Script for Figures, Equations, and Methods of IP&PR Final Project

$$B_{pq} = \alpha_p \alpha_q \sum_{m=0}^{M-1} \sum_{n=0}^{N-1} A_{mn} cos\left(\frac{(2m+1)u\pi}{2M}\right) cos\left(\frac{(2n+1)v\pi}{2N}\right)$$

with $0 \leq p \leq M-1$ and $0 \leq q \leq N-1$

and the constants α_u and α_v are

$$\alpha_u = \begin{cases} \sqrt{\frac{1}{M}} \text{ for u} = 0 \text{ and } \sqrt{\frac{2}{M}} \text{ for } 1 \leq u \leq M-1 \end{cases}$$

$$\alpha_v = \begin{cases} \sqrt{\frac{1}{N}} \text{ for v} = 0 \text{ and } \sqrt{\frac{2}{N}} \text{ for } 1 \leq v \leq M-1 \end{cases}$$

$M \times n$ M

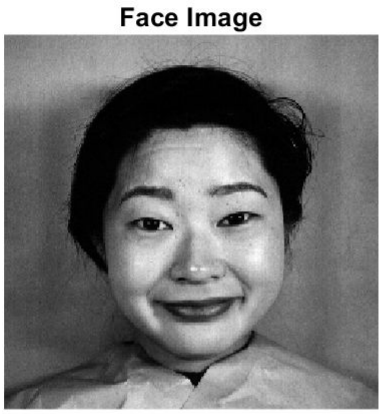
A_{mn} B_{pq} p q

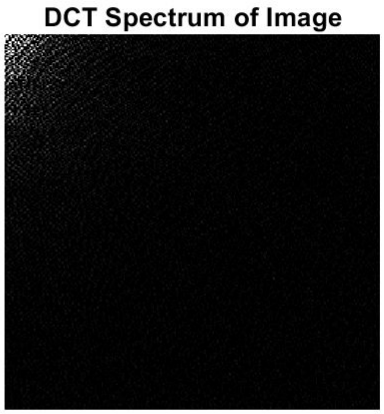
$2 * n^2$

$D_j(x) = ((x - m_j) * (x - m_j)^T)^{1/2}, \ j = 1, 2, 3, \ldots, N_c$

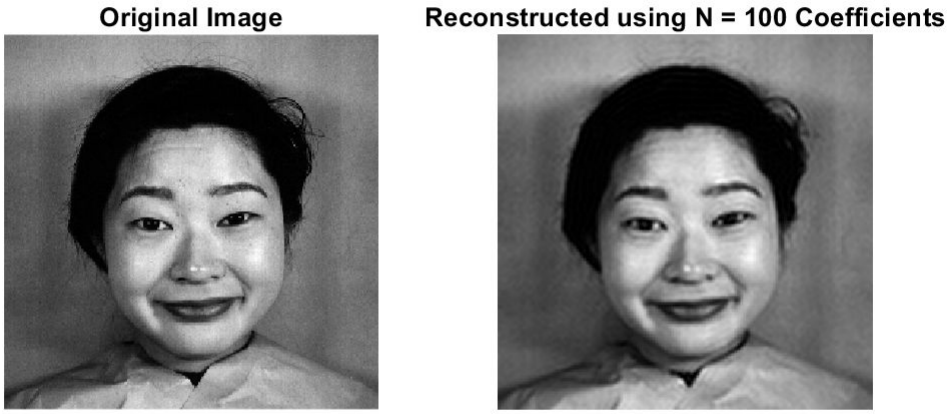
m_j jth

```
f = intensityScaling(imread('HA5.tiff'));
n = 100;
[M,N] = size(f);
g = dct2(f);
figure
subplot(1,2,1), imshow(f), title("Face Image")
subplot(1,2,2), imshow(g), title("DCT Spectrum of Image")
```

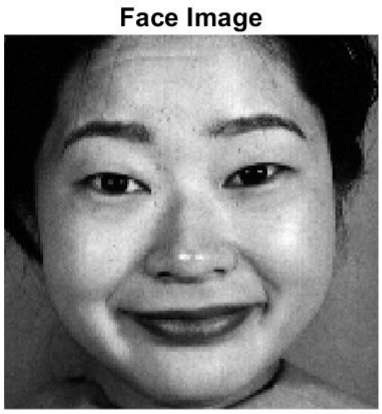


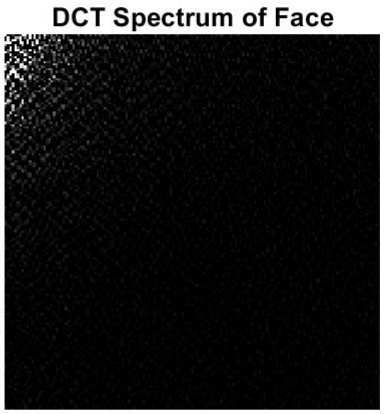



```
mask = zeros(M,N);
mask(1:n,1:n) = (g(1:n,1:n));
h = idct2(mask);
figure,
subplot(1,2,1), imshow(f), title("Original Image")
subplot(1,2,2), imshow(h), title("Reconstructed using N = 100 Coefficients")
```




```
% Use Computer Vision Toolbox Functions to extract Face crop image
FaceDetect = vision.CascadeObjectDetector;
face_bboxes1 = step(FaceDetect, f);
% Crop face from original image
face1 = imcrop(f,face_bboxes1);
g1 = dct2(face1);
figure
subplot(1,2,1),imshow(face1), title("Face Image")
subplot(1,2,2), imshow(g1), title("DCT Spectrum of Face")
```

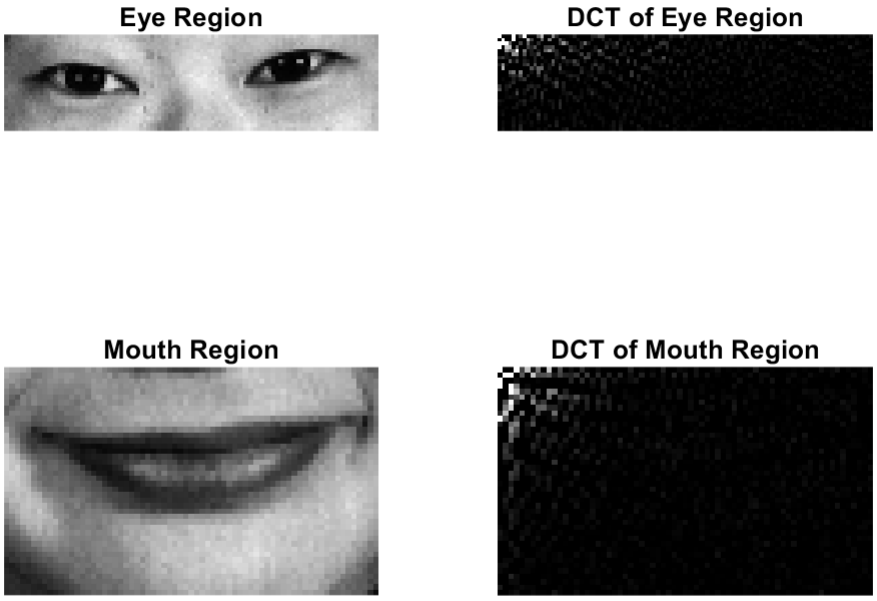





```
EyeDetect = vision.CascadeObjectDetector('EyePairBig','MergeThreshold',7);
eyes_bboxes = step(EyeDetect,f);
% Crop Eyes from original image
eyes = imcrop(f,eyes_bboxes);
e = dct2(eyes);

MouthDetect = vision.CascadeObjectDetector('Mouth','MergeThreshold',150);
mouth_bboxes = step(MouthDetect,f);
% Crop Eyes from original image
mouth = imcrop(f,mouth_bboxes);
m = dct2(mouth);

figure
subplot(2,2,1), imshow(eyes), title('Eye Region')
subplot(2,2,2), imshow(e), title('DCT of Eye Region')
subplot(2,2,3), imshow(mouth), title('Mouth Region')
subplot(2,2,4), imshow(m), title('DCT of Mouth Region')
```




```
%Detect Eyes and Mouth
EyeDetect = vision.CascadeObjectDetector('EyePairBig','MergeThreshold',7);
MouthDetect = vision.CascadeObjectDetector('Mouth','MergeThreshold',150);
eyes_bbox = step(EyeDetect,face);
mouth_bbox = step(EyeDetect,face);
% Annotate detected Eye Region
IFaces1 = insertObjectAnnotation(face, 'rectangle', eyes_bbox, 'Eyes');
IFaces2 = insertObjectAnnotation(face, 'rectangle', eyes_bbox, 'Mouth');
figure('Units','inches','Position',[0,0,12,4]);
subplot(1,2,1), imshow(IFaces1)
subplot(1,2,2), imshow(IFaces2)

% Detect Mouth
MouthDetect = vision.CascadeObjectDetector('Mouth','MergeThreshold',150);
mouth_bboxes1 = step(MouthDetect,girl);
mouth_bboxes2 = step(MouthDetect,ballerina);
mouth_bboxes1(1) = mouth_bboxes1(1) + 5;
mouth_bboxes2(1) = mouth_bboxes2(1) - 15;
mouth_bboxes2(3) = mouth_bboxes2(3) + 15;
% Annotate detected Mouth Region
IFaces1 = insertObjectAnnotation(girl, 'rectangle', mouth_bboxes1, 'Mouth');
IFaces2 = insertObjectAnnotation(ballerina, 'rectangle', mouth_bboxes2, 'Mouth');
```