

Mapping Green Over Time: Automated Change Detection in Aerial Imagery Using Machine Learning.

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1 Motivation

Urban areas are increasingly experiencing the urban heat island (UHI) effect, where built environments retain more heat compared to surrounding rural areas, leading to elevated temperatures that can adversely affect public health and overall livability. Green spaces, such as parks and tree canopies, play a crucial role in mitigating UHI by providing cooling effects through shade and evapotranspiration. However, rapid urbanization and land-use changes over the decades have led to the reduction and fragmentation of these vital green spaces. Understanding the temporal dynamics of green space distribution is essential for developing effective urban planning and climate adaptation strategies. Advancements in machine learning (particularly deep neural network models) offer powerful tools for analyzing vast archives of aerial and satellite imagery dating back to the 1940s. By automating the detection of green space changes over time, these models can provide high-resolution insights into how urban landscapes have evolved, informing policies aimed at enhancing urban resilience and combating the UHI effect.

2 Data

This study uses historical and contemporary aerial imagery from two primary sources: the National Aerial Photography Program (NAPP) and the National Agriculture Imagery Program (NAIP).

The NAPP imagery dataset, available through GEE Community Catalog, consists of over 160,000 aerial images sourced from the USGS EROS Archive. These images were taken between 1940 and 1970. The NAIP dataset provides high-resolution aerial imagery collected during the agricultural growing season (“leaf-on” conditions). Imagery from 2003 to 2017 is included.

3 Related Work

1. Green spaces provide substantial but unequal urban cooling globally.
2. Green Space Cooling Effect and Contribution to Mitigate Heat Island Effect of Surrounding Communities in Beijing Metropolitan Area.
3. SatMAE: Pre-training Transformers for Temporal and Multi-Spectral Satellite Imagery

4 GitHub Repo

Here is the GitHub repo for our project.