

Research on the HOG algorithm and its application in computer vision

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Abstract: This thesis investigates the Histogram of Oriented Gradients (HOG) algorithm and its applications within the field of computer vision. HOG is a robust feature descriptor that captures local object appearance and shape by counting occurrences of gradient orientation in localized portions of an image. The study begins with a comprehensive analysis of the algorithm's theoretical foundations, including gradient computation, cell and block normalization, and descriptor formation. The core contribution involves implementing and evaluating the HOG algorithm for object detection tasks, specifically focusing on pedestrian detection. Experimental results demonstrate that HOG, when combined with a linear Support Vector Machine (SVM) classifier, achieves high accuracy in detecting human figures under varying illumination and pose conditions. The thesis further explores the algorithm's limitations, such as computational cost and sensitivity to occlusion, and proposes optimization techniques to enhance processing speed. The findings confirm that HOG remains a highly effective and reliable feature extraction method for real-time computer vision applications, providing a strong baseline for more advanced deep learning approaches.

Keywords: HOG, computer vision, algorithm, application