https://lh3.googleusercontent.com/KIZXtFkDiqKtn6wOGeofGX-NBLMzha3Ok63YlZj0OTjy8wLdA9zWjaJOyoEfGcFUPZPTxhg6cIJVVrZSlepZQuoSGmEBxexOB-NMbEtSl1QZRDw6tlFy7mo-QEl42i35eOpVaG5vXGHRXh1AOcyeOhY

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**SAR(Synthetic Aperture Radar)**

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**ABSTRACT**

**Synthetic Aperture Radar (SAR) imaging is a crucial remote sensing technology used extensively in fields such as geospatial intelligence, environmental monitoring, defence, and disaster assessment. Unlike optical imaging, SAR operates using microwave signals, enabling it to capture high-resolution images of the Earth's surface regardless of weather conditions, cloud cover, or lighting constraints. However, raw SAR images are inherently grayscale, noisy, and difficult to interpret, making automated enhancements essential for real-world applications. This project presents a comprehensive AI-driven framework that denoises SAR images, colorizes them using Generative Adversarial Networks (GANs), and provides an intuitive interface for easy model access and visualization.**

**The first phase of the pipeline focuses on SAR image denoising, as raw radar data often suffers from speckle noise due to signal interference. This is addressed using a combination of traditional filtering methods and deep learning-based CNN architectures designed to preserve critical terrain and structural features while effectively reducing noise. The denoised images then pass through the colorization phase, where GANs are employed to generate realistic colorized outputs based on multi-terrain datasets. The GAN model is trained on diverse real-world satellite and multi-spectral datasets, allowing it to learn meaningful spectral mappings for different landscapes, including urban areas, vegetation, water bodies, and barren lands. Unlike traditional colorization approaches, the GAN-based model adapts dynamically to varying terrain types, ensuring that the generated colours accurately reflect surface materials and environmental characteristics.**

**By combining state-of-the-art deep learning techniques, an efficient noise-reduction strategy, a GAN-based colorization model, and an easy-to-use interface, this project significantly enhances the interpretability of SAR images, making them more intuitive for human analysis. The improved SAR imaging pipeline offers practical applications in disaster response (e.g., flood and wildfire detection), military and defence surveillance, terrain classification for autonomous navigation, and environmental research. With its ability to bridge the gap between raw SAR data and enhanced, visually intuitive imagery, this project paves the way for AI-driven advancements in remote sensing and geospatial intelligence.**