Assignment-2: Cs215

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Q6

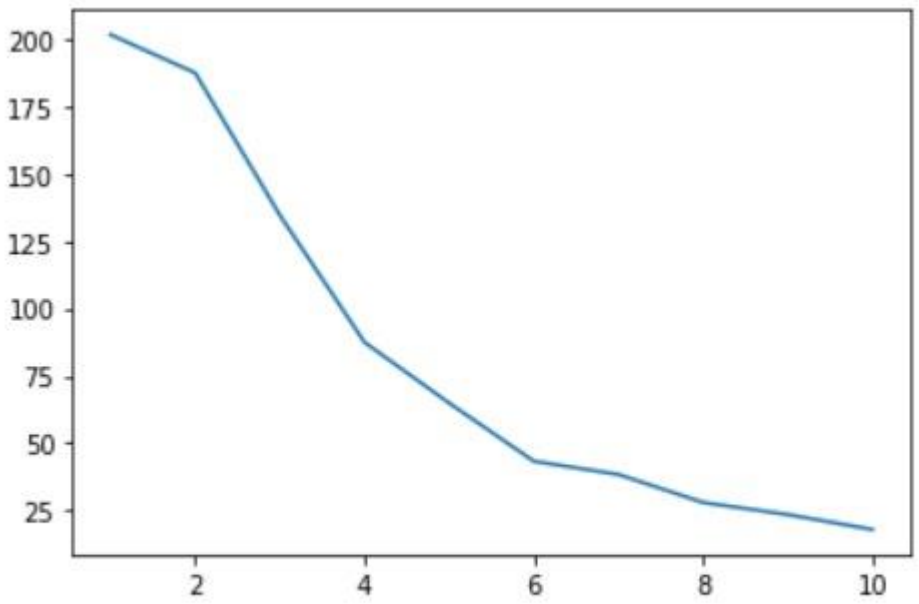
Instructions to run the code is given in the end

**For writing the code for this question we have shifted to MATLAB, because the normal python compiler in our pc is giving the msg “Killed” because of the size of the covariance matrix (19200,19200) and all the calculations involving the covariance matrix can not be computed using my python compiler.

Mean and eigen vectors

Mean and covariance matrix are calculated using the standard method, i.e add the images and divide by 16 for mean and ∑a*transpose(a)/16 -mean*transpose(a) for calculation of covariance matrix. From covariance matrix, 10 eigen values and vectors are generated using the eigs function of matlab. Below is the image of mean and 4 eigen vectors side-by-side

The top 10 eigen values are sorted and the below is the plot of eigen values.



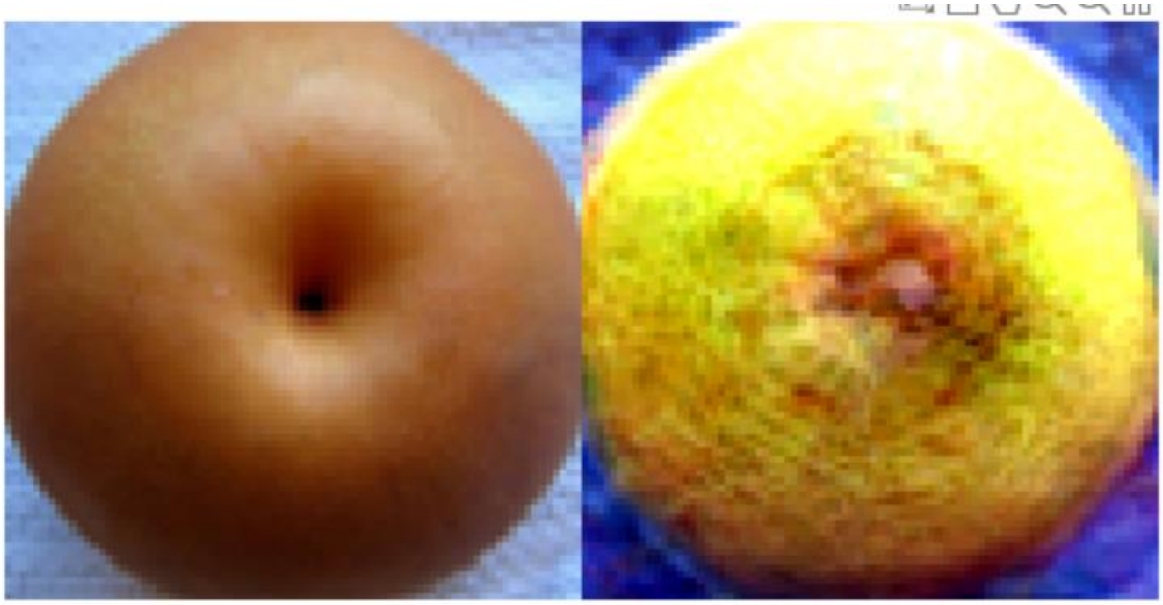
Closest representation.

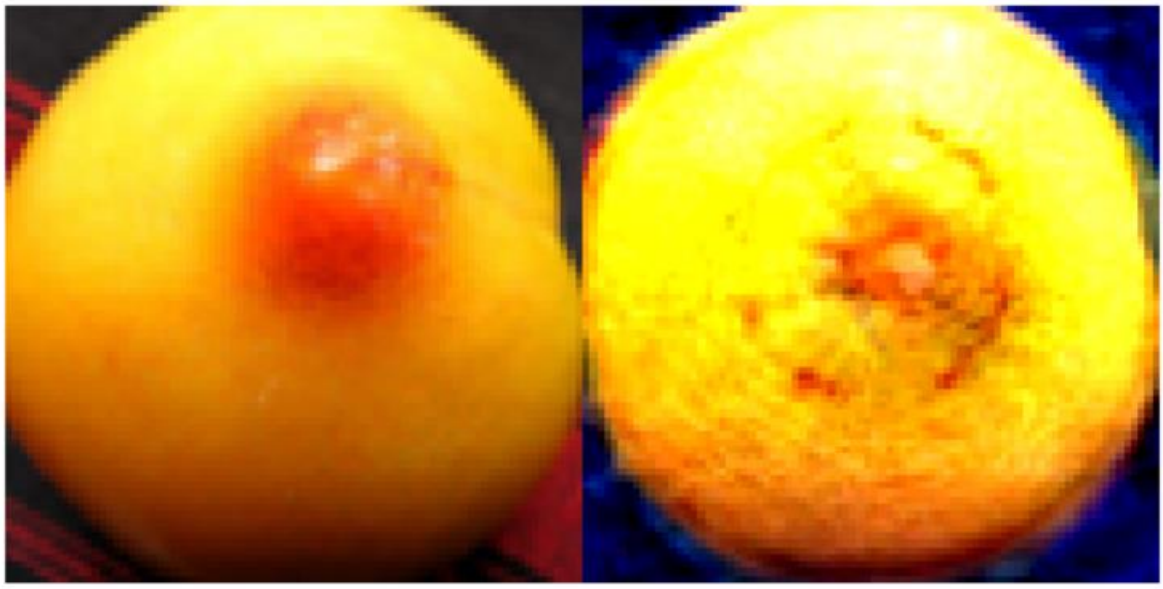
For finding the closest representation as linear combination of the first 4 eigen vectors and mean, the idea is to find the component of the image along the eigen vector, that component will be the linear combination coefficient of that eigen vector, and this idea make sense because eigen vectors are just another set of coordinate's axis's, so finding the component along each vector and multiplying by eigen vector will give the vector along that direction.

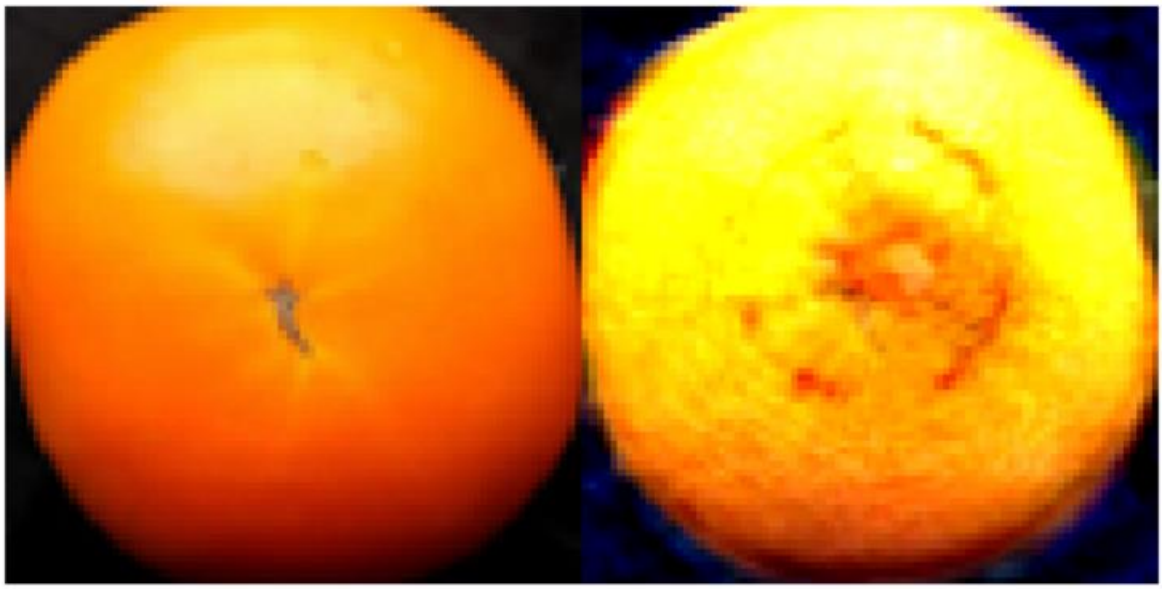
```
closestimage=mean+dot(a,eigenvectors(:,1))*eigenvectors(:,1)+dot(a,eigenvectors(:,2))*eigenvect
ors(:,2)+dot(a,eigenvectors(:,3))*eigenvectors(:,3)+dot(a,eigenvectors(:,4))*eigenvectors(:,4)
```

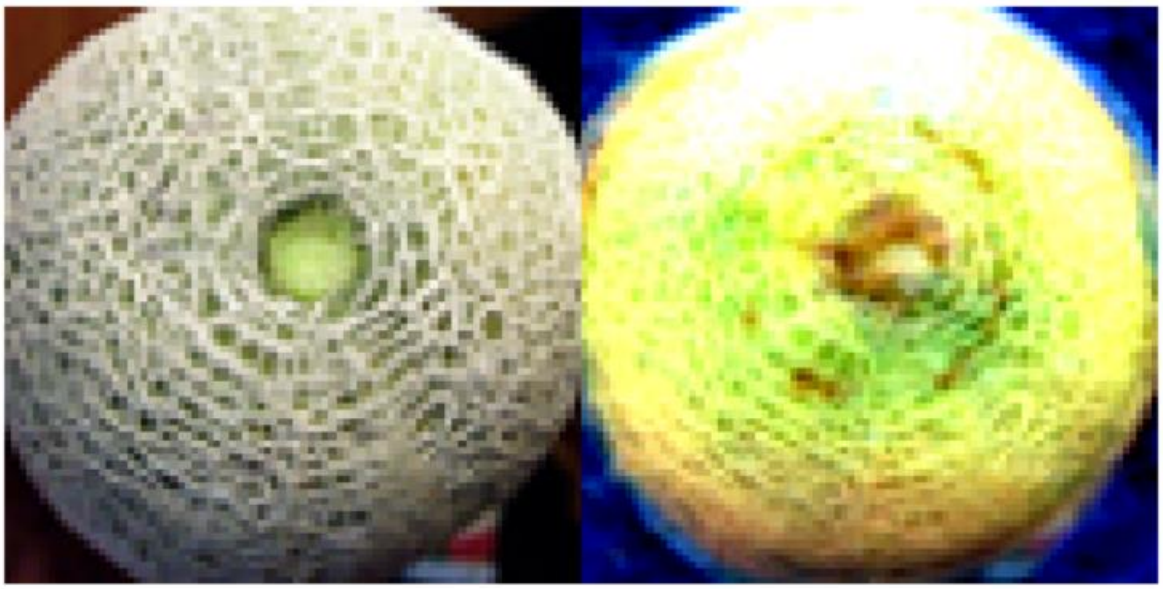
the above is the linear combination of first 4 eigen vectors and mean with coefficients as `dot(a, eigenvectors(:,1))`, `dot(a, eigenvectors(:,2))`, `dot(a, eigenvectors(:,3))`, `dot(a, eigenvectors(:,4))` and `1`. This coefficients calculate the closest image.

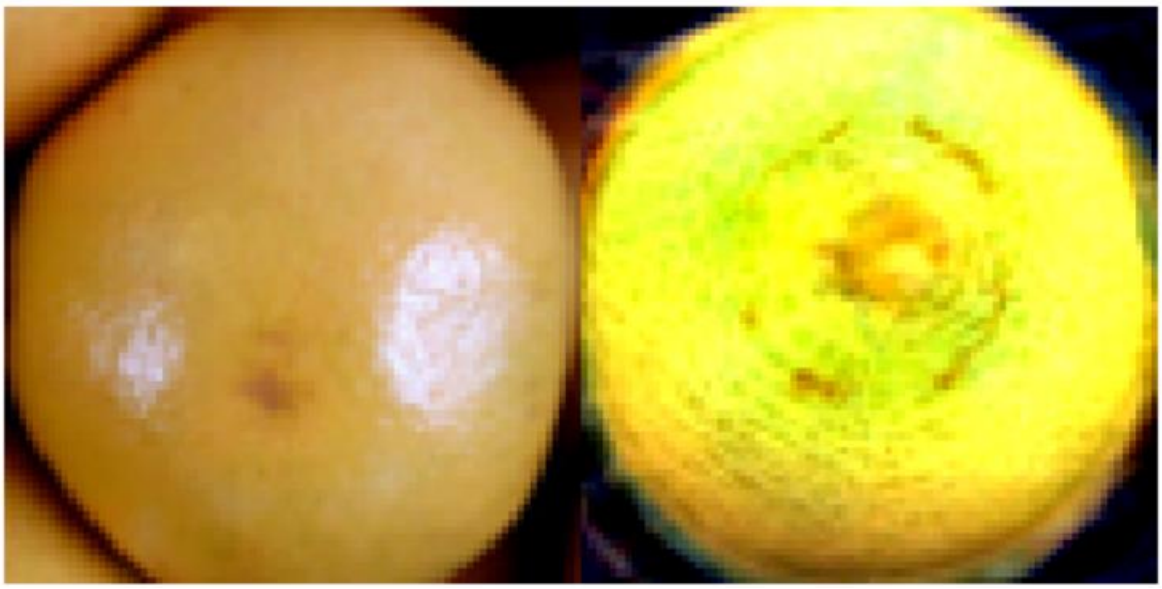
Below are the images, original and closest representation

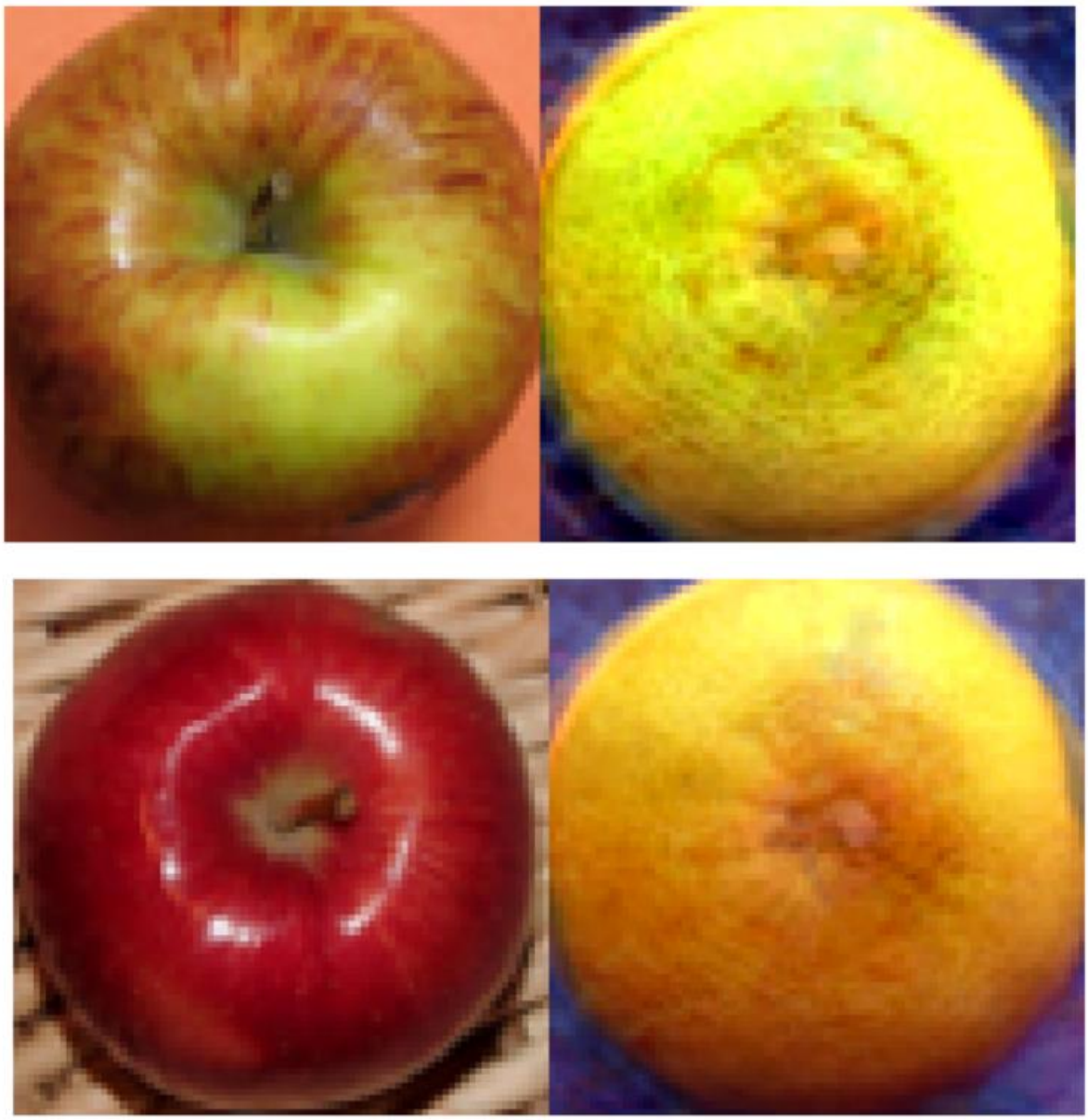












Instructions to run the code

In the code directory please find the q6.m file

- On running the q6 file a total of 17 images are created one is the mean and eigen values and other 16 are the side-by-side images asked in part 2 of the question.