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INTERNATIONAL SCIENCE, TECHNOLOGY AND INNOVATION CENTRE FOR SOUTH-SOUTH COOPERATION UNDER THE AUSPICES OF UNESCO

XI'AN JIAOTONG UNIVERSITY 1896

INTERNATIONAL TRAINING WORKSHOP ON BIG DATA AND ARTIFICIAL INTELLIGENCE

14-19 October 2024

Xi'an,China

PROGRAMME BOOK

BACKGROUND

Industry 4.0, also known as the fourth industrial revolution, represents the next significant phase in the digitization of the manufacturing sector. The previous three major shifts in manufacturing include the lean revolution of the 1970s, the outsourcing boom of the 1990s, and the rise of automation in the 2000s. The convergence of big data, advanced analytics, artificial intelligence (AI), the Internet of Things (IoT), human-machine interfaces, and digital-to-physical transfer (such as 3D printing) is driving this new industrial era.

In this new era, data generation is increasing exponentially, presenting fresh challenges in how knowledge should be acquired, disseminated, and utilized to benefit humanity. The vast amount of data distributed across various social institutions comes from diverse backgrounds, structures, and is constantly expanding. Despite its availability, professionals in science, technology, and innovation (STI) often struggle to fully leverage this data due to a lack of interconnection among different sources. A Big Data platform offers a potential solution by collecting and integrating these data resources, fostering collaboration, and strengthening academic exchanges to address these challenges.

Relevant data is crucial not only for providing timely information to support efficient planning but also for effective monitoring. In the context of the UN Sustainable Development Goals (SDGs), Big Data can be used to obtain high-quality, detailed information, integrating insights from new technologies with traditional data sources.

Big Data and artificial intelligence (AI) are central to the industry 4.0 transformation, driving profound changes across the manufacturing sector and beyond. Big Data refers to the enormous volumes of structured and unstructured data generated by digital systems, machines, and sensors. AI uses this data to conduct complex analyses, make predictions, and automate decision-making processes that once required human intervention.

Within Industry 4.0, Big Data and AI are key enablers for smart factories, where interconnected machines and systems operate with high levels of autonomy and efficiency. By leveraging Big Data, businesses can gain deep insights into their operations—from supply chain logistics to product quality control—allowing for real-time adjustments and optimization. AI algorithms can predict equipment failures before they occur, streamline production processes, and customize products to meet specific customer needs with precision.

For professionals in developing countries, understanding the role of Big Data and AI in economic and market development is increasingly crucial. These technologies not only drive productivity and innovation but also create opportunities for transitioning from low-end manufacturing to high-tech industries. However, the rapid pace of technological change presents challenges, particularly in terms of skills development, infrastructure, and regulatory frameworks.

To overcome these challenges, it is essential for professionals to develop strategic capabilities in Big Data and AI. This requires not only technical proficiency but also a comprehensive understanding of how these technologies intersect with broader economic, social, and market trends. With this expertise, professionals can contribute to designing policies and strategies that fully harness the potential of Industry 4.0, driving sustainable growth and development in their countries and organizations.

Recognizing this, ISTIC and IKCEST are committed to ensuring that developing countries are not left behind in the pursuit of economic development. The absence of technological capability to harness new opportunities can impede progress, but with the right tools and knowledge, countries can generate income, jobs, and revenue. The application of Big Data in engineering, science, and technology offers a promising solution to elevate decision-making and problem-solving in STI to a higher level.

OBJECTIVES

- Knowledge Exchange: Foster a dynamic environment for the exchange of ideas, experiences, and best practices in Big Data and AI.
- Skill Enhancement: Provide participants with essential tools, techniques, and methodologies to effectively manage and leverage Big Data and AI.
- Networking Opportunities: Facilitate connections and collaborations among industry professionals, researchers, and stakeholders from the Global South.
- Drive Innovation: Showcase cutting-edge advancements and success stories to inspire new ideas and creative applications in data-driven technologies.

EXPECTED OUTCOMES

The expected outcomes of the training programme are:

- All participants will gain the necessary knowledge and experience on the big data systems for STI knowledge management strategies for their countries/organisations.
- The establishment of networking among and between participants from the various countries in the Developing Countries.
- Participants trained from the workshop can provide training and leadership on Big Data system formulation to other possible audiences from their own organisations/countries.

PARTICIPANTS

About 50 international participants from developing countries are expected to participate in this programme. The combination of participants from other developing countries will allow for exchange of knowledge, ideas and experiences as well as opportunities for networking and collaboration.

TIME AND VENUE

Date: **14-19 October 2024. (6 Days)**

Venue: **IKCEST Silk Road Training Base, Room 1400, Xi'an Jiaotong University, Xi'an, China**

MODES OF DELIVERY

The training workshop will be conducted in English and will utilize a combination of the following methods:

- **Series of Lectures:** Expert-led sessions providing in-depth insights into key topics.
- **Demonstration:** The demonstration of new trend and technology in Big Data and Artificial Intelligence.
- **Discussions and Presentations:** Interactive discussions and participant presentations to encourage knowledge sharing and engagement.
- **Study Visits:** On-site visits to selected local organizations for practical exposure and learning.

Upon completion of the training workshop and the presentation, participants with the good attendance will be awarded a certificate issued by the organizers.

ORGANISING COMMITTEE

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PROGRAMME

Time		Lecture	Lecturer
October 13th Sunday	16:00-19:00	Registration (Nanyang Hotel Lobby) *ONLY for trainees from ISTIC	
October 14th Monday	08:30-09:10	Opening Ceremony	Class Adviser
	09:00-12:00	Introduction to Big Data and Deep learning	Lyu Na
	14:30-17:30	Artificial Intelligence and Large Model	Zhang Jie
October 15th Tuesday	09:00-12:00	Brain Machine Interfaces	Chen Badong
	14:30-17:30	Intelligent Campus: iHarbour Campus of Xi'an Jiaotong University (visit)	Class Adviser
October 16th Wednesday	09:00-12:00	The Qin Han Museum of the Shaanxi History Museum (visit)	Class Adviser
	14:30-17:30	Shaanxi: Home to Chinese Civilization	Jin Rong
October 17th Thursday	09:00-12:00	Intelligent UAV Lab: Practical Applications of AI Technology in Aviation (visit)	Zhao Yihan
	14:30-17:30	The Internet of Things and Smart Life	Luo Wenfeng
October 18th Friday	09:00-12:00	AI for Education: Current, History Insight and Cases	Tian Feng
	14:30-17:30	Grad Ceremony（Online Assessment, Online Examination）	Class Adviser
October 19th Saturday	Campus and City Visit		
October 20th Sunday	Departure		

上课地点：西安交通大学兴庆校区1400教室

Place for Training: Room 1400 at XingQing Campus of Xi 'an Jiaotong University

Introduction to Big Data and Deep learning

Speaker: Lyu Na

Abstract: This course introduces the methods and frontiers in big data processing and analysis, machine learning, deep learning and data mining. The representative big data processing platform Hadoop and the classic big data analysis mechanism Map-reduce will be introduced. The foundations of machine learning and artificial intelligence will be discussed, including linear regression, logistic regression, neural networks, other supervised learning and unsupervised learning methods. The concept and motivation of deep learning will be discussed. The breakthrough methods in deep learning, including auto Encoder, Restricted Boltzmann Machine, and Convolutional Neural Network will be introduced. Take the benchmark competitions as examples, the applications of deep learning and big data analysis will be introduced.

Speaker: Lyu Na, Ph.D., Professor School of Automation, Xi'an Jiaotong University.

Artificial Intelligence and Large Model

Speaker: Zhang Jie

Abstract: In this lecture we will introduce knowledge related to artificial intelligence and large-scale models. We will introduce the definition, development process, basic research content, and key technologies of artificial intelligence from its application in various fields.

Then we introduce the risks, challenges, and development trends of the big model, the pearl above the AI crown. Introduce the development process and trends of large-scale models from the development direction and risk challenges of artificial intelligence.

These risk challenges includes the insufficient computing power, energy depletion, data constraints, system loss of control, ecision ethics, malicious use, excessive dependence and so on. Finally, the development trends will be stated.

We will have a preliminary understanding of the key technologies of artificial intelligence and large-scale models.

Speaker: Zhang Jie, PhD, School of Computer Science and Engineering, Xi'an Jiaotong University of Technology.

Brain Machine Interfaces

Speaker: Chen Badong

Abstract: Brain machine interface, as an important direction in the field of neuroscience, mainly explores innovative technologies for direct communication between the brain and external devices. Brain machine interfaces have enormous potential for applications in fields such as healthcare, national defense and security, human factors engineering, and smart education, making them a strategic high ground for global technological competition among countries. Accurately decoding perceptual information and behavioral intentions in the brain is a key technology that needs to be overcome in brain machine interfaces, and it is also a current research hotspot and challenge in the field of brain machine interfaces. This report will introduce the basic principles, methods, and research status of brain machine interfaces, and elaborate on the technological frontiers and challenges in brain signal decoding.

Speaker: Chen Badong, PhD, Professor, College of Artificial Intelligence, Xi'an Jiaotong University.

The Qin Han Museum of the Shaanxi History Museum

Abstract: As one of the most important cradles for the origin of Chinese nation and the Huaxia civilization, Shaanxi Province possesses a wide range of ideological hallmarks and natural landmarks of Chinese civilization, China’s history of revolution, and Chinese geography, including the Mausoleum of the Huangdi Emperor, the Terracotta Army, the Yan’an Pagoda, the Qinling Mountains, the Huashan Mountains, and so forth. Fourteen historical dynasties including the Zhou, Qin, Han and Tang dynasties founded their capitals and flourished here. The rich cultural heritage and profound cultural achievements stimulated the formation of distinctive historical and cultural ethos in Shaanxi. Regarded as ‘the pearl of the ancient city and treasury of the Huaxia civilization’, the Shaanxi History Museum is the art pavilion to curate and exhibit Shaanxi’s historical culture and ancient Chinese civilization.

The Shaanxi History Museum is a comprehensive historical museum. Since its opening, it has greatly emphasized on its advantage of rich and diverse collection and adhered to the principle of ‘conservation as the main task, rescue as the priority, appropriate utilization, and enhanced management’. It organically integrates social education, curation and conservation,

scientific research and industrial development and organizes different kinds of exhibitions. It now has permanent exhibitions, special thematic exhibitions, and regular temporary exhibitions. This wide array of exhibitions complements to each other and displays the great achievements of the Huaxia civilization from multiple perspectives.

As the first set of China's '4A' tourist attractions, the Shaanxi History Museum continues to attract numerous domestic and international visitors for its copious collection, impressive exhibitions, beautiful environment and great service. It has become one of the most important windows to disseminate great cultures of Chinese nation and for cultural exchanges between China and other countries.

In the new era, as the culture pavilion of cultural relics of Shaanxi, the Shaanxi History Museum will continue to focus on high-quality development and make greater contributions to the great rejuvenation of Chinese nation and the building of the community of shared future for mankind with its vigorous and vibrant brand new look.

Shaanxi: Home to Chinese Civilization

Speaker: Jin Rong

Abstract: Shaanxi Province boasts unique geographical location, which makes it the birthplace of the splendid Chinese civilization. In Shaanxi, you can feel the primitive human splendor of the earliest Homo Erectus, Lantian Ape-man； the prosperity of the earliest Matriarchal Clan Society, the Banpo Clan Culture; the great contribution of Yan Di and the Yellow Emperor； the glory enjoyed from the Zhou Dynasty, Qin Dynasty, Han Dynasty to the Tang Dynasty as well as the cradle of the New China, Yan'an. Shaanxi is not only the birthplace of human activities and Chinese civilization, but also the venue for witnessing the previous splendor of about 1,000 years during the entire span of about 5,000 years.

Being the provincial capital city of Shaanxi province, Xi'an with the name of Haojing and Chang'an in ancient time was the ancient capital of thirteen dynasties and the starting point of the Silk Road. Besides, Xi'an enjoys equal fame with Athens, Cairo, and Rome as one of the four major ancient civilization capitals all over the world. Therefore, in China, you can always hear such sayings as "If you want to see a China of 5,000 years, please go to Xi'an; if you want to see a China of 1,000 years, you may go to Beijing; and for a China over one century, you'd better go to Shanghai. "

In the lecture, I will guide you to touch the profound Chinese culture through knowing Shaanxi and Xi'an.

Speaker: Jin Rong, associate Professor, School of Foreign Studies, Xi'an Jiaotong University.

Intelligent UAV Lab: Practical Applications of AI Technology in Aviation

Speaker: Zhao Yihan

Abstract: Yanliang District school of Aeronautics and Technology. This course introduces practical applications of UAV and the AI technology in aviation industry. Specifically, the history and practice of UAV will be introduced. UAV applied to surveying will be discussed, including 3D real model drawing, data processing and other application scenarios. UAV applied to military field and civilian field will be demonstrated where DJI M300 and JOUAV CW-30 will be displayed. Moreover, UAV pilot training will be practiced in UAV simulation training room.

SCHEDULE

9:00-10:00 UAV training room

10:00-10:30 UAV & Model airplane show

10:30-11:30 Aviation science and technology museum: History of aviation equipment in China and worldwide

Speaker: Zhao Yihan, Lecturer,Office of International cooperation and exchange, Xi'an Aeronautical Polytechnic Institute

The Internet of Things and Smart Life

Speaker: Luo Wenfeng

Abstract: The Internet of Things (IoT) is an important part of a new generation of information technology. It means installing sensors for everything, and connecting them to the Internet through specific protocols for information exchange and communications, in order to achieve intelligent recognition, location, tracking, monitoring and management in

the whole process of information collection, transmission, storage and processing. As an emerging field, IoT has drawn great attention of academia, IT, and industry, so it is called the third wave of world information industry after the computer and the Internet. IoT is a convergence of multiple technologies, including ubiquitous wireless communication, real-time analytics, machine learning, commodity sensors, and so on.

Firstly, the development and convergence of Internet technology and mobile communication technology has been reviewed. The target of these technologies has shifted from the connection of anyone at anytime and anyplace to the connection of anything. So the Internet of Things comes.

Secondly, IoT architecture has been explained. The background, current situation and trends are discussed in detail including barcode, RFID, big data, cloud computing and so on.

Thirdly, applications of IoT are introduced in the following fields, such as smart city, smart home, smart transportation, smart dust, smart environmental monitoring, etc.

In the end, the future vision of IoT has also been discussed.

Speaker: Luo Wenfeng, Ph.D, associate Professor, School of Optoelectronic Engineering, Xi'an Jiaotong University of Posts and Telecommunication

AI for Education: Current, History Insight and Cases

Speaker: Tian Feng

Abstract: Firstly, the current status of artificial intelligence (AI) in higher education is introduced from the perspectives of nations and universities. Secondly, drawing insights from the history of science and technology, and education, the applications and challenges of AI in the field of education are deeply explored. The importance of integrating education with technology is emphasized, highlighting the lag in technology application to education and the challenges posed by complex educational scenarios. Then, a human-machine augmented intelligent paradigm is proposed, and a detailed introduction is given to Xi'an Jiaotong University's research on key technologies, typical applications and smart campus, including infrastructure architecture of the smart campus, human-machine augmented situational understanding, personalized online learning guidance, and comprehensive educational effectiveness evaluation techniques. Finally, several thinkings about future are proposed.

Speaker: Dr. Tian Feng, Professor in School of Computer Science and Technology of Faculty of Electronic & Information Engineering, Xi'an Jiaotong University.

ORGANISER

INTERNATIONAL KNOWLEDGE CENTRE FOR ENGINEERING SCIENCES AND TECHNOLOGY (IKCEST) UNDER THE AUSPICES OF UNESCO

The International Knowledge Centre for Engineering Sciences and Technology (shortened as "IKCEST") is a Category 2 Centre under the auspices of the United Nations Educational, Scientific and Cultural Organization (shortened as "UNESCO"). IKCEST was established on June 2, 2014. The Chinese Academy of Engineering is responsible for the operation and management of the IKCEST.

IKCEST is a comprehensive and international knowledge centre devoted to the engineering sciences, technology and applied technology. IKCEST aims at connecting engineering sciences and technology institutions globally, assembling various digital resources relating to engineering sciences and technology, building up a public data service platform and corresponding service environment, and coordinating the building of various professional knowledge systems, thus providing knowledge- based services at a global scale in the form of consultancies, scientific research and education for policy-makers and engineering science and technology professionals in the world, with particular reference to the developing countries.

The specific tasks and functions of IKCEST are as follows: to establish an international engineering and technology resources hub; to establish a public data service platform, and to develop the technology for mining and analyzing knowledge from big data; to cooperatively build professional knowledge service systems, and to build capacity in developing countries; to foster interdisciplinary engineering talents with big data processing ability; and to assist UNESCO to fulfill its aims and support its action plans.

INTERNATIONAL SCIENCE, TECHNOLOGY AND INNOVATION CENTRE FOR SOUTH- SOUTH COOPERATION (ISTIC) UNDER THE AUSPICES OF UNESCO

The creation of the International Science, Technology and Innovation, Centre for South-South Cooperation under the auspices of UNESCO (ISTIC) is a follow up of the Doha Plan of Action which has been adopted by the head of States and Government of the Group of 77 and China, during the meeting in Doha, Qatar, from 12-16 June 2005 on the occasion of the Second South Summit of the Group of 77. The Summit urged UNESCO to develop and implement a programme for South-South cooperation in science and technology with the objective of facilitating the integration of a developmental approach into national science and technology and innovation policies, capacity building in science and technology through providing policy advice and exchange of experience and best practices, and creating a problem solving network of centres of excellence in developing countries as well as supporting the exchange of students, researchers, scientists and technologists among developing countries. ISTIC will act as an international platform for South-South cooperation in science, technology and innovation and make use of the network of the G77 plus China and the Organization of the Islamic Conference (OIC). The overall goal of ISTIC is to increase the capacity for management of science, technology and innovation throughout developing countries.

XI'AN JIAOTONG UNIVIERSITY (XJTU)

Xi'an Jiaotong University (XJTU) is a key university under the direct administration of the Ministry of Education of China and is one of the oldest universities in China. The predecessor of Xi'an Jiaotong University was Nanyang College, which was founded in 1896 in Shanghai and renamed Jiaotong University in 1921. In 1956, the main part of Jiaotong University was relocated to Xi'an according to the decision of the State Council, and this relocated part of Jiaotong University was later officially renamed Xi'an Jiaotong University in 1959. In 2000, approved by the State Council, the former Xi'an Medical University and former Shaanxi Institute of Finance and Economics were merged with Xi'an Jiaotong University. XJTU, as one of the first batch of the universities in China, was supported by the central Government at the seventh and eighth five- year plan, as well as China's "Project 211" and "Project 985" to develop into a world-class university. Now, Xi'an Jiaotong University is on the List of World-class Universities and First-class Disciplines (abbreviated as "Double First-class") released in 2017 by the Ministry of Education of China, as a Double First-class university in Category A, which means that the government will support it financially to develop into a world-class university, and its eight disciplines into the first-class level in the world.

Map of Xi'an Jiaotong University

ABOUT XI'AN

Xi'an is the capital of Shaanxi Province, China. A sub-provincial city on the Guanzhong Plain in northwestern China, it is one of the oldest cities in China, and the oldest of the Four Great Ancient Capitals, having held the position under several of the most important dynasties in Chinese history, including Western Zhou, Qin, Western Han, Sui, and Tang. Xi'an is the starting point of the Silk Road and home to the Terracotta Army of Emperor Qin Shi Huang. In 2018, the population in Xi'an is about 12 million.

Xi'an is the most selected city on the China city tour list just after Beijing. "Xian" in Chinese literally means "Peace in the West", historically known as "Chang An" (Perpetual Peace), an ancient capital city for some of the most important dynasties in Chinese history, including the Zhou, Qin, Han, the Sui, and Tang dynasties. Many tourists say the city of Xian looks more Chinese than the metropolitan cities such as Beijing, Shanghai. It is a favorite haven for those who are interested in Chinese culture and its people.

Top 10 Place of Interest in XI'an