IV. Conclusions

This research demonstrated that the U-Net model is capable of efficient and precise semantic segmentation of various land cover types using an aerial imagery dataset. Testing under different scenarios—such as integrating lower-quality secondary datasets, applying data augmentation techniques, and using the SGD optimizer revealed its adaptability for environmental monitoring. However, trade-offs were observed: while data augmentation improved segmentation accuracy, it increased computational costs, and the inclusion of lower-quality datasets occasionally reduced performance for certain classes. The use of the SGD optimizer highlighted the need for precise hyperparameter tuning to maintain accuracy.

Despite these limitations, the results confirm U-Net's effectiveness in tasks like land cover mapping for carbon stock and GHG emission assessments. Future work should explore advanced datasets like LiDAR or hyperspectral imagery to enhance model generalizability and consider real-time applications to evaluate its practicality in dynamic environmental contexts.

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