

## **SFAI'18 (Spring) Program**

Date: 2018.05.19

Venue: AMSS/CAS

Organizer: Sanjiang Li, Songmao Zhang, Ruqian Lu

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### **8:30 - 9:20: Talk 1**

#### **Machine Theorem Discovery**

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Prof Fangzhen Lin

Department of Computer Science and Engineering

Hong Kong University of Science and Technology, Hong Kong

#### **Abstract**

I will describe a framework for machine theorem discovery and illustrate its use in discovering state invariants in planning domains and properties about Nash equilibria in game theory, as well as its potential use in program verification in software engineering. My main message will be that many AI problems can and should be formulated as machine theorem discovery tasks.

#### **Short Bio**

Fangzhen Lin is a Professor in the Department of Computer Science and Engineering at the Hong Kong University of Science and Technology. He is interested in AI, particularly in Knowledge Representation and Reasoning, and currently has related projects in computer program verification, game theory, and social choice theory. He received his PhD degree in computer science from Stanford University. He is a Fellow of AAAI, and received the Croucher Foundation Senior Research Fellowship award in 2006, a Distinguished Paper Award at IJCAI-97, a Best Paper Award at KR-2000, an Outstanding Paper Honorable Mention at AAAI-04, the Ray Reiter Best Paper award at KR-06, and an Honorable Mention for his planner R at the AIPS-2000 planning competition. He had served as Associate Editor of Artificial Intelligence and Journal of AI Research, and was program co-chairs of IJCAI 2015 KR Track, KR 2010 and LPNMR'09.

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### **9:20 - 10:10: Talk 2**

#### **Strong Spatial Cognition -- A new AI paradigm for spatial problem solving**

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Prof Christian Freksa

Bremen Spatial Cognition Center, University of Bremen, Germany

#### Abstract

Computational problem solving requires (1) the formal representation of the problem; (2) the solution of the formalized problem; and (3) the interpretation of the solution in terms of the problem domain. In the case of spatial problems this involves two transformations between the spatial and the formal domain. Natural cognitive agents (humans and animals) avoid these transformations; they employ spatial affordances to solve problems directly in the spatial domain, whenever possible. In my talk I will present the *Strong Spatial Cognition* paradigm. This paradigm makes direct use of spatial structures and spatial affordances ('knowledge in the world') in the physical or conceptual spatial domain. Computation shifts from object-level reasoning (spatial calculi) to meta-level reasoning about spatial reference systems, spatial perception, and spatial operations. I will provide examples of spatial problems that can be solved in the strong spatial cognition paradigm and discuss crucial properties of space that help avoid the computational complexity trap in spatial reasoning. I will argue that the new paradigm is suitable for today's autonomous robotic systems and may have uses well beyond the spatial domain.

#### Short Bio

Christian Freksa is a Research Professor of Cognitive Systems at the Faculty of Mathematics and Informatics, University of Bremen, Germany. He directs the Bremen Spatial Cognition Center. His research concerns representation and reasoning with incomplete, imprecise, lean, coarse, approximate, fuzzy, and conflicting knowledge about physical environments. Particular emphasis is on qualitative spatial and temporal reasoning and on spatial cognition. Freksa received a PhD in Artificial Intelligence from UC Berkeley. Before joining the University of Bremen he carried out research at the Max Planck Institute and the Technical University of Munich, the International Computer Science Institute in Berkeley, and the University of Hamburg. From 1996 to 2014 he directed national research initiatives on Spatial Cognition supported by the German Research Foundation (DFG). Freksa is a Fellow of the European AI society EurAI.

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**10:10 - 10:30 Tea Break**

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**10:30 - 11:20: Talk 3**

## **Ontology-based data access: Walking the tightrope between efficiency and expressiveness**

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A/Prof Heng Zhang  
Tianjin University

### **Abstract**

A major topic of knowledge representation and reasoning (KR) is how to reconcile two conflicting goals: (i) to represent knowledge as generally as possible, and (ii) to reason with it in an automated way as efficiently as possible. In this talk, I will present a survey of the efforts of this topic in ontology-based data access (OBDA, an emerging subfield of KR concerned with querying incomplete data sources in the presence of domain-specific knowledge provided by an ontology). Then, I will also report our recent work on finding expressive/universal language for tractable OBDA.

### **Short Bio**

Heng Zhang is currently an associate professor at the Department of Software Engineering, Tianjin University. Previously, he was an associate professor of computer science at Huazhong University of Science and Technology, and a postdoctoral research fellow at University of Western Sydney. He published a number of research papers in AAI, IJCAI, KR, AAMAS and TOCL. His current research interests focus on knowledge representation and reasoning, databases, logic in computer science, and foundations of artificial intelligence.

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## **11:20 - 12:10 Talk 4**

### **An introduction to the AI group at the Institute of Mathematics CAS**

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Prof Songmao Zhang  
AMSS, CAS

### **Abstract**

Ruqian Lu and his group began their study on Artificial Intelligence since 1982 at the Institute of Mathematics, Chinese Academy of Sciences. Lu was one of the pioneers in AI research in China. 35 years along the road, innovative theories and technologies have been developed. The early stage work includes knowledge representation language Tuili that integrates Prolog, production

rule system, modularization and heuristic search, and the very first expert system development environment in China, Tianma, that has been utilized in many real-world applications. At the middle stage, the full life-cycle computer-aided animation generation technology SWAN features a knowledge-based, automatic workflow from understanding stories in natural language to producing 3D animations; and the domain modeling-based technology PROMIS transforms from requirement descriptions in natural language into MIS systems. In the 2000s, the proposal of Knowware and Knowware engineering emphasizes the knowledge as a third power after hardware and software. Moreover, the group has been working on ontology quality assurance and ontology matching especially for large, complex domain systems, and applying the Semantic Web technologies to support the automatic animation generation. The current research of the group is of diversity, including formalization of the notion of big knowledge and the big knowledge system, knowledge orchestration, the incorporation of machine learning techniques, and many others.

#### Short Bio

Songmao Zhang received her PhD degree from the Institute of Mathematics, Chinese Academy of Sciences (CAS) in 1992. She has been a full-time professor at Academy of Mathematics and Systems Science, CAS from 2007. Besides, she was visiting scholars in research institutions and universities in the US, Australia, Germany, France and UK. Within the area of artificial intelligence, Songmao Zhang's research interests include ontology matching, knowledge representation and reasoning in the Semantic Web, AI-based automatic animation, data mining, and natural language understanding. She has been the principal investigator of many national projects, including those from NSF of China, National 863 High-Technology Foundation of China, and from the Chinese Academy of Sciences.

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**12:10 - 2:00 Lunch**

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**2:00 - 2:50 Talk 5**

**Applications of knowledge representation on conversational system**

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Prof Xiaoyan Zhu  
Tsinghua University

Abstract

First of all, we would like to introduce human-machine conversation system, including question answering and the dialog systems. Then we will try to compare the role of knowledge representation in different kind of conversation systems. Finally, some of our work will be introduced.

#### Short Bio

Prof. Xiaoyan ZHU: Head of State key Lab of Intelligent Technology and Systems, Tsinghua University. Since 1993, Prof. Zhu has been on the faculty of Department of Computer Science and Technology, Tsinghua University. She was the deputy director of Department of Computer Science and Technology, Tsinghua University. Currently her research interests are focus on intelligent information processing, internet information acquisition, and question and answering system. She has successfully conducted the research supported by National Basic Research Program (973 program), National High Technology Research and Development Program of China (863 program), and National Natural Science Foundation of China (NSFC). She has got Okawa award, Japan, 2014, Google research award, 2012, 2014, best paper award, COLING 2011, best student paper award, ACL 2012, and best student paper award, SDM 2014, respectively. Prof. Zhu has authored or co-authored more than 100 papers in the top scientific journals such IEEE Tran.on SMC, Journal of Knowledge and Information Systems, Communications of the ACM, and conference proceedings SIG KDD, IJCAI, SIGIR, ACL, AAAI, ICDM, COLING, SDM, and CIKM.

Homepage: [http://www.csai.tsinghua.edu.cn/~zxy/index\\_cn.asp](http://www.csai.tsinghua.edu.cn/~zxy/index_cn.asp)

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#### 2:50 - 3:40 Talk 6

#### **Knowledge representation and reasoning for knowledge graphs: theory and practice**

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Prof Guilin Qi  
Southeast University

Abstract: In this talk, we will introduce our work on knowledge representation and reasoning for knowledge graphs in the last ten years. First, we will introduce our recent work on representing expressive ontologies with graph such that parallel reasoning can be performed on the graphs. We will also introduce some work on non-standard

reasoning with knowledge graphs. Second, we will introduce our work on knowledge representation learning by considering context information. Third, we will introduce our work on learning lightweight ontologies from data. Finally, we will discuss applications of knowledge graphs in different areas, such as finance, e-commerce.

Bio: Dr. Guilin Qi is a professor working at Southeast University in China. He was a visiting professor of Griffith University (from November 2011 to February 2011 and from June 2013 to July 2013) and a visiting professor of IRIT - Université Toulouse 1. He is the head of the Knowledge Science and Engineering Lab and the director of institute of cognitive science at Southeast University. He received his PhD in Computer Science from Queen's University of Belfast in 2006. Before he moved back to China, he has worked in the Institute AIFB at University of Karlsruhe for three years. His research interests include knowledge representation and reasoning, uncertainty reasoning, and semantic web. He has published over 100 papers in these areas, many of which published in proceedings of major conferences or journals. He has published a book on knowledge management for the semantic web in 2015. He has won the best-short paper runner-up award in CIKM 2017, and has a paper won the best-student paper award in ICTAI 2015. He is the principal investigator of three national natural science foundation of China projects. He is a workpackage leader of a EU FP7 Marie Curie IRSES project and a co-investigator of an ARC discovery project. He is in the editorial board of the Journal of Web Semantics and Semantic Web Journal. He is involved in the organization of many conferences, such as ISWC 2011, EKAW 2013, JIST 2016, CCKS 2017. He was invited to give a lecture at Reasoning Web summer school in Vienna in 2012 and gave several tutorials in some top conferences, such as AAIL'10 and ISWC'11.

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**3:40 - 4:00 Tea Break**

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**4:00 - 4:50 Talk 7**

**Representation Learning for Large-Scale Knowledge Graphs**

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A/Prof Zhiyuan Liu

Tsinghua University

Abstract:

Knowledge graphs organize human knowledge about the world in a structured form. In a typical knowledge base, entities are connected by multiple relations. Knowledge bases are playing an important role in most tasks in natural language processing and information retrieval. Recent years have witnessed the significant advances of distributed representation of knowledge graphs, which exhibits powerful capability in both relation extraction and knowledge inference. In this talk, I will introduce recent advances of representation learning of large-scale knowledge graphs and outlook its research challenges and trends.

Short Bio:

Zhiyuan Liu is an associate professor at the Department of Computer Science and Technology, Tsinghua University. He received his Ph.D. degree in Computer Science from Tsinghua in 2011. His research interests include representation learning, knowledge graphs and social computation, and has published more than 60 papers in top-tier conferences and journals of AI and NLP including ACL, IJCAI and AAI, cited by more than 2100 according to Google Scholar. He is the recipient of the Excellent Doctoral Dissertation of Tsinghua University, the Excellent Doctoral Dissertation of CAAI (Chinese Association for Artificial Intelligence), and Outstanding Post-Doctoral Fellow in Tsinghua University. He serves as Youth Associate Editor of Frontiers of Computer Science, Area Chairs of ACL, COLING, IJCNLP, etc.

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**5:50 - 6:00 General Discussion**

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**6:00 - 8:30 Dinner**

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