Object Detection in Satellite Images

Background:

Satellite imagery has become a key source of information for numerous applications such as agriculture, urban planning, and environmental monitoring. However, analyzing these images is a challenging task due to their large size, variations in illumination, and the presence of multiple objects in the scene. Object detection in satellite images can provide valuable insights into different domains, such as detecting infrastructure damage, illegal constructions, and land-use changes. In this project proposal, we present a plan to develop a deep learning-based object detection model for satellite imagery.

Objective:

The objective of this project is to develop a deep learning-based object detection model for satellite imagery that can accurately detect various objects in the scene. We aim to leverage state-of-the-art deep learning techniques to improve the performance of existing models and address challenges such as variations in illumination and the presence of multiple objects in the scene.

Methodology:

We will use the latest deep learning techniques to develop an object detection model for satellite imagery. We will leverage the You Only Look Once version 4 (YOLOv4) architecture, which has shown impressive performance in object detection tasks. YOLOv4 uses a single neural network to make predictions, resulting in a faster and more accurate model. We will fine-tune the pre-trained YOLOv4 model on a large dataset of annotated satellite images, such as the SpaceNet dataset, which contains over 7,000 high-resolution images. We will also augment the dataset using various techniques such as random cropping, rotation, and flipping. We will evaluate the

performance of the model using standard metrics such as precision, recall, and F1-score.

Dataset:

We will use publicly available satellite image datasets such as the SpaceNet dataset, which contains high-resolution images of different cities annotated with various objects such as buildings, roads, and cars. We will also consider augmenting the dataset by incorporating additional publicly available satellite image datasets. We will use a significant portion of the dataset to train the model, and the remaining portion for validation and testing.

Expected Outcomes:

We expect to develop a deep learning-based object detection model for satellite imagery that outperforms existing models in terms of accuracy, speed, and robustness. We also aim to identify and address challenges such as variations in illumination and the presence of multiple objects in the scene. The model can provide valuable insights into different domains such as agriculture, infrastructure development, and disaster response.

Conclusion:

In conclusion, this project proposal outlines a plan to develop a deep learning-based object detection model for satellite imagery. We will use the YOLOv4 architecture to develop the model and fine-tune it on a large dataset of annotated satellite images. The model will provide valuable insights into different domains and can help advance research in the field of satellite image analysis. We believe that the proposed model will contribute significantly to the state-of-the-art in object detection in satellite imagery.

References:

1. **Data sources:**

- SpaceNet dataset: https://spacenet.ai/sn7-challenge/
- Sentinel-2 dataset: https://sentinel.esa.int/web/sentinel/missions/sentinel-2/data-products
- DigitalGlobe OpenData: https://www.digitalglobe.com/ecosystem/open-data

2. **Software tools:**

- TensorFlow: https://www.tensorflow.org/
- PyTorch: https://pytorch.org/
- OpenCV: https://opencv.org/

3. **Research papers:**

- YOLOv4: Optimal Speed and Accuracy of Object Detection, Alexey Bochkovskiy et al., 2020.
- R2CNN: Rotational Region CNN for Orientation Robust Scene Detection, Jian Ding et al., 2018.
- FPN: Feature Pyramid Networks for Object Detection, Tsung-Yi Lin et al., 2017.
- Mask R-CNN, Kaiming He et al., 2017.

Teammate:

- Mayson Ahmed Ahmed Mohamed.
- Eman Abdelwhab Gaber Abdelwhab.
- Hussein Mohamed Hussein Ibrahim
- Aml kamal kamal shalaby.
- Khaled Tarek Mohamed Elbahansy.