Intelligent Systems Research Group (ISRG)

The Intelligent Systems Research Group (ISRG) specialises in the theory and application of systems that perceive, reason, learn, and act intelligently. The aim of the group is to create intelligent systems to make life and the work environment more comfortable than it currently is.

3.4.1 Research Topics

The primary focus areas of the group currently are:

(1) Automatic control

Automatic control is everywhere. It is a truly ubiquitous technology without which modern life will not be possible. In general, it includes two parts: Control Theory and Control Engineering. Control theory is an interdisciplinary branch of engineering and mathematics that deals with the behavior of dynamical systems. The usual objective of control theory is to calculate solutions for the proper corrective action from the controller that result in system stability, that is, the system will hold the set point and not oscillate around it. Control engineering or control systems engineering is the engineering discipline that applies control theory to design systems with predictable behaviors. Multi-disciplinary in nature, control systems engineering activities focus on implementation of control systems mainly derived by mathematical modeling of systems of a diverse range. Moreover, there is a concept called ‘intelligent control’ which also belongs to Control Theory and Control Engineering and is a class of control techniques, which use various artificial intelligent computing approaches like neural networks, fuzzy logic, machine learning, evolutionary computation and genetic algorithms.

(2) Measurement and Instrumentation

Scientists, engineers and other humans use a vast range of instruments to perform their measurements. These instruments may range from simple objects such as rulers and stop watches to electron microscopes and particle accelerators. Virtual instrumentation is widely used in the development of modern measuring instruments. An intelligent instrument comprises all the usual elements of a measurement system and is only distinguished from dumb (non-intelligent) measurement systems by the inclusion of a microprocessor to fulfill the signal processing function.

(3) Computational intelligence

Computational intelligence (CI) is a set of Nature-inspired computational methodologies and approaches to address complex problems of real world applications to which traditional (first principles, probabilistic, black-box, etc.) methodologies and approaches are ineffective or infeasible. It primarily includes Fuzzy logic systems, Neural Networks and Evolutionary Computation. Nowadays CI is widely used in automatic control and measuring instrumentation to obtain a good performance.

(4) Analysis of Nonlinear dynamics

Nonlinear dynamics are changes that occur over time in a nonlinear way. Many natural phenomena including control systems are subject to nonlinear dynamics. One of the important research fields of nonlinear systems is Chaos. Chaotic behavior can be observed in many natural systems, such as the weather. Chaos theory is a field of study in mathematics, with applications in several disciplines including physics, engineering, economics, biology,
and philosophy. Chaos theory studies the behavior of dynamical systems that are highly sensitive to initial conditions, an effect which is popularly referred to as the butterfly effect.

(5) Encryption

For a complicated intelligent system, data or information must be protected and encryption is necessary. Encryption is now commonly used in protecting information within many kinds of civilian systems. Encryption is also used to protect data in transit, for example data being transferred via networks (e.g. the Internet, e-commerce), mobile telephones, wireless microphones, wireless intercom systems, Bluetooth devices and bank automatic teller machines.

3.4.2 Project


3.4.3 Publications of research group members (2010—present)

(1) Accredited Journal papers

(2) Peer reviewed international journal paper

(3) Peer reviewed conference papers


3.4.4 Research group profile

Staff: Prof. Z Wang (Research group leader), Dr. WH Ho, Mr. P Umenne

Student: Mr. A Amadi, Mr. J Nana, Mr. KW Ngidi, Mr. AM Daud

3.4.5 Collaboration

Shandong University of Science and Technology: “An ultrasonic logging sample instrument”.

3.4.6 Contact

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