Ahmedabad University

CSE 641 Computer Vision

Weekly Report - Week 7

Project Title: Evaluate Performance of YOLO Family Models in Small Object Detection (HBB)

Section - 1
Group - 02

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Introduction

The major goal of Week 7 was to improve the performance of the YOLOR model, particularly its ability to detect small objects, by enhancing its architecture as well as data augmentation approach. For datasets such as VisDrone, where objects tend to occur at smaller scales, localization and classification are hard for traditional detection pipelines. We therefore experimented with attention mechanisms, improved feature fusion approaches, and a more advanced augmentation pipeline to solve this issue.

Methodology

1. **Architectural Improvements**:
    - **CBAM Integration**:The Convolutional Block Attention Module (CBAM) was integrated into the YOLOR backbone. CBAM sequentially applies channel and spatial attention, which enables the model to pay greater attention to important object features and disregard background noise, especially when small objects are embedded in cluttered environments.
    - **BiFPN Integration (In Progress)**: YOLOR's default FPN + PAN structure is replaced by BiFPN (Bidirectional Feature Pyramid Network). BiFPN supports convenient and effective multi-scale feature fusion through learnable weights. The design promotes more aggregation capacity in features of varied resolutions in the model, something important in detection of better small and distant object accuracy..
2. **Augmentation Strategy**:
    - **Mosaic-9 Implementation**: We also enlarged the current 4-image Mosaic augmentation to 9-image Mosaic. This greatly boosts the variety of object scale and context in one training batch. It gives the model a more general learning environment where small objects occur more and are more diverse in their spatial location, finally enhancing its robustness when detecting.

Observations:

After applying Cbam we saw an increase in mAP scores from 0.15 to 0.19 and it demonstrates improvement for small object detection.