IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 2, May 2025
Impact Factor: 7.67

Improved Mapping of Surface Urban Heat Islands Using Machine Learning and Enhanced Environmental Indicators

Vijaya Kumar Gavara, Sudheer Babu Golla, Maheh Chekka
Computer Science & Engineering
RVR & JC College of Engineering, Guntur, India

Abstract: *Addressing climate change is crucial for the development of sustainable and resilient smart cities, particularly in mitigating the impacts of Surface Urban Heat Islands (SUHI). This study presents a machine learning-based framework for modelling SUHI by predicting Land Surface Temperature (LST) using a diverse set of environmental and socioeconomic variables. Expanding upon previous research, our approach integrates additional environmental indicators including the Normalized Difference Water Index (NDWI), Soil Adjusted Vegetation Index (SAVI), and soil moisture data, alongside conventional metrics such as NDVI and NDBI. The analysis was conducted over the metropolitan region of Milan, Italy, utilizing 15 cloud-free Landsat 8 images captured between 2019 and 2021, with complementary data from Sentinel-2 and Planet Scope satellites. Six machine learning models were evaluated to estimate LST, with Decision Tree achieving the highest accuracy (R^2 = 1.00, MAE = 0.00 °C, RMSE = 0.07 °C), closely followed by Random Forest (R^2 = 1.00, MAE = 0.01 °C, RMSE = 0.04 °C). Our findings highlight the significance of incorporating multi-seasonal imagery and enriched feature sets in improving SUHI characterization. The proposed approach not only enhances the precision of temperature mapping but also offers valuable insights for urban planning strategies aimed at combating urban heat in rapidly developing cities*

Keywords: urban heat island, land surface temperature, machine learning, remote sensing, environmental indicators (NDWI, SAVI, soil moisture)

DOI: 10.48175/IJARSCT-26289