

# Simultaneous Localisation and Mapping (SLAM) Based Scene Reconstructions

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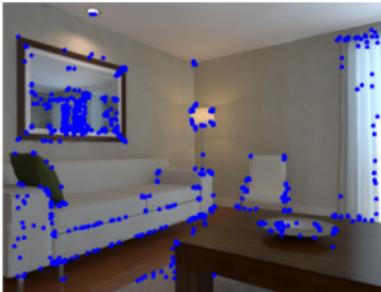
# Overview

- Introduction
- Motivation
- Literature Survey
- Problem Statement and Objectives
- Approach / Solution
- Dataset Analysis / Description
- Experimental Results/ Simulation / Observation
- Contributions
- Plan of Action and Conclusion
- References

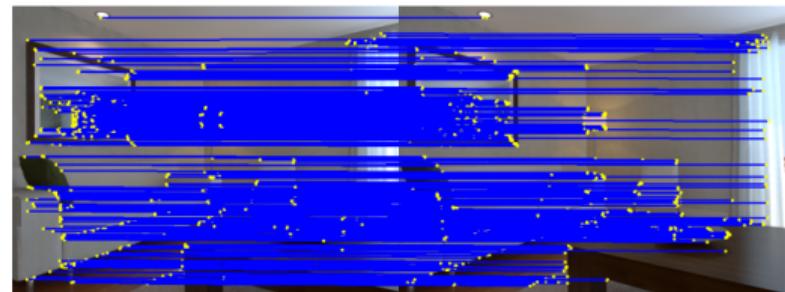
# Simultaneous Localisation and Mapping (SLAM) Based Scene Reconstructions



(a) Raw Image



(b) Keypoints in ORB-SLAM



(c) Keypoint Matching without Descriptor (Ours)

**SLAM:** It consists of two major functions.

- **Localization:** Estimation the robot's position.
- **Mapping:** Building the map
- Building a map and localizing in it simultaneously

# Introduction towards SLAM

Important elements involved in SLAM are

- **Key points:** Key points represent extracting the location of distinct local features in image
- **Descriptors:** represent how to describe the extracted key points (usually a vector)

Different algorithms to implement SLAM are **SIFT, SURF, BRIEF, ORB**

**ORB(Oriented FAST Rotated BRIF)**

- ORB is faster than other algorithms
- ORB considers the rotation for individual key points:  
In real world scenarios cameras may undergo rotation, robot carrying camera observes the objects from different viewpoints. ORB slam ensures that the extracted features remain invariant to rotation

# Motivation

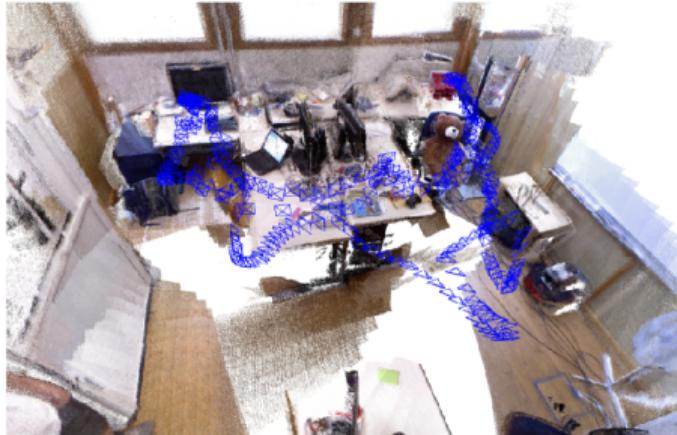


Figure: ORB-SLAM2 using monocular camera

- **Real-time 3D Understanding:** Enable robots and vehicles to build a 3D understanding of their surroundings for tasks like navigation and interaction with the environment.
- **Low-Cost 3D Reconstruction:** Offer an affordable and accessible way to reconstruct 3D scenes using cameras, promoting applications like rapid prototyping or cultural heritage preservation.

## Paper title

### Relocalization of Camera in a 3D Map on Memory Restricted Devices

- The paper discusses the distinction between landmark-based SLAM, which uses range measuring devices like LiDar, and visual SLAM, which relies on raw data from cameras, highlighting the advantages of visual SLAM in providing texture and visual information of surroundings without constraints of planar movements
- Various relocalization methods are explored, place recognition using bag of binary words, real-time relocalization for keyframe-based mapping, and a convolutional neural network approach for camera relocalization, each addressing the need for accurate camera pose recovery in SLAM systems.

## Paper title

### 3D Reconstruction System Based on Multi Sensor

- The research presents a 3D reconstruction system for indoor scene mapping by mobile robots, utilizing the ORB-SLAM algorithm with depth and inertial sensors to enhance accuracy and efficiency
- Integration of depth and inertial sensor data with visual information enables precise positioning, real-time 3D reconstruction, and dense map construction, improving robot navigation and scene understanding in complex environments

# Problem Statement and Objectives

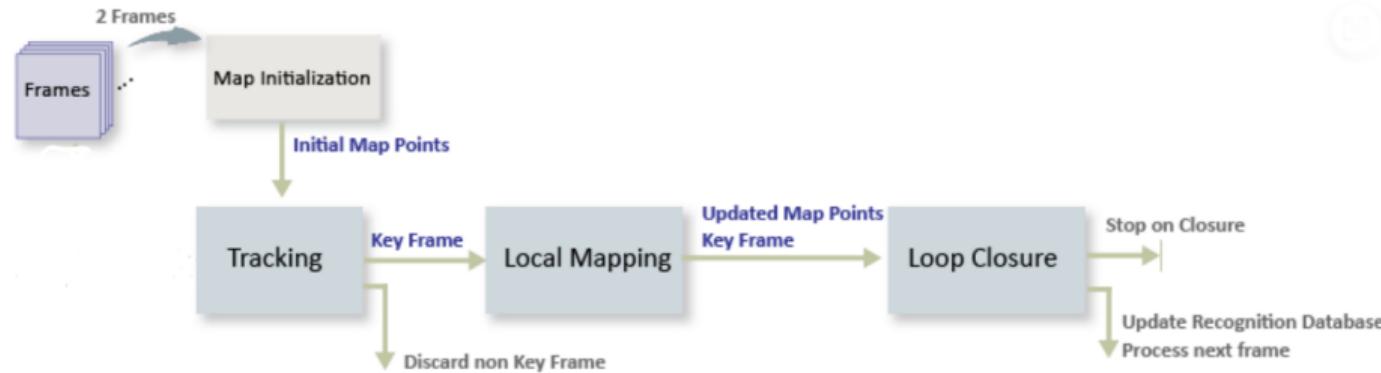
## Problem Statement

Simultaneous Localisation and Mapping (SLAM) Based 3D Scene Reconstructions.

## Objectives

- Setup a ORB Based SLAM for 3D Scene Reconstruction..
- Camera Calibration and scene reconstruction.
- To make 3D dense reconstructions using NICER-SLAM

# Overview of ORB-SLAM



**Figure:** ORB-SLAM system overview, showing all the steps performed by the tracking, local mapping, and loop closing threads.

# INPUT VIDEO

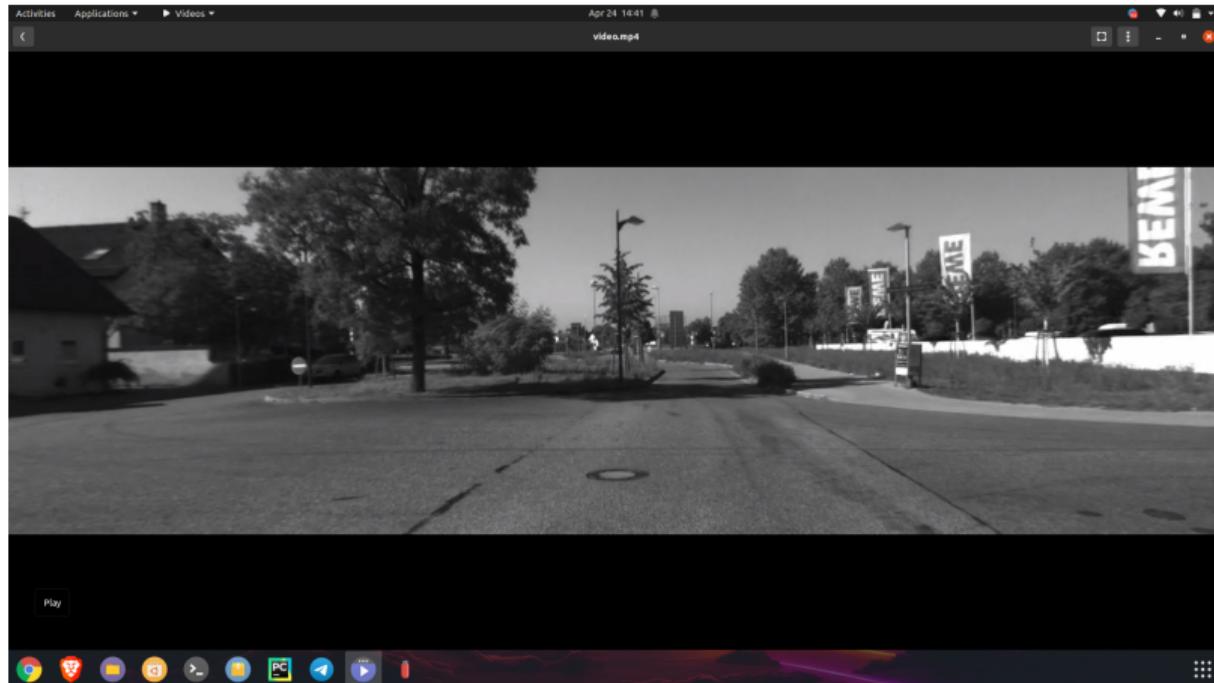


Figure: Input Video

# RESULTS OF VISUAL ODOMETRY

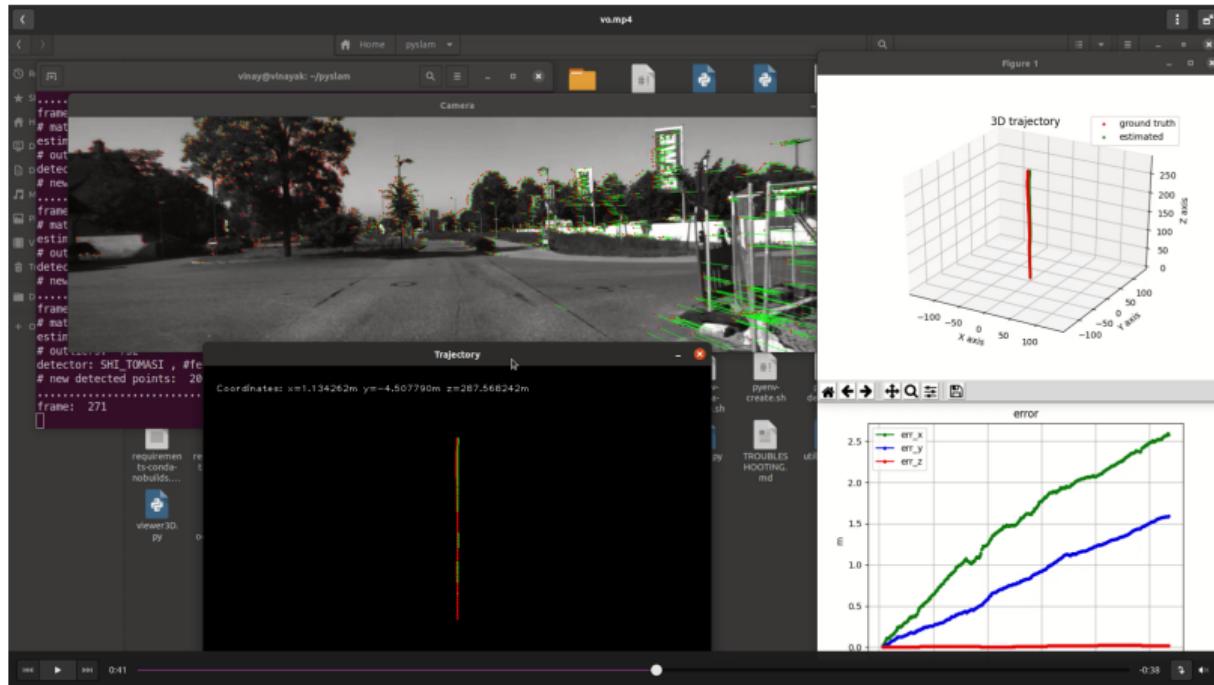


Figure: Visual Odometry

# RESULTS of 3D reconstruction using ORB-SLAM

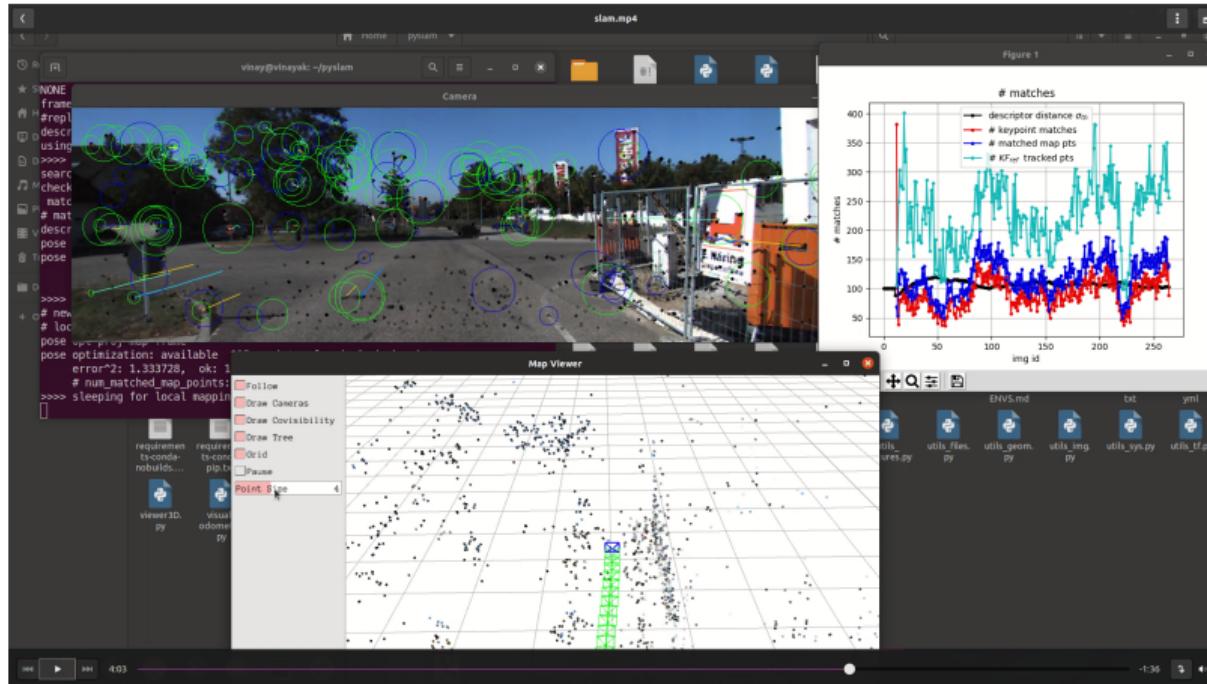


Figure: 3d reconstruction using SLAM

## References

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# Thank You