

Project Group 115

Project Title: Building Detection and Location Intelligence in Aerial Satellite Imagery.

Project summary:

Building structures detection and information about these buildings in aerial images is an important solution for city planning and management, land use analysis. It can be the center-piece to answer important questions such as planning evacuation routes in case of an earthquake, flood management, etc. These applications rely on being able to accurately retrieve up-to-date information. Being able to accurately detect buildings in a bounding box centered on a specific latitude-longitude value can help greatly. The key challenge is to be able to detect buildings which can be commercial, industrial, hut settlements, or skyscrapers. Once we are able to detect such buildings, our goal will be to cluster and categorize similar types of buildings together.

Approach:

We plan on reproducing CNN models based on You-Only-Look-Once (YOLO) [1], U-net and Segnet [2] algorithms, trained by transfer learning using different backbones such as COCO/VOC, ImageNet and Volan2018 datasets. In addition, we will optimize these different models with focal loss, cross entropy loss, hierarchical loss and differently weighted intersection-over-union (IoU) loss to overcome issues of scale difference [3] in building detection.

A big focus of our project will be to find alternative efficient models that do not have to classify an exhaustive list of potential object locations like the models mentioned above. As such, we will look at non bounding based models like CenterNet [4] that uses keypoint estimation, PENet [5] that remedies for imbalanced datasets and predicts object cluster centerpoints. Lastly, we plan on implementing Deep Reinforcement Learning based methods to contextually scale input image resolution for efficient object detection [6].

Resources/Related Work:

[1] "Pi, Y., Nath, N. D., & Behzadan, A. H. (2020). Convolutional neural networks for object detection in aerial imagery for disaster response and recovery. *Advanced Engineering Informatics*, 43, 101009."

[2] "Abdollahi, A., Pradhan, B., & Alamri, A. M. (2020). An ensemble architecture of deep convolutional Segnet and Unet networks for building semantic segmentation from high-resolution aerial images. *Geocarto International*, 1–16."

[3] "Wang, Y., Zhang, Y., Zhang, Y., Zhao, L., Sun, X., & Guo, Z. (2019). SARD: Towards Scale-Aware Rotated Object Detection in Aerial Imagery. *IEEE Access*, 7, 173855–173865."

[4] "Pailla, D. R. (2019). *Object Detection on Aerial Imagery Using CenterNet*."

[5] “Tang, Z., Liu, X., & Yang, B. (2020). PENet: Object Detection Using Points Estimation in High Definition Aerial Images. 2020 19th IEEE International Conference on Machine Learning and Applications”

[6] “Uzkent, B., Yeh, C., & Ermon, S. (2020). Efficient Object Detection in Large Images Using Deep Reinforcement Learning. *2020 IEEE Winter Conference on Applications of Computer Vision (WACV)*.”

Datasets

<https://spacenet.ai/sn7-challenge/>

<https://captain-whu.github.io/DOTA/dataset.html>

<https://github.com/microsoft/USBuildingFootprints>

<https://www.image-net.org/>

<https://cocodataset.org/#home>

Group members: Project Group 115: Ahmed Bilal, Sandeep Singh, Madhuri Jamma, Christian Wiles

Looking for more members:

No

Piazza Link:

https://piazza.com/class/kni1g8lh43l3ie?cid=223_f131