CS6550 Computer Vision

Homework 2: Camera Calibration & Homography Transformation

Due : 23:59 11/10/2016

Part 1. Camera Calibration(50%)

Perform camera calibration from a set of 3D points & 2D points correspondences in the chessboard image.

Use “clicker.m” provided by TA to get lists of 3D points and the corresponding 2D points for each image. You should save your 2D points & 3D points using save( ) in matlab.

A. Write a program to compute the projection matrix from a set of 2D-3D point correspondences by using the least-squares (eigenvector) method for each image.

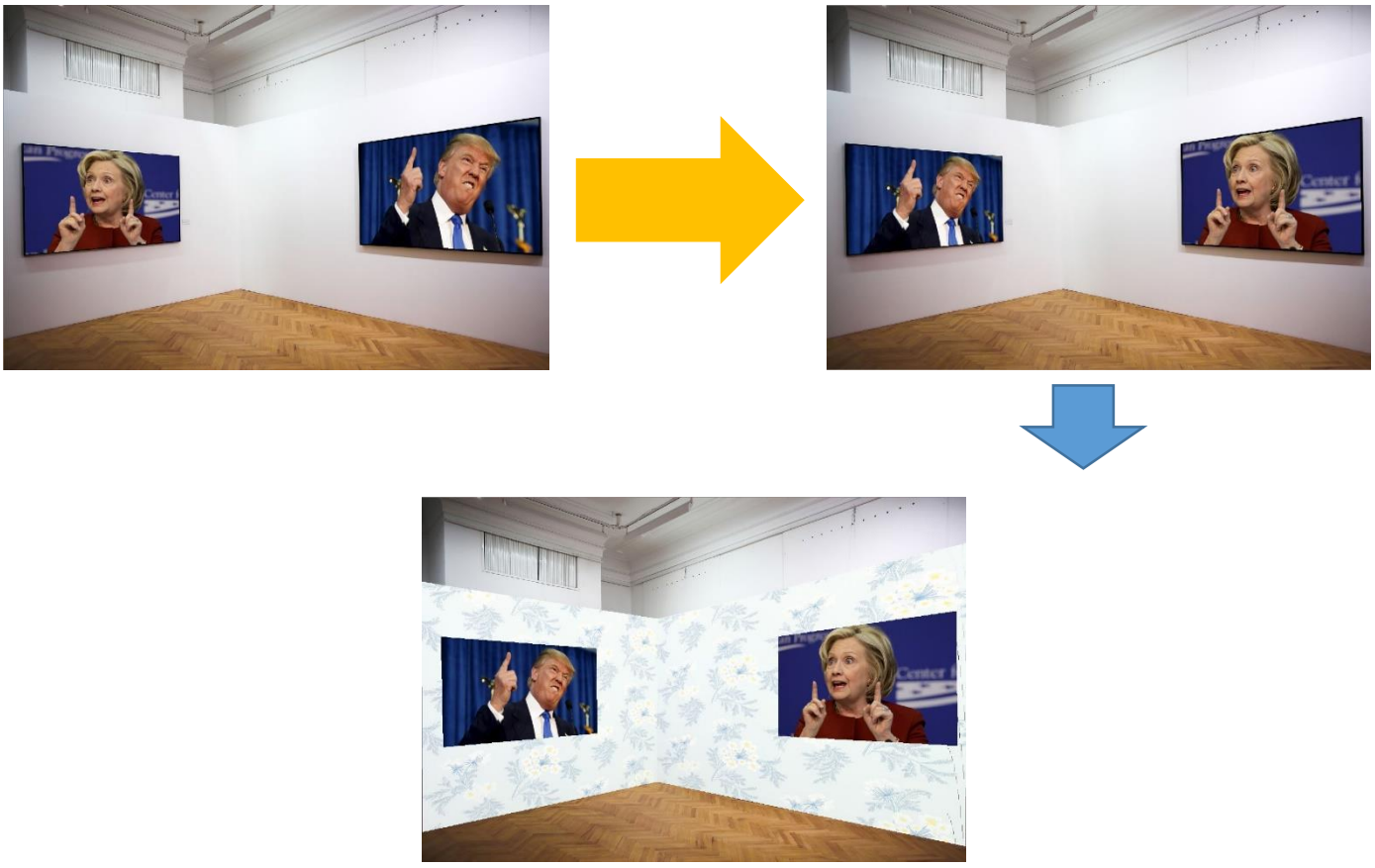
B. Decompose the two computed projection matrices from (A) into the camera calibration matrices, rotation matrices and translation vectors to obtain the camera intrinsic parameters (calibration matrix K) and extrinsic parameters (rotation matrix R and translation vector t) by using the Gram-Schmidt process.

C. Re-project 2D points on each of the chessboard images by using the computed calibration matrix, rotation matrix and translation vector. Show the results (2 images) and compute the point re-projection root-mean-squared errors.

D. Complete “visualizeCamera.m” provided by TA to plot camera poses for the computed extrinsic parameters (R, t) and then compute the angle between the two camera pose vectors.

Part 2. Homography transformation(50%)

The **United States presidential election of 2016** is scheduled on November 8, 2016. You are asked to generate an image with the photos of the two candidates switched.
Compute the homography transformations (projective plane transformations) to switch the two photos and fill the left blank wall and the right blank wall with other images of your choice. (Trump and Hillary)



A. Show the homography H that maps points in the input image to the corresponding points in the left frame and right frame.

B. Warp the left photo (Hillary) to replace the right photo (Trump) and warp the original right photo to replace the left photo by using bilinear interpolation with backward warping. (1 image)

C. Warp a new texture image (of your choice) to the two-sided wall by using bilinear interpolation with forward warping. (1 image)

D. Discuss the results of the two warping methods (forward and backward) you implement above.

Reminder

- You can also apply other paintings to your own images in part 2 and share the results with us.

- MATLAB functions **like** these are allowed to use:
  corner, svd

- MATLAB functions **like** these are **not** allowed to use in this homework:
  qr, imwarp , **estimateGeometricTransform** etc. which you can get the result directly

- Your code should display and output your results so that we can judge if your code works correctly.

- Please compress your code, result images and report in the file named

  HW2_{Student-ID}.zip and upload it to iLMS.
  Before 11/10(Thr.) 23:59.
- Your package should contain a README file about your execution instruction.

- If you encounter any problem, please feel free to contact us, or post questions or discussions on iLMS.