3-D Reconstruction

Computer Vision Challenge

Team member:

Weiqi Luo

Wanting Huang

Yuanjing Liu

Yanglu Zeng

1. Challenge Introduction

Given two stereo images of a desk with groceries, we are supposed to find an image from any angle between those of the two given ones. Using parameter p with values from 0 to 1 to represent angles from left view image to right view image.

We handle the task as three parts. First part is pre-processing the raw images, including feature selection and correspondence, fundamental matrix deriving and epipolar rectification. Next part is calculating the disparity map, implementing xxxxxxxx. The last part is to construct the new image from new angle, xxxxxxxxxxx.

Epipolar rectification

DIBR

disparity map

dense matching

F matrix deriving

Feature selection

Fig. 1.1 Flow diagram

1. Image Rectification

The file free\_viewpoint.m describes the whole process of this part. To begin with, we get two raw pictures as out input, from here we need to load and analyze them and thus deriving the essential matrix as well as the fundamental matrix.

* 1. Feature Correspondence

In this part, we process the two images using several function files, namely rgb\_to\_gray, harris\_detektor, korrespondenzen and RanSaC. Therefore, we get several pairs of correspondent points, which prepare us to calculate the essential matrix and fundamental matrix. The detailed explanations of functions are as follows.

rgb\_to\_gray .m: convert the colorful image to one gray image, using

0.299\*R+ 0.587\*G+ 0.114\*B.

harris\_detektor .m: we can get corner points so that the matching complexity can be reduced by calculating the harris matrix using

H= det(G) – k\*tr2(G).

korrespondenzen .m: according to NCC criterium to match the found point pairs.

RanSaC .m: use RanSaC algorithm to find and avoid incorrect points, as an improvement.

* 1. Estimate Fundamental Matrix

Eight points algorithm is implemented here to derive the fundamental matrix from the points we have got.

In which E is the essential matrix and A is the Kronecker product of two corresponding points in a pair, namely:

After implementing 8-point pairs into it, we can get E, therefore also F.

Seeing in achtpunktalgorithmus.m.

* 1. Epipolar Rectification

After rectification, the epipolar lines between two pictures will be horizontal, which means the corresponding points will be of the same y value, which apparently makes finding the disparity map easier and more precisely. Seeing the file epipolar\_rectification.m and image\_rectification.m.