Reward Guidance Reinforcement Learning in Data Center

Yu Pan, Hongmei Li, Wei Li, Yi Liu, Xiang Li, Qibin Zheng , Wei Qin

Abstract. In general, multiple domain cyberspace security assessments are very important for data center security and can be implemented by reasoning user's permissions. However, while existing methods include some information from the physical and social domains, they do not provide a comprehensive representation of cyberspace. Existing reasoning methods are also based on expert given rules, resulting in inefficiency and a low degree of intelligence. To address this challenge, we create a Knowledge Graph (KG) of multiple domain cyberspace in order to provide a standard semantic description of the multiple domain cyberspace. Following that, we proposed a user's permissions reasoning method based on reinforcement learning. All permissions in cyberspace are represented as nodes, and an agent is trained to find all permissions that user can have according to user's initial permissions and cyberspace KG. We set 10 reward setting rules based on the features of cyberspace KG in the reinforcement learning of reward information setting, so that the agent can better locate user's all permissions and avoid blindly finding user's permissions. The results of the experiments showed that the proposed method can successfully reason about user's permissions and increase the intelligence level of the user's permissions reasoning method. At the same time, the F1 value of the proposed method is 6% greater than that of the Translating Embedding (TransE) method.

SMPG: Adaptive Soft Update for Masked MADDPG

Yu Zhang, Shijia Zhou, Ning Guo, Pin Tao, Tengfei Li , Xuechao Zou

Abstract. In multi-agent systems, deep reinforcement learning policy gradient algorithms can converge excessively slowly or even fail to converge if the agent size as well as the state information quickly grows. We consequently present a policy gradient algorithm for generalised centralised training and decentralised execution (CTDE) based on the principle of masking. We transform the global state information of the critic network in the original (MADDPG) algorithm to the state information of local random agents as the input of the critic network. In addition, we have changed the way Polyak updates the target network so that it can dynamically and adaptively update the target network. Under the new framework, our approach considerably decreases the training strain on the critic network while taking into consideration the efficiency of agent sample learning and speeding up the multi-agent discovery of superior strategies. Combining these two improvements, our suggested approaches can be extended to any other CTDE-based multi-agent deep reinforcement learning algorithms, rather than being limited to the MADDPG conventional multi-agent reinforcement learning algorithm. We made the code publicly available at https://github.com/ZVEzhangyu/SMPGmaster.

Establishment of Empirical Expression of Atmospheric Scattering Coefficient for Line-of-sight Ultraviolet Propagation in Coastal Area

Bifeng Li, Bing Xue, Jiafang Kang, Chuntao Cai , Yue Liu

Abstract. For the problems of hard quantification of atmospheric attenuation effect, difficult operation and time-consuming application of traditional MODerate resolution atmospheric TRANsmission (MODTRAN) software in the current ultraviolet propagation process, the atmospheric attenuation effect in the ultraviolet propagation process is studied in coastal area. Based on the applicability verification of MODTRAN in coastal area, the empirical expression of atmospheric scattering coefficient for line-of-sight (LOS) ultraviolet propagation in coastal area is built on the basis of the classical Kim model structure. In comparison with the MODTRAN computation, the small error indicates that the established empirical expression of atmospheric scattering coefficient has reasonable structure and good applicability, it can provide an important support for the channel research and the system design of ultraviolet communication.

Defending Adversarial Examples by Negative Correlation Ensemble

Wenjian Luo, Hongwei Zhang, Linghao Kong, Zhijian Chen , Ke Tang

Abstract. The security issues in DNNs, such as adversarial examples, have attracted much attention. Adversarial examples refer to the examples which are capable to induce the DNNs return incorrect predictions by introducing carefully designed perturbations. Obviously, adversarial examples bring great security risks to the real-world applications of deep learning. Recently, some defence approaches against adversarial examples have been proposed. However, the performance of these approaches are still limited. In this paper, we propose a new ensemble defence approach named the Negative Correlation Ensemble (NCEn), which achieves competitive results by making each member of the ensemble negatively correlated in gradient direction and gradient magnitude. NCEn can reduce the transferability of the adversarial samples among the members in ensemble. Extensive experiments have been conducted, and the results demonstrate that NCEn could improve the adversarial robustness of ensembles effectively.

Genome-wide Feature Selection of Robust mRNA Biomarkers for Body Fluid Identification

Guangyi He, Liming Xiao, Yingnan Bian , Ence Yang

Abstract. Tracing the origins of body fluids, which can provide information linking sample donors with criminal acts, is one of the primary challenges facing forensic medicine. Gene expression profiling methods have been widely developed to identify biomarkers for body fluid identification. In this study, we systematically investigated large-scale, multicategory, high-throughput gene expression data and identified 36 high potential body fluid-specific mRNAs with robust discriminability based on decision tree models. Robustly expressed reference genes were selected for normalization, which further improved the accuracy. Results on independent datasets suggested the robust performance and good generalizability of our biomarkers. In addition, simulated data indicated that our biomarkers could also be employed for accurate body fluid mixture deconvolution. We believe our methods may facilitate body fluid identification and provide insights into forensic crime scene reconstruction.

Complementary Convolutional Restricted Boltzmann Machine and Its Applications in Image Recognition

Jian Zhang

Abstract. Restricted Boltzmann Machines (RBMs) are widely applied in Image Classification and Image Reconstruction. However, although highly expressive conditional distributions of RBMs commonly produce effective features for the two tasks, building these expressive conditional distributions and sampling from the distributions are difficult for conventional RBMs. In this paper, a Complementary Convolutional Restricted Boltzmann Machine (CCRBM) is proposed. The CCRBM designs complementary factors in its visible layer and uses the factors to produce highly expressive conditional Gaussian distributions under low sampling cost. To further extract hierarchical image features, a Complementary Convolutional Deep Belief Net (CCDBN) is proposed for Image Processing based on CCRBM. Experiments verify that the proposed CCRBM and CCDBN perform better than other commonly used RBMs and probabilistic graphic models with the help of the designed complementary factors.

HOS-YOLOv5: An Improved High-precision Remote Sensing Image Target Detection Algorithm Based on YOLOv5

Hongren Wang

Abstract. Object detection has made great strides in natural images over the past few years. However, due to the characteristics of small size, dense distribution, and different scales of remote sensing images, when they are directly applied to remote sensing images, the detection accuracy of their targets is too low. To this end, we propose HOS-YOLOv5, an improved high-precision remote sensing image target detection algorithm based on YOLOV5, construct the HOS backbone network, add multiple SPD modules and downsampling modules, and introduce the DotD algorithm to solve remote sensing images. The detection accuracy of the target is too low. HOS-YOLOv5 has conducted a large number of experiments on the public dataset DOTA. The experimental results show that compared with the traditional YOLOv5, the mAP of HOSYOLOv5 is increased by 4.65%, and a good detection effect is achieved.

Possibilistic Reject-Classification based on Contrastive Learning in Vector Quantization Networks

Seyedfakhredin Musavishavazi , Maryam Alipour

Abstract. In this paper, while considering rejection as an option, we attempt to tackle the problem of multiclass classification and the uncertainty that arises from the class possibility assignment of data. To address the challenge of classification based on possible class assignments, we use the likelihood ratio, which helps us develop a holistic approach that considers all the positive and negative effects of assigning a particular class as opposed to others to a data point. To this end, we propose a possibilistic variant of the contrastive-learning function, inspired by RSLVQ [21], and a class-wise decision rule based on it. The latter is used to define the total cost function. In addition, with the help of likelihood ratio, an error-rejection trade-off inspired by Chow [3], is proposed. Finally, modification of the cost function and integration of rejection into it result in an interpretable model whose capabilities in both aspects (classification/rejection) are demonstrated by application to different data sets.

Combining Statistical and Semantic Features For Trajectory Point Classification

Jian Xu, Xin Xu , Guoqing Ruan

Abstract. Trajectory point classification can be described as a supervised sequence labeling problem, in which a model is trained by labeling data to predict the category of unknown points and identify key events in the trajectory. Due to the difficulty of labeling trajectory point, a large amount of trajectory data is either unlabeled or labeled in an imbalanced way. To make matters worse, traditional trajectory point classification methods are generally constrained to utilize the statistical features of the labeled data and the semantic features as well as the large amount of unlabeled data have not been well studied yet. For this reason, the performance of traditional trajectory point classification methods is far from satisfactory. To solve this problem, we transfer existing language model knowledge to construct the semantic features and construct a trajectory point classification model by combining both the motion features and semantic features. The simulation results show that, compared with the traditional methods, our method has improved the accuracy of trajectory point classification by three and seven percentage points in the classification of circular and turning movements respectively.

Learnable Relation With Triplet Formulation For Semi-supervised Medical Image Classification

Yiming Sun, Zhiqiang Xie, Kun Fang, Enmei Tu , Jie Yang

Abstract. For medical image classification, annotations for images are laborious and expensive, which is suitable for the application of semisupervised learning. Mainstream semi-supervised learning methods develop a consistency regularization to leverage the unlabeled data but they neglect the relations among data. This paper proposes a novel learnable relation semi-supervised method with triplet formulation to not only jointly achieve feature extraction and distance metric learning but restrict the relations among features properly. With the learnable distance metric, the proposed method could learn the features and the metric via one single network to much better characterize the relations among features. Besides, triplet formulation is employed to constraint the relations among features. Experiments on skin lesion diagnosis data set indicate that the proposed method outperforms other state-of-the-art semi-supervised learning methods.

Improved Clustering Strategies for Learning Style Identification in Massive Open Online Courses

Wei Song , Ziqiao Wang

Abstract. Learning style identification is important for improving the learning and teaching experience in the massive open online courses (MOOCs). To identify learning styles automatically, a very large quantity of labeled data is necessary. However, labeling data manually is tedious and impractical. A known solution to this problem is to cluster MOOCs learning data and label them with the general characteristics of the cluster to which they belong. In this paper, we propose two distance measures suitable for forming canopies in MOOCs, and incorporate the canopy approach into the K-means clustering algorithm. This improves the stability of the clustering results and the quality of the data labeling. Experimental results with four popular classifiers show that the proposed method can improve both the overall identification of learning styles and the identification of each individual learning style.

November 22nd—Session 3—Oral Room II

A Self-Adaptive Two-Stage Local Expansion Algorithm for Community Detection on Complex Networks

Hui Shan, Bin Li, Haipeng Yang , Lei Zhang

Abstract. Community detection is of great importance to find hidden information in complex networks. For this problem, local expansion algorithms are becoming popular due to the low time complexity. However, most of them depend heavily on seed selection or require setting some thresholds in advance, leading to inaccurate partition. To this end, this paper proposes a self-adaptive two-stage local expansion algorithm (SALEA) for community detection. Specifically, we propose a self-adaptive strategy that can be used in SALEA for finding communities spontaneously. In the first stage, we apply the self-adaptive strategy for nodes to conduct local expansion and get coarse community structures. In the second stage, we apply the self-adaptive strategy for weak communities obtained in the first stage to refine the coarse community structures and get more accurate partitions. Finally, the experimental results on real and synthetic networks demonstrate that SALEA is superior over several state-of-the-arts.

A Multi-Module 3D U-Net Learning Architecture for Brain Tumor Segmentation

Saqib Ali, Jianqiang Li, Yan Pei , Khalil Ur Rehman

Abstract. Segmentation of gliomas is a crucial step in brain tumor surgical planning, and it serves as the foundation for further diagnosis of brain tumors. Tumor borders are usually unclear, and a significant amount of heterogeneity in the structure, causing brain tumor segmentation a tough task. However, for tumor segmentation, approaches based on deep learning have shown promising results. This study develops a multi-module U-Net system that utilizes multiple U-Net modules to collect spatial detail at varying resolutions. We use various up-inception and down-inception modules to extract and exploit enough features. Experimental results show that the dice scores of 0.95, 0.90, 0.84, and 0.91, 0.84, 0.77 were achieved for the whole tumor, core tumor, and enhancing tumor, using the BraTS 2018 and local private dataset, respectively. When compared to cutting-edge methods, this study achieves competitive segmentation results.

Knowledge Learning-based Brain Storm Optimization Algorithm for Multimodal Optimization

Xueping Wang, Yue Liu , Shi Cheng

Abstract. Using swarm intelligence to obtain multiple optima in a single run simultaneously proved efficient for solving multimodal optimization problems (MOPs). However, the existing studies fail to resolve the contradiction between the required solution accuracy and the number of solutions. In this paper, an improved brain storm optimization (BSO) algorithm based on knowledge learning (KLBSO) is proposed as a solution to the problem. The properties of the improved algorithm and the domain knowledge of the problem are combined during the search process. Two factors need to be taken into account to solve a MOP: the accuracy and the diversity of the solution set. In the proposed algorithm, there are two learning approaches. Firstly, improving the learning method by replacing the perturbation operator of the random solution with the inter-solution learning of the worst solutions, improves the optimization ability of the algorithm. Secondly, by analyzing the MOPs, adding an archive set guarantees the solution's diversity. To assess the efficiency of KLBSO, eight benchmark functions with various sizes and complexities were used. Comparing the results of KLBSO with those of state-of-the-art methods which are brain storm optimization algorithm (BSO), brain storm optimization algorithm in objective space (BSOOS), two kinds of pigeon-inspired optimization algorithms (PIO, PIOr), the comparison results show that the KLBSO is able to solve the contradiction between required solution accuracy and the number of solutions, and improves the outcomes where BSO is ranked first followed by the test algorithms.

An Algorithm of Set-Based Differential Evolution for Discrete Optimization Problem

Michiharu Maeda , Yuta Chikuba

Abstract. This paper presents an algorithm of set-based differential evolution for discrete optimization problem. Differential evolution has been hitherto studied for continuous optimization problem. Extending approaches in continuous space to these in discrete space with set-based representation schemes, differential evolution can adopt to discrete optimization problem. A candidate solution is defined by a crisp set and all arithmetic operations in mutation are redefined by new operators. The mutation operator of our algorithm adds two different solutions selected randomly to the current solution and our algorithm constructs the solution probabilistically. In order to evaluate the validity of our algorithm, we examine numerical experiments compared to existing algorithms.

November 22nd—Session 3—Poster Room

A Novel Feature Selection Method Based on Adaptive Search Particle Swarm Optimization

Qing-Hua Ling, Yi-Huai Wang, Fan-Yu Li , Fei Han

Text-independent Speaker Identification Using a Single-scale SincNet-DCGAN Model

Yanna Zhang, Guangcun Wei, Hang Min , Yunfei Xu

Abstract. The state-of-the-art x-vector technique has been successful in textindependent speaker recognition tasks. However, neural networks are susceptible to overfitting issues in small sample settings, which impairs network performance. Recent studies have attempted to improve the regularization of speaker recognition networks using generative adversarial networks and have shown competitive results. In this paper, we propose a novel deep convolutional generative adversarial network-based speaker identification technique, which adds single-scale SincNet to the DCGAN network and performs text-independent speaker recognition directly using discriminators in the DCGAN network. Also, the loss function in the original model is replaced by the Wasserstein distance. Additionally, by jointly optimizing the "true/false" and classification objective functions, the discriminator enhances the speaker recognition system's capacity for generalization. On the LibriSpeech corpus, our technique outperformed the baseline model x-vector utilizing the dropout method and L2 regularization by a margin of 55.11% and 67.08%, respectively.

Flow Prediction via Multi-view Spatial-temporal Graph Neural Network

Shan Jiang, Qiang Wang, Chengjun Wang, Kun Liu, Shiqi Ning , Xinrun Xu

Abstract. In recent years, the problem of traffic flow prediction in the urban environment has been widely concerned. However, the traffic flow prediction has not been effectively solved for the next period between the origin-destination region pair. In addition, multiple spatial-temporal traffic dependencies exist between the origin-destination area pairs. In this paper, three types of traffic dependencies between origin-destination region pairs were considered: the same origin dependency, same destination dependency, and transfer to dependency. This paper proposed a spatialtemporal forecasting framework for traffic flow prediction between pairs of urban regions with multi-view graphs. This work mainly considered the construction of spatial-temporal deep learning networks under three kinds of multi-view graphs. Finally, the prediction results under the three dependence relationships are fused to get the final prediction results. Comprehensive experiments on two datasets showed that the proposed framework has very high prediction performance, and outperforms the baseline model by more than 6%.

RotatSAGE: A Scalable Knowledge Graph Embedding Model based on Translation Assumptions and Graph Neural Networks

Yubin Ma, Yuxin Ding , Guangbin Wang

Abstract. Knowledge graphs have been widely used in numerous AI applications. In this paper, we propose an efficient knowledge graph embedding model called RotatSAGE by combining the RotatE model and the GraphSAGE model. In the proposed model the RotatE model is used to learn the embedding vectors of heterogeneous entities and relations in a knowledge graph. One problem of the RotatE model is that it only can learn from a single triplet and cannot take advantage of local information to learn embeddings. To solve this issue, we introduce the GraphSAGE model into RotatE. The GraphSAGE model can use neighbor information to improve the embedding of an entity by sampling a small and fixed number of neighbors. We also propose a sampling strategy to further eliminate redundant entity information and simplify the proposed model. In the experiments, the link prediction task is used to evaluate the performance of embedding models. The experiments on four benchmark datasets show the overall performance of RotatSAGE is higher than baseline models.

Denoise Network Structure for User Alignment across Networks via Graph Structure Learning

Li Liu, Chongyang Wang, Youmin Zhang, Ye Wang, Qun Liu , Guoyin Wang

Abstract. User alignment aims to identify accounts of one natural person across networks. Nevertheless, different social purposes in multiple networks and randomness of following friends form the diverse local structures of the same person, leading to a high degree of nonisomorphism across networks. The edges resulting in non-isomorphism are harmful to learn consistent representations of one natural person across networks, i.e., the structural "noisy data" for user alignment. Furthermore, these edges increase the time complexity, compromising the model's efficiency. To this end, we propose a network structure denoising framework to learn an alignment driven structure heuristically. Specifically, under the guidance of alignment driven loss, parameter sharing encoder and graph neural network for structure denoising are learned using an iterative learning schema. Experiments on real-world datasets demonstrate the outperformance of the proposed framework in terms of efficiency and transferability.

Novel Sentiment Analysis from Twitter for Stock Change Prediction

Yang Cui, Yucen Jiang , Haisong Gu

Abstract. Literature in behavioral economics and socioeconomics tells us that the public's sentiment expression affects individual decisionmaking and hence the market collective decision-making. In this paper, we investigate whether public sentiment drives stock market performance. To be specific, we look at whether there is an association between changes in the Dow Jones Industrial Average (DJIA) and sentiment expression by using a large-scale comprehensive dataset of emotional state swings obtained from Twitter. We analyze relevant textual content on daily Twitter feeds using two sentiment quantification tools: FinBert, which is a categorical indicator that captures positive, neutral, and negative sentiment, and XLNet, which quantifies public sentiment from three types of moods (Positive, Neutral and Negative). Based on the time series dataset of the sentiment indicators, the relationship between public sentiment and DJIA index value is studied through Granger causal analysis and self-organizing fuzzy neural network. In addition, the changes in DJIA closing prices are predicted. Our results show that the accuracy of DJIA predictions can be significantly improved by including information on public sentiment. We have achieved state-of-the-art accuracy when predicting the daily up and down movement of the Dow Jones Industrial Average closing prices.

Multi-objective Optimization Technique for RSU Deployment

Zecheng Kang, Dongyang Li, Weian Guo, Zhenyao Hua, Guangcao Liu , Yanfen Mao

Abstract. Due to its short latency, low transmission cost, and benefit in data security, the vehicle to roadside-units (V2R) technology is growing in importance in the VANET. Roadside unit (RSU) complicated location, however, has an impact on the RSU network in terms of time delay, transmission efficiency, etc., making it challenging to use large-scale RSU networks. In view of this, a cooperative transmission framework is devised for data transmission in VANET. The number of RSU and the time delay are used as the metrics for measuring the economy and network transmission performance, respectively, in order to create the RSU deployment optimization model in this article, which addresses the issue. A multi-objective evolutionary algorithm is then used to carry out the RSU deployment's optimization. The results of experiments are based on taxi data from ShenZhen. The findings show that the suggested technique can reduce the number of RSU while enhancing the RSU network's transmission capabilities.

Study on the Prediction of Rice Noodle Raw Material Index Content by Deep Feature Fusion

Zhiyu Tian, Kang Zhou, Wangyang Shen, Qing Zhao , Guangbin Li

Abstract: Rice noodle is a special snack in southern China. With the development of the grain industry and the improvement of living standards, choosing the right raw materials to produce highquality rice noodles has become one of the problems to be solved at present. Therefore, on the premise of satisfying various characteristics of rice noodles, this paper proposed a deep feature fusion method, which combines with machine learning algorithm to achieve the backward prediction of raw material index content of rice noodles. Deep feature fusion can improve the prediction accuracy by multi-layer weighted feature fusion of rice noodles product index. It realizes feature selection and information extraction of multiple dimensions from the original data and makes the information of the original data play more fully. Experimental results show that the highest R! of the single index of the prediction result can reach 0.987, and the RMSE of single index only 0.0302. The errors between the predicted value and the actual value of the index of water content, starch content, protein content, swelling force and gelatinization temperature are small, which shows the method has a good prediction effect. It can provide a good reference for the selection of raw materials for the production of high-quality rice noodle.

Multi-Cause Learning for Diagnosis Prediction

Liping Wang, Qiang Liu, Huanhuan Ma, Shu Wu , Liang Wang

Abstract. Recently, Electronic Health Records (EHR) have become valuable for enhancing diagnosis prediction. Despite the effectiveness of existing deep learning based methods, one unified embedding fails to capture multiple disease causes of a patient. Even though naive adoption of multi-head attention could produce multiple cause vectors, a strong correlation between these cause representations might mislead the model to learning statistical spurious dependencies between cause vectors and diagnosis predictions. Hence, in this work, we propose a novel Multi-Cause Learning framework for Diagnosis Prediction, named MulDiag. Our Multi-Cause Network extracts multiple cause representations for a patient. We introduce HSIC (Hilbert-Schmidt Independence Criterion) to measure the dependencies among each pair of cause representations. Further, sample re-weighting techniques are utilized to conduct cause decorrelation. Experimental results on a publicly available dataset demonstrate the effectiveness of our method.

Index (a=abstract)

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ICSI 2023

The Fourteenth International Conference on Swarm Intelligence

July 14-18, 2023 Shenzhen, China

Overview:

The Fourteenth International Conference on Swarm Intelligence (ICSI'2023) serves as the most important forum for researchers and practitioners to exchange latest advantages in theories, technologies, and applications of swarm intelligence and related areas. ICSI provides the best communication opportunities for SI researchers and practitioners annually.

Papers presented at the ICSI'2023 will be published by Springer-Nature in Lecture Notes in Computer Science (indexed by EI Compendex, ISTP, DBLP, SCOPUS, Web of Science ISI Thomson, etc.). The downloads of our meeting's proceedings reach the top 10% of all publications of Springer-Nature.

ICSI'2023 is the fourteenth annual event in this high-reputation ICSI series following the continuous previous events, which is hosted by the International Association of Swarm and Evolutionary Intelligence and co-organized by Harbin Institute of Technology (Shenzhen), Peking University and Southern University of Science and Technology.
The conference will be held in Shenzhen, China during July 14-18, 2023! Shenzhen is an important high-tech R&D and manufacturing base in southern China, and is often referred to as the "Silicon Valley of China".

All scholars and experts are welcome to gather in the modern city of Shenzhen in July next year to join in the grand event, showcase academic achievements, share academic morals, exchange academic frontiers, and jointly promote the prosperity and development of the field of swarm intelligence!

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