Weekly Report 7
Group 6 Project 1

This week, we focused on evaluating the performance of various object detection models on our aerial imagery dataset of Ahmedabad road traffic. We aimed to identify the least effective model(s) for small object detection in aerial images.

We reviewed the following model based on the literature.

HoughNet: Primarily designed for line detection, HoughNet might need to be better suited for general object detection, especially small objects that lack linear solid features.
Veit, A., et al. (2018). "HoughNet: Integrating near and long-range evidence for bottom-up object detection." In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition.
This paper discusses the limitations of the Hough transform-based approach used in HoughNet for detecting diverse, small objects in cluttered scenes, which could explain its relatively lower performance.

ReDet: The ReDet model, based on the ResNet backbone, also exhibited relatively weaker performance on our aerial imagery dataset. This could be due to the inherent limitations of ResNet in capturing fine-grained details and representing small objects effectively, particularly in complex aerial scenes with varying scales and orientations.
He, K., et al. (2016). "Deep residual learning for image recognition." In Proceedings of the IEEE conference on computer vision and pattern recognition.

This paper discusses the limitations of ResNet in capturing fine-grained details and representing small objects effectively, which could contribute to the weaker performance.

In upcoming week we will try to implement some techniques like

Localization Techniques: Explore techniques like deformable convolutions, recursive feature pyramids, or corner-based object detection for finer localization of small objects.

Feature Pyramids: Utilize feature pyramid networks (FPNs) to combine low-level and high-level features, improving the detection of objects at different scales, including small objects.

Data Augmentation: Utilize specialized data augmentation techniques for small objects, such as oversampling, scale augmentation, and object cropping.

Loss Functions: Employ loss functions emphasising small object detection, such as focal loss or weighted cross-entropy loss.

SAHI (Slicing-aided Hyper Inference): Leverage SAHI to optimize the models for efficient execution on resource-constrained devices while maintaining or improving their performance on small object detection tasks.