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Enhancing Land Surface Temperature Imaging Through Deep Learning-based Super-Resolution

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Recent advances in deep learning for image super-resolution have found utility in diverse fields, including medical imaging, scientific visualization, and image enhancement. Traditional single-image super-resolution (SISR) methods often rely on synthetically degraded low-resolution images generated from their high-resolution counterparts, usually through techniques such as bilinear down-sampling. However, such synthetic images may not accurately capture the characteristics of genuine low-resolution images encountered in real-world applications. This discrepancy is particularly critical in the context of weather satellite imaging, where data features like Land Surface Temperature (LST) can be compromised by SISR methods that introduce noise. To address this issue, we assemble real low-resolution and high-resolution LST datasets from two different satellites observing the same area simultaneously. The low-resolution data comes from GEO-KOMPSAT2A, a geostationary satellite, while the high-resolution data is sourced from Sentinel and LANDSAT, low-Earth orbit satellites. Given the geostationary satellite's superior temporal resolution and the low-Earth orbit satellite's better spatial resolution, super-resolving the geostationary dataset can yield benefits from both. We train multiple Super-Resolution (SR) models, including GAN-based models known for generating realistic images, to explore their viability as substitutes for authentic high-resolution data. Additionally, we test a reference-based super-resolution technique using GEO-KOMPSAT2B satellite products, which offer better spatial resolution over the same

observation area as GK2A. We will assess how different models perform in generating high-resolution images from actual low-resolution and high-resolution datasets.