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Human Detection by Quadratic Classification on Subspace of Extended Histogram of Gradients

Abstract:

This paper proposes a quadratic classification approach on the subspace of Extended Histogram of Gradients (ExHoG) for human detection. By investigating the limitations of Histogram of Gradients (HG) and Histogram of Oriented Gradients (HOG), ExHoG is proposed as a new feature for human detection. ExHoG alleviates the problem of discrimination between a dark object against a bright background and vice versa inherent in HG. It also resolves an issue of HOG whereby gradients of opposite directions in the same cell are mapped into the same histogram bin. We reduce the dimensionality of ExHoG using Asymmetric Principal Component Analysis (APCA) for improved quadratic classification. APCA also addresses the asymmetry issue in training sets of human detection where there are much fewer human samples than non-human samples. Our proposed approach is tested on three established benchmarking data sets - INRIA, Caltech, and Daimler - using a modified Minimum Mahalanobis distance classifier. Results indicate that the proposed approach outperforms current state-of-the-art human detection methods.