Department of Statistics

DISSERTATION PRESENTATION AND DEFENSE

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Three Essays on Statistical Models for Computer Vision

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ABSTRACT

We present three statistical models with applications in computer vision. In the first part of this thesis, we revisit and provide a new interpretation to linear and quadratic discriminant analyses for the classification of multivariate binary data. Multivariate binary distributions are partitioned into equivalence classes using the concept of exponential tilting. We use normal approximations and show that the resulting approximate maximum likelihood inferences resemble LDA and QDA.

In the second part of the thesis, we build probabilistic models for object detection. An adaptive alternative hypothesis motivated by a generalized likelihood ratio test is used for non-objects in lieu of negative training examples. We propose a novel standardization scheme to log likelihood ratios that improves detection performance. The stability of the standardized likelihood ratios further provides a unified framework for occlusion reasoning.

In the third part of the thesis, we develop a sequential algorithm for the learning of object part models. This algorithm is based on approximate inference for a generative image model with configurations of parts and patchwork-of-parts composition. The algorithm emphasizes reconstruction while encouraging sparsity using a repulsive spatial point process.

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