CS 565 Computer Vision – Assignment 3

Dr. Nazar Khan

December 07, 2015
Due Date: Monday, 14th December, 2015 before class.

Q1) (10 marks): Edge Detection. Incomplete code for the Canny edge detector is available in the file **canny/canny.m**. Wherever the file contains the following line

```
------------ADD_CODE_HERE------------
```

add the missing code. Then run the following commands

```
get_results('../kanizsa_triangle.jpg');
get_results('../illusory_square.jpg');
get_results('../pucit_old_campus.jpg');
```

This will create results in the parent folder (where the image files are located).

Submission: Submit the completed

- **canny.m**

and the result files

- **kanizsa_triangle_edges.png**,
- **illusory_square_edges.png**, and
- **pucit_old_campus_edges.png**.

Q2) (10 marks): Corner Detection. Incomplete code for corner detection is available in the file **corner/detect_corners.m**. Wherever the file contains the following line

```
------------ADD_CODE_HERE------------
```

add the missing code. The file requires implementations of the following 3 approaches to estimate corner strength

- **Tomasi**. Corner strength = λ_{small} where λ_{small} is the smaller eigen-value of the structure tensor.
- **Rohr**. Corner strength = determinant of the structure tensor.
- **Harris**. Corner strength = trace of the structure tensor.

In addition to passing a suitable corner strength threshold T, a corner should also be a locally maximum point in the corner strength array. You also need to add missing code in **corner/find_local_maxima.m**.

Then run the following commands

```
get_results('../kanizsa_triangle.jpg');
get_results('../illusory_square.jpg');
get_results('../pucit_old_campus.jpg');
```

This will create results in the parent folder (where the image files are located).

Submission: Submit the completed

- **detect_corners.m**, and
- **find_local_maxima.m**

and the result files

- **kanizsa_triangle_corners.png**,
- **illusory_square_corners.png**, and
- **pucit_old_campus_corners.png**.

Q3) (10 marks): Line Detection. For this part, you will need the completed **canny.m** from Question 1 and the completed **find_local_maxima.m** from Question 2. Copy them into the **hough/** folder.

(a) Fill in the missing code in **hough/draw_line_polar.m** that draws a line using its polar representation (r, θ).

(b) Fill in the missing code in **hough/hough_transform.m**.

(c) Fill in the missing code in **hough/detect_lines.m**.

Then run the following commands

```
detect_lines('../kanizsa_triangle.jpg');
detect_lines('../illusory_square.jpg');
```

This will create results in the parent folder (where the image files are located).

Submission: Submit the completed

- **draw_line_polar.m**,
- **hough_transform.m**, and
- **detect_lines.m**

and the result files

- **kanizsa_triangle_lines.png**, and
- **illusory_square_lines.png**.

Q4) BONUS (10 marks): Circle Detection. Write a program to detect circles in an input image using the Hough transform for circles. Use your program to detect circles in **illusory_square.jpg**. To visualise your results, you might also need a program to draw a circle given its center and its radius.

Submission

Paste your submission as a .zip file into the following folder on \\printsrv:

\\printsrv\Teacher Data\Dr.Nazar Khan\Teaching\Fall2015\CS 565 Computer Vision\Submissions\Assignment3

Write access to this folder will be disabled after the submission deadline. The .zip file should have the following naming convention

`RollNumber_Assignment3.zip`

For example, if your roll number is MSCSF15M999, then the .zip file should be named

`MSCSF15M999_Assignment3.zip`

The .zip file should contain the following directories:

- **canny/**
- **corner/**
- **hough/**
- **hough_circle/**