

Abstract of Main Thesis

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Title of Thesis

Linear and Multilinear Independent Component Analysis for Color Image Classification

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Abstract on the Content of the Applicant's Thesis

Image recognition and understanding are important and challenging problems in the fields of computer vision and pattern recognition. They are usually viewed as the image classification issue which has received considerable attention recently. To achieve high accuracy, image classification requires distinctive image features for effective image representation and suitable fusion methods to combine different features. To date, many global and local features such as color histogram, scale invariant feature transform (SIFT), bag of features have been proposed for image classification. Some linear subspace learning methods such as principle component analysis (PCA), linear discriminant analysis (LDA) have been proposed or used to select significant components from a variety of image features. Since PCA and LDA are based on second order statistics, they cannot be used for effectively representing the features with non-Gaussian distributions.

This thesis utilizes independent component analysis (ICA) for effective image representation. Compared to PCA and LDA, ICA can represent statistically independent non-Gaussian components by decorrelating the higher order moments beside the first and second order moments. Meanwhile, it is able to describe local variations. Three contributions are obtained in the thesis. (1) We use ICA to obtain an adaptive color transformation for each category, which enhances the contrast between the object and its background. The proposed color independent components based SIFT descriptor (CIC-SIFT) can extract more effective and discriminative local features for image classification. (2) We utilize ICA to select more distinctive and compact independent components from image features for both scene and object classification. (3) Based on multilinear algebra theory, we also propose a framework by extending linear ICA to generalized N -dimensional ICA (GND-ICA). It can be used not only for feature selection but also for feature fusion. The proposed methods lead for an impressive increase on the image classification.