MICHIGAN ENGINEERING
UNIVERSITY OF MICHIGAN

ROB 530 Project Pitch [Group 22]

Neural Networks for SLAM: Pose Estimation with Deep Learning Architectures

Presenter: Aaron Sequeira, Aryaman Rao, Kunal Siddhawar, Kush Patel

Fab 26th, 2025

MICHIGAN ENGINEERING
UNIVERSITY OF MICHIGAN

Neural Networks for SLAM: Pose Estimation with Deep Learning Architectures

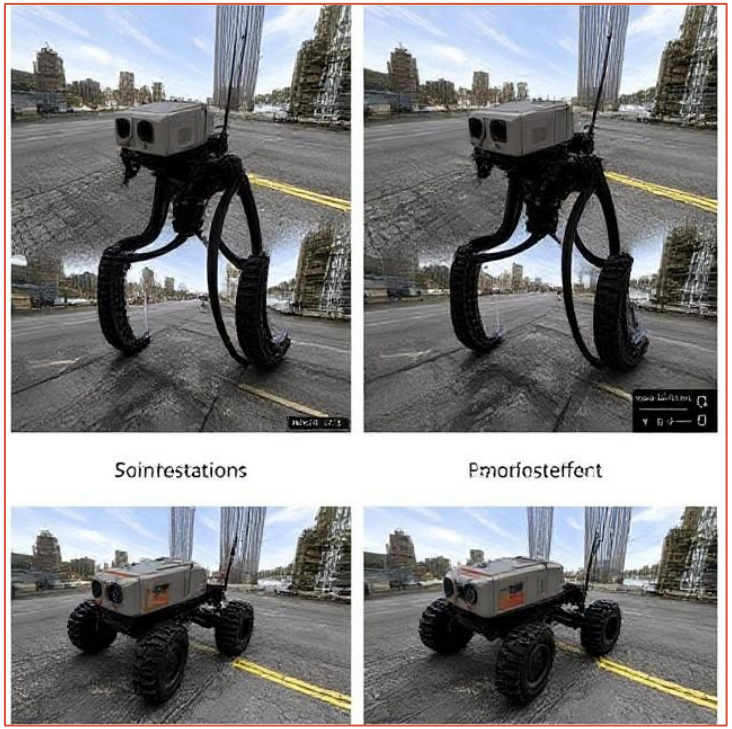
- **Problem Statement**
  - Achieving accurate **6-DoF** pose estimation in **SLAM** is challenging, especially in dynamic and unstructured environments.
  - There is a need for a **deep learning**-based approach to improve pose estimation and **loop closure** detection in SLAM.

- **Objective**:
  - Utilize **Vision Transformers (ViTs)** to estimate 6-DoF pose from sequential images, using the **KITTI** dataset for training and evaluation.
  - Integrate LIDAR and IMU data for improved robustness in challenging conditions like motion blur and occlusions.
  - Enhance SLAM adaptability, accuracy, and real-time performance.

Neural Networks for SLAM: Pose Estimation with Deep Learning Architectures

- **Innovative Architecture**
  - Utilize Transformer-based models (ViTs) and CNNs to process a continuous image stream for deep learning-based 6-DoF pose estimation.
  - Self-attention mechanisms for improved feature extraction

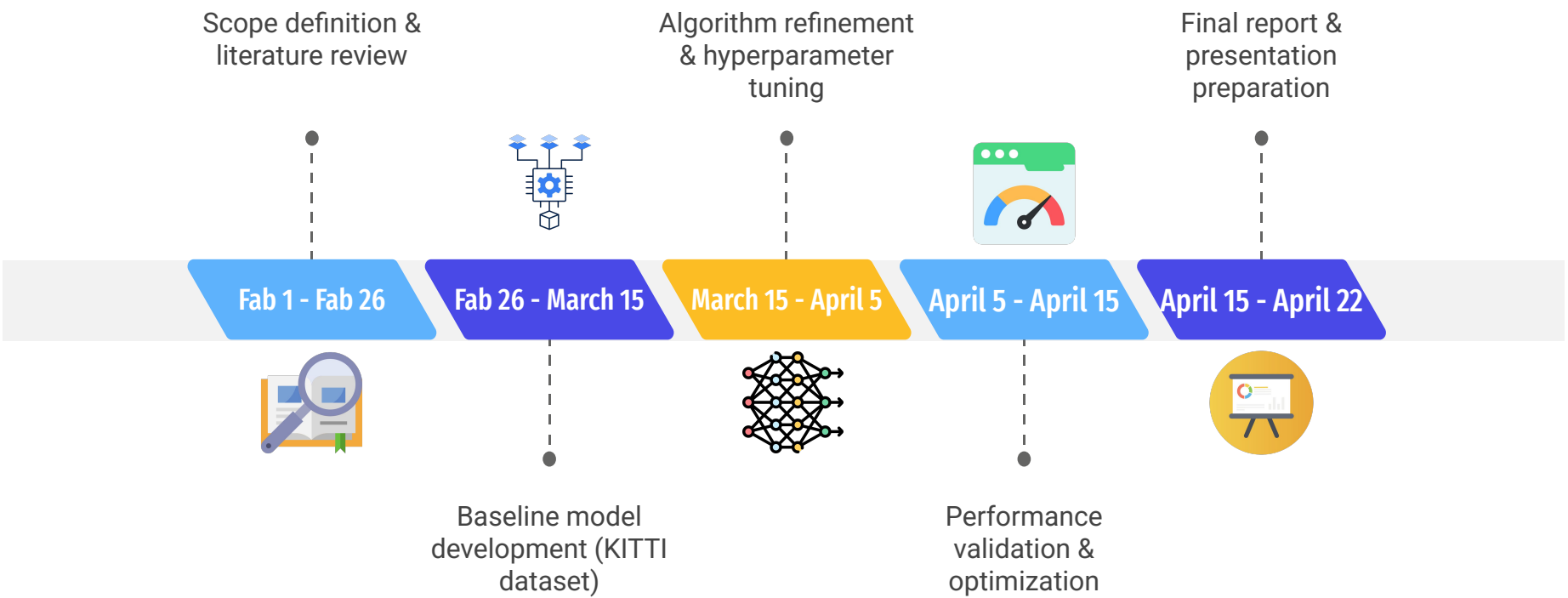
- **Key Features**
  - *Robust Against Perceptual Variations:* Train on diverse environments to enhance adaptability to lighting, occlusions, and dynamic scenes.
  - Spatial-temporal feature extraction from sequential frames
  - Pose-to-Map Alignment: Feed the extracted pose estimates into SLAM to refine localization and reduce drift over time.



MICHIGAN ENGINEERING
UNIVERSITY OF MICHIGAN

Neural Networks for SLAM: Pose Estimation with Deep Learning Architectures

Project Milestones



MICHIGAN ENGINEERING
UNIVERSITY OF MICHIGAN

Thank you!

Any questions ?