Analysing Satellite Imagery Classification Under Spatial Domain Shift Across Geographic Regions (Abstract Reprint)

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Abstract

Deep learning models are designed based on the i.i.d. assumption; consequently, they experience a significant performance drop due to the distribution shifts when deployed in real environments. Domain Generalisation (DG) aims to bridge the distribution shift between the source and target domains by improving the generalisability of the model to Out-Of-Distribution (OOD) data. This challenge is prominent in satellite imagery classification due to the scarcity of data from underrepresented regions such as Africa and Oceania. In this paper, we address the limitations of existing datasets in capturing distribution shifts caused by geospatial differences between geographic regions by constructing a new, large-scale dataset called Domain Shift across Geographic Regions (DSGR). This dataset aims to help researchers better understand the impact of distribution shifts on satellite imagery classification. Furthermore, we perform rigorous experiments on DSGR to investigate and benchmark the robustness of existing DG techniques under single- and multi-source domain settings and the role of foundation models in enhancing the DG techniques. Our evaluations reveal that recent DG techniques have a comparable, yet weak, performance on DSGR. However, when combined with a foundation model like CLIP, ERM (introduced in 1999) achieves highly competitive results, surpassing even recent state-of-the-art DG solutions in enhancing the generalisability of deep learning models across different geographic regions. Our dataset and code are available at https://github.com/RWGAI/DSGR.

References

Al-Emadi, S. A.; Yang, Y.; and Ofli, F. 2025. Analysing Satellite Imagery Classification under Spatial Domain Shift across Geographic Regions. *International Journal of Computer Vision*, 133: 76727709.