### A Bayes Filter based Adaptive Floor Segmentation with Homography and Appearance Cues

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#### What is Floor Segmentation??

Extracting floor from an image or given a sequence of images.



# Outline

#### Why needed?

### Related Work

#### Our Approach

- Algorithm
- Results
- Why this method is better?
- Future Work and possible variations
- Conclusion.

# Why Needed??

Indoor Robotic Vision Application.

- Indoor Navigation
- Indoor Exploration
- Indoor Localisation
- Indoor Mapping
- VSLAM

#### **Related Works**

#### <u>Purely appearance based formulation through colour</u> <u>and texture cues.</u>

L. Lorigo, R. Brooks, and W. Grimsou. Visually-guided obstacle avoidance in unstructured environments. In Intelligent Robots and Systems, 1997. IROS'97., Proceedings of the 1997 IEEE/RSJ International Conference on, volume 1, pages 373–379. IEEE, 1997.

#### Primarily from a geometric/homographic stand point.

J. Zhou and B. Li. Robust ground plane detection with normalized homography in monocular sequences from a robot platform. In Image Processing, 2006 IEEE International Conference on, pages 3017–3020. IEEE, 2006.

#### Combinations of geometry and appearance cues.

E. Fazl-Ersi and J. Tsotsos. Region classification for robust floor detection in indoor environments. Image Analysis and Recognition, pages 717–726, 2009.

## Contd..

The previous works didn't shown results under challenging conditions such as

- Homogenous Environment
- When camera is rotating
- When the environments are changing.

Most of other work doesn't talks about improvement in segmentation with time.

• Class Probability improvement.

# Our Approach

Combination of graph based segmentation and homography cues.  Segment Feature Tracking and Bayesian Framework.

 Recursive Segmentation till features are tracked.





### **Different Situations where recursive**

### method helps.



It may happens that obstacle (low lying) in front of camera may start satisfying floor homography (popularly known as virtual plane problem)

In case of homogenous environment, to separate floor and non-floor region correctly(precise boundary).

### **Recursive update on different Environment**



## Results





#### Results under challenging conditions

#### 1. when camera rotates



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### 2. When texture of the floor is changing



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## Why this method??

Simple to implement.

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Computationally feasible Accurate results over large sequence of images in several indoor environments.

Speed.

Monocular camera based approach.

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## Future Works

Extending the above algorithm to Exploration and VSLAM framework
Outdoor Ground Plane Segmentation.

## Possible Variation

- Machine Learning Techniques can be incorporated for classification.
- Can be extended for outdoor ground plane detection and segmentation.

## Conclusion

This work presented a robust floor segmentation algorithm that used  $\bigcirc$ both appearance and geometric cues dovetailed into a Recursive Bayes Filter formalism. The filter enables to maintain accurate segmentation even as the floor appearance changes and also obtains a precise boundary between floor and no floor areas. The cornerstone of this effort is the efficacy of the segmentation even in areas where floor texture changes, where floor and non floor areas are of same colour, where the robot rotates into a new view, in presence of varying illumination and over extremely long sequences.

## THANKS

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