Program of

2019 International Conference on Data Intelligence & Neutrosophic Sets with Applications

(DI-NSA 2019)

Dec. 20–22, Xi'an, China

程序册

2019 年数据智能与中智集理论及应用国际学术会议

Hosted by:

Chinese Association for Artificial Intelligence (CAAI)
Neutrosophic Science International Association (NSIA)

Organized by:

Shaanxi University of Science and Technology
Xi'an Polytechnic University

Co-organized by:

Northwest University, Shaanxi Normal University, Xi'an Jiaotong University, Xidian University, Xi'an Shiyou University, Xi'an University of Posts and Telecommunications

Contents

Description of the Topics on DI-NSA 2019

(DI-NSA 2019 会议主题说明)

Big data and artificial intelligence are currently two hotspots in science and technology, both of which combines and forms data intelligence. Data intelligence, to be simple, is to make data intelligent. The main conference topics include:

(1) The Mathematical Basis of Data Intelligence

The combination of big data and artificial intelligence gave birth to the concept of data intelligence, which has got attention from all walks of life. However, the theoretical basis of data intelligence has not yet reached an academic consensus, and it needs our long-term and solid research efforts. This conference will mainly discuss the mathematical basis of data analysis and data mining (DM), including new theories and methods of statistical analysis, non-classical logic and reasoning, random matrix theory, rough set theory, new mathematical methods of knowledge representation and processing, efficient data mining algorithm, deep neural network models, interpretable deep learning theories and methods, and cognitive computing theories and methods.

(2) The Mathematics of Uncertainty and Neutrosophic Sets with Applications

Uncertainty is ubiquitous, and the mathematical theory of studying uncertainty is collectively called uncertainty mathematics, among which probability theory and fuzzy set theory are typical representatives. In addition, various generalized fuzzy sets (including interval-valued fuzzy sets, intuitionistic fuzzy sets, etc.), rough sets, soft sets, and neutrosophic sets all belong to uncertainty mathematics. This conference, a communication platform between different disciplines, focuses on the comparative study of new theoretical and new methods of uncertainty mathematics, in order to provide referable mathematical tools for big data intelligence. In particular, neutrosophic sets, which is an extension of the traditional fuzzy sets, gains different views from scholars. This conference welcomes deeper discussion and research on its basic concepts, theoretical basis, practical application and other aspects.

Program and Organization Committee of DI-NSA 2019

(DI-NSA 2019 程序与组织委员会)

- Program Committee Chairs
  Florentin Smarandache (University of New Mexico, USA)
  Qiang Shen (Aberystwyth University, UK)
  Young Bae Jun (Gyeongsang National University, Korea)
  Enhong Chen (University of Science and Technology of China)
  Xiaohong Zhang (Shaanxi University of Science and Technology, China)

- Program Committee
  Jing He (Swinburne University of Technology, Australia)
  Rajab Ali Borzooei (Shahid Beheshti University, Iran)
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  Madad Khan (COMSATS University Islamabad, Pakistan)
  Yanhui Guo (University of Illinois Springfield, USA)
  Jun Ye (Shaoxing University, China)
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  Bingzhen Sun (Xidian University, China)
  Tao Zhou (North Minzu University, China)
  Feng Feng (Xi'an University of Posts and Telecommunications, China)
  Shigui Du (Shaoxing University, China)
  Jihong Pei (Shenzhen University, China)
  Tao Lei (Shaanxi University of Science and Technology, China)

DI-NSA 2019 Program

Dec. 20, Friday

10:00 ~ 21:00 Registration (注册)
Location: Hall on the first floor Xi'an Tangcheng Hotel
(西安唐城宾馆一楼大厅)

Dec. 21, Saturday (am)

08:50 ~ 09:10 Opening Ceremony (开幕式)
Host introduces guests;
Leaders give welcome speech
Host: Xiaohong Zhang (Shaanxi University of Science and Technology)
Location: Conference Room Lihua in Tangcheng (Second floor)
(唐城宾馆梨花厅，二楼)

09:10 ~ 09:30 Photo (合影)
Location: Gate of Tangcheng Hotel (唐城宾馆门口)

09:30 ~ 10:05 Plenary Report 1
Title: Feature Selection in Systems Modeling with Imprecise Data
(不精确数据系统建模中的特征选择)
Speaker: Prof. Qiang Shen (Aberystwyth University, UK)
Host: Prof. Enhong Chen (University of Science & Technology of China)
Location: Conference Room Lihua in Tangcheng (Second floor)
(唐城宾馆梨花厅，二楼)

10:05 ~ 10:40 Plenary Report 2
Title: On Overview of the Neutrosophic Theories and Applications
(中智理论及其应用综述)
Speaker: Prof. Florentin Smarandache (University of New Mexico, USA)
Host: Prof. Young Bae Jun (Gyeongsang National University, Korea)
Location: Conference Room Lihua in Tangcheng (Second floor)
(唐城宾馆梨花厅，二楼)

10:40 ~ 10:55 Coffee Break (茶歇)

10:55 ~ 11:30 Plenary Report 3

Title: Data Intelligence Based Cognition Modeling and Learning Path Recommendation of Students

(基于数据智能的学生认识建模与学习路径推荐)

Speaker: Prof. Enhong Chen (University of Science & Technology of China)

Host: Prof. Qiang Shen (Aberystwyth University, UK)

Location: Conference Room Lihua in Tangcheng (Second floor)

(唐城宾馆梨花厅，二楼)

11:30 ~ 12:00 Plenary Report 4

Title: Neutrosophic Set in Artificial Intelligence

(人工智能中的中智集)

Speaker: Prof. Yanhui Guo (University of Illinois Springfield, USA)

Host: Prof. Rajab Ali Borzooei (Shahid Beheshti University, Iran)

Location: Conference Room Lihua in Tangcheng (Second floor)

(唐城宾馆梨花厅，二楼)

12:00 ~ 14:00 Lunch (午餐)

Location: Restaurant on the first floor of Tangcheng Hotel

(唐城宾馆一楼餐厅)

Dec. 21, Saturday (pm)

14:05 ~ 14:30 Plenary Report 5

Title: MBJ-Neutrosophic Graphs (MBJ-中智图)

Speaker: Prof. Rajab Ali Borzooei (Shahid Beheshti University, Iran)

Host: Prof. Juanying Xie (Shaanxi Normal University, China)

Location: Conference Room Lihua in Tangcheng (Second floor)

(唐城宾馆梨花厅，二楼)

14:30 ~ 14:55 Plenary Report 6

Title: Neutrosophic Algebraic Structures in BCK/BCI-Algebras

(BCK/BCI-代数中的中智代数结构)

Speaker: Prof. Young Bae Jun (Gyeongsang National University, Korea)

Host: Prof. Xiaolong Xin (Northwest University, China)

Location: Conference Room Lihua in Tangcheng (Second floor)
(唐城宾馆梨花厅，二楼)

14:55 ~ 15:20 Plenary Report 7

Title: Micanorm Aggregation Operators
(Micanorm 聚合算子)

Speaker: Prof. Eunsuk Yang (Jeonbuk National University, Korea)

Host: Prof. Madad Khan (COMSATS University Islamabad, Pakistan)

Location: Conference Room Lihua in Tangcheng (Second floor)
(唐城宾馆梨花厅，二楼)

15:20 ~ 15:45 Plenary Report 8

Title: Subtraction Operational Aggregation Operators of Simplified Neutrosophic Numbers and Their Multi-Attribute Decision Making Approach (简化中智数减运算集成算子及其它们的多属性决策方法)

Speaker: Prof. Jun Ye (Shaoxing University, China)

Host: Prof. Keyun Qin (Southwest Jiaotong University, Chian)

Location: Conference Room Lihua in Tangcheng (Second floor)
(唐城宾馆梨花厅，二楼)

15:45 ~ 16:00 Coffee Break (茶歇)

16:00 ~ 16:25 Plenary Report 9

Title: M-polar Fuzzy Sets−−An Extension of Bipolar Fuzzy Sets
(M-极模糊集—双极模糊集的一种推广)

Speaker: Prof. Shenggang Li (Shaanxi Normal University, China)

Host: Prof. Guilong Liu (Beijing Language University, China)

Location: Conference Room Lihua in Tangcheng (Second floor)
(唐城宾馆梨花厅，二楼)

16:25 ~ 16:50 Plenary Report 10

Title: Fusions of Neutrosophic Sets, Rough Sets and Three-way Decisions (中智集、粗糙集与三支决策的融合)

Speaker: Prof. Hailong Yang (Shaanxi Normal University, China)

Host: Prof. Ling Wei (Northwest University, China)

Location: Conference Room Lihua in Tangcheng (Second floor)

(唐城宾馆梨花厅，二楼)

16:50 ~ 17:15 Plenary Report 11

Title: A Bibliometric Analysis of Neutrosophic Set: Two Decades Review from 1998 to 2017

(中智集文献计量分析: 1998 年至 2017 年的二十年回顾)

Speaker: Xindong Peng (Shaoguan University, China)

Host: Prof. Yanhui Guo (University of Illinois Springfield, USA)

Location: Conference Room Lihua in Tangcheng (Second floor)

(唐城宾馆梨花厅，二楼)

17:15 ~ 17:40 Plenary Report 12

Title: From Boolean Algebras to Pseudo EQ-Algebras

(从布尔代数到伪 EQ-代数)

Speaker: Prof. Xiaolong Xin (Northwest University, China)

Host: Prof. Hongjun Zhou (Shaanxi Normal University, China)

Location: Conference Room Lihua in Tangcheng (Second floor)

(唐城宾馆梨花厅，二楼)

17:40 ~ 19:50 Dinner (晚餐)

Location: Restaurant on the first floor of Tangcheng Hotel

(唐城宾馆一楼餐厅)

Dec. 22, Sunday (am)

08:50 ~ 09:10 Plenary Report 13

Title: Unifying Discriminative Learning Principles Based on Mathematical Programming

(基于数学规划的统一判别学习原则)

Speaker: Prof. Jing He (Swinburne University of Technology, Australia)

Host: Prof. Jun Ye (Shaoxing University, China)

Location: Conference Room Mudan in Tangcheng (Second floor)

(唐城宾馆牡丹厅，二楼)

09:10 ~ 09:30 Plenary Report 14

Title: General Forms of Ordinal Sums of Fuzzy Implications

(模糊蕴涵序和的一般形式)

Speaker: Prof. Hongjun Zhou (Shaanxi Normal University, China)

Host: Prof. Jihong Pei (Shenzhen University, China)

Location: Conference Room Mudan in Tangcheng (Second floor)

(唐城宾馆牡丹厅，二楼)

09:30 ~ 09:50 Plenary Report 15

Title: Three-way Concept Analysis and Others

(三支概念分析及其它)

Speaker: Prof. Ling Wei **(**Northwest University, China)

Host: Prof. Bingzhen Sun (Xidian University, China)

Location: Conference Room Mudan in Tangcheng (Second floor)

(唐城宾馆牡丹厅，二楼)

09:50 ~ 10:10 Plenary Report 16

Title: The Partially Ordered Data Analysis and Multi-Label Learning Based on Neighborhood Rough Sets

(基于领域粗糙集的偏序数据分析与多标签学习)

Speaker: Prof. Hongying Zhang (Xi'an Jiaotong University, China)

Host: Prof. Tao Zhou (North Minzu University, China)

Location: Conference Room Mudan in Tangcheng (Second floor)

(唐城宾馆牡丹厅，二楼)

10:10 ~ 10:25 Coffee Break (茶歇)

10:25 ~ 10:45 Plenary Report 17

Title: Three-way Fuzzy Matroids and Granular Computing

(三支模糊拟阵与粒计算)

Speaker: Prof. Xiaonan Li (Xidian University, China)

Host: Prof. Feng Feng (Xi'an University of Posts and Telecommunications)

Location: Conference Room Mudan in Tangcheng (Second floor)

(唐城宾馆牡丹厅，二楼)

10:45 ~ 11:05 Plenary Report 18

Title: Soft Set from the Perspective of Methodology: A Soft Decision Making Scheme

(从方法论角度看软集: 一种软决策模式)

Speaker: Prof. Banghe Han (Xidian University, China)

Host: Prof. Hongying Zhang (Xi'an Jiaotong University, China)

Location: Conference Room Mudan in Tangcheng (Second floor)

(唐城宾馆牡丹厅，二楼)

11:05 ~ 11:25 Plenary Report 19

Title: Neutrosophic Fusion of Rough Set Theory: An Overview

(粗糙集理论的中智融合综述)

Speaker: Prof. Chao Zhang (Shanxi University, China)

Host: Prof. Shigui Du (Shaoxing University, China)

Location: Conference Room Mudan in Tangcheng (Second floor)

(唐城宾馆牡丹厅，二楼)

11:25 ~ 11:45 Plenary Report 20

Title: Probabilistic Neutrosophic Hesitant Fuzzy Sets with Applications in Complex Fuzzy Multi-Attribute Decision Making

(概率中智犹豫模糊集及在复杂模糊多属性决策中的应用)

Speaker: Dr. Songtao Shao (Shanghai Maritime University, China)

Host: Prof. Banghe Han (Xidian University, China)

Location: Conference Room Mudan in Tangcheng (Second floor)

(唐城宾馆牡丹厅，二楼)

11:45 ~ 12:00 Establishment Ceremony of NSIA branch of CHINA

(国际中智科学学会中国分会成立仪式)

Host: Prof. Yingcang Ma (Xi'an Polytechnic University, China)

Special Guest: Prof. F. Smarandache (University of New Mexico, USA)

Location: Conference Room Mudan in Tangcheng (Second floor)

(唐城宾馆牡丹厅，二楼)

(Closing)

Plenary Reports
(大会报告)

Plenary Report 1

Title: Feature selection in systems modeling with imprecise data

Biography:

Professor Qiang Shen received a PhD in Knowledge-Based Systems and a DSc in Computational Intelligence. He holds the Established Chair of Computer Science and is a Pro Vice-Chancellor at Aberystwyth University. He is a Fellow of the Learned Society of Wales (aka. the Royal Society of Wales) and a UK Research Excellence Framework (2008-2014 and 2014-2021) panel member (for Computer Science and Informatics), one of the only two overseas Chinese scholars who have been twice appointed to such an important role across all assessment panels. He has been a long-serving Associate Editor or Editorial Board member of many leading international journals (e.g., IEEE Transactions on Cybernetics and IEEE Transactions on Fuzzy Systems), and has chaired and given keynotes at numerous international conferences. Professor Shen's current research interests include: computational intelligence, learning and reasoning under uncertainty, pattern recognition, data modelling and analysis, and their applications for intelligent decision support (e.g., space exploration, crime detection, consumer profiling, systems monitoring, and medical diagnosis). He has authored 2 research monographs and approximately 400 peer-reviewed papers, including an award-winning IEEE Outstanding Transactions paper. He has served as the first supervisor of more than 60 PDRAs/PhDs, including one UK Distinguished Dissertation Award winner. Professor Shen is a London 2012 Olympic Torch Relay torchbearer, nominated to carry the Olympic torch in celebration of the centenary of Alan Turing.

Abstract:

Feature selection (FS) addresses the problem of selecting those system descriptions that are most predictive of a given outcome. Unlike other dimensionality reduction methods, with FS the original meaning of the features is preserved. This has found application in tasks that involve datasets containing very large numbers of features that might otherwise be impractical to model and process (e.g., large-scale image analysis, text processing and Web content classification), where feature semantics play an important role.

This talk will focus on the development and application of approximate FS mechanisms based on rough and fuzzy-rough theories. Such techniques provide the means by which imprecisely described data can be effectively reduced without the need for user-supplied

information. In particular, fuzzy-rough feature selection (FRFS) works with discrete and real-valued noisy data (or a mixture of both). As such, it is suitable for regression as well as for classification. The only additional information required is the fuzzy partition for each feature, which can be automatically derived from the data. FRFS has been shown to be a powerful technique for semantics-preserving data dimensionality reduction. In introducing the general background of FS, this talk will first cover the rough-set-based approach, before focusing on FRFS and its application to real-world problems. The talk will conclude with an outline of opportunities for further development.

Plenary Report 2

Title: On overview of the neutrosophic theories and applications

Biography:

Florentin SMARANDACHE is a professor of mathematics at the University of New Mexico, United States. He got his MSc in Mathematics and Computer Science from the University of Craiova, Romania, PhD in Mathematics from the State University of Kishinev, and Postdoctoral in Applied Mathematics from Okayama University of Sciences, Japan. He has been the founder of Neutrosophy (generalization of dialectics), neutrosophic set, logic, probability and statistics since 1995, and has published hundreds of papers on many peer-reviewed international journals and many books in areas of neutrosophic physics, superluminal and instantaneous physics, unmatter, quantum paradoxes, absolute theory of relativity, redshift and blueshift due to the medium gradient and refraction index besides the Doppler effect, paradoxism, outerart, neutrosophy as a new branch of philosophy, Law of Included Multiple-Middle, multispace and multistructure, degree of dependence and independence between neutrosophic components, refined neutrosophic set, neutrosophic over-under-off-set, plithogenic set, neutrosophic triplet and duplet structures, quadruple neutrosophic structures, DSmT and so on. He also has presented papers and plenary lectures to many international conferences around the world.

Abstract:

A history of evolution of neutrosophic theories and applications is presented (1995-2019).

We prove that Neutrosophic Set (NS) is an extension of Intuitionistic Fuzzy Set (IFS) no matter if the sum of single-valued neutrosophic components is < 1, or > 1, or $= 1$. For the case when the sum of components is 1 (as in IFS), after applying the neutrosophic aggregation operators one gets a different result from that of applying the intuitionistic fuzzy operators, since the intuitionistic fuzzy operators ignore the indeterminacy, while the neutrosophic aggregation operators take into consideration the indeterminacy at the same level as truth-membership and falsehood-nonmembership are taken. NS is also more flexible and

effective because it handles, besides independent components, also partially independent and partially dependent components, while IFS cannot deal with these. Since there are many types of indeterminacies in our world, we can construct different approaches to various neutrosophic concepts.

Neutrosophic Set (NS) is also a generalization of Inconsistent Intuitionistic Fuzzy Set (IIFS) {which is equivalent to the Picture Fuzzy Set (PFS) and Ternary Fuzzy Set (TFS)}, Pythagorean Fuzzy Set (PyFS) {Atanassov's Intuitionistic Fuzzy Set of second type}, Spherical Fuzzy Set (SFS), n-HyperSpherical Fuzzy Set (n-HSFS), and q-Rung Orthopair Fuzzy Set (q-ROFS). And Refined Neutrosophic Set (RNS) is an extension of Neutrosophic Set. And all these sets are more general than Intuitionistic Fuzzy Set.

We prove that Atanassov's Intuitionistic Fuzzy Set of second type (AIFS2), and Spherical Fuzzy Set (SFS) do not have independent components. And we show that n-HyperSpherical Fuzzy Set that we now introduce for the first time, Spherical Neutrosophic Set (SNS) and n-HyperSpherical Neutrosophic Set (n-HSNS) {the last one also introduced now for the first time} are generalizations of IFS2 and SFS.

The main distinction between Neutrosophic Set (NS) and all previous set theories are: a) the independence of all three neutrosophic components {truth-membership (T), indeterminacy-membership (I), falsehood-nonmembership (F)} with respect to each other in NS-while in the previous set theories their components are dependent of each other; and b) the importance of indeterminacy in NS-while in previous set theories indeterminacy is completely or partially ignored.

Also, Regret Theory, Grey System Theory, and Three-Ways Decision are particular cases of Neutrosophication and of Neutrosophic Probability. We have extended the Three-Ways Decision to n-Ways Decision, which is a particular case of Refined Neutrosophy. Neutrosophy is a particular case of Refined Neutrosophy, and consequently Neutrosophication is a particular case of Refined Neutrosophication.

In 2016 Smarandache defined for the first time the Refined Fuzzy Set (RFS) and Refined Fuzzy Intuitionistic Fuzzy Set (RIFS). We now, further on, define for the first time: Refined Inconsistent Intuitionistic Fuzzy Set (RIIFS){Refined Picture Fuzzy Set (RPFS), Refined Ternary Fuzzy Set (RTFS)}, Refined Pythagorean Fuzzy Set (RPyFS) {Refined Atanassov's Intuitionistic Fuzzy Set of type 2 (RAIFS2)}, Refined Spherical Fuzzy Set (RSFS), Refined n-HyperSpherical Fuzzy Set (R-n-HSFS), and Refined q-Rung Orthopair Fuzzy Set (R-q-ROFS).

Plenary Report 3

Title: Data Intelligence Based Cognition Modeling and Learning Path Recommendation of Students

Biography:

Enhong Chen, male, professor, PhD supervisor, Senior Member of IEEE, University of Science and Technology of China. He received his PhD in computer software from the University of Science and Technology of China in 1996. In 2005, he was selected into the New Century

Excellent Talents Support Program of the Ministry of Education. He is currently the Deputy Dean of the School of Computer Science and Technology of the University of Science and Technology of China, the Deputy Director of the Ministry of Education-Microsoft Key Laboratory of Multimedia Computing and Communication, the Deputy Director of the Knowledge Engineering and Distributed Intelligence Professional Committee of the Chinese Institute of Artificial Intelligence, a member of the Machine Learning Special Committee, and a member of the Artificial Intelligence and Pattern Recognition Committee of the Chinese Computer Society. He has served as the program committee member of more than 30 international academic conferences such as ICTAI 2006, ICTAI 2007, AIRS2009, AIRS2010, and KDD2010. As the main member, he has participated in many projects including the National Natural Science Foundation of China, the 863 and 973 programs. As the project leader, he has undertaken more than 20 scientific research projects, including 4 National Natural Science Foundation projects, 1 National Natural Science Key Project (the second undertaking unit), one 863 Program project, 1 doctoral fund project of Ministry of Education, 2 special projects of the Ministry of Education Science and Technology Development Center, 2 Anhui Natural Science Foundation projects, and the cooperation projects with Microsoft Research Asia, Nokia, Alibaba, and Huawei Technologies, etc. He has published more than 90 academic papers on important international and domestic academic journals such as Theoretical Computer Science, WWW Journal, Information Processing and Management, and important international academic conferences in the field of data mining such as KDD, WWW, SIGIR, ICDM, and CIKM, etc. Among them, the paper published on KDD2008 won the Best Application Paper Award.

报告人简介：陈恩红，男，中国科学技术大学，教授，博导，IEEE 高级会员（Senior Member）。1996 年获中国科学技术大学计算机软件专业博士学位。2005 年入选教育部新世纪优秀人才支持计划。现任中国科学技术大学计算机科学与技术学院副院长，多媒体计算与通信教育部-微软重点实验室副主任，中国人工智能学会知识工程与分布智能专业委员会副主任委员、机器学习专委会委员，中国计算机学会人工智能与模式识别专委会委员。担任了 ICTAI 2006、ICTAI 2007、AIRS2009、AIRS2010、KDD2010 等 30 余个国际学术会议的程序委员。作为项目主要成员，参与过包括国家自然科学基金、863、973 计划等多个项目。作为项目负责人，承担了 20 多项科研项目，其中包括 4 项国家自然科学基金项目、1 项国家自然科学重点项目（第 2 承担单位）、1 项 863 计划项目、1 项教育部博士点基金项目、2 项教育部科技发展中心专项课题、2 项安徽省自然科学基金项目，以及与微软亚洲研究院、诺基亚、阿里巴巴、华为科技公司等的合作项目等。在国内外重要学术期刊《Theoretical Computer Science》、《WSWW Journal》、《Information Processing and Management》和数据挖掘领域重要国际学术会议 KDD、WWW、SIGIR、ICDM、CIKM 等上发表学术论文 90 余篇，其中，在数据挖掘的国际顶级会议 KDD2008 上的论文获最佳应用论文奖（Best Application Paper Award）。

Abstract:

Intelligent education systems can help the personalized learning of students with computer-assisted technology. Along this line, it is well known that modeling the cognitive structure including the knowledge level of learners and the knowledge structure (e.g., the prerequisite relations) of learning items is important for intelligent education services (e.g., learning path recommendation). In this talk, I will first introduce our attempts to extract

knowledge from learning items and show the way to trace the evolving knowledge levels of learners at each learning step. Then, I will give a general framework to fully exploit the multifaceted cognitive structure for learning path recommendation. Extensive experimental results demonstrate both the effectiveness and the superior interpretability of our proposed solutions.

Plenary Report 4

Title: Neutrosophic Set in Artificial Intelligence

Biography:

Yanhui Guo is now an Assistant Professor in Department of Computer Science at University of Illinois Springfield. He was a co-founder and chief scientist of MedSights Tech Inc., a high technology company focusing on Computer Assisted Surgery (CAS) system. One product was released to provide a real-time, 3-D visual guidance for health care providers. He was a chief scientist of PVmed Inc., a company focusing on artificial intelligence diagnosis for different diseases. He won the award University Scholar for 2019, and the university system's highest faculty honor, recognizing outstanding teaching and scholarship. Dr. Yanhui Guo was an Assistant Professor, a director of High-Performance Cloud Computing Lab, and a Coordinator of Computer Science Program in School of Science at Saint Thomas University. He has published 2 academic books, 97 journal papers and 32 conference papers, and completed 11 grant funded research projects, and 3 projects are undergoing. 2 patents were approved and 3 are pending. He has worked as an associate editor for 5 journals, a guest editor for 3 journals, reviewers for 15 journals and 4 conferences. He has more than 6 years on site and online teaching experience for undergraduate and graduate students.

Abstract:

Artificial intelligence (AI), a relatively novel frontier and comprehensive subject, refers to the intellectual abilities and qualities of computers, comparative to the intellect of human beings. Neutrosophic set (NS) provides a distinguished frame to represent the indeterminacy of events. Aiming to promote the research in AI and NS, this presentation surveys the current accomplishments of NS in the combination of AI. Firstly, it briefly introduces the key concepts of AI and NS. Then the ways to integrate NS in different branches of AI are discussed in detail, and various achievements in machine learning and computer vision are employed to illustrate the prior efficiency of NS in AI. Finally, challenges and trends are proposed and summarized for future research.

Plenary Report 5

Title: MBJ-neutrosophic graphs

Biography:

Prof. R. A. Borzooei is working at Department of Mathematics, Shahid Beheshti University, Tehran, Iran. He has received his PhD. at University of Kerman. He has published more than 200 papers in several journals. His mathematical research areas are algebra (general algebra，logical algebras)，algebraic hyper structures, fuzzy mathematics, algebraic graphs and fuzzy graphs. He is working as an (managing) editor of 8 journals, such as:

- From 2002-to date: Managing Editor and Founder: Iranian Journal of Fuzzy Systems (IJFS) (Iran).
- From 2019-to date: Editor-in-Chief and Founder: Journal of Algebraic Hyper structures and Logical Algebras (JAHLA) (Iran).

Abstract:

In this paper, the *MBJ*-neutrosophic set is applied to graph theory. The notion of *MBJ* -neutrosophic graph is introduced, and many properties are considered. Then the notions of *MBJ*-neutrosophic path, *MBJ*-neutrosophic diameter, *MBJ*-neutrosophic complete graph, *MBJ*-neutrosophic strong graph and strength of *MBJ*-neutrosophic graphs are defined and several examples to illustrate these notions are provided. Moreover, the concepts of *MBJ*-neutrosophic bridge and *MBJ*-neutrosophic cut vertex are given, and related properties are investigated. Finally, we have an application of *MBJ*-neutrosophic graphs.

Plenary Report 6

Title: Neutrosophic algebraic structures in BCK/BCI- algebras

Biography:

Young Bae Jun got PhD from Kyung Hee University, Seoul, South Korea. Post-Doctoral Fellow at University of Alberta, Canada, 1989-1990 (Supported by Korea Science & Engineering Foundation). He worked at the Department of Mathematics Education, Gyeongsang National University (GNU) as a professor (from 1982 to 2016), and now Emeritus Professor of GNU. His research interests: BCK/BCI-Algebra; Fuzzy Algebraic Structure; Soft (Rough) Algebraic Structure; Smarandache Notions in Algebraic Structures.

He published a book, “BCK-algebras”, with Professor J. Meng, and more than 766 research papers in several journals. Awards and Honors: Academic Achievement Award (7

July 2006), Busan-Gyeongnam Branch of the Korean Mathematical Society. Listed in the eighth edition of "Marquis Who's Who in Science and Engineering". Listed among the Highly Cited Researchers 2016 published by Thomson Reuters. Listed at the 2017 and 2018 Highly Cited Researchers which has been published in Clarivate Analytics.

Abstract:

We would like to consider the Neutrosophic set theory will be applied to the algebraic structures, such as residuated lattices, MV-algebras, BL-algebras, MTL-algebras, R_0-algebras, equality algebras, effect algebras, EQ-algebras, lattice implication algebras, BCK/BCI-algebras, IS-algebras, hoop algebras, etc. There are several kinds of neutrosophic sets which can be applied to algebraic structures such as fuzzy neutrosophic set theory, bipolar fuzzy neutrosophic set theory, intuitionistic fuzzy neutrosophic set theory, interval-valued neutrosophic set theory, multi-valued neutrosophic set theory, neutrosophic duplet and triplet theory, neutrosophic hesitant fuzzy set theory, neutrosophic vague set theory, neutrosophic sets based on neutrosophic points, neutrosophic quadruple structures, neutrosophic soft and rough set theory, neutrosophic *N*-structures, neutrosophic hyper structures, neutrosophic pseudo algebraic structures, neutrosophic cubic set theory, generalized neutrosophic set theory, MBJ-neutrosophic set theory, multipolar fuzzy neutrosophic set theory, etc. These concepts in relation to neutrosophic set theory are primarily intended to be addressed above BCK/BCI-algebras.

Plenary Report 7

Title: Micanorm aggregation operators

Biography:

Eunsuk Yang received his PhD in Department of Philosophy from Yonsei University in 1997, visited Indiana University (Bloomington), IN, USA, in 2001-2002 as a postdoctoral researcher, and is an Associate Professor of Philosophy Department at Jeonbuk National University, Jeonju, South Korea. His research interests include non-classical logics, in particular, fuzzy logic, sub structural logic, relevance logic, and algebraic logic. He has published many articles in journals and conference proceedings in these research areas.

Abstract:

Yager introduced a generalization of uninorms, a variant of the concept of uninorm obtained by removing the associativity condition in its definition: he (1994a; 1994b) introduced a class of MICA (Monotonic Identity Commutative Aggregation) operators, and claimed that MICA operators constitute the basic operators needed for aggregation in fuzzy system modeling. Recently, Yang (2015) introduced micanorms as binary MICA operations. In particular, he (2009; 2016; 2017) has introduced micanorms with three weak forms of associativity and micanorm analogues of the Lukasiewicz, Goedel, and Product t-norms. Note

that Yang's investigations in Yang (2009; 2015; 2016; 2017) concentrate on introducing logical systems based on such micanorms and their corresponding standard algebraic semantics, whereas his works do not concentrate on introducing good examples for such micanorms and their algebraic properties.

The main purpose of the paper is to provide more thorough investigation of basic algebraic properties of micanorms introduced by Yang. For this, we organize the paper as follows. In Section 2, we first recall the definitions of micanorms in general, micanorms with three weak forms of associativity, and Lukasiewicz, Goedel, and Product weak e-associative (wea-) uninorms. In Section 3, we introduce micanorm analogues of the Lukasiewicz, Goedel, and Product t-norms and investigate some characteristic algebraic properties of those analogues.

Plenary Report 8

Title: Subtraction operational aggregation operators of simplified neutrosophic numbers and their multi-attribute decision making approach

题目：简化中智数减运算集成算子及其它们的多属性决策方法

Biography:

Jun Ye is a professor in Shaoxing University, China. He has more than 30 years of experience in teaching and research. His research interests include engineering neutrosophic theory and applications, soft computing, decision making theory and methods, control system analysis and design, robotics, pattern recognition and artificial intelligent, fault diagnosis, medical diagnosis, and rock mechanics. He has published more than 260 papers in journals, written few books related to his research work, and finished a few projects sponsored by the government of P.R.. Especially in engineering neutrosophic theory and applications he has published more than 100 papers in international journals and made many important contributions, like simplified neutrosophic theory, linguistic neutrosophic theory, neutrosophic decision making theory and methods, neutrosophic graph theory, neutrosophic linear equations and solutions, neutrosophic interval probability and statistics, neutrosophic linear and nonlinear programming, neutrosophic neural network, neutrosophic optimization and design, neutrosophic control system analysis and design, neutrosophic image processing and dynamic object tracking, neutrosophic rock mechanics, and so on. Additionally, he is an editor-in-chief of “Current Chinese Computer Science”, one of editorial board members and one of section editors of many international journals.

报告人简介：叶军（1959—），男，汉族，浙江上虞人，1997 年毕业于波兰科沙林工业大学，获工业自动化与机器人专业理学硕士学位。回国后在绍兴文理学院任教，现为电气与信息工程系教授，硕士生导师。2012 年在美国南方理工州立大学（现更名为肯尼索大学）工程学院做访问学者半年。2015 年至目前，兼任印度巴拉蒂尔大学（Bharathiar University）博士学位考试团成员。主要从事机电一体化系统设计、决策理论与方法、自动控制、机器人技术与数值分析的教学与研究。目前主要研究方向为中智理论与应用、

软计算、模糊决策理论与方法、机器人智能控制、模式识别与故障诊断、医学智能诊断、岩石力学与工程建模。在国内外发表学术论文 260 余篇，其中，ESI/SCI/SSCI/EI 收录论文共计 160 篇（其中 SCI/SSCI 收录论文 114 篇，EI 收录论文 47 篇，进入 ESI 高被引用论文 11 篇，进入 Web of Science 数据库总引频次 4100 余次、h-index 论文 34 篇）；2007 年参编《控制工程基础》省级重点建设教材一部（副主编），浙江大学出版社出版；2018 年参编《Neutrosophic Multi-Criteria Decision Making》专著一部，瑞士 MDPI 出版公司出版。现作为主要成员参与国家自然科学基金项目 3 项；主持完成浙江省自然科学基金项目 2 项；参与完成省级项目 7 项。获得国家发明专利 10 余项；获浙江省自然科学优秀论文二等奖 3 篇、三等奖 1 篇。建立的“欠驱动多指节机器人手的运动分析与设计方法”、“复合正交神经网络与控制”与“工程中智理论与应用为主要原创性贡献”。已担任 1 家国际期刊《Current Chinese Computer Science》主编、6 家国际期刊编委/编辑、8 家国际期刊有关中智理论及其应用的特刊客座编辑，还担任 10 多家 SCI 源国际期刊的审稿员，并多次荣获 2009、2015、2017 年度《Applied Soft Computing》国际期刊（SCI 源期刊，2 区）、2016 年度《Expert Systems with Applications》 国际期刊(SCI 源期刊，2 区) 与《Computers & Industrial Engineering》国际期刊（SCI 源期刊，3 区）、2018 年度《Knowledge-Based Systems》国际期刊（SCI 源期刊，2 区）与《Measurement》国际期刊（SCI 源期刊，3 区）杰出审稿人奖。2015 年荣获中智科学国际学会、悖论学国际学会荣誉会员称号以及 2018 年优秀论文奖 1 篇，并入编 2016 年中智科学国际学会中智研究者百科全书（第一辑）；曾多次担任国外召开的有关计算机、信息与智能系统的国际会议技术程序委员会委员。2019 年荣获浙江省留联会“最美留学报国之星”称号。依据斯坦福大学 John P. A. Ioannidis 教授团队发布的全球高被引学者排行榜中，叶军教授在全球 10 万科学家中排名为 17030 位，其中，全球人工智能科学家排名第 248 位，中国人工智能科学家排名第 18 位。

Abstract:

The simplified form of a neutrosophic set (NS) was introduced as the simplified NS (S-NS) containing a single-valued NS (SV-NS) and an interval-valued NS (IV-NS) when its truth, indeterminacy and falsity membership degrees are constrained in the real standard interval [0, 1] for convenient actual applications. Then, Ye presented subtraction operations of simplified neutrosophic numbers (S-NNs), containing the subtraction operations of interval-valued neutrosophic numbers (IV-NNs) and single-valued neutrosophic numbers (SV-NNs) in S-NN setting. However, the subtraction operations of S-NSs lack actual applications in current research. Since simplified neutrosophic aggregation operators are one of important mathematical tools in multi-attribute decision making problems, the subtraction operational aggregation operators of S-NNs have been not investigated so far. Regarding the subtraction operations of S-NNs (SV-NNs and IV-NNs), this paper proposes a SV-NN subtraction operational weighted arithmetic averaging (SV-NNSOWAA) operator and an IV-NN subtraction operational weighted arithmetic averaging (IV-NNSOWAA) operator as a necessary complement to existing aggregation operators of S-NNs to aggregate S-NNs (SV-NNs and IV-NNs). Then, a decision-making approach is developed based on the SV-NNSOWAA and IV-NNSOWAA operators. Finally, an illustrative example is provided to indicate the applicability and effectiveness of the proposed approach. However, the main advantage of the proposed DM approach is that the DM results in this study reveals stronger identification than the DM results of existing DM approaches because the values of the

relative closeness degrees show bigger difference than the score values in the existing approaches. In the future work, the developed approach will be further extended to other fields, such as image processing and clustering analysis.

报告摘要：简化中智集是中智集的一种简化形式，它是通过真、假、不确定隶属度限制在实标区间[0,1]以方便实际应用，并包含单值中智集(SV-NS)和区间中智集(IV-NS)。然后，叶提出了简化中智数减运算,（包含单值中智数减运算和区间值中智数减运算）。但是，当前的中智数减运算缺乏实际应用。在多属性决策问题中由于简化中智数集成算子是重要的数学工具之一，到目前为止简化中智数减运算集成算子一直没有研究。针对简化中智数减运算（单值中智数减运算与区间值中智数减运算），本文提出了单值中智数减运算加权算术平均算子（SV-NNSOWAA）、区间值中智数减运算加权算术平均算子（IV-NNSOWAA）作为现有简化中智数集成算子的必要补充，然后建立了它们的决策方法。最后，通过一个说明性实例来阐述所提方法的可应用性和有效性。因为，所提决策方法中的相关接近度值比现有决策方法中的计分值存在较大的差异性，因此，所提决策方法的决策结果比现有方法的决策结果显示出较强辨识力的优点。在将来的研究中，所提方法将可进一步拓展到其它领域，如图像处理与聚类分析。

Plenary Report 9

Title: M-polar fuzzy sets---An extension of bipolar fuzzy sets

题目：M 级模糊集---双级模糊集的一种推广

Biography:

Shenggang Li, Male, Shaanxi Normal University, Professor, PhD Supervisor. The main research topics: Fuzzy Topology, Fuzzy Matroids, Rough Sets. Shenggang Li has published over 50 papers, including over 30 papers indexed by SCI and 4 ESI Papers. Now he has hosted several National foundations.

报告人简介：李生刚，男，陕西师范大学，教授，博导，主要研究领域为：模糊拓扑、模糊拟阵、粗糙集。已在国内外重要杂志和国际学术会议上发表学术论文 50 余篇，其中 SCI 收录近 30 篇，ESI 论文 4 篇。主持过国家自然科学基金面上项目多项。

Abstract:

In this talk we will prove that bipolar fuzzy sets and $[0,1]^2$-sets are actually cryptomorphic mathematical notions. We put forward (or highlight) the notion of m-polar fuzzy set (actually, $[0,1]^m$ which can be looked as a generalization of bipolar fuzzy set, where m is an arbitrary ordinal number), and illustrate how many concepts which have been defined based on bipolar fuzzy sets and many results which are related to these concepts can be generalized to the case of m-polar fuzzy sets. We also give examples to show how to apply m-polar fuzzy sets in real world problems.

报告摘要： 本报告将证明双级模糊集是$[0,1]^2$-集并且说明其推广概念(即 M 级模糊集)在理论和实际应用中的一些可能的应用。

Plenary Report 10

Title: Fusions of neutrosophic sets, rough sets and three-way decisions

题目：中智集、粗糙集与三支决策的融合

Biography:

Hai-Long Yang, Shaanxi Normal University, Professor, PhD Supervisor. He received his MS degree in basic mathematics in 2006 and PhD degree in basic mathematics in 2010 from Shaanxi Normal University, China. From 2012–2016, he was a postdoctoral researcher in School of Management, Xi'an Jiaotong University, China. Between August 2014–August 2015, he was a visiting scholar in University of Regina, Canada. He has worked in School of Mathematics and Information Science, Shaanxi Normal University since 2001, where he was promoted to associate professor in 2011 and full professor in 2017. He has published over forty academic papers, most of which are in international journals. His current research interests include three-way decisions, rough sets, neutrosophic sets, and intelligent information processing.

报告人简介：杨海龙，博士（后），陕西师范大学数学与信息科学学院教授，博导。2012 年 7 月至 10 月，在中科院数学与系统科学研究院做访问学者，2012 年 12 月至 2016 年 11 月，在西安交通大学管理学院从事博士后研究，2014 年 8 月至 2015 年 8 月，在加拿大里贾纳大学做访问学者。现为国际粗糙集学会会员，中国人工智能学会高级会员，中国人工智能学会粒计算与知识发现专委会委员。在《Fuzzy Sets and Systems》、《Information Sciences》、《Knowledge-Based Systems》、《International Journal of Approximate Reasoning》、《Computers and Mathematics with Applications》、《Soft Computing》、《International Journal of Machine Learning and Cybernetics》等国内外学术期刊上发表论文 40 多篇。近几年，先后主持的项目有：国家自然科学基金面上项目、中国博士后基金项目、陕西省博士后基金项目、中央高校基本科研业务费重点项目、一般项目各 1 项。目前主要研究领域：三支决策，粗糙集，智能信息处理。

Abstract:

This talk contains two folds: 1. Fusions of neutrosophic sets and rough sets. In this part, we will introduce single valued neutrosophic rough sets, generalized interval neutrosophic rough sets, single valued neutrosophic refined rough sets, and (I, N)-single valued neutrosophic rough sets based on single valued neutrosophic triangle norm. 2. Fusions of neutrosophic sets and three-way decisions. In this part, we will introduce three-way decision model and method based on decision-theoretic rough sets with single valued neutrosophic information.

报告摘要：在这个报告中，我们将讨论两个方面的内容。1、中智集与粗糙集的融合，

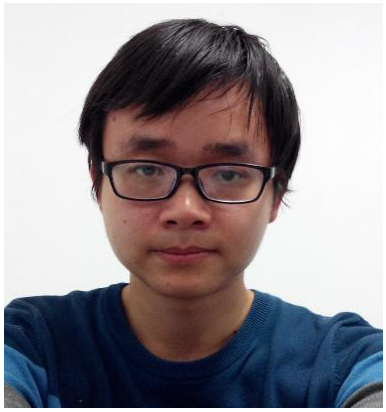
将介绍单值中智粗糙集、广义区间中智粗糙集、单值中智精细粗糙集以及基于单值中智三角模的（I,N）-单值中智粗糙集等四种融合模型。2、中智集与三支决策的融合，将介绍单值中智信息下基于决策粗糙集的三支决策模型与方法。

Plenary Report 11

Title: A bibliometric analysis of neutrosophic set: two decades review from 1998 to 2017

题目：中智集的文献计量分析：1998 年至 2017 年的二十年回顾

Biography:



Xindong Peng is a lecturer in SGU and PhD candidate in NUDT. He is a guest commentator of Mathematical Reviews and a reviewer of more than 30 SCI/SSCI journals including TFS, KBS, AIR, ASOC, TEDE, EAAI, KAIS and JCP. He has been engaged in the research of uncertain multi-attribute decision-making methods and their applications, and has published more than 30 papers in SCI/SSCI journals such as ASOC, TEDE, AIR, IJIS and NCAA.

报告人简介：彭新东，韶关学院讲师，国防科技大学博士生。担任 Mathematical Reviews 特邀评论员与 TFS、KBS、AIR、ASOC、TEDE、EAAI、KAIS、JCP 等 30 多本 SCI/SSCI 期刊审稿人。长期从事不确定多属性决策方法及其应用研究，在 ASOC、IJIS、TEDE、AIR、NCAA 等 SCI/SSCI 期刊上发表论文 30 余篇。

Abstract:

Neutrosophic set is a novel tool to deal with vagueness more sufficiently than intuitionistic fuzzy set. Neutrosophic set has been extended to new types and these extensions have been used in many areas such as aggregation operators, decision making, image processing, information measures, graph and algebraic structures. Because of such a growth, an overview on neutrosophic set with the aim of offering a clear perspective on the different concepts, tools and trends related to their extensions are presented. A total of 137 neutrosophic set publication records from WoS are analyzed. Many interesting results with regard to the annual trends, the top players in terms of country level as well as institutional level, the publishing journals, the highly cited papers, and the research landscape are yielded and explained in-depth. The results indicate that some developing economics are quite active in neutrosophic set research. Moreover, the co-authorship analysis of the country and institution, the co-citation analysis of the journal, reference and author, and the co-occurrence analysis of the keywords are presented by VOSviewer software.

报告摘要：中智集是一种比直觉模糊集更有效地处理不确定性的新工具。中智集已扩展到新的类型，并且这些扩展模型被用于聚合算子，决策，图像处理，信息测度，图和代数结构的许多领域。由于这种增长，提出了关于中智集的概述，目的是对与它们的扩展有关的不同概念，工具和趋势提供清晰的视角。分析了来自 WoS 的 137 个中智集记录，探索并深入解释了有关年度趋势，国家级和机构级等顶级参与者，出版期刊，高被引论

文以及研究前景的许多有趣结果。结果表明，一些发展中经济体在中智集研究中非常活跃。此外，VOSviewer 软件还提供了国家和机构的共同作者分析；期刊，文献和作者的共同引文分析以及关键字的共现分析。

Plenary Report 12

Title: From Boolean algebras to pseudo EQ-algebras

题目：从布尔代数到伪 EQ-代数

Biography:

Xiaolong Xin is a professor of the School of Mathematics of Northwest University. He received his PhD degree from the National Gyeongsang University in Korea in 1999. He serves as the editorial board members of some journals, such as *Chinese Journal of Mathematics*, *Hyper structures and logic algebras*, *Annals of Communications in Mathematics*, etc. Currently, he has mainly studied fuzzy logics, logical algebras and uncertainty theory. He has published more than 130 papers in academic journals, and guided more than 50 graduate students and 14 PhD students. He has been the leader of more than 10 fund projects, which are the National Natural Science Foundation of China, the Ministry of Education's Returned Overseas Chinese Research Fund, and the Shaanxi Provincial Education Natural Science Fund Project. He won the first prize of Science and Technology Progress Award of Shaanxi Province in 2009 and the second prize of Shaanxi Science and Technology Award in 2013. Besides, he published 6 monographs in Science Press and Higher Education Press.

报告人简介：辛小龙，教授，博士生导师。1997 年至 1999 年于韩国国立庆尚大学攻读博士并获理学博士学位。2001 年晋升为教授, 现为西北大学数学学院三级教授。现担任国际学术杂志《Chinese Journal of Mathematics》、《Hyper structures and logic algebras》、《Annals of Communications in Mathematics》的编委，中文杂志《纯粹数学与应用数学》、《运筹与模糊学》等期刊的编委。目前主要从事模糊逻辑、逻辑代数、序代数上的算子和不确定性理论等方向的研究工作。在国内外学术刊物发表论文 130 余篇(SCI 收录 70 余篇，EI 收录 40 余篇)，共招收培养代数学和信息论与密码学方向的硕士研究生 50 余名，博士研究生 14 名。先后主持国家自然科学基金、教育部留学回国人员科研基金、陕西省教自然科学基金项目等基金项目 10 余项，1994 年获陕西省科技进步一等奖，2007 年获陕西省优秀教学成果奖二等奖，2009 年获陕西省高等学校科学技术进步奖一等奖，2013 年获陕西省科学技术奖二等奖。在科学出版社和高教出版社出版教材和专著共 6 部。

Abstract:

In this talk, we will present connections between the Boolean algebras and classical logic, MV-algebras and fuzzy logic, effect algebras and quantum logic, and EQ-algebras and higher-order fuzzy logic. Then we introduce a new structure called pseudo EQ-algebras,

which are generalization of EQ-algebras. We present some related properties of pseudo EQ-algebras, good pseudo EQ-algebras and residuated pseudo EQ-algebras, respectively. Especially we discuss the relations between pseudo EQ-algebras and pseudo residuated lattices, pseudo equalities, pseudo BE-algebras, pseudo BCK-algebras and pseudo hoops. Then we set up the connection from meet-semilattices groups to pseudo EQ-algebras. Moreover, we introduce notions of prefilters and filters in pseudo EQ-algebras. By use of strong normal filter, we set up a quotient space and show that it is a separated pseudo EQ-algebra. Finally, we will introduce the notion of forest product of EQ-algebras, and prove that a kind of finite EQ-algebras are representable as forest products of finite pseudo EQ-chains.

报告摘要：首先，我们将介绍布尔代数和经典逻辑、MV-代数和模糊逻辑、效应代数和量子逻辑以及 EQ-代数和高阶模糊逻辑之间的内在联系及其相互影响。其次，我们将重点讨论伪 EQ-代数，建立其公理化体系，研究它与其余伪结构之间的关系，完善 EQ-代数的滤子理论，为高阶模糊逻辑的多样化推理方法奠定代数基础。最后，我们引入伪 EQ-代数的森林积的概念，并证明一类有限伪 EQ-代数可以表示为一些有限伪 EQ-链的森林积。

Plenary Report 13

Title: Unifying discriminative learning principles based on mathematical programming

Biography:

Jing He is a professor in school of software and electrical engineering, Swinburne University of Technology (SUT, Australia), and chairman of international society of algorithm and chips (ACS). She was awarded a PhD degree from the Academy of Mathematics and System Science, Chinese Academy of Sciences and joined SUT in 2018 from Victoria University (Australia), where she has been promoted to a full professor at the age of 38. Prior to joining Victoria University, (2008-2018), she worked in the University of Chinese Academy of Sciences, China during 2006-2008. She has been active in areas of Data Mining, Web service/Web search, Spatial and Temporal Database, Multiple Criteria Decision Making, Intelligent Systems, Scientific Workflow and some industry fields such as E-Health, Petroleum Exploration and Development, Water Recourse Management and e-Research. She has published over 150 research papers (including 77 SCI-cited papers) in refereed international journals and conference proceedings, including Information Sciences, ACM Transaction on Internet Technology (TOIT), IEEE Transaction on Knowledge and Data Engineering (TKDE), Information Systems, the Computer journal, Computers and Mathematics with Applications, Concurrency and Computation: Practice and Experience, International Journal of Information Technology & Decision Making, Applied Soft Computing, and Water Resource Management. She has received over 7 million Australian

dollars research funding from the Australian Research Council (ARC) with ARC Early Career Researcher Award (DECRA), ARC Discovery Project, ARC Linkage Project and National Natural Science Foundation of China (NSFC) since 2007.

Abstract:

The classification model could be used for identifying cancers by gene selection, resource allocation in decision making, image processing in artificial intelligence, and so on. How to classify the unknown samples efficiently and effectively is among the most critical and challenging procedures in machine learning. We propose a unified model in feature space based on mathematical programming (UMFS). UMFS adopts two central ideas. First, it uses a global measurement rather than a local approximation; second, it embeds a multiple criteria and non-convex mathematical programming to unify the discriminative learning principles. Through classification accuracy-based iterations, UMFS obtains the feature weight vector and finally extracts the optimal feature subset. The performance of the proposed method is evaluated in extensive experiments on synthetic and real microarray benchmark datasets. Eight classical feature selection methods, four classification models, and two popular embedded learning schemes, including CNN, Fisher's discrimination, *k*-nearest neighbor (KNN), hyperplane *k*-nearest neighbor (HKNN), Support Vector Machine (SVM), Random Forest and Logistic regression are employed for comparisons.

Plenary Report 14

Title: General forms of ordinal sums of fuzzy implications

题目：模糊蕴涵序和的一般形式

Biography:

Hongjun Zhou, male, born in 1980, is a professor and doctoral supervisor with the School of Mathematics and Information Science of Shaanxi Normal University. He is currently the Deputy Secretary-General of the Fuzzy Mathematics and Systems Association of China, the Deputy Secretary-General of the Non-Classical Logic and Computation Association of China, and the editorial board member of the Journal of Shaanxi Normal University (Natural Science Edition). His research interests include Ordered Algebra and Logic, Mathematics of Uncertainty. He finished 3 projects granted by NSF of China, and published more than 40 journal papers and 2 treatises in Science Press. He made more than 10 invited talks on domestic or international conferences in related fields. He won the 2012 Excellent Doctoral Dissertation of Shaanxi Province, and was selected as the 2016 Youth Science and Technology New Star and the 2017 Youth and Middle-aged Science and Technology Innovation Leader of Shaanxi Province.

报告人简介：周红军，男，1980 年生，陕西师范大学数学与信息科学学院教授，博士

生导师。现任中国系统工程学会模糊数学与模糊系统专委会副秘书长，中国逻辑学会非经典逻辑与计算专委会副秘书长，《陕西师范大学学报（自然科学版）》编委。主要从事序代数与逻辑、不确定性数学研究。主持完成国家自然科学基金青年项目 1 项、面上项目 2 项，教育部博士点基金新教师类项目、陕西省青年科技新星计划项目及陕西省基础研究计划各 1 项。在国内外学术期刊上发表论文 40 余篇，在科学出版社出版专著 2 部，在相关国内国际会议上作大会学术报告 10 多次。曾获陕西省 2012 年度优秀博士学位论文，入选陕西省 2016 年度青年科技新星与 2017 年度中青年科技创新领军人才。

Abstract:

The present talk will present two construction ways to study the general forms of ordinal sums of fuzzy implications with the intent of unifying the ordinal sums existing in the literature. The first ordinal sum construction way, which we call ``Implication Complementing'', is to study how to complement a specific fuzzy implication to the linear transformations of given fuzzy implications defined on respective disjoint subsquares whose principal diagonals are segments of the principal diagonal of the unit square, in order that the resulting ordinal sum on the unit square is a fuzzy implication. The second way, which we call ``Implication Reconstructing'', is to study how to reconstruct an initial fuzzy implication through replacing its some values on given rectangular regions of the unit square with the respective linear transformations of given fuzzy implications such that the redefined function is a new fuzzy implication. In both ways, necessary and sufficient conditions for the final reconstructed functions to be fuzzy implications are given and several new constructions of ordinal sums of fuzzy implications are obtained, which generalize the existing ordinal sums from several aspects.

报告摘要：为统一目前文献中的各种序和模糊蕴涵，本报告将提出模糊蕴涵序和一般形式的两种构造方法。第一种序和构造法，称为“蕴涵补充”构造法，将研究如何在沿单位方形的主对角线的互不相交子方形上定义的给定模糊蕴涵的线性变换的基础上补充一个模糊蕴涵使它们的序和构成新的模糊蕴涵。第二种序和构造法，称为“蕴涵改造”法，将研究如何利用给定模糊蕴涵的线性变换改造一个初始模糊蕴涵在相应区域上的函数值使之成为新的模糊蕴涵。在这两种序和构造方法中，我们将给出构造出的函数是模糊蕴涵的充要条件，进而给出多种新型的序和模糊蕴涵。这些广义序和蕴涵将从多个角度推广已有的序和蕴涵。

Plenary Report 15

Title: Three-way Concept Analysis and Others

题目：三支概念分析及其它

Biography:

Ling Wei is a professor and doctoral supervisor of the School of Mathematics of Northwest University. She is an executive member of the Professional Committee on Granular Computing and Knowledge Discovery of the Chinese Academy of Artificial Intelligence. She has ever been a visiting scholar at the Chinese University of Hong Kong and

the University of Regina. She has long been engaged in research and teaching of formal concept analysis, rough set theory, granular computing, and probability theory. She has presided over four projects of the National Natural Science Foundation of China, published about 90 papers in domestic and foreign journals and international conferences, such as *Science China*, *IEEE Transactions on Cybernetics*, *Information Sciences*, and *Knowledge-Based Systems*.

报告人简介：魏玲，西北大学数学学院教授，博士生导师，中国人工智能学会粒计算与知识发现专业委员会常务委员。曾在香港中文大学、加拿大里贾那大学进行访问研究。长期从事形式概念分析、粗糙集理论、粒计算、概率论等方面的研究与教学工作。主持国家自然科学基金项目四项，在《中国科学》、《IEEE Transactions on Cybernetics》、《Information Sciences》、《Knowledge-Based Systems》等国内外期刊和国际会议发表论文约 90 篇。

Abstract:

The theory of formal concept analysis is introduced firstly, including the basic notions and main research topics; then, the idea of theory of three-way decision is presented. Finally, three-way concept analysis is given. The main research framework and methods of three-way concept analysis are still that of formal concept analysis, while the core semantic is from the theory of three-way decision.

报告摘要：首先介绍形式概念分析理论的基本概念与研究内容，其次阐述三支决策理论的核心思想；在此基础上，介绍将二者结合所产生的三支概念分析的思想、基本定义，以及其他相关内容。

Plenary Report 16

Title: The partially ordered data analysis and multi-label learning based on neighborhood rough sets

题目：基于邻域粗糙集的局部序数据分析和多标记学习

Biography:

Hongying Zhang, Female, Xi'an Jiaotong University, Professor, PhD Supervisor. The main research topics include: Granular Computing, Approximate Reasoning, Uncertain Big Data Analysis. Hongying Zhang has published over 30 papers, including over 20 papers indexing by SCI and 2 ESI Papers. Now she is the Committee Member of GCKD Committee in CAAI, Committee on Fuzzy Mathematics and Fuzzy Systems in Systems in Engineering Society of China (SESC), Knowledge Engineering and Distributed Intelligence Committee in CAAI. She has visited the University of Texas at Austin, the Chinese University of Hongkong, the University of Regina. She has hosted several National foundations.

报告人简介：张红英，女，西安交通大学，教授，博导，主要研究领域为：粒计算、近

似推理、不确定大数据分析。已在国内外重要杂志和国际学术会议上发表学术论文 30 余篇，其中，SCI 收录近 20 篇，ESI 论文 2 篇。目前是中国人工智能学会粒计算与知识发现专委会、中国系统工程学会模糊数学与模糊系统专委会、中国人工智能学会知识工程与分布式智能专委会委员。多次到美国德州大学奥斯汀分校、香港中文大学、加拿大 Regina 大学等国内外著名大学进行学术交流。主持国家自然科学基金面上项目多项。

Abstract:

Uncertainty analysis is the core assignment and research foundation of dig data analysis. Neighborhood rough sets is a kind of vital approach to uncertain data analysis. This lecture mainly introduced the partially ordered data analysis and multi-label learning based on neighborhood rough sets. The parallel algorithm has been designed to cope with the large-scale data and the experiments showed the efficiency and effectiveness.

报告摘要：不确定信息处理与分析是大数据时代数据分析和未来人工智能的核心任务和研究基础。邻域粗糙集是一种重要的不确定数据分析工具。本报告主要介绍本人及其团队在利用邻域粗糙集模型研究基于模糊偏好关系的局部序数据集的特征提取并设计并行算法将其应用到大规模数据分析中的研究成果；同时鉴于数据日益复杂，呈现多标记特性，我们将介绍团队在利用邻域粗糙集研究复杂数据的多标记学习研究中的成果。

Plenary Report 17

Title: Three-way fuzzy matroids and granular computing

题目：三支模糊拟阵与粒计算

Biography:

Xiaonan Li is an associate professor of Xidian University. He mainly studies data processing based on uncertain mathematical methods, such as rough sets and fuzzy sets, three-branch decision theory and application, matroid and its extension. He has published more than 20 papers in journals such as *China Science*, *Fuzzy Sets and Systems*, *Information Science*, *International Journal of Approximate Reasoning*, and *Soft Computing*. He is the leader of some fund projects, such as the National Natural Science Foundation of China and the Shaanxi Provincial Education Natural Science Fund Project.

报告人简介：李小南，1981 年生于陕西长安，博士，副教授，博士生导师，陕西省数学会理事。主要研究方向为基于粗糙集、模糊集等不确定性数学方法的数据处理、三支决策理论与应用、拟阵及其推广。在《中国科学》、《Fuzzy sets and systems》、《Information Science》、《International Journal of Approximate Reasoning》、《Soft Computing》等期刊上发表论文二十余篇，主持完成国家自然科学基金青年基金一项、中央高校基本科研业务费 3 项；主持在研国家自然科学基金面上项目一项、陕西省自然科学基础研究计划面上项目一项，荣获西安市科技进步 2 等奖 1 项。

Abstract:

Three-way decision is a new information-process approach introduced by Prof. Y.Y Yao in 2009. Matroid is a combinatorial structure and connects closely with graph theory. Based on three-way decision theory, we propose a generalization of matroid: three-way fuzzy matroids. Construction and properties of three-way fuzzy matroids are also studied. Granular computing is a theory and tool of problem solving and information processing based granular structures. The three main ingredients of granular structures are granules, levels and hierarchies. We point out that three-way fuzzy matroids give specific mathematical models of three elements of granular structures.

报告摘要：三支决策是姚一豫教授于 2009 年提出的一种新的信息处理方法。拟阵是一种组合结构且和图论联系紧密。基于三支决策方法，提出了一种拟阵推广理论，即三支模糊拟阵。研究了三支模糊拟阵的构造及性质。粒计算是基于粒结构的思维模式及问题求解、信息处理的理论和工具。粒结构的三要素为粒、层次、系统，我们指出三支模糊拟阵恰好给出了一个粒结构三元论的具体数学模型。

Plenary Report 18

Title: Soft Set from the Perspective of Methodology: a Soft Decision Making Scheme

题目：从方法论角度看软集：一种软决策模式

Biography:

Han Banghe, an associate professor from the School of Mathematics and Statistics, Xidian University. He was graduated from Shaanxi Normal University, majored in basic mathematics. At present, he is mainly engaged in the education of mathematical modeling, the research of uncertainty reasoning and computational intelligence. He is familiar with propositional logic, multi-valued logic, fuzzy set theory, valued algebra, soft constraint, soft set and so on. In recent years, he has been focused on the research of soft set theory, especially in the reduction of soft set parameters and the decision-making methods of incomplete soft sets. His research results have been published in international journals like *European Journal of Operational Research*, *Knowledge Based Systems*, *Applied Mathematical Modelling* and *Applied Soft Computing*.

报告人简介：韩邦合，西安电子科技大学数学与统计学院副教授，毕业于陕西师范大学，基础数学专业。目前主要从事数学建模教育，不确定性推理与计算智能方向的研究，熟悉命题逻辑、多值逻辑、模糊集理论、赋值代数、软约束、软集等领域。近几年来一直专注软集理论方面的研究，特别是在软集参数约简以及不完备软集的决策方法上取得了一些成果。这些成果发表在国际期刊《European Journal of Operational Research》、《Knowledge Based Systems》、《Applied Mathematical Modelling》、《Applied Soft Computing》上。

Abstract: From the mathematical point of view, soft set is a set-valued mapping, which can

be expressed as a 0-1 matrix (table) or image. In recent years, the research of soft set has fallen into a low ebb. In the reporter's opinion, the reason is that its mathematical description is relatively broad, and it lacks its own unique semantics and research category. As a result, on the face of it, soft set overlaps with information system, relationship, fuzzy relationship, etc. The unilateral model extensions are difficult to support the development of soft set theory. From the perspective of methodology, this report tends to take the concept of soft set as a soft decision-making mode itself, which tells us decision making should be different to different situations and we should never make it one-size-fits--all. Some examples will be given to improve the understanding of the proposed idea.

报告摘要：软集从数学角度，就是一个集值映射；其可以表示为一个 0-1 矩阵（表格）或者图像。近几年软集的研究陷入低谷，究其原因是因为其数学刻画比较宽泛，缺乏自身独特的语义及研究范畴，从而造成了与信息系统、关系、模糊关系等的重叠，单方面的模型推广难以支撑软集理论的发展。本报告提出：从方法论角度，提出软集概念本身是给出了一种软决策模式，本质上是对具体问题具体分析，实事求是，不搞一刀切的内涵刻画。报告给出的若干实例，将有助于提升对软集概念的认识。

Plenary Report 19

Title: Neutrosophic fusion of rough set theory: An overview

题目：粗糙集理论的中智融合综述

Biography:

Chao Zhang, an associate professor of Institute of Intelligent Information Processing, Shanxi University. His main study interests include granular computing and intelligent decision making. In recent years, he has published more than 20 first-author papers including *Information Sciences*, *Applied Mathematical Modelling*, and *Journal of Computer Research and Development*. Among them, one paper has been selected as "ESI highly cited paper". He has published 3 academic monographs in national publishers. He has published 2 national invention patents. He has been awarded the first prize of Outstanding Achievements in Scientific Research in Institutions of Higher Learning in Shanxi Province, the second prize of Outstanding Achievement Award in Social Sciences in Shanxi Province, two Excellent Academic Paper Awards in Taiyuan City, ACM Excellent Doctoral Dissertation Award in Taiyuan Chapter, the best student paper award in CGCKD. He has also been in charge of six projects sponsored by National Natural Science Foundation of China, Key Program of Natural Science Foundation of Shanxi Province and others. He has been selected as "Sanjin Talent", Cultivation Plan for Excellent Young Scholars in Institutions of Higher Learning in Shanxi Province.

报告人简介：张超，山西大学智能信息处理研究所副教授，硕士生导师，主要从事粒计算与智能决策研究。近年来以第一作者身份在《Information Sciences》、《Applied

Mathematical Modelling》、《计算机研究与发展》等国内外重要学术刊物上发表论文 20 多篇，其中 1 篇论文入选“ESI 高被引论文”。在国家级出版社出版学术专著 3 部。公开国家发明专利 2 项。获得山西省高等学校科学研究优秀成果奖一等奖、山西省社科联“百部篇工程”二等奖、太原市科协自然科学优秀学术论文一、二等奖、ACM 中国理事会太原分会优秀博士论文奖、中国粒计算与知识发现学术会议优秀学生论文奖等奖项。主持国家自然科学基金、山西省重点研发计划等项目 6 项。入选山西省“三晋英才”支持计划、山西省高等学校青年科研人员培育计划。

Abstract:

Neutrosophic sets (NSs) and logic are one of the influential mathematical tools to manage various uncertainties. Among diverse models for analyzing neutrosophic information, rough set theory (RST) provides an effective way in the field of neutrosophic information analysis, and a multitude of scholars have focused on neutrosophic fusion of RST in recent years. At present, there are not comprehensive literature reviews and statistics of these generalized rough set theories and applications. This review study first explores a summarization of current neutrosophic fusion of RST from five basic aspects, i.e., rough neutrosophic sets (RNSs) and neutrosophic rough sets (NRSs), soft rough neutrosophic sets (SRNSs) and neutrosophic soft rough sets (NSRSs), mathematical foundations of RNSs and NRSs, RNSs and NRSs-based decision making, RNSs and NRSs-based other applications. Then, on the basis of the overview from five fundamental perspectives, a systematic bibliometric overview of current works with respect to neutrosophic fusion of RST is further conducted. Finally, in light of the results of this review, different challenging issues related to the main topics are listed, which are beneficial to future studies of NSs and logic.

报告摘要：中智集与中智逻辑是处理各类不确定性问题的常见数学工具。在分析中智信息的诸多模型中，粗糙集理论是一种行之有效的方法，并且近年来许多学者已逐渐关注粗糙集理论的中智融合研究。目前，还缺乏关于中智集与粗糙集融合方面的全面性文献综述与统计。本篇综述性研究首先从五个方面总结了粗糙集理论的中智融合研究，即：粗糙中智集与中智粗糙集、软粗糙中智集与中智软粗糙集、粗糙中智集与中智粗糙集的数学基础、基于粗糙中智集与中智粗糙集的决策、基于粗糙中智集与中智粗糙集的其他应用。接着，基于之前五个方面的总结，我们做了已有粗糙集理论的中智融合方面的文献统计。最后，依据本篇综述的结论，我们总结了主要研究话题的未来发展趋势，它们同样有益于推动未来中智集与中智逻辑的研究。

Plenary Report 20

Title: Probabilistic Neutrosophic Hesitant Fuzzy Sets and Its Application in Complex Fuzzy Multi-attribute Decision Making

题目：概率中智犹豫模糊集及其在复杂模糊多属性决策中的应用

Biography:

Songtao Shao received the M.S. in foundation of mathematics from Liaocheng University, Liaocheng, China, in 2017 and is currently pursuing the PhD

degree under the supervision of Prof. Xiaohong Zhang in the College of Information Engineering, Shanghai Maritime University, Shanghai, China. His current research interests include fuzzy logic and rough set theory, neutrosophic set theory, uncertainty mathematics and its application in artificial intelligence and management decision.

报告人简介：邵松涛于 2017 年在聊城大学获得基础数学硕士学位。目前在上海海事大学信息工程学院攻读博士学位（导师：张小红教授）。主要研究方向：模糊逻辑与粗糙集理论、中智集理论、不确定性数学及其在人工智能与管理决策中的应用。

Abstract:

The concurrence of randomness and imprecision widely exists in real-world problems. To describe the aleatory and epistemic uncertainty in a single framework and take more information into account, we propose the concept of probabilistic neutrosophic hesitant fuzzy set (PNHFS) and define the basic operation laws of PNHFSs. According to whether there are correlations in decision attributes, we also propose different types of aggregation operators. The model is applied to the complex fuzzy multi-attribute decision-making problem of maintaining the safety of the site operation system. The validity and flexibility of the concept are illustrated, and the advantages and limitations of PNHFS are discussed in detail.

报告摘要：随机性和不精确性并存在于现实世界中的多属性决策问题中。为了在单个框架中描述随机性和认知不确定性，考虑更多的信息，我们将概率论与中智犹豫模糊集结合，提出了概率中智犹豫模糊集，定义了 PNHFS 的基本运算法则，并构造了属性无关下的基本集成算子和属性相关下的概率中智犹豫模糊 Choquet 集成算子、广义 Shapley 概率中智犹豫模糊 Choquet 集成算子。将该模型应用于维护工地作业系统安全的复杂模糊多属性决策问题中，说明了该概念的有效性和灵活性，并详细讨论了 PNHFS 的优点和局限性。

Written Reports

(书面报告)

Written Report 1

Title: Neutrosophic Extended Triplet Group and Generalized Neutrosophic Extended Triplet Group

题目：中智扩展三元群和广义中智扩展三元群

Biography:

Yingcang Ma, Xi'an Polytechnic University, Professor, Master Supervisor. He received his MS degree in Basic mathematics in 2000 from Shaanxi Normal University and PhD in Computer science and Software in 2006 from Northwestern Polytechnical University, China. Between Jan. 2015–August 2016, he was a visiting scholar in University of Nebraska at Omaha, NE, USA. Currently, he is a professor at School of Science, Xi'an Polytechnic University. He is also a Committee Member of Mathematical Society of Shaanxi Province, Committee Member of Industrial and Applied Mathematics Society of Shaanxi Province, etc. He has published over seventy academic papers and his current research interests include machine learning, neutrosophic sets and uncertainty reasoning theory.

报告人简介：马盈仓，博士（后），西安工程大学理学院教授，硕导。2000 年陕西师范大学数学系硕士毕业，2006 年西北工业大学博士毕业。2015.1-2016.1 美国内布拉斯加大学（奥马哈）访问学者。现为陕西省数学学会理事、陕西省工业与应用学会理事等。近年来，发表论文 70 余篇，主要研究方向为机器学习、中智集及不确定性推理理论。获陕西省自然科学三等奖 1 项、陕西高等学校科学技术一等奖二等奖各 1 项、陕西省自然科学优秀学术论文三等奖 1 项。

Abstract:

In this report, we will introduce the neutrosophic extended triplet group(NETG) and generalized neutrosophic extended triplet group(GNETG), which are different from the classical group. Firstly, the definition of the NETG is introduced and the properties are studied. Moreover, the relations of generalized groups, completely regular semigroup and NETG are given. Secondly, the fact is revealed that (Zn, •) is an example of NETG iff the factorization of n is a product of single factors. Thirdly, the neutrosophic ring, neutrosophic quadruple ring and refined n-ary neutrosophic ring are introduced. The idempotents, neutral element and opposite elements of them are deeply studied. Moreover, algorithms for solving the neutral element and opposite elements of each element in neutrosophic ring (or neutrosophic quadruple ring, or refined n-ary neutrosophic ring) are given. Lastly, the notion of generalized neutrosophic extended triplet group is proposed and some properties are

discussed. In particular, the following conclusions are strictly proved: (1) an algebraic system is a generalized neutrosophic extended triplet group if and only if it is a quasi-completely regular semigroup; (2) an algebraic system is a weak commutative generalized neutrosophic extended triplet group if and only if it is a quasi-Clifford semigroup. (3) for each n, (Zn, •) is a commutative generalized neutrosophic extended triplet group.

报告摘要：在这个报告中，我们主要介绍中智扩展三元群和广义中智扩展三元群。首先，介绍了中智扩展三元群的定义及其与广群、完备正则半群的关系。其次，揭示了(Zn, •)是中智扩展三元群当且仅当 n 是单因子的乘积。第三，给出了中智环、中智四元素环和加细 n 元中智环的定义，并通过算法给出它们中每个元素的中元和反元的计算。最后，给出了广义中智扩展三元群，讨论它与拟完备正则半群的关系，给出了(Zn, •)是交换的广义中智扩展三元群。

Written Report 2

Title: Some results on fusions of neutrosophic sets and rough sets

题目：关于中智集和粗糙集融合的一些结果

Biography:

Hu Zhao received the B.S. degree in mathematics and applied mathematics from Datong University, Datong, China, in 2007, received the M.S. degree in mathematics from Shaanxi Normal University, Xi'an, China, in 2010, and the PhD degree in mathematics from Shaanxi Normal University, Xi'an, China, in 2014. He was awarded the National scholarship for PhD students in 2013. He is currently an associate professor of Xi'an Polytechnic University.

Dr. Zhao is one of the editorial board members for International Journal of Management and Fuzzy Systems and SCIREA Journal of Mathematics. His research interests are in the fields of fuzzy topology, rough sets, neutrosophic sets, and neutrosophic decision-making problems. His work has been published in a number of different journals including *Iranian Journal of Fuzzy systems*, *Journal of intelligent and fuzzy systems*, *Symmetry*, *Journal of computational analysis and applications*, *Annals of Fuzzy Mathematics and Informatics*, *Asia Mathematika*, and so on.

报告人简介：赵虎，博士，西安工程大学理学院副教授，硕士生导师，九三学社社员，中国工业与应用数学学会专业会员，第一届中国自动化学会粒计算与多尺度分析专业委员会委员。在《Artificial Intelligence Review》、《Iranian Journal of Fuzzy systems》，《Journal of Intelligent and Fuzzy Systems》和《模糊系统与数学》等国内外著名杂志发表和接收学术论文 30 多篇。近几年，主持陕西省教育厅专项科研项目 1 项（18JK0360），合作青海省科技厅项目 1 项（2019-ZJ-7078），参与国家自然科学基金面上项目 2 项（11771263，61473181），参与国家自然科学基金青年科学基金项目 1 项（11301316），主持西安工程大学博士启动基金 1 项（BS1426）。 目前主要研究领域：模糊拓扑，粗糙集，中智集，三支决策等。

Abstract:

This written report contains three folds: 1. We do a comprehensive study on the upper and lower single valued neutrosophic rough approximation operators proposed by professor Yang hailong et al. It is proved that the completely lattice isomorphic relationship between upper single valued neutrosophic rough approximation operators and lower single valued neutrosophic rough approximation operators. In this way, some research gaps in single valued neutrosophic rough approximation space are added. 2. We define the morphisms between all single valued neutrosophic relational spaces, then we show that the category of all single valued neutrosophic relational spaces and their morphisms are topological and cartesian closed over Set with respect to the forgetful factor, As a special case, some results on quotient and product single valued relational spaces were given. 3. On hesitant neutrosophic rough set over two universes and its application were mainly studied. By comparing with the previous model, the generality of the current model is proved

报告摘要：我们做了三个方面的内容：1、对杨海龙教授等人提出的单值中智上下近似算子进行更深入的研究，证明在一定条件下，单值中智上下近似算子的总体之间是完备格同构的，从而增补单值中智粗糙近似空间的一些研究空白。2、定义了单值中智关系空间之间的态射，证明单值中智关系空间范畴是拓扑范畴和笛卡尔闭范畴， 作为特例，给出单值中智关系空间的子空间、商空间和积空间等。3、主要研究两个域上的犹豫中智粗糙集模型及其应用，并对该模型和之前存在的模型对比，证明该模型的广义性。

Written Report 3

Title: New Results on Neutrosophic Extended Triplet Groups Equipped with a Partial Order

题目：带偏序的中智拓展三元群的若干研究

Biography:

Xin Zhou, Xi'an Polytechnic University, Lecturer. She received her MS degree in basic mathematics in 2012 and PhD degree in basic mathematics in 2015 from Shaanxi Normal University, China. She has published academic papers in some international journals such as *Journal of Intelligent & Fuzzy Systems* and *Symmetry*. Her current research interests include neutrosophic sets, rough sets and fuzzy mathematics.

报告人简介：周欣，博士，西安工程大学讲师。分别于 2012 年和 2015 年在陕西师范大学获得了硕士学位和博士学位。在《Journal of Intelligent & Fuzzy Systems》、《Symmetry》等国内外学术期刊上发表多篇学术论文。目前主要研究领域：中智集，粗糙集，模糊数学。

Abstract:

In this talk, I will propose the notion of a partially ordered neutrosophic extended triplet group (po-NETG), which is a NETG equipped with a partial order that is compatible with its multiplicative operation, and consider properties and structure features of po-NETGs. Firstly,

in a po-NETG, I will propose the concepts of the positive cone and negative cone, and investigate the structure features of them. Secondly, I will give the characterization of the positive cone in a po-WCNETG. Finally, I will present the definition of a po-NETG homomorphism between two po-NETGs, construct a po-NETG on a quotient set by endowing it a multiplication and a partial order, and discuss some fundamental properties of them.

报告摘要：在这个报告中，将给出带偏序的中智拓展三元群（简称 po-NETG）的概念。po-NETG 实际上是给 NETG 赋上了一个偏序关系，只不过这个偏序关系与 NETG 中的乘法运算相容。在这个概念的基础上，我们将进一步讨论 po-NETG 的性质和结构特征。首先，我们在 po-NETG 中给出正锥、负锥的概念并讨论它们的结构特征。其次，给出 po-WCNETG 中正锥的刻画。最后，通过在 po-NETG 商集上定义一种乘法运算和偏序关系，使得 po-NETG 商集关于这种乘法运算和偏序构成了一个新的 po-NETG，接着讨论这个基于商集的 po-NETG 和 po-NETG 同态的一些性质。

Written Report 4

Title: Single Valued Neutrosophic Covering Rough Sets and Their Applications to Decision Making

题目：中智覆盖粗糙集及其在决策中的应用

Biography:

Jingqian Wang was born in 1989. He is a PhD candidate of Class 2018 at Shaanxi University of Science & Technology. He received his master degree in applied mathematics from Minnan Normal University in 2015. From 2015–2018, he worked at Shaanxi Fashion Engineering University. He has published over twenty academic papers, most of which are in international journals, such as *International Journal of Approximate Reasoning*, *International Journal of Machine Learning* and *Cybernetics*, *Fundamenta Informaticae*, *Algebra Colloqui-um* and *Symmetry*. He presided over or participated in nine scientific research projects, including the Natural Science Foundation of Education Department of Shaanxi Province and the National Natural Science Foundation of China. His current research interests include rough sets, neutrosophic sets, fuzzy sets and intelligent fault diagnosis.

报告人简介：王敬前 (1989—)，男，甘肃兰州人，陕西科技大学 2018 级博士研究生 (导师：张小红)。2015 年获闽南师范大学应用数学专业硕士学位。2015 年至 2018 年，就职于陕西服装工程学院，任基础部专职数学教师兼教学秘书。现已发表学术论文 20 余篇，其中在《International Journal of Approximate Reasoning》、《International Journal of Machine Learning and Cybernetics》、《Fundamenta Informaticae》、《Algebra Colloquium》、《Symmetry》等期刊上发表 SCI 论文 9 篇。主持或参与科研项目 9 项，其中主持陕西省教育厅科研项目 1 项，参与国家自然科学基金项目 3 项。目前主要研究领域：粗糙集；中智集；模糊集和智能故障诊断。

Abstract:

We will report from the following three aspects: (1) We propose two types of single valued neutrosophic (SVN) covering rough set models based on SVN β-covering approximation spaces. Then, some properties and the matrix representations of the newly defifined SVN covering approximation operators are investigated. Furthermore, a corresponding application to the problem of decision making is presented. (2) We propose a new type of SVN covering rough set model based on the new inclusion relation. Furthermore, the graph and matrix representations of the new SVN covering approximation operators are presented. We investigate some relationships between the new type SVN covering rough set model and the SVN rough set model presented in the first aspect. (3) Based on (1) and (2), we present three types of (philosophical, optimistic and pessimistic) multigranulation SVN covering-based rough set models. The connections among these four models and corresponding matrix representations are investigated. Finally, these three models are applied to the problem of multi-criteria group decision making, and these methods which are used in the paper disease detection in printing press are compared with other methods.

报告摘要：我们将从以下三个方面进行报告：(1) 提出中智β-覆盖近似空间，在此基础上建立相应的中智覆盖粗糙集模型，并研究其相应的性质与矩阵表示方法，以及在决策中的应用；(2) 基于中智集中的另一种包含运算，建立新的中智覆盖粗糙集模型，研究该模型与(1)中模型的关系，并研究其矩阵和图表示方法，以及在决策中的应用。(3) 在(1)和(2)的基础上，提出三类多粒度中智覆盖粗糙集模型，并研究这三类模型之间的关系及其矩阵表示,最后提出基于多粒度中智覆盖粗糙集模型的决策方法，并以印刷厂对纸病检测为例与其他方法作对比。

Written Report 5

Title: Some New Results on Neutrosophic Sets

题目：中智集的一些新结果

Biography:

Qingqing Hu is a PhD candidate of Class 2019 at Shaanxi University of Science & Technology. She received the B.S. degree in applied mathematics from Xi'an University of Arts and Science in 2009. Her research interests include fuzzy logic and logical algebras. Since September 2017, she has been conducting research studies under the supervision of Professor Zhang Xiaohong. Her current research interests include fuzzy logic and logical algebra; neutrosophic set theory and its application.

报告人简介：胡青青，陕西科技大学 2019 级博士生。2009 年 7 月毕业于西安文理学院应用数学专业获理学学士学位，2017 年 9 月至今一直在张小红教授的指导下进行研究学习，主要研究方向有：模糊逻辑及逻辑代数；中智集理论及其应用。

Abstract:

Neutrosophic sets is an important generalization of fuzzy sets, and it plays an important role in solving the problem of uncertainty. This talk contains three parts: (1) Neutrosophic triplet group (NTG). In this part, the notions of NTG, NT-subgroups, strong NT-subgroups, and weak commutative neutrosophic triplet groups (WCNTGs) are introduced. Some new properties of NTGs are obtained and it is proved that every element has unique neutral element in any NTG. (2) Single-valued neutrosophic multisets (SVNMSs). In this part, the notions, operation and operational properties of the cut sets and strong cut sets of SVNMSs are introduced and discussed. The decomposition theorem, representation theorem and the application of a new similarity measures of SVNMSs are studied by using theoretical analysis and calculations. (3) Neutrosophic triangular norms (t-norms) and their residuated lattices. In this part, neutrosophic t-norms, neutrosophic residual implications, and the residuated lattices derived from neutrosophic t-norms are investigated deeply. Residual neutrosophic t-norms are proved to be infinitely $\vee$-distributive, and then some important properties possessed by neutrosophic residual implications are given.

报告摘要：中智集作为模糊集的重要推广，在解决不确定性问题中发挥着重要的作用。本次报告包括三个内容：（1）中智三元组群。介绍了中智三元组群，中智三元组子群，强中智三元组子群及弱可交换的中智三元组群的定义。讨论了中智三元组群的一些新性质，并证明了在任何中智三元组群中，每个元素都有唯一的中性元。（2）单值中智多重集。讨论了单值中智多重集的截集（强截集）的定义、运算及运算性质。利用理论分析和计算的方法研究了单值中智多重集的分解定理、表示定理和一种新的相似度及其应用。（3）中智 t 模及其导出的剩余格。深入地研究了中智 t 模，中智剩余蕴涵及基于中智 t 模的剩余格。证明了剩余中智 t 模是有限并分配的，并给出了中智剩余蕴涵的一些重要性质。

Written Report 6

Title: unsubmitted

Biography:

Madad Khan, Post doc (Bio Mathematics), Department of Mathematics, University of Chicago, USA, 2014-15. Post doc (Computational Mathematics), School of Mathematics, University of Birmingham, UK, 2013. He visited the Center of Mathematical Sciences and Isaac Newton Institute for Mathematical Sciences, University of Cambridge, UK, July 10-11, 2013. He is an academic visitor of the Mathematical Institute University of Oxford, UK, from May 19, 2012 to June 6, 2012; invited speaker in Third High Mile Conference on Nonassociative Mathematics, August 11-17, 2013, University of Denver, Denver, Colorado, USA. His fields of research cover Bio Mathematics (Genetics); Fuzzy Mathematics (Fuzzy Logics &

Foundation, Decision Analysis, Fuzzy Algebra), Computational Mathematics (Programing in GAP); Pure Mathematics (Semigroups, AG-groupoids). He has published at least 100 papers.

Appendix

Some Papers in Neutrosophic Set Theory by Shaanxi University of Science and Technology

[1] Zhang, X.H.; Wu, X.Y.; Mao, X.Y.; Smarandache, F.; Park,C. On Neutrosophic Extended Triplet Groups (Loops) and Abel-Grassmann's Groupoids (AG-Groupoids), Journal of Intelligent & Fuzzy Systems, 2019, 37: 5743-5753.

[2] Zhang, X.H.; Wang, X.J.; Smarandache, F.; Jaíyéolá, T.G.; Lian, T.Y. Singular Neutrosophic Extended Triplet Groups and Generalized Groups. Cognitive Systems Research, 2019, 57: 32-40.

[3] Shao, S.T.; Zhang, X.H. Measures of Probabilistic Neutrosophic Hesitant Fuzzy Sets and The Application in Reducing Unnecessary Evaluation Processes. Mathematics, 2019, 7(7): 649.

[4] Zhang, X.H.; Mao, X.Y.; Wu, Y.T.; Zhai, X.H. Neutrosophic Filters in Pseudo-BCI Algebras. International Journal for Uncertainty Quantification, 2018, 8: 511-526.

[5] Zhang, X.H.; Bo, C.X.; Smarandache, F.; Dai, J.H. New Inclusion Relation of Neutrosophic Sets with Applications and Related Lattice Structure. International Journal of Machine Learning and Cybernetics, 2018, 9(11): 1753-1783.

[6] Zhang, X.H.; Smarandache, F.; Ma, Y.C. Symmetry in Hyperstructure: Neutrosophic Extended Triplet Semihypergroups and Regular Hypergroups, Symmetry, 2019, 11(10): 1217.

[7] Zhang, X.H.; Ma, Z.R.; Yuan, W.T. Cyclic Associative Groupoids (CA-groupoids) and Cyclic Associative Neutrosophic Extended Triplet Groupoids (CA-NET-groupoids). Neutrosophic Sets and Systems, 2019, 29: 19-29.

[8] An, X.G.; Zhang, X.H.; Ma, Y.C. Generalized Abel-Grassmann's Neutrosophic Extended Triplet Loop, Mathematics, 2019, 7(12): 1206.

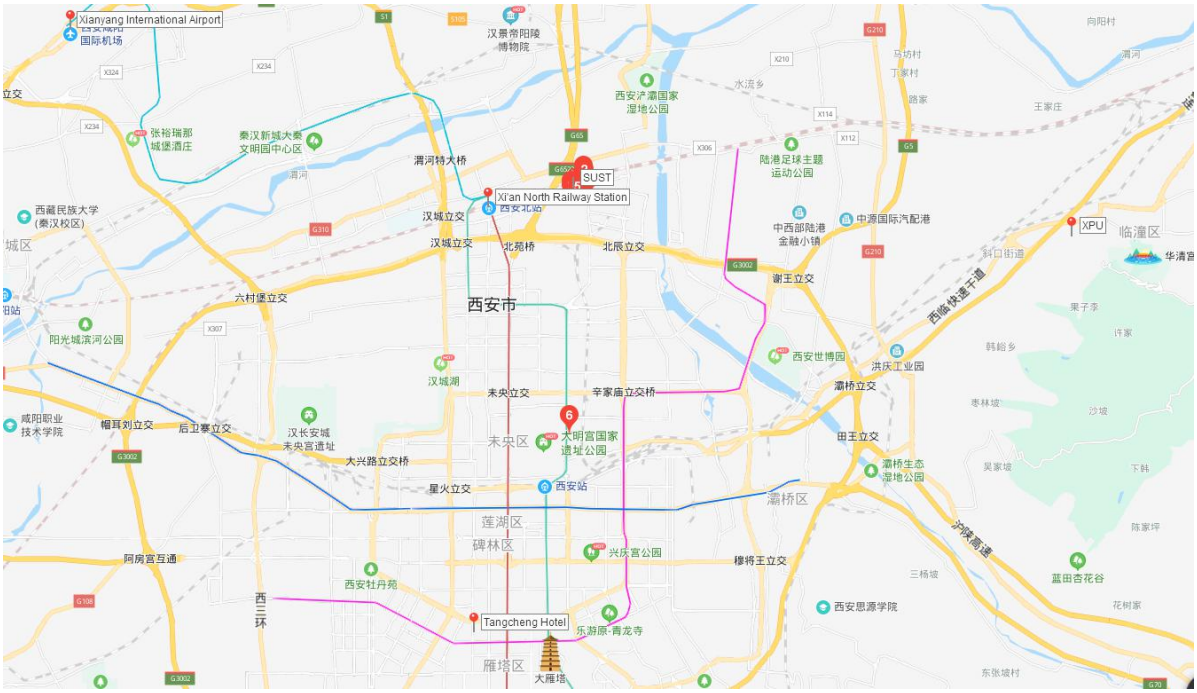
[9] Wang, J.Q.; Zhang, X.H. A New Type of Single Valued Neutrosophic Covering Rough Set Model, Symmetry, 2019, 11(9): 1074.

[10] Wu, X.Y.; Zhang, X.H. The Decomposition Theorems of AG-Neutrosophic Extended Triplet Loops and Strong AG-(l, l)-Loops, Mathematics, 2019, 7(3): 268.

[11] Hu, Q.Q.; Zhang, X.H. Neutrosophic Triangular Norms and Their Derived Residuated Lattices, Symmetry 2019, 11(6): 817.

Transportation and Hotel Location

(交通与宾馆位置)



Transportation of Tangcheng Hotel

From **Xianyang International Airport** to Tangcheng Hotel

Distance: 38km（咸阳国际机场距唐城宾馆 38km）

Airport Bus: Please select "Xianyang International Airport-Tangcheng Hotel-Shaanxi History Museum Line"

Subway: Take the Airport Intercity Line, get off at North Passenger Station (North Square), and transfer to Line No. 4, get off at Dayan Pagoda Station, and transfer to Line No. 3, get off at Jixiang Village Station (A2 Port)

机场巴士：请选择“咸阳国际机场—唐城宾馆—陕西历史博物馆线路”

地铁：请乘坐机场城际线，在咸阳机场西（T1/T2/T3）站（始发站）乘坐机场城际线到北客站（北广场）站，换乘地铁 4 号线到大雁塔站，再换乘地铁 3 号线到吉祥村站，从 A2 口出站

From **Xi’an North Railway Station** to Tangcheng Hotel

Distance: 20km（西安北火车站（高铁站）距唐城宾馆 20km）

Subway: Line No. 2, get off at Xiaozhai Station, and transfer to Line No. 3, get off at Jixiang Village Station (A2 Port)

地铁：请乘坐地铁 2 号线到小寨站，同站换乘地铁 3 号线到吉祥村站，请选择 A2 口出站

From **Xi’an South Railway Station** to Tangcheng Hotel

Distance: 27.7km（西安南火车站（长安县引镇）距唐城宾馆 27.7km）

Bus: Take bus No. 920 to Dayan Pagoda Station, then transfer to No. 24 to Tangcheng Hotel

Subway: Take bus 920, get off at Dayan Pagoda Station, transfer to Line No. 3, get off at Jixiang Village Station (A2 Port)

公交车：乘坐 920 路公交车至大雁塔站，换乘 24 路，直达唐城宾馆

公交车换乘地铁：乘坐 920 路公交车，到大雁塔站，换乘地铁 3 号线，到吉祥村站，请选择 A2 口出站

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Brief Introductions to XPU and SUST

(学校简介)

Brief Introduction to XPU

Xi'an Polytechnic University, or XPU, is a typical industry-based university in China under the direct leadership of the Education Department of Shaanxi Provincial Government. As one of the earliest institutions where China's higher education in textile took shape, XPU at present goes beyond the textile by offering education at different levels including 63 undergraduate programs, 25 graduate programs, and 1 joint PHD program. Located in the eastern part of Xi'an，XPU consists of Jinhua Campus and Lintong Campus.

In 1912, XPU started as Beijing Higher Industry Institute Weaving Academy. With a 66-year development, Northwest Textile Science and Technology University was founded in 1978 under the direct leadership of the Ministry of Textile. It transferred to the supervision of Shaanxi Provincial Government in 1998. In 2006, it took on its current name Xi'an Polytechnic University (XPU). At present, XPU consists of 14 schools and 1 teaching department covering many subjects with textile and engineering as its pillar.

The university boasts a high-level staff of over 1500, among whom Professor Yao Mu, an academician of Chinese Academy of Engineering, has been devoted to the teaching and researching on textile materials for more than 60 years. The applied research centers and comprehensive talents training bases are multidisciplinary and have connections and cooperation with many institutes and enterprises both at home and abroad.

XPU is always open to international friends. To date, more than 500 students have been studying abroad between XPU and partner universities in the U.S, UK, Australia and Canada. More than 400 faculties and students have visited partner universities and more than 400 foreign students have studied at XPU since 1995. XPU has successfully held international conferences, such as the first and second International Wool Conference, The Sixth China International Warp Knitting Design Awards, TBIS2014, etc. With the opening up of "One Belt, One Road" Initiative, we have made it a strategic priority to go global.

Website: http://www.xpu.edu.cn/
Postal address: No.19 Jinhua South Road Xi'an Shaanxi China (Postal code: 710048)
Contact number: 0086-29-62779091

Brief Introduction to SUST

Shaanxi University of Science & Technology is the only multi-disciplinary university with the characteristics of light industry in the western region of China. It was selected into the National Basic Ability Construction Project of Western and Central China, a key high-level university in Shaanxi Province during the 12th Five Year Plan period, and one of first-class national educational institutions in Shaanxi Province. It is also a key university jointly built by the People's Government of Shaanxi Province, China Light Industry Council and Sinolight.

The school has 15 colleges (departments). There are 3 postdoctoral research flow stations, 4 first level disciplines and 19 second level disciplines authorized for doctoral degree, 19 first level disciplines authorized for master's degree, 87 second level disciplines authorized for master's degree and 59 undergraduate majors. According to the data released by ESI, Materials science (entered in January 2017) and Chemistry (entered in September 2019) are ranked in the top 1% of ESI in the world, ranking first in the world.

Since the 12th Five Year Plan was launched, our university has undertaken 1934 vertical scientific research projects, including National Natural Science Foundation, National Social Science Foundation, national key R & D plan, major key projects in Shaanxi Province, etc. It has published 1406 papers included in the third area of SCI, 1761 journal papers included in EI, and 6487 authorized patents. According to the data from the State Intellectual Property Office, our university ranks 31st in the national ranking of effective invention patents in universities. SUST has been among the top 50 universities in China for 8 consecutive years, ranking the 1st in provincial colleges and universities.

In the development process of more than 60 years, Shaanxi University of Science & Technology has experienced the struggle and brilliance of "three times of entrepreneurship, two times of relocation and one time of transfer". It adheres to the spirit of "three times of innovation and two times of relocation" with the connotation of "self-improvement and hard work spirit of entrepreneurship, practical innovation, enterprising scientific spirit and dedication rooted in the West and serving the society".

Website: https: //www.sust.edu.cn/

Postal address: **Xi'an Campus**: Xi'an Weiyang University Park, Xi'an, Shaanxi Province (Postal code:710021)

Xianyang Campus: No. 49, Renmin West Road, Xianyang City, Shaanxi Province (Postal code:712081)

Contact number: (029) 86168012