

# PROGRAMME



太原科技大學



**The 16<sup>th</sup> International Conference on Bio-inspired  
Computing: Theories and Applications  
(BIC-TA 2021)**

**December 17-19, 2021, Taiyuan, China**

**School of Computer Science and Technology  
Taiyuan University of Science and Technology**

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## Welcoming Notes from the General Chairs

It is our great pleasure and honor to welcome you to the 16<sup>th</sup> International Conference on Bio-inspired Computing: Theories and Applications (BIC-TA 2021). The conference is to be held on December 17-19, 2021 at Taiyuan, sponsored by six International Journals and six Chinese Universities.

As aimed from its beginning, the conference provides an international forum from professionals, academics, and researchers to present latest developments and to exchange experiences from interdisciplinary theoretical studies, DNA computing, computational algorithms development and applications. Reflecting these technological trends and methodology progression, this conference includes presentations of excellent and interesting papers in all engineering and science branches.

BIC-TA2021 received more than 200 submissions from 14 countries and regions, and among them, 82 papers were accepted. Each accepted paper was peer reviewed by at least three or more program committee members. We would like to thank the BIC-TA2021 international program committees and the additional reviewers for providing the reviews in time. Our special thanks also go to all the plenary speakers for providing the very interesting and informed talks to catalyze subsequent discussions.

We would like to express our sincere gratitude to all the authors. We look forward to seeing you in Taiyuan, China during December 17-19,2021.

Sincerely yours,

Jianghui Cai, Zhihua Cui and Linqiang Pan

General Chairs

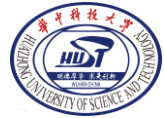
December 1, 2021



# Sponsors



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Huazhong University of Science and Technology



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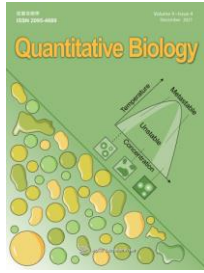
Xinzhou Teachers University



Communications in Computer and Information Science



Journal of Membrane Computing



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Foundations



Frontiers in Bioengineering and Biotechnology



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# **BIC-TA 2021 Organization**

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Ronghua Shang, Xidian University, Xi'an, China



## Schedule

<b>December 17, 2021 (Friday)</b>	
14:00-21:00	Registration
18:00-21:00	Dinner
腾讯会议：235-765-756	
9:00-10:00	Tutorial 1 (online)
10:00-10:15	Break
10:15-11:15	Tutorial 2 (online)
11:15-15:00	Lunch
15:00-16:00	Tutorial 3 (online)
16:00-16:15	Break
16:15-17:15	Tutorial 4 (online)
<b>December 18, 2021 (Saturday)</b> (腾讯会议：203-551-539)	
8:30-9:00	Opening Ceremony
9:00-10:00	Keynote Speech 1
10:00-11:00	Keynote Speech 2
11:00-11:10	Tea Break
11:10-12:10	Keynote Speech 3
12:10-14:00	Lunch

14:00-15:00	Keynote Speech 4
15:00-16:00	Keynote Speech 5
16:00-16:10	Tea Break
16:10-17:10	Keynote Speech 6
17:10-18:10	Keynote Speech 7
18:10	Dinner
<b>December 19, 2021 (Sunday)</b>	
9:00-11:30	Session 1 (online) (腾讯会议: 461-773-461)
	Session 2 (online) (腾讯会议: 463-943-092)
	Session 3 (online) (腾讯会议: 876-440-594)
	Session 4 (online) (腾讯会议: 479-798-843)
	Session 5 (online) (腾讯会议: 423-820-433)
	Session 6 (online) (腾讯会议: 513-156-190)
	Session 7 (online) (腾讯会议: 804-521-962)

## Keynote Speakers 1



**Chengde Mao**  
**Professor**  
**Purdue University**

**Title:** The Simple Side of Programmed DNA Self-Assembly

**Abstract:**

**Biography:** Chengde Mao received his Bachelor's Degree from the Peking University and the doctor degree from the New York University. From 1999 to 2000 and 2001 to 2002, he was a Postdoctoral Fellow at the New York University and Harvard University. From 2002 to 2012, he was an Assistant Professor at the Purdue University and currently is a Professor in the Department of Chemistry. His main research interests are programmed self-assembly of nucleic acids (DNA and RNA) and DNA nanotechnology. Current research topics in his group include DNA/RNA self-assembly, Structural determination of biomacromolecules, DNA-directed guest self-assembly, DNA-based molecular lithography, DNA nanomachines, DNA-based nanomedicines, and Interrogation of basic biological processes/interactions related to spatial-temporal controls.

## Keynote Speakers 2



**Ling Wang**  
**Professor**  
**Tsinghua University**

**Title:** Research Development of Intelligent Optimization and Scheduling

**Abstract:** Introduce the background and significance of the research about optimization and scheduling, and explain the classification and challenge of the research about optimization, and point out the key points and development directions about optimization and scheduling based on several application fields and scenarios.

**Biography:** Ling Wang received the B.Sc. and Ph.D. degrees from Tsinghua University, Beijing, China, in 1995 and 1999, respectively, and now is a tenured Full Professor in Tsinghua Univ. His research interests mainly include intelligent optimization, scheduling and applications. He has authored 5 academic books and more than 230 SCI-indexed papers. His publications have attracted over 20K Google Scholar Citations. He is the Editor-in-Chief of International J of Automation and Control, Complex System Modeling and Simulation, the Associate Editor of IEEE Trans on Evolutionary Computation, Expert Systems with Applications, Swarm and Evolutionary Computation, Sensors, and the Editorial Board Member of Memetic Computing, Sensors, Control Theory & Applications, Control and Decision, Control Engineering, System Engineering and Electronics, etc.

## Keynote Speakers 3



**Wenjian Wang**  
**Professor**  
**Shanxi University**

**Title:** Adaptive output noise filtering framework

**Abstract:** The increasing abundance of data resources makes its value fully accepted by the society. Machine learning, as the core supporting technology for big data applications, has always received widespread attention, and some classic machine learning algorithms have been successfully applied in many fields. But the noise in the data is very complex, and the low-quality features of data such as unreliable labeling, uncertainty, and particularity may further aggravate the complexity of the noise, which will be difficult for machine learning algorithms to obtain highly credible rules from the data. This topic will introduce a unified framework of optimal sample selection for the output noise from the perspective of error bound, and two necessary and sufficient conditions for a fixed goodness of fit in regression are deduced. Some experimental results on benchmark regression and ordinal classification data sets are also reported.

**Biography:** Wenjian Wang is a full professor and doctoral supervisor of Shanxi University. She is currently the Dean of the School of Computer and Information Technology, Shanxi University, and the deputy director of the Key Laboratory of Computational Intelligence and Chinese Information Processing of the Ministry of Education. In recent years, she has mainly engaged in researches on artificial intelligence, machine learning and data mining et al. She has published more than 200 academic papers in the Journal of JMLR、TKDE、TSC、NN et al.

## Keynote Speakers 4



**Wensheng Zhang**  
**Professor**  
**Chinese Academy of Sciences**

**Title:** Scalable learning and inference in Markov logic networks

**Abstract:** Markov logic networks (MLNs) have emerged as a powerful representation that incorporates first-order logic and probabilistic graphical models. They have shown very good results in many problem domains. However, current implementations of MLNs do not scale well due to the large search space and the intractable clause groundings, which is preventing their widespread adoption. In this paper, we propose a general framework named Ground Network Sampling (GNS) for scaling up MLN learning and inference. GNS gradually builds up a representative subset of simple paths, which are then robustly translated into ground definite clauses. When inference is concerned, a template network is introduced to quickly locate promising paths that can ground given logical statements. The resulting sampled paths are then transformed into ground clauses, which can be used for clause creation and probabilistic inference. The experiments on several real-world datasets demonstrate that our approach offers better scalability while maintaining comparable or better predictive performance compared to state-of-the-art MLN techniques.

**Biography:** Wensheng Zhang is currently a Professor and Vice Chief Engineer at Institute of Automation Chinese Academy of Sciences (CASIA). He is also a Chief Professor in Artificial Intelligence at the University of Chinese Academy of Sciences. His research focuses on artificial intelligence, statistical machine learning, intelligence analysis for big data and video/image understanding. He is a member of the General Expert Group of National Key R&D Program of China on “Cloud Computing and Big Data”, and also a member of the General Expert Group of National Key R&D Program of China on “Internet of Things and Smart City”. He is now an Expert of the National Natural Science Foundation of China (NSFC), and the Review Expert of National Science and Technology Awards. He

is also the Vice Director of the Internet of Things Work Committee in China Instrument and Control Society (CIS), Vice Chairman of the Special Committee on Intelligent Service in the Chinese Association for Artificial Intelligence (CAAI) and Vice Chairman of the Special Committee on Intelligent Control in Chinese Association of Automation (CAA).

## Keynote Speakers 5



**Qiang Yan**  
**Professor**

**Taiyuan University of Technology**

**Title:** Multi-task Interactive Attention Learning Model based on Hand Images for Assisting Chinese Medicine in Predicting Myocardial Infarction

**Abstract:** Acute myocardial infarction (AMI) is one of the most serious and dangerous cardiovascular diseases. In recent years, the number of patients around the world has been increasing significantly, among which people under the age of 45 have become the high-risk group for sudden death of AMI. AMI occurs quickly and does not show obvious symptoms before onset. In addition, post-onset clinical testing is also a complex and invasive test, which may cause some postoperative complications. Therefore, it is necessary to propose a non-invasive and convenient auxiliary diagnostic method. In traditional Chinese medicine (TCM), it is an effective auxiliary diagnostic strategy to complete the disease diagnosis through some body surface features. It is helpful to observe whether the palmar thenar is hypertrophy and whether the metacarpophalangeal joint is swelling in detecting acute myocardial infarction. Combined with deep learning, we propose a depth model based on traditional palm image (MTIALM), which can help doctors of traditional Chinese medicine to predict myocardial infarction. By building the shared network, the model learns information that covers all the tasks. In addition, task-specific attention branch networks are built to simultaneously detect the symptoms of different parts of the palm. The information interaction module (IIM) is proposed to further integrate the information between task branches to ensure that the model learns as many features as possible. Experimental results show that the accuracy of our model in the detection of metacarpophalangeal joints and palmar thenar is 83.16% and 84.15%, respectively, which are significantly improved compared with the traditional classification methods. This article has been published in *Computational and Mathematical Methods in Medicine* (IF = 2.238).



**Biography:** Qiang Yan received his Doctor degree from Taiyuan University of Technology in 2013. Currently, he is the vice dean of the School of Information and Computer Science, Taiyuan University of Technology. His current research interest includes big data processing, cloud computing, medical image processing. He is now an Expert of the engineering education certification and evaluation expert of the Ministry of Education. He has authored 10 academic textbooks and 19 national invention patents.

## Keynote Speakers 6



**Mingyong Han**  
**Professor**  
**Tianjin University**

**Title:** Biologically Active Materials and Applications

**Abstract:**

**Biography:** Ming-Yong worked with IBM and Indiana University followed by National University of Singapore as a faculty member before his current appointments with Tianjin University and Institute of Materials Research and Engineering. His research addresses problems at the interfaces of nanoscience, nanotechnology, biotechnology and energy/biomedical applications. He has published >220 papers and filed >100 patents including national entries with >24,000 citations and >300 research highlights. He is the Fellow of the Royal Society of Chemistry (FRSC) and the Web of Science Highly Cited researcher.

## Keynote Speakers 7



**Rui Wang**  
**Professor**

**National University of Defense Technology**

**Title:** The Not So Short Introduction to Evolutionary Multi-objective Optimization

**Abstract:** Population-based heuristics, e.g., evolutionary algorithms, usually require few mathematics, and are robust to the problems' underlying features, thus, being easy to use in practice. In May 2015, the special issue of machine intelligence published by nature listed evolutionary computing as one of the representative fields of machine intelligence research. Multi-objective optimization is commonly seen in real-world. After years of efforts, solving multi-objective optimization problems by evolutionary algorithms has become the mainstream methods. This presentation therefore will introduce both the state-of-the-art achievements and recent developments in evolutionary multi-objective optimization.

**Biography:** Rui Wang received his Bachelor's degree from the National University of Defense Technology, P.R. China in 2008, and the Doctor degree from the University of Sheffield, U.K in 2013. Currently, he is with the College of Systems Engineering, National University of Defense Technology and is the vice director of the Hunan Key Laboratory of Multi-Energy System Intelligent Interconnection Technology. His current research interest includes evolutionary computation, multi-objective optimization and the development of algorithms applicable in practice. Dr. Wang received the Operational Research Society Ph.D. Prize at 2016, and the National Science Fund for Outstanding Young Scholars at 2021. He is also an Associate Editor (or Guest Editor) for the Swarm and Evolutionary Computation, Information Sciences, IEEE Trans on Emerging Topics in Computational Intelligence, the IJAAC, IJBIC, CSMS.

# Tutorial 1



**Cheng He**

**Southern University of Science and Technology**

**Title:** Evolutionary Large-scale multiobjective optimization

**Abstract:** Large-scale multiobjective optimization problems (LSMOPs) are widely existed in real-world applications, which has proposed great challenge for existing evolutionary algorithms (EAs). In this tutorial, we first introduce a benchmark LSMOP test suite exacted from the power delivery system. Then we survey some representative EAs for large-scale multiobjective optimization. Afterwards, some of recent our work on handling LSMOPs from four aspects, i.e., problem reformulation, efficient offspring generation, constraint handling, and dealing with expensive objective functions, are explicated. Eventually, some open questions are mentioned.

**Biography:** Cheng He is currently a Research Assistant Professor with the Department of Computer Science and Engineering, Southern University of Science and Technology, Shenzhen, China. Dr. He has published over 30 high-quality papers on different journals, including IEEE TEVC, IEEE TCYB, IEEE TSMCS, IEEE TNNLS, etc. He is the leading Guest Editor for “Special Issue: Emerging Topics in Evolutionary Multiobjective Optimization” of the Complex and Intelligent Systems. His research interests include model-based evolutionary algorithms, multiobjective optimization, large-scale optimization, deep learning, and their applications.

## Tutorial 2



**Tingfang Wu**  
**Soochow University**

**Title:** An Introduction of Spiking Neural P Systems

**Abstract:** Spiking neural (SN) P systems are a class of spiking neural networks within the framework of membrane computing, inspired from the way biological neurons cooperate by means of sending to each other electrical impulses (spikes) of identical shape (with the frequency, the distance between consecutive spikes, encoding the information). The SN P system was introduced in 2006, and this model has already been investigated in a large number of papers, from many points of view, from theory to applications. The tutorial briefly presents the biological background of the SN P system and the relationship between SN P systems and artificial neural networks, and spends more time on reviewing basic (types of) results of the model and ideas of modifying the initial definition in order to get new classes of SN P systems.

**Biography:** Tingfang Wu received the Ph.D. degree in control science and engineering from Huazhong University of Science and Technology, Wuhan, China, in 2018. He is currently an Associate Professor with the College of Computer Science and Technology, Soochow University, Suzhou, China. He is an awardee of the Program of Entrepreneurship and Innovation Doctors in Jiangsu Province and the Excellent Young Scholar of Soochow University. He has published over 30 scientific papers in international journals or conferences, and his current research interests include membrane computing and computational complexity theory.

## Tutorial 3



**Weigang Chen**  
**Tianjin University**

**Title:** Coding for DNA data storage

**Abstract:** In this tutorial, we will survey the main challenges in coding for DNA storage. Then, on the one hand, we present the novel insertion/deletion correction codes special for DNA storage channels. On the other hand, we will demonstrate how the traditional error-correction codes and DNA codes can be employed in the new DNA storage paradigm.

**Biography:** Weigang Chen is a Distinguished Associate Professor, supervisor of Ph.D candidates in School of Microelectronics, Tianjin University. He received the B.E. degree from Shandong University in 2003 and Ph.D. degree from Tsinghua University in 2008, respectively. From September 2008 to September 2009, he was a postdoc research fellow with ETIS (CNRS UMR 8051), Cergy, France. From October 2014 to September 2015, he was a visiting research fellow with UCLA, California, USA. In 2012, he was awarded by the Program for New Century Excellent Talents in University (NCET-12-0401) from Ministry of Education in China. His current research interest includes information theory and coding, DNA data storage, wireless communications, and maritime communication networks. etc.

## Tutorial 4



**Gexiang Zhang**

**Chengdu University of Information Technology**

**Title:** Twenty years of Membrane Computing: a bibliometric overview

**Abstract:** The mention as a topic in the Mathematics Subjects Classification 2020 by Mathematical Reviews and zbMATH is a sign of maturity of membrane computing. This talk presents the state of the art of membrane computing research through bibliometric analysis across twenty years. On the basis of more than twenty widely used databases, the analysis is made by considering landmarking successes, milestone events, international flagship conferences/workshops, special issues of international journals, doctoral theses, funds, author distribution, authorship, co-authorship, countries, citation and co-citation. Underlying the analysis, the ground-breaking research topics, the most influential authors/countries and the most vigorous research lines are revealed.

**Biography:** Gexiang Zhang received his Ph.D. degree in 2005 from Southwest Jiaotong University, Chengdu, China. Now he is a full professor at School of Control Engineering, Chengdu University of Information Technology, Chengdu, China. He was a (senior) visiting professor at The University of Sheffield, UK, Universidad de Sevilla, Spain, and New York University, USA. He is the President of International Membrane Computing Society (IMCS), a Fellow of the IET, Senior Member of the IEEE. Managing Editor of Journal of Membrane Computing and editorial board member of IJPEDS. He is the co-winner of Grigore Moisil Prize of the Romanian Academy in 2019. He is listed in World's Top 2% Scientists in 2020 and in Highly Cited Chinese Researchers by Elsevier in 2021. Research areas include membrane computing, evolutionary computation and neural network. He is the author/co-author of more than 200 publications, three monographs, and (lead) guest editor/co-editor of more than 10 volumes/proceedings.

# Session List

## Session 1: Swarm Intelligence

**Session Char: Prof. Weian Guo**  
**Tongji University**

**Application a hybrid swarming algorithm to solve wireless sensor charging circuit planning**

*Zhang Yi and Yu Hongda*

**Optimal coverage method for heterogeneous AUV groups**

*Yongle Chang, Chang Xiong and Xinglong Ma*

**A Heterogeneous AUV Group Algorithm Based on Time Delay Theory**

*Ling Li, Chang Xiong and Ke Tian*

**Event trigger control method in heterogeneous AUV group**

*Mingzhi Gu, Xin Zhen and Xinbo Bao*

**Research on Collision Avoidance Algorithm for Unmanned Ship Based on Improved Particle Swarm Algorithm**

*Biao Zhang, Qicong Deng and Liseng Feng*

**A AUV algorithm design combining ant colony algorithm and artificial potential field**

*Zhenrui Wang, Zijun Gao, Lixun Lu and Xie Ma*

**A multi-UUV formation control and reorganization method based on path tracking controller and improved ant colony algorithm**

*Bin Yang, Shuo Zhang, Guangyu Luo and Dongming Zhao*

**Research on Collision Avoidance Algorithm for Unmanned Ship Based on Improved Particle Swarm Algorithm**

*Xinzhao Gao, Xin Zhen and Zhan Yan*

**Collision avoidance algorithm design for unmanned surface vehicle based on artificial potential field and ant colony algorithm**

*Zijun Gao, Shuai Xiong and Jiulong Wei*

**Solving Satellite Range Scheduling Problem with Learning-based Artificial Bee Colony Algorithm**

*Yanjie Song, Luona Wei, Lining Xing, Yi Fang, Zhongshan Zhang and Yingwu Chen*

**A Cuckoo Quantum Evolutionary Algorithm for the Graph Coloring Problem**

*Yongjian Xu and Yu Chen*

**Firefly Algorithm with Opposition-Based Learning**

*Yanping Qiao, Feng Li, Cong Zhang, Xiaofeng Li, Zhigang Zhou, Tao Zhang and Quanhua Zhu*



## Session 2: DNA Computing

**Session Char: Prof. Fei Xu**

**Huazhong University of Science and Technology**

**Construction of complex logic circuit based on DNA logic gate AND and OR**

*Mengyang Hu, Luhui Wang, Sunfan Xi, Rong Liu and Yafei Dong*

**Tetracycline intelligent target-inducing logic gate based on triple-stranded DNA nanoswitch**

*Sunfan Xi, Yue Wang, Luhui Wang, Mengyang Hu, Meng Cheng and Yafei Dong*

**Application of Chain P Systems with Promoters in Power Coordinated Control of Multi-microgrid**

*Wenping Yu, Fuwen Chen, Jieping Wu and Xiangquan Xiao*

**Sequential Spiking Neural P Systems with Polarizations Based on Minimum Spike Number Working in the Accepting Mode**

*Li Liu and Keqin Jiang*

**Graphene oxide-triplex structure based DNA nanoswitches as a programmable tetracycline -responsive Fluorescent biosensor**

*Luhui Wang, Yue Wang, Mengyang Hu, Sunfan Xi, Meng Cheng and Yafei Dong*

**Construction of four-variable chaotic system based on DNA strand displacement**

*Haoping Ji, Yanfeng Wang and Junwei Sun*

**Synchronization of chaos with a single driving variable based on DNA strand displacement**

*Zijie Meng, Xiaoyu An and Junwei Sun*

**Homogenous SNP systems with rule synchronization in the asynchronous mode**

*Luping Zhang and Fei Xu*

**StigLD: Stigmergic Coordination of Linked Data Agents**

*René Schubotz, Torsten Spieldenner and Melvin Chelli*

**A Chinese Dataset Building Method Based on Data Hierarchy and Balance Analysis in Knowledge Graph Completion**

*Yunwei Shi, Kuangrong Hao, Xuesong Tang, Tong Wang*

**Solution to Satisfiability Problem Based on Molecular Beacon Microfluidic Chip Computing Model**

*Jing Yang, Zhixiang Yin, Zhen Tang, Jianzhong Cui and Congcong Liu*

### Session 3: Evolutionary Computing

**Session Char: Prof.Hui Wang**  
**Nanchang Institute of Technology**

**Software defect prediction based on SMOTE-Tomek and XGBoost**

*Haotian Yang and Min Li*

**Attribute selection method based on artificial bee colony algorithm and neighborhood discrimination matrix optimization**

*Yuxuan Ji, Jun Ye, Zhenyu Yang, Jiaxin Ao and Lei Wang*

**Feature selection method based on discernibility matrix and fruit fly optimization algorithm**

*Jiaxin Ao, Jun Ye, Yuxuan Ji and Zhenyu Yang*

**A differential evolution algorithm for multi-objective mixed-variable optimization problems**

*Yupeng Han, Hu Peng, Aiwen Jiang, Cong Wang, Fanrong Kong and Mengmeng Li*

**Adaptive Multi-strategy Learning Particle Swarm Optimization with Evolutionary State Estimation**

*Jinhao Yu and Junhui Yang*

**Feature selection method based on ant colony optimization algorithm and improved neighborhood discernibility matrix**

*Zhenyu Yang, Jun Ye, Jiaxin Ao and Yuxuan Ji*

**Surrogate-Assisted Artificial Bee Colony Algorithm**

*Tao Zeng, Hui Wang, Wenjun Wang, Tingyu Ye and Luqi Zhang*

**An improved bare-bones multi-objective artificial bee colony algorithm**

*Tingyu Ye, Hui Wang, Wenjun Wang, Tao Zeng and Luqi Zhang*

**Fitness landscape analysis: from problem understanding to design of evolutionary algorithms**

*Xinyu Zhou, Junyan Song, Shuixiu Wu, Wenlong Ni and Mingwen Wang*

**Optimal Overbooking Appointment Scheduling in Hospitals Using Evolutionary Markov Decision Process**

*Wenlong Ni, Jue Wang, Ziyang Liu, Huaixiang Song, Xinyu Zhou and Mingwen Wan*

**Black widow spider algorithm based on differential evolution and random disturbance**

*Shida Wang and Xuncaizhang*

**Water Wave Optimization with Distributed-learning Refraction**

*Minhui Liao, Xin Chen and Yujun Zheng*

**Exploring the relationship between optimization goals for federated learning: an**

**evolutionary algorithmic approach**

*Detian Liu, Yang Cao, Liangliang Chang, Qizheng Yin and Fei Xue*

**Application of an improved Physarum polycephalum algorithm in path planning**

*Zhang Yi and Sun Xia*

## Session 4: Intelligence Systems

**Session Chair: Prof. Yinan Guo**

**China University of Mining and Technology**

**An approach for optimal coverage of heterogeneous AUV swarm based on consistency theory**

*Lu Yongzhou, Luo Guangyu, Guo Xuan and Chen Yuepeng*

**Dynamic Path Planning Algorithm for Unmanned Ship**

*Youzhi Zhang, Wei Gao and Wei Wang*

**Point clouds registration algorithm based on spatial structure similarity of visual keypoints**

*Yingshuo Gao, Jie Ma, Bingli Wu, Tianxiang Zhang and Yu Yang*

**Adaptive Differential Privacy Budget Allocation Algorithm Based on Random Forest**

*Chong-Yang Wang, Si-Yang Chen and Xin-Cheng Li*

**Location Analysis of Urban Electric Vehicle Charging Metro-Stations Based on Clustering and Queuing Theory Model**

*Chongyu Chen, Teng Li, Shugui Wang, Zhenyao Hua, Zecheng Kang, Dongyang Li and Weian Guo*

**Research on Control Algorithm of Unmanned Vessel Formation Based on Multi-agent★**

*Wei Zhao, Xiaoqiang Wang, Hao Zhou, Rui Wu and Chang Liu*

**A consensus control algorithm for heterogeneous AUV swarm under communication delay**

*Xuan Guo, Yuepeng Chen, Guangyu Luo, Liu Guangwu*

**An improved event-triggered control method based on consistency algorithm in heterogeneous AUV swarm under communication time delay**

*Ke Chen, Guangyu Luo, Hao Zhou and Dongming Zhao*

**Recognition of Pulse Wave of Pregnant Woman Based on the CNN and GRU**

*Nan Li, Jiarui Yu, Xiaobo Mao, Yuping Zhao and Luqi Huang*

**Autonomous Underwater Vehicle Formation Navigation and Formation Control**

*Qicing Deng, Zijian Dong, Wei He and Yu He*

**Research on Control Algorithm of Unmanned Vessel Formation Based on Multi-agent**

*Huajie Zhang, Wei Gao and Shengwei Li*

**Multi-workflow Scheduling Based on Implicit Information Transmission in Cloud Computing Environment**

*Xingjuan Cai, Liangqian Ji, Tingting Dong and Yang Lan*

**A method for Formation control of unmanned underwater Vehicle formation navigation based on consistency**

*Rui Wu, Xuan Guo, Hao Zhou, Dongming Zhao and Yunsheng Mao*

**An Optimization Task Scheduling Model for Multi-robot Systems in Intelligent Warehouses**

*Xuechun Jing and Zhihua Cui*

## Session 5: Machine Learning

**Session Chair: Prof. Fei Xue**  
**Beijing Wuzi University**

### **Fault-Tolerant Scheme of Cloud Task Allocation Based on Deep Reinforcement Learning**

*Hengliang Tang, Zifang Tang, Tingting Dong, Qiuru Hai, Fei Xue*

### **Enhancing Aspect-based Sentiment Classification with Local Semantic Information**

*Hengliang Tang, Qizheng Yin, Liangliang Chang, Huilin Qin, Fei Xue*

### **Edge Computing Energy-Efficient Resource Scheduling based on Deep Reinforcement Learning and Imitation Learning**

*Hengliang Tang, Rongxin Jiao, Tingting Dong, Huilin Qin, Fei Xue*

### **An effective data balancing strategy based on swarm intelligence algorithm for malicious code detection and classification**

*Dongzhi Cao, Zhenhu Ning, Shiqiang Zhang, Jianli Liu*

### **Federated Neural Architecture Search Evolution And Open Problems: An Overview**

*Detian Liu, Yang Cao*

### **Imbalance Classification Based on Deep Learning and Fuzzy Support Vector Machine**

*Kefan Wang, Jing An, Xianghua Ma, Chao Ma and Hanqiu Bao*

### **Prognostic Staging System for Esophageal Cancer Using Lasso, Cox and CS-SVM**

*Qing Liu, Wenhao Zhang, Junwei Sun and Yanfeng Wang*

### **Dynamic Path Planning Algorithm for Unmanned Ship Based on Deep Reinforcement Learning**

*Weijie Zhao, Qicong Deng and Peng Zhou*

### **Automatic Particle Swarm Optimizer Based on Reinforcement Learning**

*Rui Dai, Hui Zheng, Jing Jie and Xiaoli Wu*

### **Use Deep Metric Learning and Its Distillation to Avoid Catastrophic Forgetting of Class Incremental Learning**

*Piaoyao Yu, Juanjuan He, Qilang Min and Qi Zhu*

### **Dynamic Path Planning Algorithm for Unmanned Ship Based on Deep Reinforcement Learning**

*Yue You, Ke Chen, Xuan Guo, Hao Zhou, Guangyu Luo and Rui Wu*

### **Realized volatility prediction based on integrated LSTM model**

*Xiang Wang, Keqing Zhao and Shen Gao*

## **Session 6: Multi-objective Optimization**

**Session Chair: Prof. Chaoli Sun**

**Taiyuan University of Science and Technology**

**A Multi-objective Optimization Algorithm for Wireless Sensor Network Energy Balance Problem in Internet of Things**

*Jiangjiang Zhang, Zhenhu Ning, Kun Zhang and Naixin Kang*

**Improved AODV routing protocol based on multi-objective simulated annealing algorithm**

*Huijia Wu and Wenhong Wei*

**Implementation and application of NSGA-III improved algorithm in multi-objective environment**

*Fei Xue, Yuelu Gong, Qiuru Hai, Huilin Qin and Tingting Dong*

**Adaptive Constraint Multi-Objective Differential Evolution Algorithm Based on SARSA**

*Qingqing Liu, Caixia Cui and Qinqin Fan*

**A Hybrid Multi-Objective Coevolutionary Approach for the Multi-User Agile Earth Observation Satellite Scheduling Problem**

*Luona Wei, Yanjie Song, Lining Xing, Ming Chen and Yingwu Chen*

**A Competitive Swarm Optimization Algorithm with External Archive Set for Large-Scale Multiobjective Optimization**

*Sheng Qi, Juan Zou and Jinhua Zheng*

**A dynamic multi-objective hybrid chemical reaction optimization algorithm base on multi-direction prediction model**

*Li Hongye, Xiaoying Pan, Wei Gan and Lei Wang*

**Global path planning of unmanned surface vessel based on multi-objective hybrid particle swarm algorithm**

*Aiqing Ao, Zijian Dong, Qingkun Zeng and Chengguang Zhang*

## **Session 7: Video, Image & Applications**

**Session Chair: Prof. Shi Cheng**  
**Shaanxi Normal University**

**Community Detection based on Surrogate Network**

*Chao Lyu, Lijun Sun and Yuhui Shi*

**Attention-Guided Memory Model For Video Object Segmentation**

*Yunjian Lin and Yihua Tan*

**A Node Influence Based Memetic Algorithm for Community Detection in Complex Networks**

*Zhuo Liu, Yifei Sun, Shi Cheng, Xin Sun, Kun Bian and Ruoxia Yao*

**Pose Estimation Based on Snake Model and Inverse Perspective Transform for Elliptical Ring Monocular Vision**

*Cong Qian, Guohua Wang, Jiajian Zhang, Renjie Wang and Pengshuai Li*

**Feature Enhanced and Context Inference Network for Pancreas Segmentation**

*Zhenghao Lou, Jiancong Fan, Yande Ren and Leiyu Tang*

**Object Relations Focused Siamese Network for Remote Sensing Image Change Detection**

*Jiepei Wang, Leiyu Tang, Jiancong Fan and Guoqiang Liu*

**Multi-feature Fusion based Deep Forest for Hyperspectral Image Classification**

*Xiaobo Liu, Mostofa Zaman Mohammad, Chaochao Zhang, Xin Gong and Zhihua Cai*

**Application of bidirectional LSTM neural network in grain stack temperature prediction**

*Yongfu Wu, Hua Yang, Kang Zhou, Yang Wang and Yongqing Zhu*

**MLFF: Multiple Low-level Features Fusion Model for Retinal Vessel Segmentation**

*Tao Deng, Yi Huang and Junfeng Zhang*

**Face detection on thermal infrared images combined with visible images**

*Yujia Chen, Liqing Wang and Guangda Xu*

**Prediction model of Gasoline octane number based on GRNN**

*Bing Cai, Haikuan Yang, Hua Yang and Kang Zhou*



## Route to Shanglan International Hotel



Shanglan international hotel is a luxury and fashionable large complex high-end business hotel which is located in Xikuang Street, No.134 of Taiyuan City. Shanglan international hotel is a brand of happy harbor group. It takes "the best is like water, and the world is peaceful", which means the world is healthy, harmonious and beautiful.

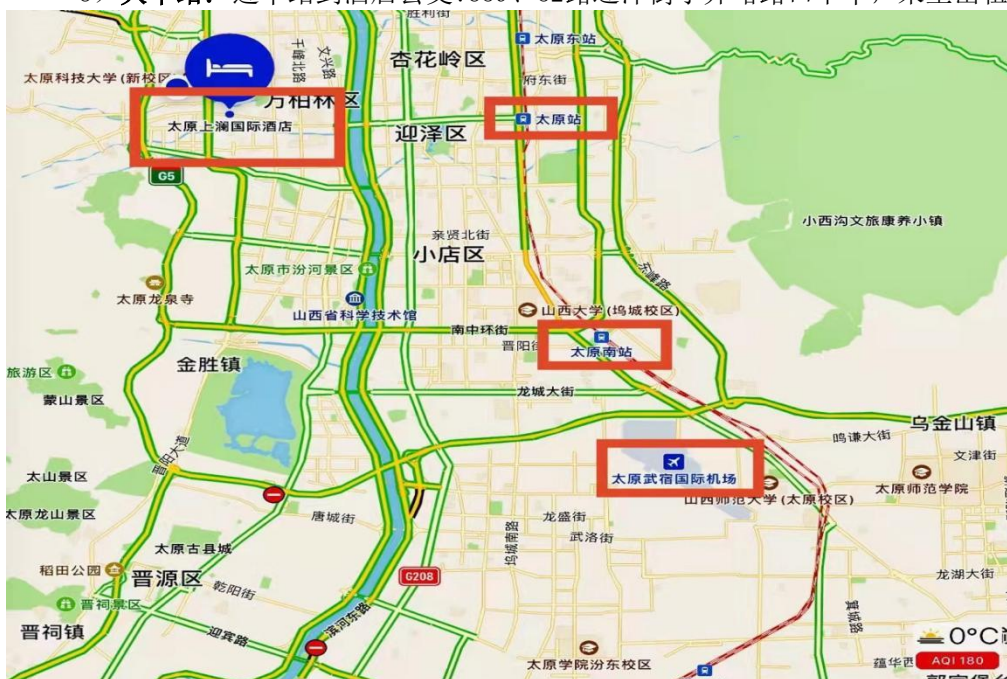


It is close to China Railway 12th Bureau, Taiyuan Heavy Industry, Xishan coal power, Wanbailin District government, Taiyuan University of technology and ad era City Shopping Center. The hotel has convenient transportation and is a good choice for business negotiation, tourism and entertainment. Here you can enjoy the same warm heart edness and care you get from your family – in fact, Shanglan is your home when you are away from home. More details can be found in website: <http://tymice.com/shanglan/167.html>.





**地址:** 山西省太原市上澜国际酒店（山西省太原市万柏林区西矿街134号）

**联系电话:** 0351-7739666

- 乘车路线:**
- 1) **机场:** 机场到酒店公交:机场巴士一号线转52路, 乘坐出租车大约44元
  - 2) **火车南站:** 火车南站到酒店公交:868路迎泽街前进路口下车, 乘坐出租车大约35元
  - 3) **火车站:** 过车站到酒店公交:859、52路迎泽街小井峪路口下车, 乘坐出租车大约18元



# Taiyuan in Brief

 <p>A map of Shanxi Province, China, with Taiyuan (太原) marked as the capital city. Other cities shown include Zhaozhou (赵州), Xinzhou (忻州), Linfen (临汾), and others. The map also shows neighboring provinces like Henan (河南省) and Inner Mongolia (自治区).</p>	<p>Taiyuan is the capital city of Shanxi Province. Located in the center of the province, it is also the political economic and cultural center of Shanxi.</p> <p>Taiyuan is a city bounded on three sides by mountains. It has a long history and in ancient times was an important military town. At present, Taiyuan is one of China's heavy industrial cities and account for more than half the national coal mining output.</p> <p>Taiyuan also has a wealth of tourist attractions and notably among these is the Jinci Temple. The Jin Shrine stands at the foot of Xuanweng Mountain, 25 kilometers southwest of Taiyuan. It was built in memory of Shu Yu, the founding ruler of the State of Jin. The Jin Shrine is famous for its scenic beauty. All buildings in the shrine were laid out ingeniously and surrounded by ancient trees. In the Hall of Holy Mother are 43 statues of young maids sculptured in the Song Dynasty. The statues, the pines planted during the Zhou Dynasty and the Nanlao Spring are known as the three rarities of the Jin Shrine. This is the city's most attractive temple although the Shuangta Si (Twin-Pagoda Temple) has become a symbol of Taiyuan on account of its unique architecture. Another major attraction is the Tianlong Shan Stone Caves where magnificent sculptures dating from the Tang Dynasty (618-907) may be seen.</p>
 <p>A photograph of the Jin Shrine (Jinci Temple) in Taiyuan, showing two prominent pagodas and traditional architecture surrounded by trees.</p>	<p>Taiyuan benefits from convenient public transport systems as the city is the provincial transportation hub. Accommodation facilities have become more and more advanced over recent years and Taiyuan benefits from convenient public transport systems as the city is the provincial transportation hub. Accommodation facilities have become more and more advanced over recent years and range from 5-star hotels to a selection of comfortable guest houses.</p>
 <p>A photograph of the entrance to the Jin Shrine (Jinci Temple), featuring a traditional Chinese gate with a blue sign and red lanterns.</p>	<p>The gourmand should be aware that Shanxi noodles are highly reputed all over China, as well as the local vinegar. Other local delicacies are the Tou Nao, the Steamed Dumpling, Sausages and Mutton Soup. To accompany these wholesome foods there are Fen Jiu (Fen Wine) and Zhuye Qing (Zhuye Qing Wine). As well as its cuisine the city is noted for products such as finely crafted lacquer ware.</p>
 <p>A photograph of the Taiyuan city skyline at night, illuminated with colorful lights and reflected in the water.</p>	<p>While the local emphasis is upon heavy industry certain aspects of city life such as cultural development has suffered from some neglect. This could be a problem and needs action to be taken.</p>

## 太原科技大学计算机科学与技术学院

太原科技大学是新中国第一所重型机械本科院校，是一所办学特色鲜明的多科性大学，也是我国重大技术装备领域重要的人才培养和科技研发基地。学校现有省级“1331工程”优势特色学科1个，服务产业创新学科群2个，省级重点学科3个，省级重点建设学科15个，工程学学科位列ESI全球前1%；拥有一级学科博士学位授权点3个，一级学科硕士学位授权点16个；拥有工商管理、法律、社会工作、电子信息、机械、材料与化工、资源与环境、能源动力、交通运输、工程管理10个硕士专业学位授权点；设有机械工程、材料科学与工程博士后科研流动站。学校现有国家级协同创新中心1个；省部共建国家重点实验室培育基地1个；教育部工程研究中心1个；国家地方联合工程研究中心1个；省级重点实验室6个、省级工程（技术）研究中心13个，省级（科技）创新团队8个；省级高等学校人文社科重点研究基地3个；省级重点马克思主义学院1个；省级协同创新中心2个；其他类型平台9个。

计算机科学与技术学院成立于1997年，经过20多年的建设，现已发展成为我校重点建设的核心院系之一。其中，计算机科学与技术专业为国家级特色专业、国家级一流专业、山西省优势特色专业、山西省本科品牌专业，软件工程专业为山西省一流专业，学院实验教学中心是山西省实验教学示范中心。学院师资力量雄厚，目前拥有专职教师63人，其中，教授17人、副教授22人、博士研究生导师6人、硕士研究生导师47人。学院拥有教育部高等学校计算机课程教学指导委员会委员1人，山西省委联系高级专家1人，山西省学术技术带头人1人，山西省高校优秀青年学术带头人2人，山西省高校教学名师1人，多名教师在全国高等学校计算机教育研究会、中国计算机学会等国家级学术团体担任社会职务。

学院拥有“计算机科学与技术”、“软件工程”2个一级学科硕士学位授权点，以及“计算机技术”、“软件工程”、“人工智能”、“大数据技术与工程”4个工程硕士授权资格，拥有山西省重点学科2个（计算机科学与技术、软件工程）、山西省科技创新重点团队1个（海量数据分析与并行计算）、山西省重点实验室1个（先进控制与智能信息系统）。近年来，在复杂系统与计算智能、大数据与智能信息系统、软件工程与软件技术、物联网与传感网、协同计算与信息安全、虚拟现实与图像处理等领域形成了鲜明的科研特色。承担和完成包括国家自然科学基金、山西省各类科学研究项目及企事业委托项目200余项。发表学术论文1300余篇，其中被SCI/EI收录600余篇，高被引论文20余篇，获省级科技进步奖和自然科学奖12项，省级教学成果奖5项，出版学术专著、主编教材30余部。学院是山西省计算机学会的挂靠单位，“控制科学与工程”一级博士点、“系统工程”山西省重点建设学科、“山西省机械行业制造业信息化生产力促进中心”、“山西省自动化工程技术研究中心”和“山西省先进制造技术网上合作研究中心”的主要依托建设单位。

学院高度重视学生创新精神和实践能力培养，积极推进实验室和实习基地建设。学院实验教学中心现拥有计算机组织与结构实验室、计算机网络实验室、嵌入式系统综合实验室、物联网工程实验室以及软件开发与设计实验室。

六十余载科大精神传承，二十多年计科诲人不倦，今天的计算机科学与技术学院，恪守科大校训，熔铸计科精神，全体师生团结一致、开拓创新，向着培养卓越人才、建设省内一流学科、打造国内知名的计算机学院努力奋进。

## 山西大学计算机与信息技术学院

山西大学是一所文理工并重的高水平综合性大学。学校拥有一批以国家重点学科、国家重点实验室、教育部重点实验室、教育部人文社会科学重点研究基地、教育部工程研究中心、教育部协同创新中心、国家地方联合实验室为代表的重要学科平台。现有博士学位一级学科授权点19个，硕士学位一级学科授权点35个，硕士专业学位种类24个；自主设置交叉学科博、硕士点各2个；目录外二级学科博、硕士点各4个。化学、工程、材料、环境-生态4个学科入选ESI全球排名前1%。近年来，学校主持的国家重点研发计划项目和国家自然科学基金、社会科学基金等各类项目稳步增加，先后荣获国家自然科学基金二等奖、技术发明二等奖、科技进步二等奖、教育部高校人文社科研究优秀成果一等奖等16项国家科研大奖。2019年，成为山西省唯一一所入选教育部“首批高等学校科技成果转化和技术转移基地”高校。

山西大学计算机与信息技术学院，其前身是成立于1980年的计算机科学系，是我国高校成立较早的计算机系之一，2003年更名为计算机与信息技术学院。2016年12月成立大数据学院同步运行。学院现有教职工107人，其中教授13人，副教授45人，博士生导师23人，硕士生导师75人，享受国务院特殊津贴专家1人，教育部高等学校计算机类教学指导委员会委员1人，教育部科学技术委员会委员1人，CCF会士1人，教育部长江学者讲座教授1人，科技部中青年科技创新领军人才1人，国家自然科学基金委优秀青年基金获得者2人，教育部新世纪优秀人才支持计划2人，全国百篇优博提名奖指导教师1人，全国模范教师1人，全国优秀教师1人，爱思唯尔中国高被引学者2人，省级各类人才37人。

学院拥有计算机科学与技术博士后科研流动站和一级学科博士点，计算机科学与技术学科是山西省“1331工程”特色重点学科、优势攀升计划重点学科；拥有计算智能与中文信息处理教育部重点实验室、智能



信息处理山西省重点实验室、山西省大数据挖掘与智能技术协同创新中心、山西省大数据与物联网重点科技创新平台、山西省人工智能产业技术研究院、山西省机器视觉与数据挖掘工程研究中心等高水平科研平台。近三年来，学院教师主持国家级、省部级及企事业委托项目150余项，在人工智能、大数据、机器学习、中文信息处理、网络安全等方面取得了丰硕的研究成果，为地方经济转型发展贡献了山大力量。

学院目前在校全日制博、硕士研究生430余人，本科生930余人。近年来，培养的研究生获全国优秀博士学位论文提名奖1人、中国计算机学会优秀博士学位论文奖1人、中国人工智能学会优秀博士学位论文奖2人、中国中文信息处理学会优秀博士论文奖1人、山西省优秀博士论文7人；培养的本科生获中国计算机学会“全国百名优秀大学生”称号7人，授予省级荣誉称号100余人，国家级和省级各类科技竞赛和素质教育中获奖130余人。

培养的学生中有在清华大学、北京大学、中国科学院、北京航空航天大学等国内知名大学任职的教授，也有美国、新加坡等国外著名研究机构的高级人才，同时也有阿里、百度、华为、腾讯等知名IT企业的高级研发和管理人员，更培养了大批在教育、银行、工商、税务、交通、邮电、广电、卫生等领域的技术骨干，近三年本科毕业生平均升学率为31.7%，一次性就业率为95.6%。

## 太原理工大学信息与计算机学院

太原理工大学是一所历史悠久、底蕴深厚、特色鲜明的世纪学府。学校以工为主、理工结合、多学科协调发展，涵盖理学、工学、经济学、法学、教育学、文学、管理学、艺术学等8个门类，设有24个专业学院、1个中外合作办学学院（筹）。现有中国科学院院士1名、中国工程院院士3名、双聘院士10名、教育部“长江学者奖励计划”特聘（讲座）教授8名、国家杰出青年科学基金获得者9名、“新世纪百千万人才工程”国家级人选17名。学校曾连续两次作为首席科学家单位承担国家重点基础研究发展计划（973计划）项目，累计承担“863”计划、“国家重点研发计划”等国家级各类项目1634项；获得国家科技三大奖42项。学校拥有省部共建国家重点实验室1个、教育部重点实验室4个、教育部创新团队2个、科技部重点领域创新团队1个。近年来，学校努力打造服务国家和区域经济社会发展的才智引擎，成果转化、技术转移等累计为地方和行业企业创造经济效益逾百亿元。

信息与计算机学院成立于2017年12月，由原信息工程学院和计算机科学与技术学院合并而成。学院以通信、电子科学、计算机为主的工科学院，现有电子信息工程、通信工程、测控技术与仪器、电子科学与技术、计算机科学与技术、物联网工程 and 信息安全等七个本科专业，其中电子信息工程是省级特色、省级品牌和校级优势专业；计算机科学与技术是国家特色、省级优势、省级品牌和校级优势专业。拥有电子科学与技术一级学科博士授权点，计算机科学与技术一级学科博士授权点，电子科学与技术一级学科博士后流动站和计算机科学与技术一级学科博士后科研流动站，信息与通信工程一级学科硕士授权点和计算机科学与技术一级学科硕士授予权，其中计算机科学与技术、电路与系统为山西省重点学科。围绕国家发展战略和地方经济转型需求，形成了“图像处理与机器视觉”、“脑信息学及医学影像复杂数据分析”、“网络媒体大

数据计算与知识工程”、“数据管理与分析”、“物联网安全”等特色鲜明的研究方向。学院建立了“微纳传感与物联网技术”院士工作站，科技部重点领域创新团队等多个学科平台，同时也是新型传感器与智能控制教育部（山西省）重点实验室、山西省高端煤矿机械设备协同创新中心的依托单位之一。



## 太原学院智能与自动化系

太原学院地处三晋文脉聚集地——有着 2500 年建城史的三晋古都——山西省省会太原。学院地理位置优越，新校区位于山西省转型综合改革示范区，北接武宿保税区，南邻潇河产业园区，西连山西国际物联网产业园区，东承晋中开发区，信息畅达、交通便利。

太原学院前身为太原大学。2002 年12月，原太原大学、太原师范学校、太原市教育学院合并为新的太原大学，2013年4月经教育部批准升格为全日制综合类普通本科院校。学院实行省市共管、以市为主的办学体制。

学院现有自有专任教师 781 人，“优秀人民艺术家”1人，教授 22 人，副高级专业技术职称以上的教师281名，具有高级专业技术职称的教师占自有专任教师比例达36%。博士、硕士学历人才 665 人，占自有专任教师比例85.15%。学院学科分布合理，专业设置科学。学科涵盖工学、理学、文学、经济学、管理学、艺术学、农学、教育学八个学科门类，其中，本科专业37个。学院设有1个学院（马克思主义学院）、13个系、1个教学部（公共体育教学部）、2个教学中心（公共实验中心、工程训练中心）和 1个继续教育学院。学院面向全国20多个省、市、自治区招生，现在校学生人数为 16820人。

学院注重科研强校。近年来，在核心期刊发表论文 336 篇，主持国家自然科学基金、国家社科基金等省（部）级以上项目 291 项，出版各类专著（译著）126 部。

学院重视对外合作交流。现已与美国科罗拉多州立大学、加拿大菲莎河谷大学、泰国西那瓦大学等院校正式签订合作协议，在学生培养、师资交流、学术科研等方面开展广泛的国际合作。

目前，学校办学条件、教学管理、教学质量基本达到了本科教学工作合格评估的要求，各项事业持续发展，呈现出良好态势。

在山西省大力推进高等院校“三个优化调整”及学院“以工为主”的办学定位背景下，智能与自动化系于2020年10月成立，由原计算机科学与工程系下的物联网工程专业和智能科学与技术专业组建而成。

我系现有物联网工程和智能科学与技术两个本科专业，在校学生600余人。现有教职工32人，其中专任教师27人，专任教师中，教授2人，副教授10人，讲师9人；博士6人，硕士21人；双师型教师9人，是一支学历和职称结构合理、教学科研水平较高的师资队伍。

我系注重学生的知识、能力和素质的综合培养，使学生在具备扎实基础理论与专业知识的同时，具备较强的工程实践能力和较高的综合素养。系部成立一年来，为加强课程建设，组建了教学团队，现有校级精品课程1门，一流课程3门，主持省级教学改革课题8项，协同育人项目1项。系部拥有先进的实验教学设备，现有5个教学实验室，分别是嵌入式系统实验室、高频电子技术实验室、物联网技术实验室、物联网综合应用实验室、人工智能实验室，实验室总面积约670平方米，设备总价值约530万元。同时，注重校企合作，建立了稳定的实践实习基地，并与企业共建产业学院。此外，我系成立了创新研究院，积极动员、组织、培训、指导学生参加各级各类专业学科竞赛，自成立一年来获省级奖26项，国家级奖3项。

我系以教授、博士为带头人，以大数据与人工智能创新实验室（山西健康大数据AI联合实验室）和智能感知与虚拟现实实验室为依托，组建了科学研究团队，并在人工智能、模式识别等领域开展研究，已经取得一定成果。

我系将会努力践行学院“崇德尚能、博知力行”的育人理念，为把学院建设成为贡献度更高、特色更鲜明的地方应用型大学而努力奋斗。