Urban Area Detection in Sri Lanka using Satellite Images and Deep Learning

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Abstract: Urbanization is reshaping landscapes globally at a rapid pace, making the automatic detection and segmentation of urban areas critical for effective planning, resource allocation, and sustainable development. This research addresses a notable gap in region-specific data by creating a dataset focused on urban area segmentation in Sri Lanka, a region often overlooked in global urban studies, using high-resolution satellite images. Existing studies have not sufficiently explored this area, highlighting the importance of targeted analysis in Sri Lanka. A deep learning model, U-Net, was employed, achieving a high segmentation accuracy with a Dice coefficient of 0.90, clearly demonstrating the model's effectiveness in distinguishing urban from non-urban regions. The dataset comprises 220 meticulously curated satellite images, covering both urban and non-urban landscapes, all of which were manually masked for accurate segmentation. To maintain consistency, images were cropped to 512x512 pixels and resized to 256x256 pixels. Specific locations in Sri Lanka were pre-listed to track previously downloaded images, ensuring comprehensive coverage. Mixed areas, containing both urban and non-urban regions, were selected for cropping to optimize model training. The dataset was divided into training and testing subsets, with 20% of the training data reserved for validation to ensure model robustness. The U-Net model effectively captured intricate spatial features, outperforming traditional methods in accuracy and efficiency. These findings provide valuable insights for urban planners and policymakers in Sri Lanka, offering a framework for sustainable urban growth and informed land-use decisions.

Keywords:Deep Learning, Satellite Images, U-Net Architecture, Urban Area Detection, Urban Area Segmentation in Sri Lanka