16623 Project Proposal: Measure it!

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Abstract

The goal of our project is to make an iOS app lets the user to measure 3D distances with the help of structured sensor. The challenge of this project lies in working with a noisy depth map and approximate user annotations.

1 GitHub

https://github.com/jujudydy8196/Measure-it

2 Background

Our projects are inspired by the Google Tango demo (https://www.youtube.com/watch?v=5ZSjpw9t1r8). The nature of mobile devices makes it handy as a measurement device, and computer vision makes it possible to input the surrounding environment into the mobile device for computation. Furthermore, efficient vision algorithms can be used to design mobile applications with simple, intuitive user interface.

3 Challenges

The challenge is to obtain accurate 3D measurement between two points the user is interested in. However, the depth map is noisy, and the user annotations are approximate.

To be more specific, we would like to compute geometrically interesting points from the depth map. This way users can easily point to desired 3D locations, and potentially the small set of geometrically interesting points could be efficiently tracked overtime to improve their depth accuracy. We are planning to try running Harris corner detector on the depth map as a starting point.

Additionally, an interesting question is what's the easiest and most natural way for users to measure or interact their environment with a mobile device? Is it easiest to tap when the center of screen points at your point of interest, and then move the device? Is it easiest to hold the device still and tap the two points of interest? Is it easiest to pick points of interest out of a few suggestions provided by the app? Can the mobile device figure out the concept of an object and directly report objects and their sizes in the scene?

From this project we will learn about the quality of depth maps from structured light sensors, and explore ways that vision algorithms can make the user interaction with mobile devices more natural.

4 Deliverables

Plan to achieve   A 3D distance measuring App, and experiments on at least two metrics for geometrically interesting points. We will record a video of the depth map of scenes with some blocky things of known size, some everyday objects like chairs, some small objects and some large objects. We will run our algorithm to produce interest points as well as estimating 3D distance between them. The distance estimations will be compared to ground truth measurements.

Hope to achieve   Efficient way to improve localization of geometrically interesting points and denoise depth map, or automatic reporting of object scales in scene.

5 Schedule

week	work
Oct 31	Project proposal
Nov 7	Compile and run structured sensor, obtain depth map obtain 3D distances between two pixels on depth map
Nov 14	Build App UI for selecting measurement points; try interest point detector for user annotation; project checkpoint writeup
Nov 21	experiment with different UI; experiment with different geometrically interesting metrics
Nov 28	improve noisy depth map
Dec 8	prepare for project presentations (videos, slides, report).