Announcing the Final Examination of Muhammad Nazar Khan for the degree of Doctor of Philosophy

Time & Location: March 28, 2013 at 9:00 AM in HEC 438
Title: Discriminative Dictionary Learning with Spatial Constraints

The coding of signals into a sparse representation has numerous benefits that have been exploited by computer vision researchers over the years. The new sparse representation requires an over-complete basis called a dictionary. In this work, we investigate how dictionaries can be learned in a discriminative yet stable manner and introduce how smoothness priors can be incorporated into the learning framework.

We show that discriminative dictionary learning is inherently unstable and how this instability can be mitigated. Furthermore, since natural images are characterized by a smoothness prior, we present a novel approach to discriminative dictionary learning with neighborhood constraints. This is done by embedding dictionaries in a Conditional Random Field (CRF) and imposing label dependent smoothness constraints on the resulting sparse codes at adjacent sites. This way, a smoothness prior is used while learning the dictionaries and not just to make inference. This is in contrast with competing approaches that learn dictionaries without such a prior. Finally, we demonstrate how higher-order, multiscale smoothness constraints can be incorporated into the learning framework.

Pixel-level classification results on the Graz02 bikes dataset demonstrate that dictionaries learned in our discriminative setting with neighborhood smoothness constraints can equal the state-of-the-art performance of bottom-up (i.e. superpixel-based) segmentation approaches.

Major: Computer Science

Educational Career:
Bachelor’s of Computer Science, BS, 2003, Lahore University of Management Sciences
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Approved for distribution by Marshall F. Tappen, Committee Chair, on February 8, 2013.

The public is welcome to attend.