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| **Using machine learning to upscale ALS derived forest structural information** |
| We present a novel machine learning approach designed to expand the coverage of structural forest datasets derived from Airborne Laser Scanning (ALS). Despite ALS's status as the benchmark for structural forest assessment, its widespread use is hampered by high costs and extensive processing needs. Our workflow integrates ALS with multispectral aerial imagery from the US National Imagery Program (NAIP) to produce a contiguous, landscape-level, 0.5 m synthetic Canopy Height Model (CHM) for the Lake Tahoe Basin. The model utilises a U-Net architecture to predict forest structure beyond the limits of existing ALS data. The upscaling technique produces a sub-meter resolution canopy height model, enabling the pairing of individual, crown dominant trees for validation purposes. We have been using the tree-matching validation technique in a first instance to optimise the point cloud processing against a stem map field survey and its second instance to correlate ALS CHM with synthetic CHM outputs. Derived products such as canopy cover maps show high overall accuracy (≥ 0.82) when compared to ALS products across all tested study sites. The workflow offers a highly scalable solution, working across the heterogenous US Geological Survey ALS database using entirely open-source tools. By aligning with NAIP's biennial updates, our model supports ongoing forest management and carbon sequestration efforts, demonstrating significant potential for landscape-scale environmental monitoring. The further development of this tool has been supported by the MBIE Catalyst program. |