



A Comparative Study of YOLOv8 Segmentation and Detection Models for Urban Object Detection & Classification in SAR Images

Arya Ahadi*

Mohammadreza Hassannejad Bibalan†

Abstract

A comparative study of two distinct approaches—detection and segmentation using YOLOv8—for object detection and classification in Synthetic Aperture Radar (SAR) images was conducted using a real-world dataset of Milwaukee from Capella’s open data. This study highlights the significance of object detection and classification in urban development and land use, emphasizing their applications in city planning, optimizing land allocation, and ensuring sustainable urban growth. Key challenges in processing SAR images stem from their grayscale nature and speckle noise, which complicate analysis and require advanced algorithms. Results indicate that the segmentation model consistently outperforms the detection model in classification tasks due to its ability to capture detailed spatial information through pixel-wise masks. While the detection model offers speed and efficiency, it struggles with cluttered backgrounds, leading to lower precision. Conversely, the segmentation model, despite requiring more computational resources, provides better localization and accuracy, making it better suited for the complexities of SAR images and crucial for urban development applications.

Keywords: Synthetic Aperture Radar (SAR), YOLOv8, Segmentation, Pixel-wise Masks, Urban Development, Grayscale Images, Speckle Noise, Localization

*Department of Electrical Engineering, Imam Khomeini International University, arya.ahadi@hotmail.com

†Department of Electrical Engineering, Imam Khomeini International University, mhbibalan@eng.ikiu.ac.ir