Stereo Vision using the OpenCV library

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June 2010

Goal

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Generating a disparity depth map of the environment using stereo vision.

Why it is interesting

A depthmap can be used for various purposes:

- 3D modeling of 2D images
- Tracking of objects
- Recognising front objects
- As information about the environment in path planning

Theoretical problems

Stereo vision in a real life environment can be split up in several subproblems:

- Camera calibration problems
- Generating epipolar line
- Matching points in both images
- Occlusion

Approach

- Camera calibration
- Epipolar geometry
- Dense stereo algorithms
  - Graph Cut
  - Belief Propagation
  - Region Based
- Using the OpenCV library

Separate goals

The goal can be seperated into two independent subgoals:

- **Calibration and rectification** Starting with two cameras and building a rectified image
- **Dense stereo** Starting with a rectified image and building a dense disparity map
  Can use an external dataset

Practical problems

- Getting webcams to work
- Learning OpenCV
- Selecting and understanding the right dense stereo algorithm

Tasks

- Martijn and Moos
  - Camera calibration
  - Epipolar geometry
- Sander and Sebastian
  - Finding corresponding points
  - Generating depth map

Planning

- Week 1
  - Reading literature
  - Getting webcams to work
  - Choosing dense algorithm
- Week 2 and 3
  - Implementing
    - Camera calibration
    - Rectification of images using epipolar geometry
    - Dense disparity map algorithm
  - Halfway report
- Week 4
  - Optimizing and testing
  - If there's enough time left
    - Generate 3D image of environment
    - Remove background using dense disparity map