**Aerial Image Super-Resolution using ESRGAN and CNN**

**Abstract**

Aerial image super-resolution is a crucial task in remote sensing, enhancing the clarity and detail of low-resolution satellite images for better analysis and decision-making. This study explores the use of both Convolutional Neural Networks (CNN) and Enhanced Super-Resolution Generative Adversarial Network (ESRGAN) to achieve high-quality image reconstruction. CNN-based approaches effectively extract spatial features, but they often struggle with fine texture details. ESRGAN, leveraging adversarial training with a generator-discriminator framework and Residual-in-Residual Dense Blocks, overcomes these limitations by producing sharper and more visually realistic images. Performance is evaluated using standard metrics such as Peak Signal-to-Noise Ratio (PSNR), Structural Similarity Index (SSIM), and Learned Perceptual Image Patch Similarity (LPIPS). Hyperparameters like learning rate, batch size, and loss functions (adversarial loss, perceptual loss, and content loss) are fine-tuned to optimize results. By integrating both CNN and ESRGAN, this research aims to improve the resolution and perceptual quality of aerial images, benefiting applications in remote sensing, urban planning, and environmental monitoring.