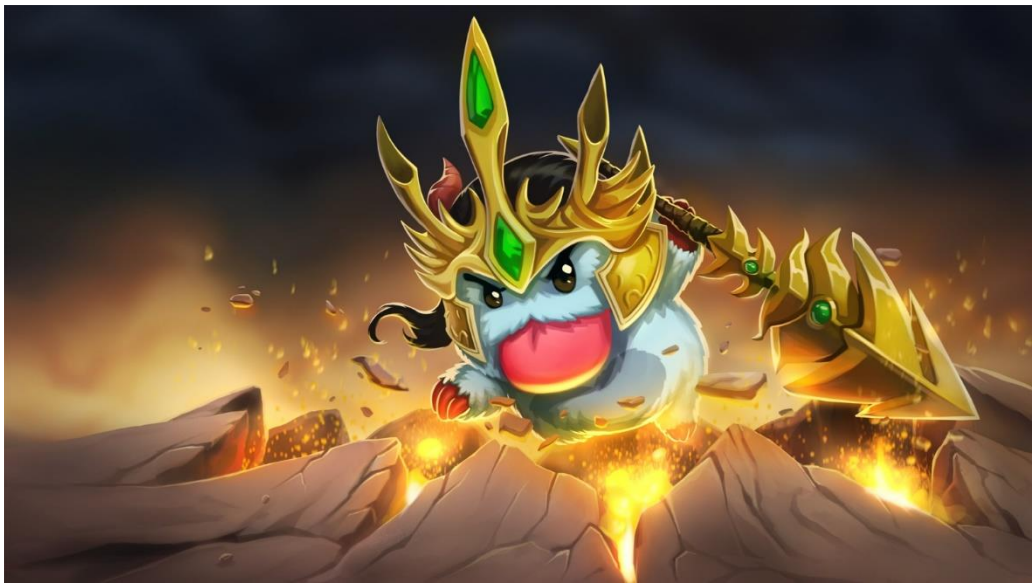
CS6550 Computer Vision

Homework 1: Feature Extraction

Due: 11:59pm, 10/20/2016

Part 1. Corner Detection (50%)



Detect the corners of the image (data/J4Poro.png) using the Harris corner detector. Then mark the detected corners on the image. Implement solution for each of the following problems **as a separate function** and show the step-by-step results.

A. Perform the Gaussian smoothing of σ=5. Show the results using kernel size decided by yourself (try two kernel sizes) and discuss the results. **(2 images)**

B. Apply the Sobel masks to the above Gaussian smoothed images (using appropriate kernel size) and compute the magnitude **(2 images)** and direction **(2 images)** of gradient. You should eliminate weak gradients by appropriate threshold.

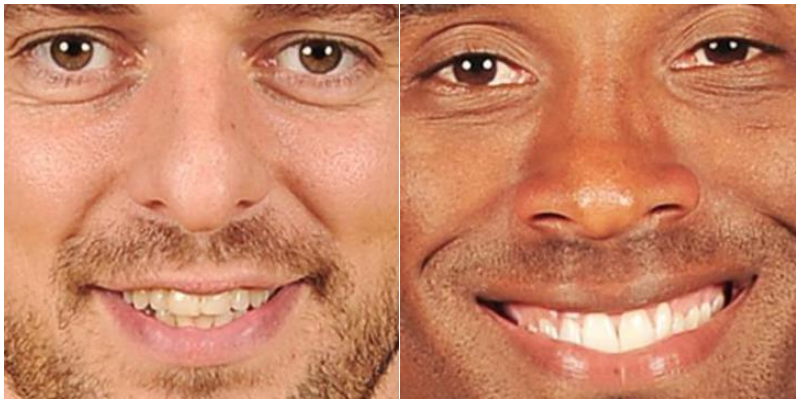
C. Use the Sobel gradient magnitude from problem 1-B to compute the structure tensor *H* of each pixel. Show the images of the smaller eigenvalue of *H* for window size 3x3 and 5x5, respectively. **(4 images)**

D. Perform non-maximal suppression on the results from 1-C along with appropriate thresholding for corner detection. Please discuss the results. **(4 images)**

E. Apply the same corner detection function to the rotated (by 30°) and scaled (to 0.5x) versions of the image. **(4 images)**

F. Compare (Try to visualize) the consistency of the detected corners on the triples of images (original, rotated and zoomed). Please discuss the results. **(1 images)**

Part 2. LBP Histogram (50%)



Implement your own LBP feature extract function, in its original form, using (8,1) neighborhood on the above 2 images. (data/gasolFace.png and data/kobeFace.png)

A. Show the results of LBP images. **(2 images)**

B. Compare face similarity by using inner product of the normalized LBP histograms.

C. Divide the face image into cells (2x2, 3x3, 4x4, 9x9, 20x20) and then repeat 2-B, discuss and try to explain the results.

D. Show the results of **uniform LBP** images. **(2 images)**

E. Compare face similarity by using inner product of the normalized **uniform LBP** histograms.

F. Divide the face image into cells (2x2, 3x3, 4x4, 9x9, 20x20) and then repeat 2-E, discuss and try to explain the results.

Reminder

- MATLAB functions **like** these are allowed to use :
  fspecial, imfilter, cov2, eig, imrotate, imscale

- MATLAB functions **like** these are restricted :
  gradient, corner, extractLBPFeatures

- 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

  HW1_{Student-ID}.zip and upload it to iLMS.

- Your package should contain a README file about your execution instruction.

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