Protecting National Airspaces: Improved Object Detection and Classification

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Lincoln Laboratory



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MIT LL's **mission** is to develop a wide range of technology for the Department of Defense and other agencies to support national security.

Image Data Data Information Public Data Sources ∞ 22,691 images ∞ 53,887 bounding box annotations
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ImageNet
Two Sets of Classes: Fine-Grain Visualization Classification Airplane Dataset
20 Fine-Grain Berkeley Deep Drive Vehicle Dataset

Problem Statement

- **Problem:** Classify 20 unique objects, including aircraft,
- vehicles, people, and animals in different images.

Importance: Fine-grain information enables operators, ranging from military to national and state agencies, to make critical decisions accurately.



7 Coarse-Grain

Objective

Our goal is to develop a model pipeline capable of both fast inference time and high accuracy in an effort to improve on established MIT LL algorithms.



Models: DEtection TRansformer (DETR)

Initial Output

Models:

DETR & Residual Network (ResNet)

DETR & Context-aware Attentional Pooling (CAP)

Results



Model Pipeline 2's DETR & CAP was the best performing model.



CAP obtained 0.47% class error which is a 89.52% point class

error improvement from Model Pipeline 1.



Impact

Curated a unique fine-grain classification dataset.

Created a model pipeline capable of giving end users fine-grain information allowing them to make informed decisions regarding airspace safety.

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