**Real-Time Traffic Sign Recognition with Open-Set Rejection and Temporal Consensus**

# Abstract

Traffic sign recognition (TSR) in the wild is harder than isolated medical image classification because signs are tiny, partially occluded, surrounded by distractors (storefronts, banners), and must be recognized under strict latency. We present a real-time TSR pipeline for roadside video that couples a lightweight one-stage detector (optimized for small objects) with a fine-grained classifier using hierarchical categories (regulatory, warning, guide). To curb false positives from look-alike non-traffic signage, we integrate an open-set rejection head and simple geometric–color priors (octagon/triangle/circle with red/blue/white consistency). A temporal consensus module with multi-object tracking stabilizes predictions across frames, improving robustness to motion blur and partial occlusion. The system targets ≤50 ms end-to-end latency on embedded GPUs and is evaluated with mAP@[.5:.95], F1, and AUROC for open-set rejection against curated negatives. Experiments on mixed public and locally collected footage show high precision at real-time speeds, with ablations confirming the contributions of priors and temporal consensus. The resulting pipeline is a deployable baseline for driver assistance and intelligent transportation applications and a platform for open-world TSR research.

**Keywords:** Traffic sign recognition; real-time detection; tiny objects; open-set rejection; shape–color priors; temporal consensus; edge deployment.