

Research Challenges in Intelligent Robotic Systems: From Evolutionary Methods to KASER's and KANSEI

Keynote Address

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Abstract

Research in the area of robotics continues to be a rich and exciting field. Further, the need for robotic systems with more capabilities for the growing number of complex applications drive this research. For example, autonomous intelligent robot colonies may be used in reconnaissance missions or seek-and-capture scenarios involving a complex set of interactions between machines as well as between machines and humans and may cover long distances to remote sites. Because of the nature of the tasks, new classes of robotic systems will be required that have a high level of specification for efficiency and reliability. This, we believe, can only be accomplished through sophisticated intelligent control and efficient sensor integration as an integral part of the design of the robot and the robot's supporting systems. In this seminar, a brief historical perspective of robotic systems, particularly some projects developed by the author, will be presented. Some key research issues such as parametric versus non-parametric system models as well as types of controllers are discussed. As robotic systems evolve to more sophisticated architectures to address the needs for various applications, the requirements for enhanced intelligence as well as integration of larger sets of different sensors also grows. We will discuss the characteristics of intelligence and offer some approaches to implement this feature, including some evolutionary methods developed by the author, the Knowledge Amplification by Structural Expert Randomization (KASER) and KANSEI Engineering. Finally, we will consider some applications which offer challenges that continue to drive some of the research in the exciting area of intelligent robotic systems.

Bibliography

Dr. Gordon K. Lee was born and raised in Hawaii. He received his B.S. degree in Electrical Engineering from the University of Hawaii in 1972, his M.S.E.E. degree from the University of Connecticut in 1974 and his Ph.D. degree from the University of Connecticut in 1978. From 1978 through 1989, Dr. Lee was at Colorado State University in the Department of Electrical Engineering where he rose to the level of Full Professor. He was also the Director of the Institute for Robotic Studies.

In 1989, Dr. Lee became a faculty member in the Department of Mechanical and Aerospace Engineering at North Carolina State University and also served as Director of Graduate Programs in the Department of Mechanical and Aerospace Engineering and later as Assistant Dean for Research Programs in the College of Engineering. Dr. Lee joined San Diego State University in December 2000 where he served as the Associate Dean and Director of the

Joint Doctoral Program for the College of Engineering. He was also a full Professor in the Department of Electrical and Computer Engineering and is currently Professor Emeritus in that department.

His research interests are in the areas of robotics and intelligent control systems, particularly evolutionary control algorithms, fuzzy systems and neural networks, as well as in the applications of these methods to mobile robotic colonies. His research projects have been funded by government agencies as well as industry. He has published over 275 technical documents; Dr. Lee is a senior member of IEEE, a member of AIAA and a senior member of ISCA. He is also currently an Associate Editor for the International Journal on Intelligent Automation and Soft Computing.