**Super-Resolution Building Height Estimation using Sentinel-1 & Sentinel-2 Data**

**Overview**

This project predicts building heights at 2.5m resolution using Sentinel-1 and Sentinel-2 data. The input includes two images from the same location, and the output is a building height prediction in .tif format. The model employs a combination of RealESRGAN and custom regression networks to predict building heights.

**Requirements**

* See details in requirements.txt

**Pretrained Weights**

* RealESRGAN weights: ./weights/realesrgan/checkpoint.tar
* Building height prediction model weights:

./weights/realesrgan\_feature\_aggre\_weight\_globe/checkpoint20.tar

**Data Preparation**

**1. Sentinel Data Download**

You can download Sentinel-1 and Sentinel-2 images using **Google Earth Engine (GEE)** for the area of interest. Ensure both datasets cover the same location. The **Download\_Sentinel.py** script automates this process, and the data is saved locally. If you encounter size limitations, you can use Google Drive to store the data. For now they don’t provide the GEE download and preprocess code, so our data is a little different from them, but it’s not a big deal, in the following folder, s1\_Austin.tif is theirs, s1\_Austin\_test.tif is downloaded by our code.

* Sentinel-1: ./data/s1
* Sentinel-2: ./data/s2

**2. Splitting the Data into Patches**

The images must be split into 64x64 patches for the model input. This can be done using the **Data\_Preparation.py** script. It splits both Sentinel-1 and Sentinel-2 images into smaller patches and stores them in the following directories:

Place the Sentinel and building height data in the appropriate directories:

/data

├── s1/ # Original Sentinel-1 images

├── s2/ # Original Sentinel-2 images

├── s1\_patches/ # 64x64 patches from Sentinel-1 images

├── s2\_patches/ # 64x64 patches from Sentinel-1 images

**How to Run the Model**

**1. Download the Repository**

**2. Install Dependencies (GDAL is not required)**

pip install -r requirements.txt

**3. Run Building Height Prediction**

Just run the predict\_building\_height.py script:

**4. Output**

* The model will generate building height predictions and save them in the output\_predictions/ directory.
* Additionally, building structure predictions are saved in the output\_predictions\_building/ directory.
* All outputs are in .tif format, and the predictions are generated at a 2.5m resolution.

**Example Workflow**

1. Download Sentinel-1 and Sentinel-2 Data: Use Download\_Sentinel.py to download the required data.
2. Split the Data into 64x64 Patches: Use Data\_Preparation.py to split the images.
3. Run the Model: Execute predict\_building\_height.py to predict building heights.
4. Merge the Predictions: The individual patches can be merged into a final output image using Merge\_tifs.py.