

## Project Documentation

### Introduction

Text detection in images is a crucial task in numerous applications such as OCR (Optical Character Recognition), autonomous driving, and assistive technologies. This project uses Region-based Convolutional Neural Networks (R-CNN) to identify and localize textual content in images accurately. By leveraging deep learning techniques, the model aims to achieve robust text detection even under challenging scenarios like cluttered backgrounds or varying illumination.

### Technical Approach

#### 1. Dataset Preparation:

- Images containing text were preprocessed and annotated for training.

#### 2. Model Architecture:

- The R-CNN model involves region proposal generation, feature extraction using a CNN backbone (e.g., ResNet), and classification with bounding-box regression.

#### 3. Training Pipeline:

- Loss Functions: Cross-Entropy for classification, Smooth L1 for bounding box regression.
- Optimizer: Adam/SGD for parameter optimization.

#### 4. Evaluation:

- Metrics: Precision, Recall, F1-Score, and IoU for bounding box accuracy.

### Dataset

## Text Detection in Images using R-CNN

The dataset comprises diverse images with varying text styles, fonts, and backgrounds. Annotations for text bounding boxes were used for supervised learning. The dataset was split into training, validation, and testing sets to ensure robust evaluation.

### Results

The model demonstrated high precision and recall in text detection tasks, with an F1-Score of X% (replace with actual results). Qualitative results showed accurate localization of text regions under different conditions.

### Future Work

1. Implement Faster R-CNN or YOLO for improved inference speed.
2. Extend the model to detect multi-lingual text.
3. Explore semi-supervised learning techniques for training on unlabeled data.

### Setup Instructions

1. Clone the repository:

```
git clone https://github.com/your-repo/text-detection-rcnn.git
```

2. Install dependencies:

```
pip install -r requirements.txt
```

3. Train the model:

```
python train.py
```

4. Test the model:

## Text Detection in Images using R-CNN

```
python test.py --input images/sample.jpg --output results/
```

### References

1. Girshick, R. et al. (2014). Rich feature hierarchies for accurate object detection and semantic segmentation.
2. Relevant papers on R-CNN and text detection.