

Tiny Object Detection

Computer Vision (CS6350)

TPA-5

1. Problem Statement:

The problem of tiny object detection involves developing computer vision algorithms capable of accurately detecting and localizing objects within images or video frames when those objects are very small in relation to the overall image. Tiny objects typically have limited visual features and are subject to challenges such as occlusion, low resolution, and background clutter. The goal is to design robust and precise object detection methods that can operate effectively in scenarios where the objects of interest are tiny and may be easily overlooked.

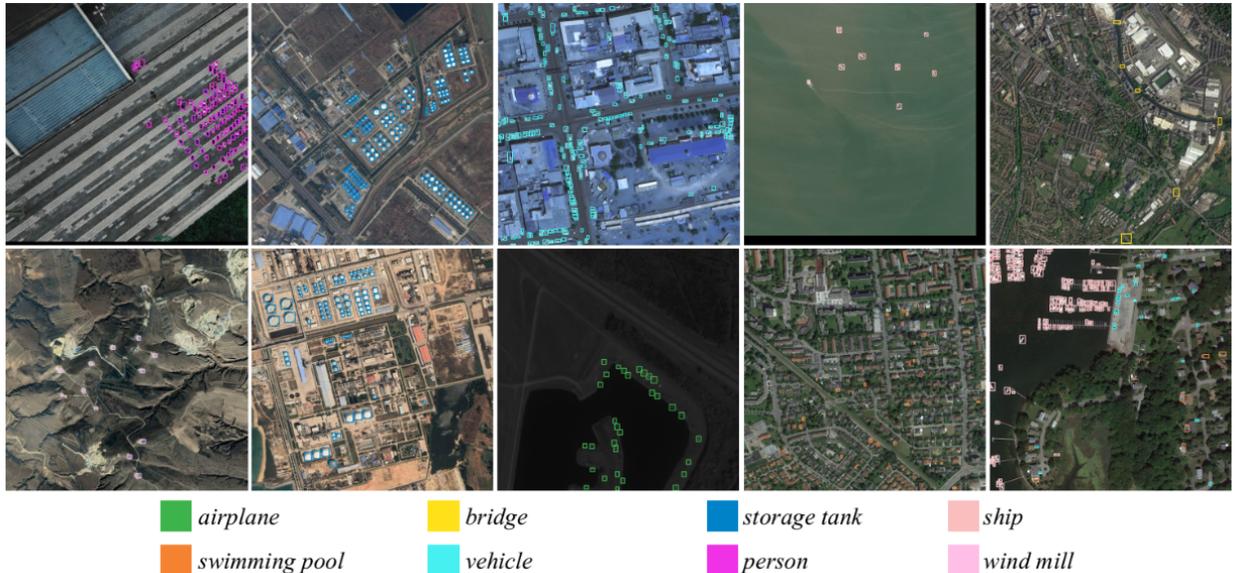
Key Challenges:

- **Scale Variation:** Tiny objects can vary significantly in size, making it challenging to design detectors that adapt to various scales.
- **Limited Context:** Tiny objects may lack contextual information within the image, making it difficult to distinguish them from similar background elements.
- **Occlusion:** Tiny objects are often prone to partial or full occlusion by other objects or environmental factors.
- **Low Resolution:** Due to their small size, tiny objects may have insufficient details for accurate detection.
- **Background Clutter:** The presence of cluttered backgrounds can hinder accurate detection and increase false positives.

2. Expected Input Output

Input: Image

Output: Bounding Boxes, Class Labels, Confidence Scores



3. Datasets

- Tiny Object Detection in Aerial Images [Paper] [Code]
 - AI-TOD : <https://github.com/jwwangchn/AI-TOD>
- iSAID: A Large-scale Dataset for Instance Segmentation in Aerial Images [Paper] [Project]

4. Relevant code links

<https://github.com/jwwangchn/AI-TOD>

<https://github.com/kuanhungchen/awesome-tiny-object-detection>

5. References

- a. J. Yi, et al., "Oriented Object Detection in Aerial Images with Box Boundary-Aware Vectors," in 2021 IEEE Winter Conference on Applications of Computer Vision (WACV), Waikoloa, HI, USA, 2021 pp. 2149-2158. doi: 10.1109/WACV48630.2021.00220
- b. Chang Xu, Jinwang Wang, Wen Yang, Huai Yu, Lei Yu, Gui-Song Xia, Detecting tiny objects in aerial images: A normalized Wasserstein distance and a new benchmark, ISPRS Journal of Photogrammetry and Remote Sensing, Volume 190, 2022, Pages 79-93, ISSN 0924-2716, <https://doi.org/10.1016/j.isprsjprs.2022.06.002>.
- c. Wang, J., Yang, W., Guo, H., Zhang, R., & Xia, G.S. (2021). Tiny Object Detection in Aerial Images. In *ICPR* (pp. 3791–3798).
- d. Xia, G.S., Bai, X., Ding, J., Zhu, Z., Belongie, S., Luo, J., Datcu, M., Pelillo, M., & Zhang, L. (2018). DOTA: A Large-Scale Dataset for Object Detection in Aerial Images. In *The IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*.