Computer Science Colloquium

Tuesday, October 23, 2012
12:30pm – 1:45pm
Petty Building, Room 136

Human Gesture Recognition and Segmentation through Machine Learning

Sambit Bhattacharya, Department of Computer Science, Fayetteville State University

Abstract: Machine Learning (ML) is useful and frequently the only option when computers cannot be explicitly programmed to make decisions based on input. This situation is increasingly common in our digital age where large and complex datasets are accumulating rapidly from diverse domains. ML algorithms are designed to output predictions on previously unseen data after having learned patterns from training data that are taken from the same problem domain. This presentation will focus on supervised learning for human gesture recognition and segmentation on visual data captured by the Kinect sensor. In supervised learning, ML algorithms learn from training data that are labeled by a human, which in our case are gesture segments that are assigned their correct gesture names from a vocabulary of terms. The ML algorithms are next tested for accuracy of prediction on unseen gesture segments and this process is repeated on large data sets through cross-validation so we can be confident that the algorithms have generalized well. This research focuses on the Support Vector Machine (SVM) and the Decision Tree (DT) Learning algorithms and compares between them using data collected on aircraft marshalling gestures. We next consider the more challenging problem of training the machine to identify the beginning and end of a gesture in a continuous data stream which may contain multiple gestures mixed with random movements occurring over time. This is known as the gesture segmentation problem. Our findings indicate that probability estimates done on SVM combined with a collection of rules allow identification of these beginning and end points.

Speaker Bio: Sambit Bhattacharya is Associate Professor of Computer Science at Fayetteville State University in Fayetteville, North Carolina. He began studying at the undergraduate level in the Indian Institute of Technology and later received the Ph.D. degree in Computer Science and Engineering in 2005 from the State University of New York at Buffalo. He is interested in computer vision, machine learning and their applications in biological sciences, robotics and human-machine interaction. He has collaborated with biologists to develop automated analysis tools for cell nuclei visualized through microscopy. These software tools have aided in the scientific understanding of the organization of genomic structures like chromosome territories and processes like DNA replication and transcription. He has worked on robot vision and on problems of integrating data from other sensors for enhanced decision making. He has also worked on human-machine interaction through gesture recognition and segmentation from visual data streams. His work has been presented in several conferences, and his papers have been published in conference proceedings and journals. His research has been supported by the National Science Foundation and he has developed programs to enhance education in scientific and technical disciplines through funding provided by the Department of Education and the National Geospatial-Intelligence Agency. He teaches programming classes with educational robots, operating systems, computer organization and electives with special topics from his research interests.