CS 365A Project Proposal

Visual Odometry in a 2-D environment

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• **Introduction** : Given a robotic arm,having two or three links with camera mounted on top of the end-effector, our aim is to determine the position and orientation of the robot by analysing the image space. The image space is the dataset obtained by the images captured by the camera placed at the end effector of the robot. We will also try to find the position of the obstacle placed in the environment by comparing its images taken from different angles. Visual Odometry(VO) improves navigation accuracy.

• **Motivation** : Let us take the instance of the Mars Land Rover mission.Now,we all know that GPS does not exist on Mars.Then,how do we tackle the problem of navigation and determination of the Robot's position.Visual Odometry allows us to overcome this hurdle.Also,it is very much accurate,as compared to the traditional odometric techniques.VO can be applied to unfamiliar terrains as well,something which GPS does not allow.

• **Approach** : Our environment will be a square shaped box with 4 coloured walls (blue, green, yellow, pink). Inside the box will be kept our robotic arm having 2(or 3) links and at the end effector camera will be placed. The camera will be having 180° field of view, it will emit rays at an angular difference of 1°.Or,we could also take images for random values of θ_1 and θ_2.The robot will see the image of what lies in front,as a strip.First we will capture the images for different configurations of the robotic arm(obtained by varying the two angles θ_1 and θ_2).This image dataset will be used to train the robot,so that when it encounters a new images,it can determine it's own configuration.

We will map this image dataset(which we expect to be a 2-D manifold,or in the case of 3 links,it will be a 3-D manifold) to a 2-D(or 3-D)space using isomap algorithm.Then we will attempt to map it to the configuration space (θ_1, θ_2),using neural network.With obstacles in the environment, we will aim to find their location by using their images taken from different angular configurations.

• **Dataset** : The image dataset will be obtained by arranging the robot in differing orientations and capturing the images.This dataset will be used to train it,so as to correctly determine its current configuration when the image is given.

References

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