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Collaborative Graduate Specialization in
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# WEEKLY COLLOQUIUM
## Tuesday, 4 March 2008
## 2:30-3:30 in RM101, Jeffery Hall

**Speaker:**   CHANG SHU
Senior Research Scientist, Inst. for Information Technology
National Research Council of Canada

**Title:**      Statistical Shape Analysis and Digital Human Modeling

**Abstract:** The shape of the human body is of great importance in a variety of applications ranging from medical diagnosis, ergonomic design, biometric identification, to computer animation and gaming. Recently, 3D imaging technology has made it possible to digitize full-length human body with reasonable accuracy and efficiency. The resulting 3D models provide tremendous amount of information about the shape of the human body. We study the space of the human body shape using a large number of 3D scans. In particular, we characterize this space through estimating the shape variability and the main modes of variation.

To conduct a statistical shape analysis, it is necessary to bring different human models into correspondence. This is traditionally done through anthropometric landmarks, which are special points on human body that specify well-defined and stable locations of anatomical parts. However, placing these landmarks on the human body is a tedious and time-consuming task. We address the problem of automatically identifying and locating anthropometric landmarks on 3D human models. Our method is based on statistical learning. Local surface properties and spatial relationships between landmarks are modeled as Markov random field. We will show that anthropometric landmarks can be located accurately through training and probabilistic inference.

Once the correspondences are established, we perform principal component analysis (PCA) on the data set. Significant modes of variation are extracted. Through visualizing the shape changes alone the PCA axes, we discovered interesting human body changes that may be used for designing ergonomic products. We also demonstrate the application of the PCA to synthesize virtual human models.

**About the speaker:**

*Dr. Chang Shu is a senior research scientist at the Institute for Information Technology, National Research Council of Canada. He is also an adjunct research professor at the School of Computer Science, Carleton University. He received Ph.D. in computer science from Queen Mary College, University of London, UK, in 1992, and B.Sc in computer science and mathematics from Harbin Institute of Technology, China, in 1985. From 1992 to 1996, he was a research associate in the Department of Mechanical and Aerospace Engineering at the Carleton University, Ottawa, Canada. From 1996 to 1998, he was a research scientist at the Integrated Manufacturing Technologies Institute of the NRC.*

*Dr. Shu is interested in solving geometric problems arising from computer vision, computer graphics, and scientific computing. He currently leads the NRC's Digital Human Modeling project and is focused on imaging, modeling, and statistical shape analysis of the human body. He has developed techniques and algorithms for representing and processing shapes in two and three dimensional space and has transferred technologies to Canadian companies. In 2003, he received NRC Outstanding Achievement Award. Dr. Shu is a member of the World Engineering Anthropometry Resource Committee.*