Project Topic: determining distance of features using parallax

Team Comp:

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Task Division:

-Jeff will focus on creating our own images to be tested, using two identical cameras.

-Ben will focus on parallax and generating heightmaps

-Trent will focus on filtering out bad matches and testing the accuracy.

Tasks:

Matching SIFT features, and filtering out bad matches.
Calculating Parallax from matched features.
Using Interpolation to form HeightMap.
Displaying Output in a way that makes sense.
Creating a system to test the accuracy of our heightMap.
Creating Own images, to test accuracy on.
Allowing for non-parallel cameras (with known angle).
Allowing for cameras at different distances from the subject.
Using More than two cameras.

Methodology:

We will be using the parallax of cognate features in two binocular images to determine the distance of regions of the image from the cameras. The features will be SIFT features taken from both images, and will be attached to their cognate feature based on how closely the features match. The difference between the position of a sift feature and its cognate in the other image can then be used to determine the distance of the feature from the camera. A topographic image can then be formed by interpolating the points between the features.

The output might be improved by grouping sift points in clusters based on their respective parallaxes. Thus outliers due to improperly matched features can be ignored. All parallax should be on along a similar vector, so matches that don't conform to the same vector as most of the matches can also be discarded.

The product could also be expanded to use inputs from cameras

Steps:

- Use SIFT to find features in both image
- Match Sift features
- Determine distance for matched features in terms of camera separation.
- From these distances, interpolate to form a heightmap of the imaged region.

Starter Code:

The starter code is the CS385 "Feature Detection and Matching" Lab.

Github for this project:
https://github.com/e102y/ObjectDetectionFinalProject/blob/master/sift_matching_features.m

Image Datasets: We will use the NORB database, it contains over 20,000 pictures in sequences of toy figures taken with (and without) different variable like a tilt in focus, scale, vertical shift, or luminescence. The database has been stored in a way to make it easy to use with matlab. It was in fact designed for 3d image detection.

Reference Papers:

Blake, Randolph, and Hugh Wilson. “Binocular Vision.” *Vision research* 51.7 (2011): 754–770. *PMC*. Web. 19 Nov. 2017. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3050089/

S Neethu, S Vinuchackravarthy, “Object detection using binocular vision.” Web. 21-24 Sept. 2016. http://ieeexplore.ieee.org/document/7732270/

Database:

https://cs.nyu.edu/%7Eylclab/data/norb-v1.0/