

Human Face Tracking and Facial Expression Recognition based on Tensor Decomposition

Hong Yan

Department of Electrical Engineering

City University of Hong Kong



Abstract:

In this presentation, we introduce tensor-based models recently developed by our research group for human face tracking and facial expression recognition. We consider a video segment as a third-order tensor and perform incremental singular value decomposition (SVD). The decomposition is updated gradually rather than computed from each segment directly, and this significantly improves the computational speed and makes it possible to implement the tracking process in real-time. The procedure learns a low-rank representation of the tensor. We integrate face tracking with facial expression recognition. Gabor wavelets are effective for recognition. However, there are too many features if we consider multiple scales and orientations of the wavelets. We have recently developed a co-clustering based method to reduce the number of features significantly. In conventional clustering algorithms, we partition input samples into different classes in terms of input features. In co-clustering, we extract coherent patterns in both sample and feature directions, and this is a more difficult problem than clustering. In our method, we represent a coherent pattern as a low-rank tensor and it can be detected from the intersection of hyperplanes in a high dimensional data space. In the co-clustering process, we can extract most discriminant features and eliminate irrelevant ones. Experiments on several video and image databases demonstrate that our system can track human faces and recognize common facial expressions with high accuracy.