**Enhanced Cloud Removal in Sentinel-2 Imagery using Hybrid Spatiotemporal and Cycle-Consistent Generative Adversarial Networks**

Lingeswaran A.1, Melvin Fredrick J.S.2, Latha Selvi G.3\*

1,2 Author’s Affiliation: Student, Department of Information Technology , St. Joseph’s College of Engineering, Chennai, India

3Author’s Affiliation: Associate Professor, Department of Information Technology, St. Joseph’s College of Engineering, Chennai, India

[3\*](mailto:lathaselvi2012@gmail.com)[lathaselvi2012@gmail.com](mailto:lathaselvi2012@gmail.com)

***ABSTRACT***

Cloud cover poses a significant challenge for satellite imagery analysis, obstructing surface observations and creating data gaps that impede various applications, including land cover classification, weather forecasting, and disaster monitoring. Traditional cloud removal techniques and recent deep learning approaches have provided promising outcome but it fails in achieving high-quality, consistent results. This work presents a novel approach combining Spatiotemporal Generative Adversarial Networks and Cycle-Consistent Generative Adversarial Networks to improve the performance of cloud removal from Sentinel 2 satellite imagery. The proposed hybrid model leverages the temporal context provided by STGAN to generate initial cloud-free images by processing sequences of satellite images over time. These initial images are then refined using CycleGAN, which employs cycle consistency loss to ensure the transformation between cloudy and cloud-free images preserves essential features and realism. This combination addresses the limitations of previous methods by ensuring both temporal consistency and high image quality. This work demonstrates the potential of integrating spatiotemporal and cycle-consistent approaches to significantly enhance cloud removal processes, offering a robust solution for real-time monitoring and analysis in various satellite imagery downstream applications.

**Keywords:** Cloud removal, CycleGAN, Satellite imagery, Sentinel 2, STGAN