Department of Computer Science
Faculty Research Focus

Artificial Intelligence

The study of how to program computers to exhibit intelligent behavior whether through problem solving, human computer interaction such as question answering, learning, solving optimization problems, or some combination of these. Areas of study include knowledge-based systems research, probabilistic reasoning and other forms of uncertainty handling, machine learning, neural networks and genetic algorithms. Common problems researched include those revolving around recognition/classification (such as speech recognition, visual comprehension, diagnosis, text mining) and planning/design.

Richard Fox works on knowledge-based systems research concentrating on problems of classification, abductive inference and routine planning/design. Among the projects that Dr. Fox has worked on with students are hand-written character recognition, identifying user behaviors in a Linux operating system, automated program code generation and automated music composition. Three recent projects with undergraduate students have been music recognition (recognizing a piece of music), tutorial systems that identify student learning errors, and music composition through planning and genetic algorithms.

Gary Newell studies problems involving Pattern Recognition with Uncertainty as well as exploring the boundaries of computation. For example, recent projects and publications have dealt with identifying Non-Recursively Enumerable Problems (i.e. highly undecidable problems), as well as Gestural Recognition using Probabilistic models. In particular, two recent publications have dealt with the extension of the INCA model which consistently surpasses existing recognition techniques in the area of pattern recognition with uncertainty. His recent research interests include examining the topic of Predictive Analytics as it might be applied to areas of Artificial Intelligence.

Cloud Computing

Cloud computing is an Internet-based computing model. It allows users to access a shared pool of compute, storage, network resources through the Internet. In cloud computing, the resources can be dynamically provisioned and released without much management effort.

Dr. Wei Hao's main research areas are Cloud Computing, Mobile Computing, and Web Technologies. He has published numerous articles with both graduate and undergraduate students in these areas. He, along with Dr. Fox, are publishing a book on Internet Infastructure.

Computer Security

Cybersecurity is the study of how to protect information, networks, and systems from threats ranging from cybercriminals to cyberespionage and cyberwarfare. Inventive attackers evolve new

attacks every day, forcing defenders to continually innovate with new techniques to prevent, detect, and respond to cyberattacks. Simultaneously, engineers are creating new types of connected devices without thinking of security like the smart TVs, cars, and medical devices that make up the Internet of Things, creating new vulnerabilities in existing networks. Traditional perimeter and endpoint defenses like firewalls and anti-virus that were effective in the 1990s, no longer stop most attackers, pushing defenders to focus on adaptive security techniques based on threat intelligence and machine learning. NKU's Department of Computer Science is home to a National Security Agency Center of Excellence in Cybersecurity. Several of the department's faculty are involved in different facets of cybersecurity research.

Yi Hu's research concentrates on Cloud Security, Intrusion Detection, Penetration Testing, Vulnerability Assessment, Data Security, Data Mining, and Trust Management in Cyberspace. He is also the faculty advisor of NKU Cyber Defense Team since 2009. The team placed top nationally and regionally in Collegiate Cyber Defense Competition. Some of his recent projects include Secure Data Erasure in Cloud, IoT Security and Privacy, Penetration Testing Using Miniaturized Devices, Data Mining for Data Exfiltration Detection, etc. He is also a Certified Ethical Hacker (CEH) and Certified Information Systems Security Professional (CISSP).

Dr. Rasib Khan works on cybersecurity in service oriented computing systems. Dr. Khan's research interests and experiences include service protocols, Internet-of-Things, cloud computing, secure authentication and access control frameworks, and secure and trustworthy provenance-aware systems. His current research projects focus on pervasive secure authentication for the Internet-of-Things, a smart and wearable secure service delivery, and scalable service-oriented computing data streams. His research on a smart cloud computing jacket has been recently featured in various tech-blogs, national media, and research portals.

Dr. James Walden works primarily in the area of software security, focusing on how to better design, implement, and validate secure software. He has worked with a variety of techniques, such as penetration testing and static analysis to identify vulnerabilities in different types of software, ranging from traditional server applications to web and mobile applications. His recent projects have focused on building vulnerability prediction models using a variety of machine learning techniques and using Internet-scale scan data to identify software update patterns.

Data Privacy

From a computational perspective and utility perspective, data privacy sits at the boundary between data collection and data usage. It involves a balancing act where the goal is to change the data to the right degree so it does not leak private information when released to third parties, or publicly, while also preserving important information that the data carries. A broader interdisciplinary view of data privacy also includes the public expectation of privacy and the legal privacy regulations and associated issues. More about the data privacy research at NKU is online at http://cscdb.nku.edu/dataprivacy/.

Traian Marius Truta works primarily on data anonymization models and social networks anonymity. His main contributions in this field are developing a new anonymity model for

microdata titled p-sensitive k-anonymity and analyzing the effect of anonymization over the utility of data. He published over 50 papers in peer reviewed journals and conferences with two best paper awards. More than 10 of this research papers were co-authored with NKU undergraduate students. He serves as workshop chair on the Privacy and Anonymity in Information Society International Workshop, which is currently in its 10th edition. Since 2013, he serves as an associate editor for the Transactions on Data Privacy Journal.

Alina Campan works on data mining applications and data anonymity. She is looking at what are the effects that one incurs over the other, and how data mining (clustering in particular) can be applied to enforce various data privacy models on data. One of her contributions to the field was introducing a clustering anonymization approach along with an efficient anonymization method for social networks. She published over 50 papers in peer reviewed journals and conferences, and won one best paper awards. Several of these research papers were co-authored with NKU undergraduate students.

Geographic Information Science

The study of data structures and computational techniques to capture, represent, process and analyze geographic information. Areas of study include visualization of geospatial data, spatial data analysis, representation of geospatial data, applications of Geographic Information Systems in various fields etc.

Hongmei Wang works on Geographic Information Systems concentrating on the human-computer interaction design, uncertainty handling, applications of Geographic Information Systems and remote sensing data in various application domains. Dr. Wang has worked with students on various projects, such as knowledge elicitation for human-computer interaction design, mapping spatial distribution of honeysuckle in large forests by using remote sensing techniques, comparison of different remote sensing techniques for honeysuckle mapping, prioritizing mapping cover units in local park areas by using of GIS tools.