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## TRACK I

## PATTERN RECOGNITION

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# 2D versus 3D Map for Environment Movement Objects

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## 1 Introduction

Real humanoid independent robot needs to localize itself and create map concurrently. So, simultaneous localization and mapping (SLAM) or Concurrent mapping and localization (CML) is a fundamental characteristic required for autonomous robot. The SLAM answers these questions "where am I?" Localization, "where do I go?" goal determination, and finally "How do I go there?" motion planning. The actual robot, which has two camera and two legs, requires estimating the 3D information of the environment. when the humanoid robots use two legs to move there is new problem will be appear such as shaky or jiggling 3D video so it needs some video stabilization which can work on 3D real time situation. There is some works has been done which works on 2D video and 3D video stabilization but there is not much work on 3D humanoid vision with two legs.Develop and modify framework for 3 Dimensional Vision simultaneous localization and mapping for humanoid robot (3D-VSLAM-Humanoid) with video stabilization is the objective of this research. 3D-VSLAM-Humanoid is a technique to localize and create map simultaneous in unknown environment in real time by using stereo camera on top of head of humanoid robot with two legs. In this paper we proposed a framework for 3D-VSLAM-Humanoid to solve problem of shaky 3D video and create 3D map of environment. First of all, the formulation of 3D SIFT descriptor that accurately captures the spatiotemporal nature of the video data need to be improved. Secondly, extension bag of words paradigm to videos in the framework based on 3D SIFT, need to be improved. Thirdly, creation of the algorithm to discover relationships between spatiotemporal words for learning discriminative word groupings needs some enhancement. Finally, comparative analysis of our 3D SIFT descriptor with previous descriptors used for the same purpose need some changes.

Object localization and recognition are important problems in computer vision. Unlike exhaustive search that is computationally prohibitive, there are several methods that make either recognition or localization more efficient, and few have dealt with both tasks simultaneously(Guo et al. 2010).

Robot navigation based upon self-measurements like odometer for moving distance and compass for angle of rotations leads to accumulative error in the final position and would be added by the period of time. One of the newest approach is

Observing landmarks then estimating the position relative to them(Prabuwono et al. 2009). Navigation requires 3D information estimation of the objects in the scene relative to the position of the camera. Three bases for extracting this information are available: Time-of-Flight cameras, Stereo Vision and Monocular Vision(Prabuwono et al. 2009).

The ability of a robot to localize itself and simultaneously build a map of its environment (Simultaneous Localization and Mapping (SLAM) or Concurrent Mapping and Localization (CML)) is a fundamental characteristic required for its autonomous operation. Recently Vision Sensors/Cameras that has been widely used are low-cost, light and compact, easily available, offer passive sensing, have low power consumption and provide rich information about the environment enabling the detection of stable features. As a SLAM system starts, landmarks for SLAM can be initialized in an un-delayed manner. By contrast, the landmarks are initialized with some delay when a single camera is used to perform SLAM without the use of any artificial target because multiple acquisitions from a single camera are required to compute 3D location of the observed features. Different algorithms have been used to perform SLAM including Extended Kalman Filtering, Particle Filtering, biologically inspired techniques like RatSLAM, and others like Local Bundle Adjustment(Naveed et al. 2008).

Kalman filters have become a standard approach for reducing errors in a least squares sense and using measurements from different sources. Moreover, Kalman filter has been widely employed as a part of vision development in robots. Using visual measurements that contains noises and uncertainties captured is an important role of this filter in the SLAM.(Prabuwono & Idris 2008)

## 2 Materials and Methods

*Problem Statement*

3D-VSLAM-Humanoid needs more and more research to incorporate to the existing algorithms the necessary tools to achieve complete invariance to these fairly common matching problems like:

- Sensor uncertainty: Uncertainties in measurements appear with the worst in case of SLAM because of their statistical dependency on each other. Generally in SLAM problem, the odometry data and sensor measurements are assumed to be available in an alternative fashion. The error in odometry (i.e. the localization error) manifests itself as topological inconsistency in the developed map. As the odometry errors grow unboundedly over time, it results an exponential accumulation of errors in the generated map(Begum et al. 2008).
- Correspondence problem: Correspondence problem or data association problem is one of the hardest problems in SLAM. It deals with the problem of establishing correspondence between two different measurements of the same place taken at two different points of time separated by the robot's navigation time. This is a challenging problem because the robot's accumulated position



uncertainty usually becomes extremely large. Besides, for navigation in featureless environment, e.g. long corridor, correspondence problem becomes very severe due to lack of natural landmarks(Begum et al. 2008).
- Loop closing problem: Loop closing problem is actually an instance of the correspondence problem which occurs when SLAM is performed in a cyclic environment. While closing the cycle, the robot needs to recognize that it has visited the same place earlier and interprets the sensor measurements accordingly. The problem becomes severe for large loops. In that case accumulated errors become unboundedly large resulting topological inconsistency in the developed map at the time of loop closing(Begum et al. 2008).
- Time complexity: For autonomous robot navigation the SLAM algorithm must have the capacity to process sensor data in real-time while allowing the robot to travel at any speed(Begum et al. 2008).
- Video stabilization: when the humanoid robots use two legs to move there is new problem will be appear such as shaky or jiggling video . There is some works has been down which works on 2D video and 3D video stabilization but there is not much work on 3D humanoid vision with two legs.(Yeon Geol et al. 2010; Yeon Geol et al. 2011).

*Proposed Framework based on SLAM phases:*

The chart shows proposed framework that could solve problem of 3D-VSLAM-Humanoid which mentioned in problem statement part. In the first step of proposed framework the system recognize whole sensors in the robot. Then by using all sensors system can detect environment of robot. After that, systems choose method to solve SLAM problem. Next, we have a loop to create map of environment that includes video stabilization, create path, append map, update map, estimates position.

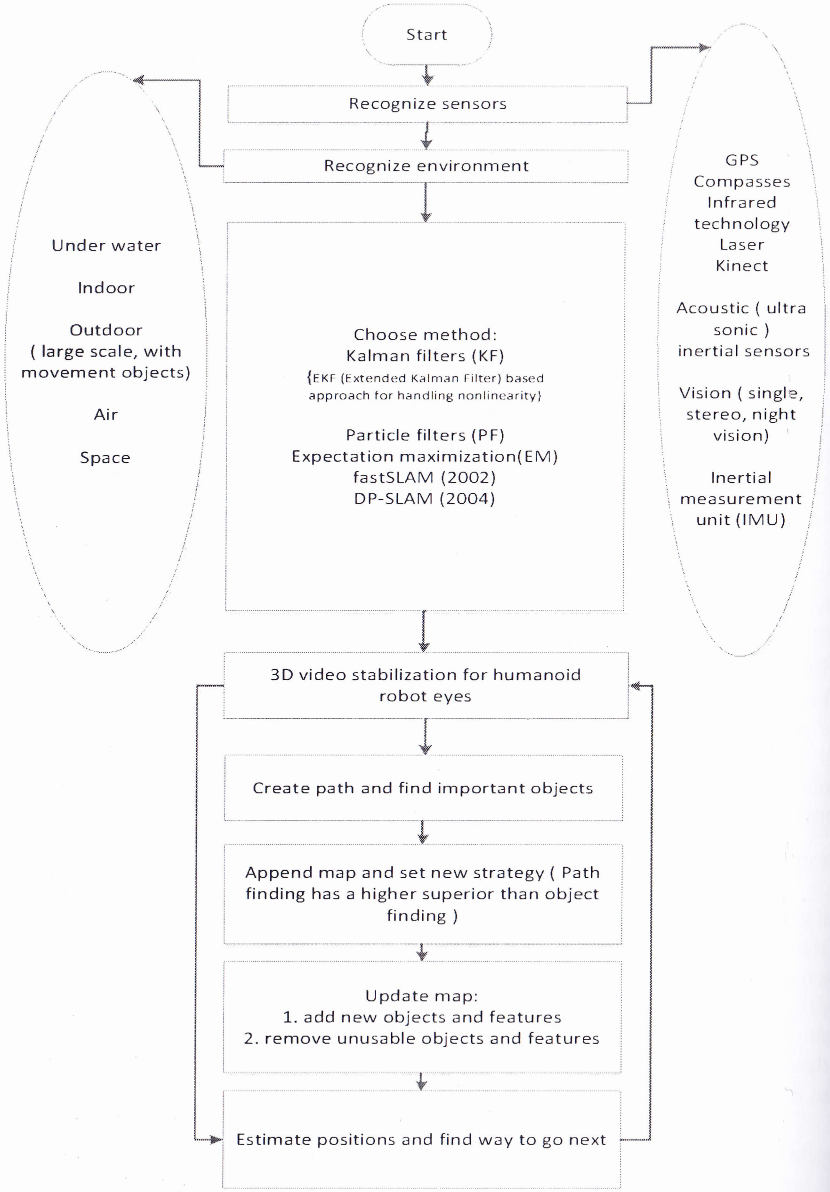


**Figure 1:** Proposed flowchart



## 3 Experiments and Discussions

*Comparison Feature Extraction Method; SIFT, SURF, ASIFT*

We demonstrate faster and more optimized technics in the object localization and mapping in the 3D systems by comparison between the current methods. The recognition of human activity is a concerning problem to provide interactive service with the user in various environments.

*Experiment*

For test the algorithms we have a original images with 1296 * 968

And for testing we resize the image 50% (648 * 484) and rotate right 90 degrees and change to monochrome bitmap.

**Table 1:** Comparison of 3 different methods

| | | SIFT | SURF | ASIFT |
|---|---|---|---|---|
| **Descriptors** | Image 1 | 1751 | 760 | 12115 |
| | Image 2 | 2113 | 2113 | 20457 |
| **Match** | | 11 | 84 | 134 |
| Nfa | | -4.57123 | -77.8567 | -156.884 |
| **Good Match Ratio** | | 1 | 0.702381 | |
| **Time** | | 1.77 s | 1.32 s | 3 s |

Surf is the best method in time and illumination; SIFT is the best method in scale, rotation and blur (Juan & Gwun 2009)

*Expected result and Contributions of research*

First of all, the formulation of 3D SIFT descriptor that accurately captures the spatiotemporal nature of the video data need to be improved. Secondly, extension bag of words paradigm to videos in the framework based on 3D SIFT, need to be improved. Thirdly, creation of the algorithm to discover relationships between spatiotemporal words for learning discriminative word groupings needs some enhancement. Finally, comparative analysis of our 3D SIFT descriptor with previous descriptors used for the same purpose need some changes.(Scovanner et al. 2007).

*Conclusion*

In this paper, we have compared several feature matching methods and by comparing between these methods we have reached the conclusion that SURF presented the fastest and the good results in the real world experiments. This method can be considered as a powerful part in the future works.

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# Video-Based Non-Cooperative Iris Recognition System

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## 1 Introduction

In various biometric authentication methods, iris recognition is considered as the most reliable and accurate method (Du and Zhou, 2008; Yahya and Nordin, 2010, Dhiman et al., 2011) because of its high recognition rate, stability (Wang et al., 2010; Cho et al., 2011) and uniqueness (Yahya and Nordin, 2010; Wang et al., 2010; Cho et al. 2011; Azzubeiry and Mohammed, 2011). In the past, most of these iris recognition systems were designed for frontal and high-quality iris images (Du et al., 2010). It suffers from a constrained acquisition setup with more imposition on the subject during image capture. This restricts the deployment of the iris biometric system in applications like criminal identification where subject cooperation is not possible (Mehrotra and Majhi, 2011). Hence, developing a video-based non-cooperative iris recognition would be a reasonable approach for such a situation.

However, it is a challenge to develop a video-based iris recognition system under a non-cooperative situation, where time as well as accuracy cannot be compromised. Therefore, a less computational complexity but accurate and more promising algorithm should be proposed for developing a better video-based non-cooperative iris recognition system. So far, little research has been done in this area (Du and Arslanturk, 2008; Mehrotra and Majhi, 2011). Thus, we try to propose a new algorithm, F-SURF for a better iris local features extraction and matching, in order to improve the efficiency and the effectiveness of the system.

## 2 Materials and Methods

*Methodology*
*Refer next page

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