

Robotics: Perception Assignment 1

Dolly Zoom

1 Introduction

In this programming assignment, we will implement Dolly Zoom effect used by filmmakers to create a sensation of vertigo, a “falling-away-from-oneself feeling”. This assignment is fairly simple and is meant to introduce you to the concepts of projection and focal length; later assignments will start to get trickier. It keeps the size of an object of interests constant in the image, while making the foreground and background objects appear larger or smaller by adjusting focal length and moving the camera. You will simulate the Dolly Zoom effect with a synthetic scene as shown in Figure 1, which illustrates two cubes and one pyramid seen from the top view. Please find an example of the Dolly Zoom simulation from this link:

<http://cis.upenn.edu/cis580/Spring2016/Projects/output.avi>

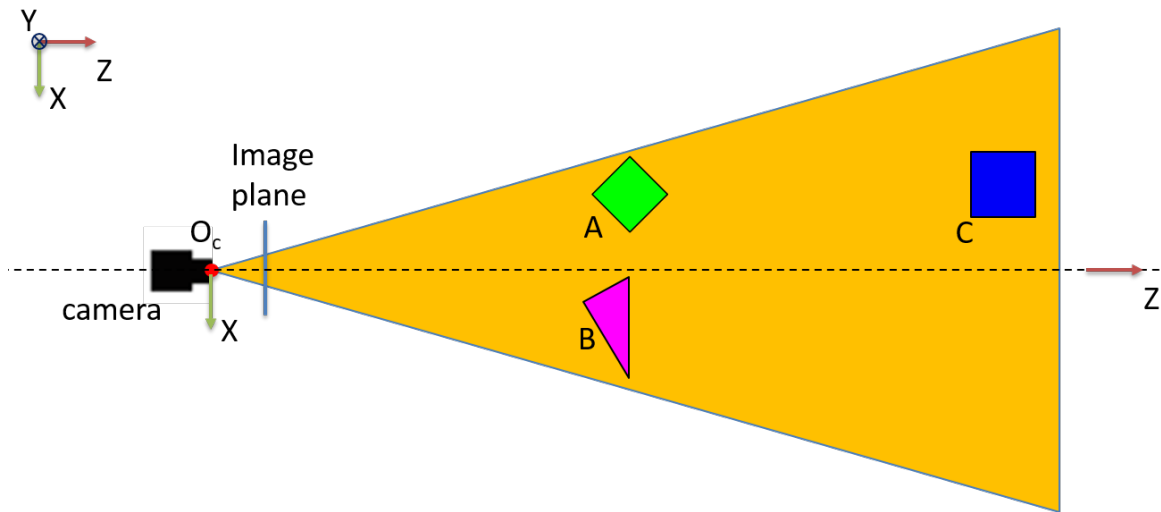


Figure 1: Top view of the synthetic scene.

2 Technical Details

The MATLAB script **run_dolly_zoom.m** will be the main script to run this assignment. Given 3D coordinates of vertices, we will complete a function, compute focal length that finds focal length such that the height of the object A remains constant while the camera moves along with Z axis. The reference depth, reference focal length and height of the object A and the camera movement will be given. We will use this function to visualize the Dolly Zoom effect using project objects. The main files you must fill out.

3 Dolly Zoom


$$u = f \frac{X}{Z}, \quad v = f \frac{Y}{Z} \quad (1)$$
$$u = f_{ref} \frac{X}{Z_{ref}} = f' \frac{X}{Z_{ref} - \Delta C} \quad (2)$$

Figure 3 illustrates the focal length/depth compensation: the camera moves away from the object while changing its focal length such that the height of the object A, $h_1 = 400$, in both original and moved images remains constant. Note that the heights of the other background objects are changed due to this effect.

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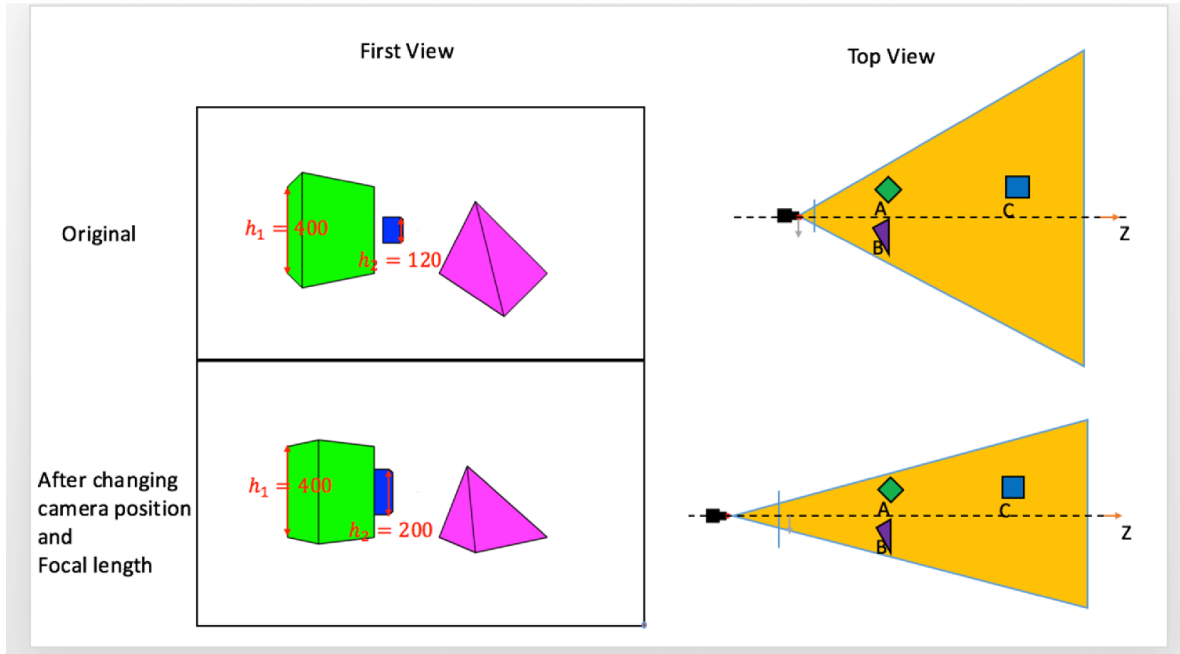


Figure 3: Dolly zoom effect.

4 Visualizing Results

We can visualize the Dolly zoom effect using `project_objects(point3D)`.

5 Submitting

To submit your results, run the **submit** script, which will test your compute focal length function by passing the depth and the camera translation. This script will generate a mat file called `RoboticsPerceptionWeek1Submission.mat`. Upload this file onto the assignment page, and you should receive your score immediately.