TEAM 404

MINI PROJECT ON

# OBJECT DETECTION

Overview and Code Analysis

# Project Overview and Objectives

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## OBJECTIVE

Develop a CNN-based model to detect objects in images using the COCO dataset.

## METHODOLOGY

1. Load and filter dataset annotations.
2. Preprocess images and handle missing data.
3. Design a CNN for multi-label classification.
4. Train and evaluate the model on 25,000 images.

## OUTCOME

Efficiently classify 80 object categories with the trained model.

# Data Loading and Filtering Annotations

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## LOADING ANNOTATIONS

- Import COCO dataset annotations from JSON.
- Define valid categories (IDs 1 to 80) to filter out irrelevant classes.

## DATA FILTERING

1. Exclude missing images by using a pre-defined list of IDs to skip.
2. Keep only valid images for training to ensure model accuracy.

# Preprocessing and Data Generator

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## IMAGE PREPROCESSING

- Resize images to (128x128) and normalize pixel values to the [0, 1] range.
- Simplifies data for consistent model input and faster computation.

## DATA GENERATOR

1. Load images in batches using a generator to reduce memory usage.
2. Efficiently labels images with valid category IDs for multi-label classification.

# CNN Model Architecture

## MODEL DESIGN

- Uses convolutional and pooling layers for feature extraction.
- Flatten layer followed by Dense layers for classification.

## OUTPUT LAYER

1. Sigmoid activation for multi-label classification across 80 object categories.
2. Uses binary cross-entropy loss to handle independent class probabilities

# Training and Evaluation

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## TRAINING

- Model compiled with the Adam optimizer and binary cross-entropy loss.
- Trained with a validation split to monitor accuracy and loss over epochs.

## EVALUATION

- Performance evaluated on validation data for accuracy and loss metrics

# Results and Analysis

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## ACCURACY AND LOSS PLOTS

- Training vs validation accuracy and loss plotted over epochs.
- Analyzes model's performance and identifies any overfitting or underfitting issues.
- **Accuracy**: Our model achieved 59.50% accuracy.

## INSIGHTS

- Observing the accuracy and loss curves helps evaluate the effectiveness of the CNN and guides further improvements.

## CODE SNIPPET

```
Epoch 15/15
3/3 ━━━━━━━━━━━━━━━━━━━━ 1s 112ms/step - accuracy: 0.5525 - loss: 0.1310 - val_accuracy: 0.7000 - val_loss: 0.1270
1/1 ━━━━━━━━━━━━━━━━━━━━ 1s 578ms/step - accuracy: 0.5950 - loss: 0.1272
Validation Loss: 0.1272, Validation Accuracy: 59.50%
```

# Conclusion and Future Enhancements

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## PROJECT SUMMARY

- Developed an object detection model on the COCO dataset with a multi-label CNN.
- Achieved a validation accuracy suitable for real-world applications.

## FUTURE SCOPE

- Explore deeper CNN architectures for enhanced accuracy.
- Fine-tune with a larger dataset or implement transfer learning.
- Test the model on real-world images and deploy as an application.

# Our Team Members

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# THANK YOU

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