AER 1515, Project Proposal

Zhenyuan Xiang, Zhentao Fan

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1 Problem

Consider the scenario that a robot with certain tasks is walking in certain areas, like gardens and campuses. In order to do the route planning or some other tasks, it would be better to have the accurate location of the agent itself.

The intention of this project is to locate the robot itself based on the picture it captured by its camera. With the help of Google Maps, we will first compare the captured image with the image in the database, find the most similar image in the database, and infer the current location.

2 Methodology

2.1 Searching and localization

The libraries and algorithms that we are going to use include opencv, matplotlib, SIFT, and so on. Here are the steps to achieve the robot localization:

1 . Import the input images captured by the robot. Adjust the RGB channels to ensure compatibility when visualizing with matplotlib.

2 . Initialize ORB (Oriented FAST and Rotated BRIEF) using the underlying SIFT method.

3 . Determine the key points and descriptors for both the reference and input images.

4 . Set up the Brute Force matcher with the necessary parameters.

5 . Utilize KNN (K-Nearest Neighbors) for matching, which provides matches based on distance similarities.

6 . Do the reverse engineering: get the regions based on the matched image from the database.

2.2 Database

The database will be stored locally in order to have a better searching runtime. We will import the map and the corresponding image either from Google Maps or from the database we set up on our own within a local spot.

3 Relationship to this course

This project would include topics of Scale-space Peak Selection and Keypoint Localization, which are all robotic vision-related.

4 Timeline and Goal

Milestones will include:

1. Set up the image map database.
2. Set up the SIFT algorithm.
3. Set up the search algorithm.
4. Integrate the location inference.

The final deliverable would make the smartphone able to identify its own location based on its camera.