

E9 208 Digital Video: Perception and Algorithms

Assignment 3

(Due Jan 2, 2020)

1. Principal components of natural images

Download the Berkeley segmentation dataset and extract 8×8 patches from a large corpus of patches (you may not need the entire dataset, you need to explore the number of sufficiently diverse patches). Compute the principal components and show them in a report.

2. Image compression and resolution

The goal of this question is to understand the bit rate below which it is better to downsample the video spatially by 2, compress the video and then upsample rather directly compress at the desired bit rate. Find this switching bit rate for the *pal_25fps.yuv* video available in the link pasted on Teams. You can solve this question either for MPEG or H.264. In order to control the bit rate, you can use ffmpeg or other publicly available compression software that allows you to do so. Compress all the videos with one I frame and rest being P frames. Quality can be measured in terms of mean squared error in the luminance data for this experiment. Clearly mention the various settings of the codec that you choose for this in the report (Hint: Explore bit rates in the range of 100 to 1000 kpps). Submit a plot of the rate vs mean squared according to the two strategies (with and without downsampling and upsampling) to demonstrate the switching rate. You may find the function `readframe.m` useful for computing the mean squared error. This function is in matlab. You can write a similar function in python if you want.

3. Quality Assessment

You have the option of choosing one among the following two questions:

- (a) Option A: Take part in a subjective study on Image Quality Assessment of Low Light Restored Images. This will involve taking part in two half hour sessions spaced 24 hrs apart. Make sure you give ratings according to your considered opinion. If you are clearly recognized as an outlier after every one has submitted their scores, you will not get complete credit! Each of you will receive a separate set of images. The study will give you an understanding of how subjective quality assessment studies are carried out and about challenges in low light photography.

You need to contact Vignesh Kannan (vigneshkanna@iisc.ac.in) to receive instructions on how to take part in the study.

- (b) Option B: Download the set of videos available at link pasted in Teams.

- Videos labeled as *ab_1.yuv* correspond to the reference video and *ab_13.yuv*, *ab_14.yuv*, *ab_15.yuv* and *ab_16.yuv* are distorted videos.
- The function `readframe.m` may be used as a guideline to understand how to read the file. This is in matlab. You may have to write this function in python if you use python.
- The subjective scores for every distorted video are available in a pair of text files. The first entry in each row is the necessary differential mean opinion score. The files contain more scores than necessary. But you can extract the scores for the desired videos.

Now compute the objective scores for every distorted video using mean squared error and multi-scale structural similarity index. Then compute the Spearman's rank order correlation coefficient between the objective scores and subjective scores of all the distorted videos.