**SATELLITE IMAGE PROCESSING AND CLASSIFICATION WORKFLOW**

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**Abstract** : Cloud motion prediction plays a pivotal role in weather forecasting, disaster monitoring, and satellite-based environ mental analysis. Traditional frame interpolation methods often overlook the complex and deformable nature of cloud movements influenced by atmospheric variables such as wind direction and velocity. In this research, we propose a novel deep learning frame work titled Flow Enhanced Interpolation Network (FEIN), which leverages attention-guided autoencoders to predict intermediate satellite frames with high temporal and spatial fidelity. Our approach integrates multi-source satellite imagery and wind vector data from scatterometer-based sources (e.g., MOS DAC/ISRO), treating wind as a dynamic flow field that guides the temporal interpolation process. The model architecture includes a dual-branch encoder to extract features from both image sequences and wind maps, a custom attention mechanism to capture spatial-temporal correlations, and a decoder that recon structs intermediate cloud frames. Additionally, perceptual loss using a pre-trained VGG19 network ensures high visual realism in the generated outputs. The system achieves smooth and accurate frame transitions even under complex atmospheric dynamics, such as during cyclones or rapidly evolving cloud systems. Experimental results show significant improvements over conventional methods, both quantitatively in loss metrics and qualitatively in visual coher ence. This research demonstrates the feasibility and impact of physics-informed, AI-driven solutions for real-time satellite video generation and atmospheric modeling.

**Keywords**: Cloud Motion Prediction, Frame Interpolation, At tention Mechanism, Autoencoder, Satellite Imagery, Wind Vector Mapping

**Github Link :** https://github.com/imyash2004/satellite\_imagery

**Video Link :** https://drive.google.com/file/d/1c03E1pfJ12mmlnJY8RG6GnDnn\_l3Hps4/view?usp=sharing