

Supplementary Information

AI-Powered Road Network Detection from Satellite Imagery with Zero Manual Labelling

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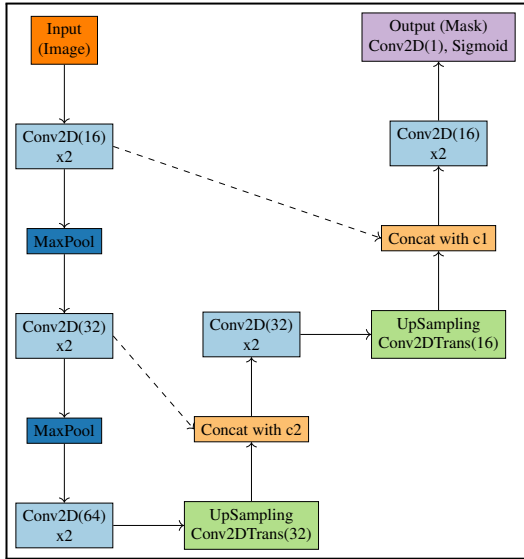
ABSTRACT

Supplementary Table

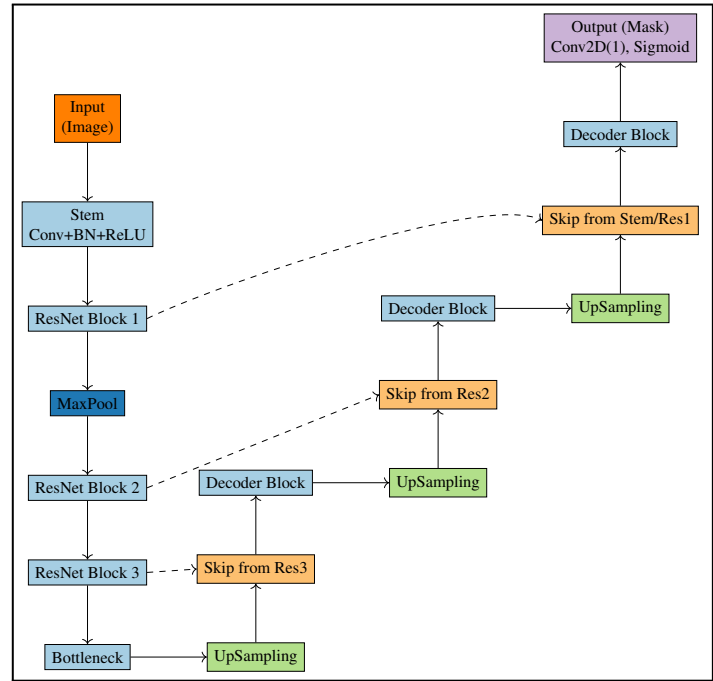
Band Name	λ (nm)	Resolution (m)
B1 - Aerosols	443	60
B2 - Blue	490	10
B3 - Green	560	10
B4 - Red	665	10
B5 - Vegetation Red Edge	705	20
B6 - Vegetation Red Edge	740	20
B7 - Vegetation Red Edge	783	20
B8 - Near Infrared (NIR)	842	10
B8A - Narrow NIR	865	20
B9 - Water Vapor	945	60
B11 - Shortwave Infrared (SWIR)	1610	20
B12 - Shortwave Infrared (SWIR)	2190	20

Table 1. Supplementary Table S1. Sentinel-2 bands used as model input. All 12 spectral bands were stacked into a multi-channel input tensor. Lower-resolution bands (20 m and 60 m) were bilinearly upsampled to a common 10 m grid for stacking.

Supplementary Figures



(a) Baseline U-Net architecture. A standard symmetric encoder-decoder network with skip connections to preserve spatial details at multiple scales.



(b) ResNet34 U-Net variant. Deeper encoder with residual blocks enables richer feature extraction and improved robustness to noisy data.

Figure 1. Supplementary Figure S1. Comparison of the Baseline U-Net (left) and ResNet34 U-Net (right) architectures. The ResNet variant introduces deeper feature hierarchies and skip connections that better capture semantic and contextual information compared to the shallower plain U-Net. For road segmentation using noisy OSM-derived labels and medium-resolution Sentinel-2 imagery, the ResNet model is better equipped to generalise and recover missing or subtle road features across diverse terrains.



(a) Original image (cropped for visibility)



(b) Salt-and-pepper noise (cropped for visibility)



(c) Original image (full scene)



(d) Localized bright/dark spots

Figure 2. Supplementary Figure S2. Augmentation examples applied to Sentinel-2 imagery of Monasterevin, Ireland. (a)–(b): Salt-and-pepper noise augmentation on a cropped region, mimicking sensor transmission artifacts. (c)–(d): Localized bright/dark spot augmentation on the full scene, simulating uneven illumination from terrain shadowing and variable surface reflectance.