Department of Computer Science
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WHEN: FRIDAY, JULY 2, 2010
WHERE: PGH 216
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SPEAKER: Dr. Mubarak Shah, University of Central Florida

Host: Dr. Ioannis Kakadiaris

TITLE: Detecting Key Motion Patterns

ABSTRACT:

Scene understanding, in general, may refer to scene layout in structured environments, motion patterns and scene status. The term motion pattern in our work refers to a spatial segment of the image that has a high degree of local similarity of speed as well as flow direction within the segment and otherwise outside. In this talk, I will present two approaches for detecting patterns of motion. Both approaches for detecting motion patterns do not rely on object detection and tracking, and use low level feature e.g. pixel wise optical flow.

The first approach employs Diffusion maps (DM) framework, which embeds the manifold points into a lower dimensional space while preserving the intrinsic local geometric structure. In our approach, each clip is split into spatiotemporal cuboids and the motion of a moving pixel is quantized in four directions. For each cuboid in a clip, a 4 - bin histogram is computed. These local histograms for all cuboids in a clip are then concatenated into one long vector. This is essentially a bag of words representation of clips. After obtaining bag of words we apply Diffusion maps embedding to map the words into a lower dimensional space while preserving the intrinsic local geometric structure. Finally, these words in lower dimensional space are clustered to discover key motion patterns.

In the second approach, we employ a mixture model representation of salient patterns of optical flow for learning motion patterns from dense optical flow in a hierarchical, unsupervised fashion. Using low level cues of noisy optical flow, K-means is used to initialize a Gaussian mixture model for temporally segmented clips of video. The components of this mixture are then filtered and instances of motion patterns are computed using a simple motion model, by linking components across space and time. Motion patterns are then initialized and membership of instances in different motion patterns is established by using KL divergence between mixture distributions of pattern instances. After deriving conditional expectation of motion flow for patterns, the learned model is applied to the commonly encountered surveillance problem of anomaly detection.

BIO: Dr. Mubarak Shah, Agere Chair Professor of Computer Science, is the founding director of the Computer Visions Lab at UCF. He is a co-author of three books (*"Automated Multi-Camera Surveillance: Algorithms and Practice" (2008); Video Registration* (2003); and "*Motion-Based Recognition* (1997)) all by Springer. Dr. Shah is a fellow of IEEE, IAPR, AAAS and SPIE. In 2006, he was awarded a Pegasus Professor award, the highest award at UCF, given to a faculty member who has made a significant impact on the university, has made an extraordinary contribution to the university community, and has demonstrated excellence in teaching, research and service. He is ACM distinguished speaker. He was an IEEE Distinguished Visitor speaker for 1997-2000 and received IEEE Outstanding Engineering Educator Award in 1997. He received the Harris Corporation's Engineering Achievement Award in 1999; the TOKTEN awards from UNDP in 1995, 1997, and 2000; Teaching Incentive Program award in 1995 and 2003; Research Incentive Award in 2003 and 2009; Millionaires' Club awards in 2005, 2009 and 2009; University Distinguished Researcher award in 2007; an honorable mention for the ICCV 2005 Where Am I? Challenge Problem; and was nominated for the best paper award in ACM Multimedia Conference in 2005. He is an editor of international book series on Video Computing; editor in chief of Machine Vision and Applications journal, and an associate editor of ACM Computing Surveys journal. He was an associate editor of the IEEE Transactions on PAMI, and a guest editor of the special issue of International Journal of Computer Vision on Video Computing.