

```
clear all
close all
n = 2; % number of feature dimensions
N = 10000; % number of iid samples
mu(:,1) = [-0.1;0]; mu(:,2) = [0.1;0];
cov(:, :, 1) = [1,-0.9;-0.9,1]; cov(:, :, 2) = [1,0.9;0.9,1];
p = [0.8,0.2];
label = rand(1,N)>=p(1);
Nc = [length(find(label==0)),length(find(label==1))];
N1 = Nc(1);
N2 = Nc(2);
x = zeros(n,N);
for l = 0:1
    x(:,label==l) = mvnrnd(mu(:,l+1),cov(:, :, l+1),Nc(l+1))';
end
figure(2), clf,
plot(x(1,label==0),x(2,label==0),'o'), hold on,
plot(x(1,label==1),x(2,label==1),'+'), axis equal,
legend('label = 0','label = 1'),
title('Data along with their labels'),
xlabel('x_1'), ylabel('x_2'),
dS = log(gaussiancalc(x,mu(:,2),cov(:, :, 2)))-log(gaussiancalc(x,mu(:,1),cov(:, :, 1)));

for i = 1:10000

    gamma(i)= log(i-1);
    decision = dS>=gamma(i);
    ind00 = find(decision==0 & label==0);
    p00(i) = length(ind00)/Nc(1); % probability of true negative
    ind01 = find(decision==0 & label==1);
    p01(i) = length(ind01)/Nc(2); % probability of false negative
    ind10 = find(decision==1 & label==0);
    p10(i) = length(ind10)/Nc(1);
    ind11 = find(decision==1 & label==1);
    p11(i) = length(ind11)/Nc(2);
    perr(i) = ([p10(i),p01(i)]*Nc')/N;
end
k = max(p10);
j = max(p11);
[M,I] = min(perr(:))
figure(3),
plot(p10,p11);
hold on,
xlabel('False Positive');
ylabel('True Positive');
legend();
plot(p10(I),p11(I),'*');
hold off;
axis([0 1 0 1]),
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```
function g = gaussiancalc(x,mu,cov)
[n,N] = size(x);
C = ((2*pi)^n * det(cov)) ^ (-1/2);
E = -0.5*sum((x-repmat(mu,1,N)).*(inv(cov)*(x-repmat(mu,1,N))),1);
g = C*exp(E);
end
```