National Remote Sensing Centre

Indian Space Research Organisation, Government of India, Hyderabad.

Science Story

11 Dec 2023

Building foot prints from AI

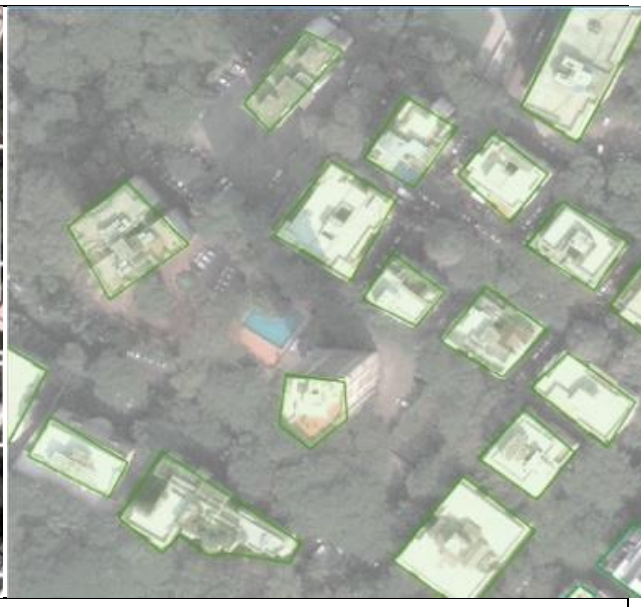
Scientists at National Remote Sensing Centre (NRSC) developed AI based techniques to detect building foot prints using high resolution satellite data.

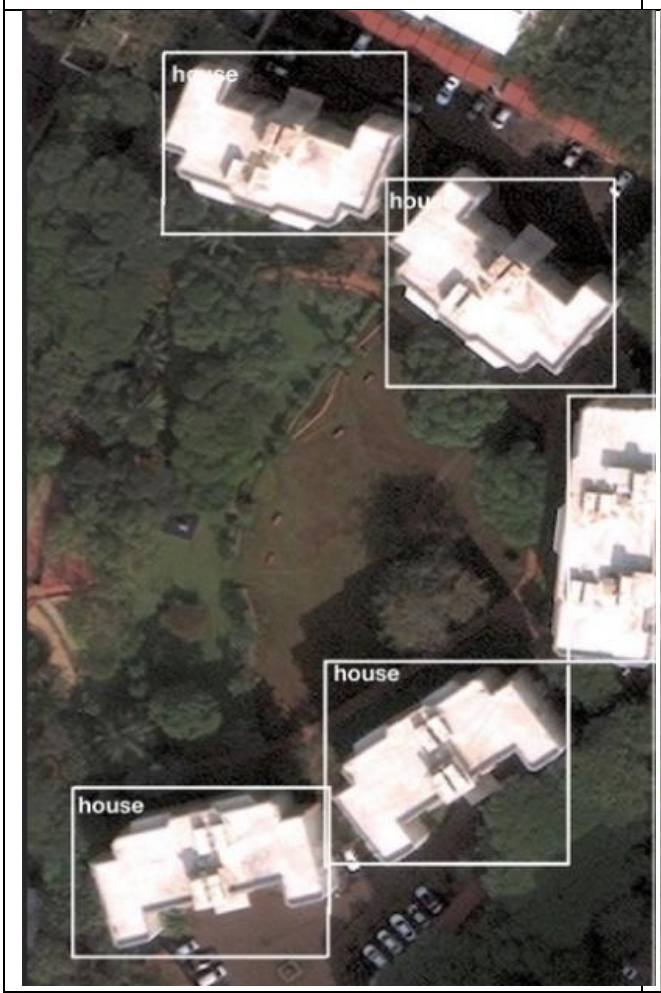
Settlement information that includes building foot prints is a very essential parameter for different applications such as urban planning, environmental planning and disaster management. A new approach was proposed by integration of VGG-16 (Visual Geometry Group) -CNN model with spectral and textural information from high resolution satellite images for identification of building foot prints. The model was trained and implemented to identify the building footprints using Worldview-3 high resolution satellite image over part of Mumbai city of Maharashtra state, India. Classification accuracy in the proposed approach is observed to be nearly 94% as compared to 82% in case of single-shot detector (SSD) algorithm alone.

Highlights

Different deep learning algorithms such as Mask-RCNN, Single-shot multibox detector (SSD), are used for detecting the building foot prints. Results indicated that the SSD-based deep learning module could not identify few small houses, which necessitates further improvement in the algorithm by integrating additional building information.

A hybrid approach has been developed, in which, classification module is integrated with additional feature (building) information to improve the classification accuracy. Spectral response of building is generated using standard satellite image processing software and included in the signature file. Maximum likelihood classification technique is applied on the input image for identification of the building footprints. Thus, the model could identify small houses, when outputs from deep learning and spectral response from maximum likelihood classification were integrated.





Result of SSD using Deep Learning

Result combining Deep learning with Spectral Response

Results obtained using hybrid approach, improves the process of building identification using high resolution satellite images. Integration of SSD technique with spectral response and signature performs well in detecting houses in high density region. It attained an accuracy up to 94.2% in terms of detecting houses, as compared to accuracy of 82% in case of SSD algorithm alone. It is observed that, both algorithms perform similar in detection of houses in low density region, although AI algorithm with induced house signature has better area optimization.

This method uses deep learning technique (SSD) integrated with remote sensing characteristics (spectral response, texture, signature file) for feature identification from high resolution satellite data. The framework developed is based on multi layered architecture.

Metric parameters such as F1 score of 0.957, intersection over union (IoU) of 94.86% and total error rate of 8.133% also indicated better performance of the proposed approach.

In Future

The approach is highly beneficial for urban development authorities to monitor the large number of vacant lands spread across urban areas