Semantic Segmentation of Roofs from Aerial Imagery using Deep Learning

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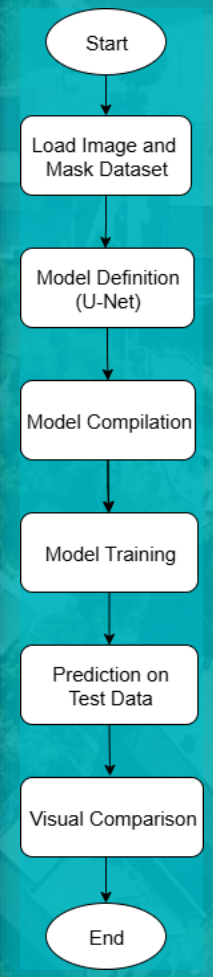
Study Area: Christchurch City, New Zealand

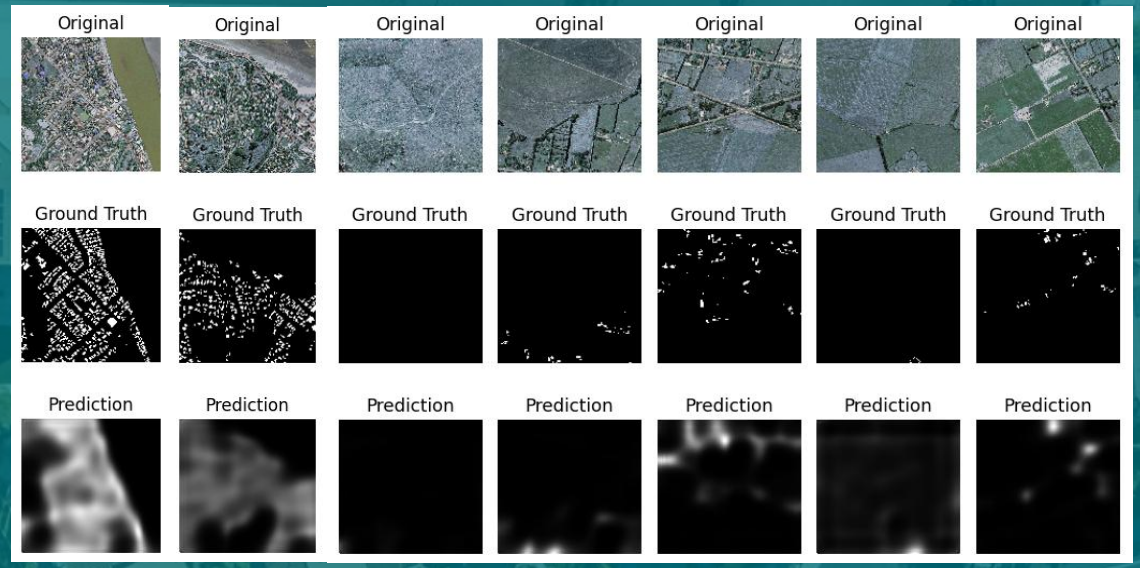
Christchurch, the largest city in the South Island of New Zealand, serves as the study area for this research. The city was selected due to the availability of very-high-resolution orthorectified aerial imagery and accurately labelled rooftop data, which are critical for training and evaluating deep learning models for semantic segmentation.

Feature	Details
Coverage	~457 km^2 of orthorectified aerial imagery
Spatial Resolution	Very high – 0.075 meters per pixel
Labelled Roof Structures	Over 220,000
Image Patch Size	128 × 128 pixels
Training Set	857 images (RGB + Mask)
Validation Set	94 images (RGB + Mask)
Test Set	95 images (RGB + Mask)

Methodology



Results



	Accuracy	Loss
Training	0.9278	0.0023
Validation	0.9301	0.0022

Conclusion

This project aimed to develop a U-Net–based semantic segmentation model for rooftop detection using high-resolution aerial imagery. Despite the high-quality data, the model produced blurry predictions due to down sampling to 128×128 resolution, class imbalance from many empty masks, and potentially imprecise ground truth labels. Future improvements include using larger image sizes, enhancing label quality, addressing class imbalance, and adopting advanced architectures like U-Net++ or DeepLabV3+.