Vision-Based Navigation for UAV Helicopter

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Introduction

The autonomous Unmanned Aerial Vehicle (UAV) is an aircraft controlled by the on-board intelligence and computing power.

**UAV Applications:**

- Search
- Rescue
- Surveillance
- Remote inspection
- Film making

To perform these tasks:

- *Vision system* is essential because vision provides a natural sensing modality for feature detection and tracking.

- *Helicopters* have advantages because they are highly maneuverable with the ability to fly at low speed, fly laterally, hover in one place and perform maneuvers in narrow spaces.
Overview

- The purpose of this study is to explore a vision-based navigation algorithm for an autonomous UAV helicopter.
- We focus on how to obtain navigational information from a 3 dimensional perspective so that the helicopter can behave in an intelligent way.
- Three methods are used to obtain 3-D information, which is very different from the obtaining 2-D images.

**Stereo**
Stereo is using two cameras to extract range data, which is also referred to as binocular Vision.

**Single View Metrology**
Single View Metrology means obtaining measurements of scene structures from a single image. This is the basic geometry of single view metrology:

**Optical Flow**
Optical flow is the apparent motion of the brightness pattern, which ideally will correspond to the velocity field.
Key Results

Implementation of Single View Metrology

Using *single view metrology*, we can calculate:

- Vanishing points and vanishing lines
- Camera height
- Linked height

Vanishing Point $V_2$ (-13098, -8924.17)
Vanishing Point $V_1$ (1377.51, -992.171)

Vanishing Line

(0,0)