Announcing the Final Examination of Nazim Ashraf for the degree of Doctor of Philosophy

Time & Location: June 26, 2012 at 10:00 AM in HEC 438
Title: STUDY OF HUMAN ACTIVITY IN VIDEO DATA WITH AN EMPHASIS ON VIEW-INVARIANCE

The perception and understanding of human motion and action is an important area of research in computer vision that plays a crucial role in various applications such as surveillance, HCI, ergonomics, etc. In this thesis, we focus on the recognition of actions in the case of varying viewpoints and different and unknown camera intrinsic parameters. The challenges to be addressed include perspective distortions, differences in viewpoints, anthropometric variations, and the large degrees of freedom of articulated bodies. We have developed algorithms that overcome these challenges. Our first algorithm is based on the rank constraint on the family of planar homographies associated with triplets of body points. We represent action as a sequence of poses, and decompose the pose into triplets. Therefore, the pose transition is broken down into a set of movement of body point planes. In this way, we transform the non-rigid motion of the body points into a rigid motion of body point planes. We use the fact that the family of homographies associated with two identical poses would have rank 4 to gauge similarity of the pose between two subjects, observed by different perspective cameras and from different viewpoints. Extensive experimental results show that our method can accurately identify action from video sequences when they are observed from totally different viewpoints with different camera parameters. We then show that it is possible to extend the concept of triplets to line segments. In particular, we establish that if we look at the movement of line segments instead of triplets, we have more redundancy in data thus leading to better results. We demonstrate this concept on “fundamental ratios.” We decompose a human body pose into line segments instead of triplets and look at set of movement of line segments. We also propose a new algorithm based on the concept of “Projective Depth”. Given a plane, we can find out a relative depth of a point relative to the given plane. The issue is finding planes in a scene and we present two methods to estimate useful plane(s): (i) Ground plane, and (ii) Mirror-symmetric planes. We present extensive experimental results, which show that our method is able to handle large variations in viewpoint.

Major: Computer Science

Educational Career:
Bachelor’s of Computer Science, BS, 2005, Lahore University of Management Sciences

Committee in Charge:
Dr. Hassan Foroosh, Chair, EECS
Dr. Charles Hughes, EECS
Dr. Marshall Tappen, EECS
Dr. Michael Mosshel, Digital Media

Approved for distribution by Dr. Hassan Foroosh, Committee Chair, on June 10, 2012.

The public is welcome to attend.