ASSIGNMENT 2

computer vision

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For assignment 2 we were required to find a few pair of images and create hybrid images using a modification of the approach described in the SIGGRAPH 2006 paper by Oliva, Torralba, and Schyns. Hybrid images are static images that change interpretation depending on the viewing distance. These images make use of the human vision system and the way it processes images. From a distance or when the image is small only the low frequency details of the image will be clearly seen. However, as distance decreases or the size of the image increases, the higher frequency information from an image is processed. There are different ways of maintaining low and high frequencies of an image. For this project we were asked to use Gaussian and Laplacian pyramids. A Gaussian image consists of a slightly blurred version of the original image. First we must configure the N parameter, this will determine the depth of the pyramids. In order to build the Gaussian pyramid, I took the image, applied the built in imgaussianblur function to maintain only low frequency information and down sampled for N iterations. Since we have 2 images I decided to use the cell data structure in matlab that allows me to save the different images from the pyramids all under one organized structure. The cell array was structured such that im1 (one of the images) occupied the first two rows. The first row contains the Gaussian filtered image pyramid. The second row contained the Laplacian pyramid for im1.The Laplacian pyramid consists of the Gaussian image at step N and Gaussian image at step n+1 subtracted such that N-(N+1)=Laplacian image. This same process was then applied for im2 using rows 3 and 4 of the cell structure. Once all the Gaussian and Laplacian pyramid images were stored in the cell, I was able to move forward on generating a hybrid image. To generate the hybrid image, we have to select A levels of the Gaussian pyramid from im1. This will determine what to maintain from a low frequency to be seen from far away or at small size. Then we must select B levels of the im2 Laplacian pyramid in order to add the high frequency

details we want to be seen at large sizes or a close distance. My algorithm for the hybrid image works by adding the Gaussian image of im1 at A+1 to the Laplacian sum from (A to N). I then add this new image with the Laplacian pyramid of im2 to from 1 to B. The formula from the output looks like this:

output = $(G^{im1}(A+1) + L^{im1}(A\ldots.N)) + (L^{im2}(1..B))$

In order to make a good hybrid image we must align images so the conceptual grouping is preserved. In order to find images with good conceptual grouping we can either align them ourselves or simply use images that ling up without need for adjustment. I tried implementing my own code to align images but was not very successful and had to modify a lot of it every time I wanted to try and make a different hybrid image. I decided to use code from professor Hoiem at the university of Illinois. This code align an image based on 2 points selected on a GUI by the user. Since we are on the mist of a political election I based 2 of my images on unpopular political figures from the past and the present. I also attempted several images with object and the one I liked the most is a hybrid between a light house and the Eiffel tower. Below you can see the examples I choose to demonstrate.

Note: The laplacian images seen below are not the ones used to compute the hybrid images. They have been modified to increase visibility of the high frequency elements.

Examples: