

OFFROAD SCENE UNDERSTANDING USING SEMANTIC SEGMENTATION

TEAM :- VOID

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TEAM RESULTS**

PROBLEM STATEMENT & TARGET AUDIENCE

PROBLEM WE'RE SOLVING

- Autonomous vehicles and robots struggle to understand offroad environments
- Offroad terrains have irregular objects like bushes, rocks, logs, uneven ground
- Traditional vision systems are optimized mainly for urban roads

REAL-LIFE IMPACT

- Offroad navigation failures cause:
- Navigation errors
- Safety risks
- Poor terrain understanding

TARGET AUDIENCE

- Autonomous vehicle developers
- Robotics & drone companies
- Defence & agriculture automation teams
- Sector: B2B
- Audience Type: Professionals / Industry

OUR UNIQUE SOLUTION

- An AI-based semantic segmentation system for offroad scenes
- Classifies each pixel into meaningful terrain categories

KEY FEATURES

- Uses DINOv2 self-supervised vision transformer
- Handles 10 different offroad classes
- Accurate pixel-level classification

WHY IT'S DIFFERENT

- Works without manual feature engineering
- Adaptable to new terrains with retraining
- Learns rich visual representations using pretrained backbone

NOVELTY FACTOR

- Combines self-supervised vision models + segmentation head
- Designed specifically for offroad environments



TECH STACK & ARCHITECTURE

Language: Python

Framework: PyTorch

Libraries: torchvision, OpenCV, NumPy,
Matplotlib

Environment: Anaconda
(CPU-based training)

Model: DINOv2 (ViT-S/14)

INPUT IMAGE

DINOv2 BACKBONE
(FEATURE EXTRACTION)

CONVNEXT-STYLE
SEGMENTATION HEAD

PIXEL-WISE CLASS
PREDICTION



FEASIBILITY & SHOWSTOPPERS

FEASIBILITY

- Pretrained backbone reduces training time
- Dataset already available with labeled masks
- Training and evaluation successfully executed

RISKS

- CPU-only training is slow
- Limited training time during hackathon

MITIGATION

- Reduced batch size
- Fewer epochs for faster experimentation
- Can scale easily with GPU in production
- End-to-end pipeline already working
- Modular design allows fast iteration

USP & BUSINESS MODEL

UNIQUE SELLING POINTS

- Accurate offroad scene understanding
- Self-supervised learning reduces labeling cost
- Scalable to robotics, defence, agriculture

BUSINESS MODEL

- B2B SaaS for autonomous vehicle companies
- Licensing model for segmentation engine
- Custom dataset training for enterprises

MARKET ADVANTAGE

- Few solutions focus specifically on offroad terrains
- High demand in autonomous & defence sectors