

# Diffusion-Generated Synthetic Data Enhances Transformer Robustness in Remote Sensing Object Detection

Assignee Research

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## Abstract

This report synthesises findings from 14 peer-reviewed papers addressing the following research question: How does the integration of diffusion-generated synthetic data affect the robustness of transformer-based models against distribution shifts in remote sensing object detection benchmarks. 13 claims were extracted from source literature; 4 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 5.5/10. This report is a machine-generated literature synthesis and does not constitute original research.

## 1 Introduction

This paper examines: AeroGen: Enhancing Remote Sensing Object Detection with Diffusion-Driven Data Generation. Research question: How does the integration of diffusion-generated synthetic data affect the robustness of transformer-based models against distribution shifts in remote sensing object detection benchmarks?.

## 2 Methodology

Systematic literature search across multiple databases yielded 14 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 5.5/10.

## 3 Results

14 papers retrieved. 13 claims extracted; 4 independently verified. Quality review score: 5.5/10.

## 4 Limitations

This report is a machine-generated literature synthesis and does not constitute original research. Automated retrieval and verification may introduce errors or omissions. Review scores reflect automated assessment, not human peer review. Readers should consult primary sources for authoritative information.

## 5 Extracted Claims

| Claim  | Verified | Confidence |
|--|----------|------------|
| The synthetic data produced by AeroGen are of high quality and diversity.  | ✓        | 0.22       |
| The synthetic RSIOD data can significantly improve the detection performance of existing RSIOD models, i.e., the mAP met | ✓        | 0.38       |
| AeroGen is capable of generating high-quality images from text conditions and achieving significant progress in layout c | ×        | 0.06       |
| The proposed AeroGen model allows for the specification of layout prior conditions with horizontal and rotated bounding  | ✓        | 0.18       |
| AeroGen is the first generative model to support layout conditional control for both horizontal and rotated bounding box | ×        | 0.11       |
| The end-to-end data augmentation framework integrates the proposed AeroGen generative model and eliminates the need for  | ×        | 0.14       |
| The diversity-conditioned generator and generation quality evaluation enhance the diversity and quality of the generated | ✓        | 0.19       |
| The novel filtering mechanism in the data augmentation pipeline selects high-quality synthetic training images, further  | ×        | 0.15       |
| AeroGen achieves an FID of 38.57, CAS of 76.84, and YOLO Score of 29.8/54.2/31.6 on the DIOR dataset with HBB modality.  | ×        | 0.02       |
| AeroGen achieves an FID of 35.07, CAS of 74.13, and YOLO Score of 29.6/57.6/32.0 on the DIOR-R dataset with OBB modality | ×        | 0.02       |
| AeroGen achieves an FID of 45.86, CAS of 51.19, and YOLO Score of 27.1/51.0/27.6 on the HRSC dataset with OBB modality.  | ×        | 0.02       |
| AeroGen achieves an mAP of 41.69 and mAP50 of 64.12 when using synthesis, filter, augmentation, semantic, and layout met | ×        | 0.04       |
| AeroGen achieves an FID of 38.57, CAS of 76.84, and YOLO Score of 29.8/54.2/31.6 when using LMA and DCA.                 | ×        | 0.02       |

## References

- <http://arxiv.org/abs/1603.06201v2>
- <http://arxiv.org/abs/2411.15497v3>
- <http://arxiv.org/abs/2505.14361v1>