Qing-Jie Kong, Xueliang Zhao,
and Cristina Olaverri

The State Key Laboratory of Management and Control for Complex Systems—A Brief Introduction

Mission

The State Key Laboratory of Management and Control for Complex Systems (SKL-MCCS) focuses on major research directions in complex systems and intelligent science, including analysis, modeling, optimization, and management of complex systems that exist in the fields of engineering, social, economic and defense systems. The goal of the SKL-MCCS is to become a leading international organization for scientific research, technical innovation and talents cultivation.

History

The State Key Laboratory of Management and Control for Complex Systems (SKL-MCCS) was officially established in 2011 by the Ministry of Science and Technology (MOST) of the People's Republic of China, and Professor Fei-Yue Wang was appointed as its Founding Director. The history of the SKL-MCCS went back to the Laboratory for Control of Complex Systems in 1991, created within the Institute of Automation, Chinese Academy of Sciences (CASIA). In 1994, it became the Key Laboratory of Complex Systems Engineering of Chinese Academy of Sciences. After combined with CASIA's Artificial Intelligence Lab in 1997, it was renamed as The Key Laboratory of Complex Systems and Intelligence Science (KL-CSIS). In 2002, KL-CSIS was merging with CAS' Intelligent Control and Systems Engineering Center (ICSEC), which was founded by Professor Fei-Yue Wang in 1999. In 2011 MOST approved the plan of construction of the SKL-MCCS based on the KL-CSIS.

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Faculty

Currently the SKL-MCCS has over 50 faculty members, 50 research staff members, and 200 graduate students and more than 100 researchers and engineers in branches outside Beijing. The SKL-MCCS also hosts more than 50 visiting scholars from China and other countries.

Research Focuses

This section mainly introduces the research directions on intelligent transportation systems. ITS research was introduced to the

FIG 1 Faculty members at the Huairou Campus at the Suburban Beijing.


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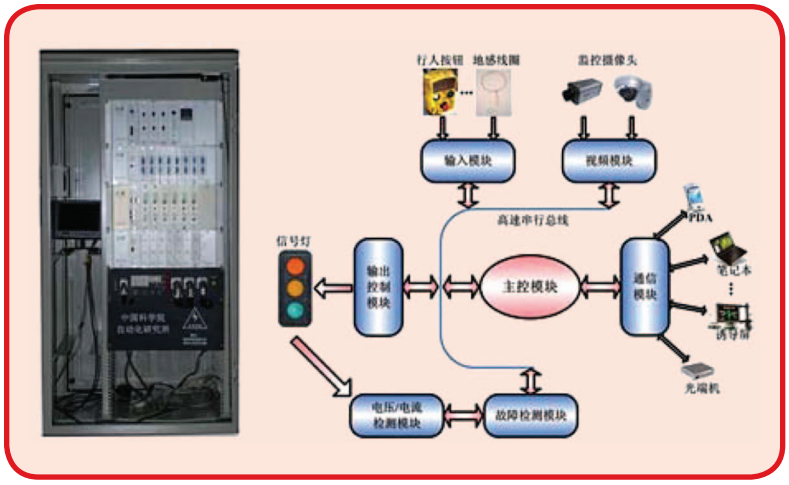


FIG 2 GreenPass 2070 agent-based traffic signal controllers.

FIG 4 Public transportation parallel management system.

SKL-MCCS in 1999 by Professor Fei-Yue Wang, who was also the Founding Director of the Complex Adaptive Systems for Transportation (CAST) Lab within the ICSEC.

Control and Management Research

To solve the current transportation problems in China, the lab has developed a series of control and management models and systems, such as the GreenPass 2070 agent-based networked traffic signal controllers, urban traffic control and network management platform iTOP, parallel traffic control and management systems PtMS, etc. By putting forward the theory of agent-based network traffic control and the idea of parallel road traffic control and management based on the ACP approach into applications, the group made significant breakthroughs in the field of transportation control and management research, effectively addressing the problems of traffic optimization and emergency management, and greatly improving the traffic quality in the selected cities in China.

FIG 3 Urban traffic control and operations platform iTOP.

Public Transportation Research

Public transportation research has always been a major focus of transportation studies. To meet the travel demand of audience and citizens during the 2010 Guangzhou Asian Games, the lab developed a public transportation parallel management system based on the ACP approach. The system is featured firstly by the bus line optimal management and taxi management based on the principle of actual/artificial dual loop parallel management, and secondly by the real-time monitoring on crowds in the BRT stations and buses, and of the traffic flow and road conditions. The system boosted the average speed of public vehicles by about 20% after implementation.

Image Recognition Research

This research focuses on the real-time image recognition technology, including vehicle image detection technology (such as traffic data collection, traffic event monitoring and vehicle license and plate recognition) used in urban roads, intersections and toll stations, and human image detection technology (such as crowd data acquisition, human behavior analysis, face captured technology) in bus stations, transportation hubs, stadiums and other open

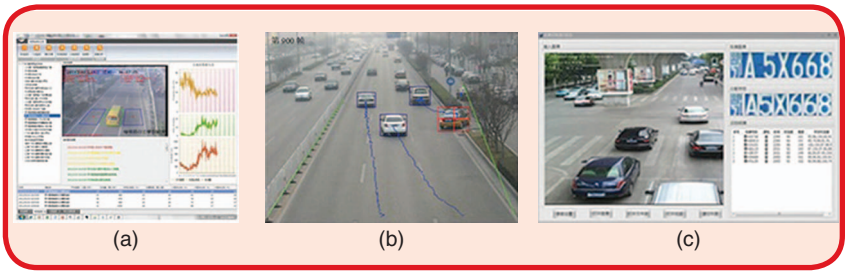
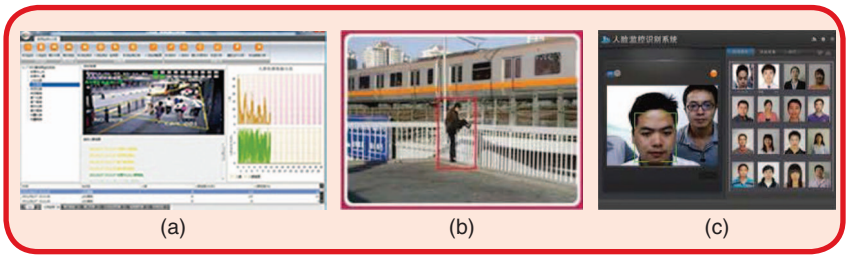


FIG 5 Vehicle image detection technology. (a) Traffic data collection, (b) traffic event monitoring, and (c) vehicular object recognition.



(a) (b) (c)

FIG 6 Human image detection technology. (a) Crowd data acquisition, (b) human behavior analysis, and (c) face recognition and analysis.

fields. Furthermore, two application systems, namely vision-based (mainly intelligent high-definition cameras developed by CAST) Internet of Things (IOT) and cloud platforms, provide technological support for the development of smarter and safer city and their innovations in social management. Another major project in this area is the Intelligent Transportation Space (ITSp) project.

Internet of Vehicle (IoV) Research

The lab has accumulated profound techniques and knowledge with regard to intelligent vehicles and internet of vehicles. Supported by the National Natural Science Foundation of China and programs of Ministry of Industry and Information, it has achieved several milestone accomplishments, such as intelligent vehicles and vehicle test platform with Internet, wireless sensor networks in traffic (WSN-T), etc. Combined with the study of IOV, On Board Unit (OBU) is developed to perceive the vehicle status, and the roadside RBU is worked out to achieve the V2V, V2R, V2I and V2H interactions. Moreover, the cloud systems are also applied in IoV so that the data collection, computing, monitoring, dispatching and management in traffic are realized. A theory for Parallel Driving Services that using software-defined artificial co-driving and monitoring systems is developed and tested currently in the lab.

New research initiatives include ITS knowledge and decision automation, social transportation, especially traffic sentiment analysis and use of social media and mobile devices for ITS.

Future Directions

In the future, the lab will concentrate on the improvement of urban artificial transportation system, intelligent video surveillance and dual-mode navigation system. These will be glorious. They highlight the newest frontiers in the lab's research areas.

Urban Artificial Transportation System

Based on the traffic control theory, the artificial transportation system evolved from the real traffic stage. It can play its role in a wide range and

FIG 8 Intelligent vehicles and vehicle test platform with Internet.

FIG 7 Vehicle positioning and navigating.

FIG 9 Urban artificial transportation system.

Quick Facts

Director: Fei-Yue Wang, Editor-in-Chief of *IEEE Transactions on Intelligent Transportation Systems*

The State Key Laboratory of Management and Control for Complex Systems (SKL-MCCS)
Institute of Automation, Chinese Academy of Sciences (CASIA)
Website: http://www.sklmccs.ia.ac.cn/
Established: 2011
Research Focus: complex systems and intelligent science, including analysis, modeling, optimization, and management of complex systems.

Dr. Wang received his Ph.D. degree in Computer and Systems Engineering from Rensselaer Polytechnic Institute, Troy, NY, in 1990. He joined the University of Arizona, Tucson, in 1990 and became a Professor and the Director of the Robotics and Automation Laboratory and the Program in Advanced Research for Complex Systems. In 1999, he founded the Intelligent Control and Systems Engineering Center, Chinese Academy of Sciences (CAS), Beijing, China. From 1995 to 2000, he was the Editor-in-Chief of the International Journal of Intelligent Control and Systems and the World Scientific Series on Intelligent Control and Intelligent Automation. His research interests include social computing, web science, and intelligent control.

Dr. Wang is a member of Sigma Xi; an elected Fellow of IEEE, the International Council on Systems Engineering (INCOSE), the International Federation of Automatic Control (IFAC), the American Society of Mechanical Engineers (ASME), and the American Association for the Advancement of Science (AAAS); and Vice President and Secretary-General of the Chinese Association of Automation. He has served as Chair of more than 20 IEEE, Association for Computing Machinery (ACM), and Institute for Operations Research and Management Sciences (INFORMS) conferences. He was the President of the IEEE Intelligent Transportation Systems Society from 2005 to 2007, the Chinese Association for Science and Technology, USA, in 2005, and the American Zhu Kezhen Education Foundation from 2007 to 2008. He was the recipient of the National Prize in Natural Sciences of China in 2007 and the Outstanding Scientist Award from the ACM for his work in intelligent control and social computing.

Contact Info:
Address: 95 Zhongguancun East Road
100190, BEIJING, CHINA
Phone: +86-10-82544799
E-mail: feiyue.trans@gmail.com

(a) (b) (c)

FIG 10 Intelligent video surveillance system. (a) Sparse degree test in subway, (b) real-time detection of pedestrian, and (c) tracking from multiple angles.

FIG 11 Big Dipper/GPS dual-mode navigation system.

Related Information

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in a comprehensive manner with the characteristics of "intelligence, visualization and simulation". It's a real-time, accurate and effective traffic management system.

Intelligent Video Surveillance System

This system provides the function of intelligent visual recognition and statistical analysis, meeting the demand of big data analysis and

multi-terminal access. By means of high-definition intelligent cameras and cloud computing platform, the system can fulfill the goals of multi-terminal monitoring, object detection in multiple scenes, synchronous tracking from multiple angles, content recognition and dynamic target analysis, offering a green and effective scientific experience for users.

Dual-Mode Navigation System

The Big Dipper/GPS dual-mode navigation system combines the satellite signals with navigation software to make sure a more accurate navigation, positioning and timing service. It is featured by a high degree of integration, reliability and energy conservation. It can be widely applied in the areas of vehicle and marine navigation and meteorological detection.

ITS

Chess Puzzle Solution

Solution: 1.Kc3. This is a much wiser move than taking Black's Knight with KxD2. Instead, with Kc3, nothing will prevent White's next move to do Kf3#, checkmate!

Employment Opportunities Solicitation

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