**[HW6](https://ualearn.blackboard.com/webapps/assignment/uploadAssignment?content_id=_4655281_1&course_id=_164945_1&group_id=&mode=view)**

**Assignment:**

Learn how to use Gaussian mixtures.

**Grading criteria:**

1. Correctness of the models and your explanations - 90 pts

2. Clarity and completeness of the report - 10 pts

**Expectation maximization:**

1. Study the Expectation Maximization MATLAB [tutorial](http://mccormickml.com/2014/08/04/gaussian-mixture-models-tutorial-and-matlab-code/). You may use the MATLAB code from the tutorial in the assignment.

2. Use the code below to generate a dataset. Use Expectation Maximization algorithm to fit the mixture of N Gaussians to the data.

3. Vary N between 1 and 20. Use [Elbow method](https://www.quora.com/How-can-we-choose-a-good-K-for-K-means-clustering) to determine the best number of clusters to represent the dataset. Visualize the mixture for N=1, N=2, and N=optimal number of clusters. Based on the figures, discuss if found number of clusters is indeed optimal for this dataset.

**%MATLAB code to generate data:**

xa=1; xb=4; ya=1; yb=2;         % coordinates of the rectangle C1

xa2=3; xb2=4; ya2=2; yb2=5;         % coordinates of the rectangle C2

hold on; plot([xa xb xb xa xa],[ya ya yb yb ya],'-');    % draw it

plot([xa2 xb2 xb2 xa2 xa2],[ya2 ya2 yb2 yb2 ya2],'-');    % draw it  
% generate positive and negative examples  
N=500;   % no of data points  
ds=zeros(N,2);

i=1;

while i<N

x=rand(1,1)\*8; y=rand(1,1)\*8;

% +ve if falls in the rectangle, -ve otherwise  
if ((x > xa) && (y > ya) && (y < yb) && ( x < xb)) ds(i,1)=x; ds(i,2)=y; plot(x,y,'b+'); i=i+1;  
elseif ((x > xa2) && (y > ya2) && (y < yb2) && ( x < xb2)) ls(i)=2; ds(i,1)=x; ds(i,2)=y; plot(x,y,'b+'); i=i+1;  
end;     
end