

Novel Unsupervised Approaches for Traffic Sign Image Segmentation in Autonomous Driving

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Abstract : Road sign recognition is a key element in advanced driver-assistance systems (ADAS) and self-driving technologies, as it is fundamental to maintaining safe and effective navigation. Conventional supervised learning approaches rely heavily on extensive labeled datasets for training, which can be resource-intensive and challenging to obtain. This study examines the effectiveness of three unsupervised image segmentation approaches—Kmeans clustering, GrabCut, and Gaussian Mixture Model (GMM)—in detecting road signs within complex settings. Using a publicly available Road Sign dataset from Kaggle, we assess the effectiveness of these methods based on clustering performance metrics. Our results indicate that GMM achieves the highest performance across these metrics, demonstrating superior segmentation accuracy under diverse lighting and weather conditions, followed by GrabCut and K-means clustering. This research highlights the potential of unsupervised techniques in reducing the dependency on labeled data, offering insights for future advancements in road sign detection systems for ADAS and autonomous vehicles.

Keywords : silhouette score, calinski-harabasz index, davies-bouldin index, k-means clustering, grabcut, gaussian mixture mode

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