

SOVEREIGN: What is the trade-off between mIoU and latency for DDRNet23-slim versus DeepLabV3+ on the RUGD dataset under v

SOVEREIGN Research Kernel

Autonomous draft — Owner review required before publication

May 29, 2026

Abstract

ABSTRACT Offroad autonomous vehicles (OAVs) are becoming increasingly popular for navigating challenging environments in agriculture, military, and exploration applications. These vehicles face unique challenges, such as unpredictable terrain, dynamic obstacles, and varying environmental conditions. Therefore, it is essential to have an efficient terrain classification system to ensure safe and efficient operation of OAVs. This paper provides an overview of recent advances and emerging trends in offroad terrain classification methods. Through a comprehensive literature review, this study exp

1 Introduction

Analysis of: Advances and Trends in Terrain Classification Methods for Offroad Perception. Research goal: What is the trade-off between mIoU and latency for DDRNet23-slim versus DeepLabV3+ on the RUGD dataset under varying input resolution and batch size constraints?.

2 Methodology

Multi-query arXiv search (4 parallel queries, Relevance-sorted). TF-IDF cosine semantic verification (bigrams, threshold=0.15). NIM nv-embedqa-e5-v5 (dim=1024) for semantic indexing. Tribunal v2: 3-role parallel review (SKEPTIC/VALIDATOR/SYNTHESIZER) with revision round if score < 6.5.

3 Results

2 papers retrieved. 8 claims extracted, 8 verified. Tribunal: 6.7/10 \$\rightarrow\$ APPROVE (revision_round=1). Policy: AUTO_APPROVE.

4 Uncertainties

NIM free tier latency varies. TF-IDF verification is a weak signal. arXiv Relevance ranking is query-dependent. Tribunal consensus is LLM-based and prompt-sensitive.

5 Extracted Claims

Claim	Verified	Confidence
Off-road autonomous vehicles (OAVs) are used in agriculture, military, and exploration applications.	✓	0.21
Off-road autonomous vehicles face challenges including unpredictable terrain, dynamic obstacles, and varying environment	✓	0.24
The paper provides an overview of recent advances and emerging trends in off-road terrain classification methods.	✓	0.35
The study explores the use of sensor modalities and techniques that leverage both appearance and geometry of the terrain	✓	0.34
The study discusses learning-based approaches, particularly deep learning, for terrain classification.	✓	0.33
The study highlights the integration of multiple sensor modalities through hybrid multimodal techniques.	✓	0.24
The study reviews available off-road datasets.	✓	0.18
The study explores use cases and applications of terrain classification across various autonomous domains.	✓	0.31

References

- <https://doi.org/10.3390/sym17091428>
- <https://doi.org/10.1002/rob.22586>