CS 565 Computer Vision – Assignment 2

Dr. Nazar Khan

Assigned	Wednesday, December 13, 2017
Due	Wednesday, December 20, 2017 before 5:30 pm.

1 Programming

1. **(10 marks): Recovering Best Affine Transform**. Incomplete code for recovering the best affine transform from corresponding points is available in the file **recover_affine_transform.m**. Wherever the file contains the following line

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

   add the missing code.

2. **(10 marks): Image Warping**. Incomplete code for warping an image using a 3×3 transformation matrix is available in the file **warp_image.m**. Wherever the file contains the following line

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

   add the missing code.

3. **(10 marks): Homography Estimation**. Write a MATLAB function called **recover_projective_transform.m** to recover the homography between two corresponding point sets `P1` and `P2`. Generate results that verify the correctness of your program.

Note:
Question No. 3 is compulsory for MPhil and PhD students.
Question No. 3 is a bonus question for BS students.

2 Generating Results

To generate all required results for this assignment, just run the script **get_results.m**. Please read the script in order to understand what it does. It does 2 things:

1. Affine Recovery

   (a) Generate random pixel locations `P1`.

   (b) Setup a transformation matrix `T`.

   (c) Transform `P1` by `T` to obtain new locations `P2`.

   (d) Recover the affine transformation `estimatedT` from only `P1` and `P2`. (If your code is correct, then the recovered transformation `estimatedT` should be the same as the original transformation `T`).

   (e) Transform `P1` by `estimatedT` to obtain new locations `P3`.

   (f) Plot scatter diagram showing point set `P1`, `P2` and `P3`. (If your code is correct, then `P3` will be plotted on the same locations as `P2`).

   (g) Store the scatter plots as the image **affine_transformation.png**.

2. Warp Image

   (a) Read in image **illusory_square.jpg** and add a small white mark to it.

   (b) Generate a $2D$ affine transform A and a $2D$ projective transform (homography) H.

   (c) Transform the image using A. Store result in **illusory_square_affine_warped.png**.

   (d) Transform the image using H. Store result in **illusory_square_projective_warped.png**.

3 Official Results

To verify correctness, you can compare your results with this official solution.

1. **Recovering Best Affine Transformation**

$$\begin{pmatrix} 1.3000 & 4.8000 & -1.0000 \\ 3.6000 & 5.8000 & 20.0000 \\ 0 & 0 & 1.0000 \end{pmatrix} \tag{1}$$

2. **Image Warping Official Results**

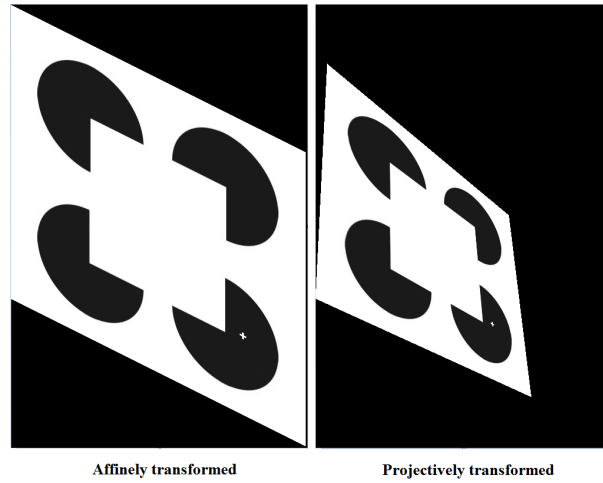**Affinely transformed**   **Projectively transformed**

Figure 1: Official results.

3. **Homography Estimation**

$$\begin{pmatrix} 1.3000 & 4.8000 & -1.0000 \\ 3.6000 & 5.8000 & 20.0000 \\ 0.5401 & 0.0016 & 1.0000 \end{pmatrix} \tag{2}$$

Submission

This assignment is to be done in **groups of 3 for undergraduate students** and **individually for graduate students**. It is highly recommended that you try this assignment individually at first and then combine your results. Paste your submission as a .zip file into the following folder on \\printsrv:

\\printsrv\Teacher Data\Dr.Nazar Khan\Teaching\Fall2017\CS 565 Computer Vision\Submissions\
    Assignment2\SECTION

where

SECTION=Morning or MPhilPhd

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

`RollNumber1_RollNumber2_RollNumber3_Assignment2.zip`

For example, if roll numbers of your group members are BCSF11M997, BCSF11M998 and BCSF11M999, then the .zip file should be named

`BCSF11M997_BCSF11M998_BCSF11M999_Assignment2.zip`

The .zip file should *only* contain

- completed **recover_affine_transform.m**

- completed **warp_image.m**

- completed **recover_projective_transform.m** (optional for BS students)

Please follow naming conventions. If conventions are not followed, you will not receive any credit.