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URBAN PLANNING AND SIMULATION THROUGH ENHANCED GAN-BASED MULTISPECTRAL SATELLITE IMAGERY

Abstract

The L40 Satellite Simulator represents an advanced integration of urban planning and artificial intelligence, offering a sophisticated tool for modeling and analyzing urban scenarios. Through the use of vector data and the application of Generative Adversarial Networks (GANs) to satellite imagery, this system allows for detailed and highly customizable simulations of urban interventions, serving as a tool for exploring innovative urban configurations and for optimizing existing plans. Using a label-conditional GAN, we can generate synthetic RGB images with a resolution of 1 meter. This process involves feeding simulation scenarios (in the form of vectors) into the system, which then produces the corresponding 1-meter resolution RGB image. Additionally, for the multispectral domain, we focus on the area of interest and for each specific land cover class (es. grassland, built-up, water, etc.), we simulate the multispectral content taking Sentinel-2 spectral bands as reference. Finally, a matching process is utilized to combine the multispectral reflectance values with the ones derived from the RGB image produced by the GAN, thereby ensuring a precise and accurate match in both visual and spectral dimensions. The L40 Satellite Simulator serves as a crucial tool for urban developers, researchers, and emergency response agencies. It enables urban developers to evaluate and prioritize development projects based on location, environmental impact, and integration with existing infrastructure through a comprehensive scoring system. Researchers can use the simulator to monitor urban projects, analyzing changes in land use, population density, and environmental impacts to assess the long-term effects of development strategies. For emergency response agencies, the L40 offers simulations of potential disasters in urban areas, aiding in the development of effective response plans to minimize community and infrastructure damage. This tool is essential for enhancing urban resilience and ensuring the safety of urban populations.