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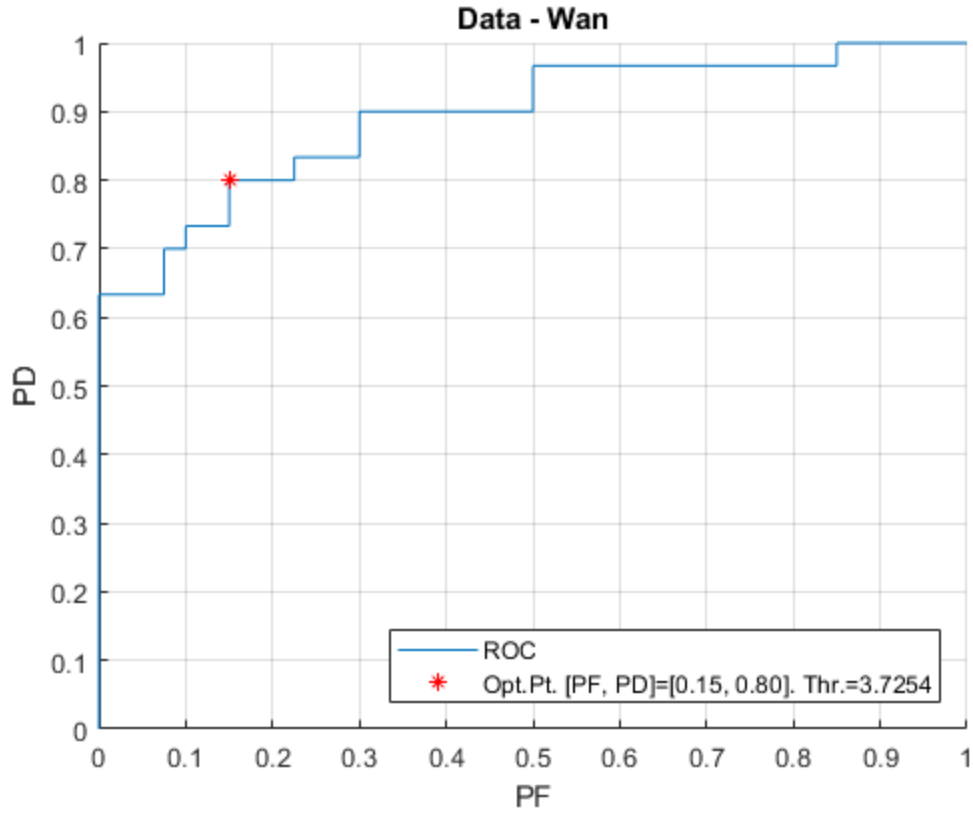
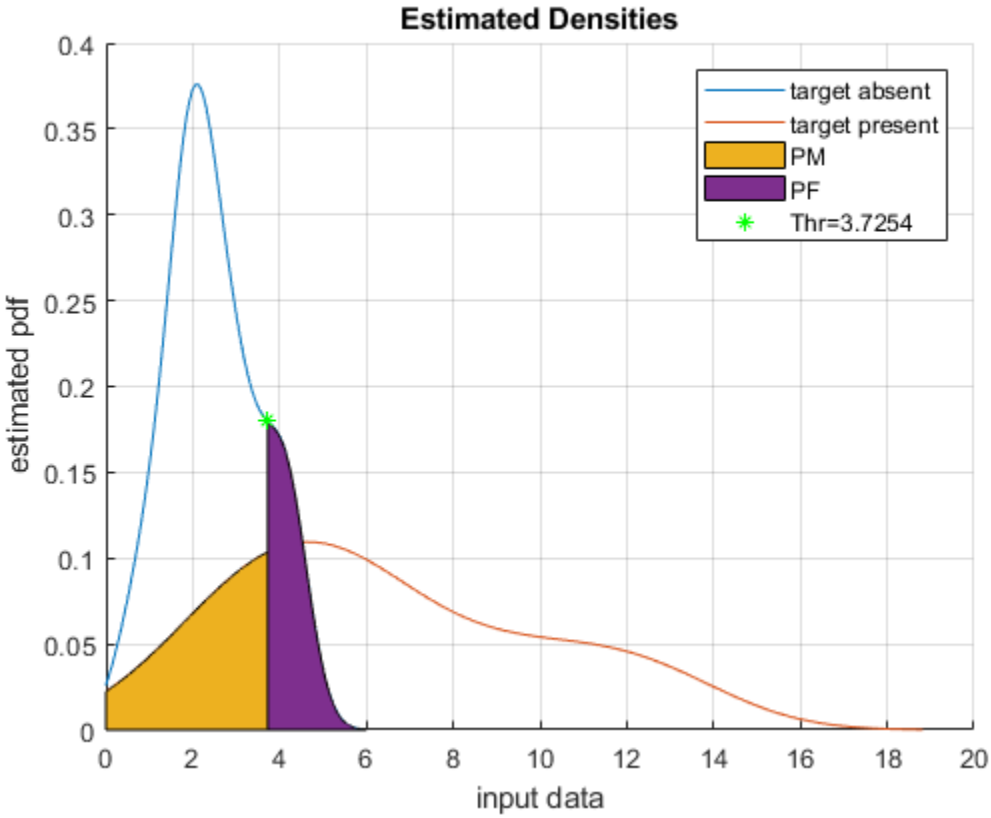
```
clear, clc, warning('off'), close all
```

Question 10

```
%{
Data collected from a machine vision lab to see the efficieny of an
 object
recognition system is given (HW5_data_shankar). The IR data set
 consist of
a column of samples (one for each of you as indicated by your last
 name),
the first 40 values are the responses when there is no target in the
 field
of view of the robot with remaining 30 values are the responses when
 there
is target in field of view. As shown in the lecture, obtain the
 receiver
operating characteristic curve for the system, determine the area
 under the
ROC curve, optimal operational point, the positive predictive value
corresponding to the
%}
data = xlsread("HW5_data_shankar_Spring.xlsx", 1, "CF:CF");
no_target = data(1:40);
target = data(41:70);

gs0 = [zeros(40, 1) data(1:40)];
gs1 = [ones(30, 1) data(41:70)];
gs = sortrows([gs0 ; gs1], 2, 'descend');
counts = [0 0];
for i = 1:length(gs)
%    counts = [counts; sum(gs(1:i) == 1) sum(gs(1:i) == 0)];
    counts(i+1,:) = [sum(gs(1:i) == 1) sum(gs(1:i) == 0)];
end
prob = [counts(:,1)/length(target) counts(:,2)/length(no_target)];
dist = sqrt(prob(:,2).^2 + (1-prob(:,1)).^2);
[M , I] = min(dist);
opt_pt = prob(I,:);
opt_PD = opt_pt(1,1);
opt_PF = opt_pt(1,2);
thr = gs(I,:);
figure;
hold on;
grid on;
plot(prob(:,2),prob(:,1));
plot(opt_PF, opt_PD, 'r*');
title("Data - Wan")
xlabel("PF");
ylabel("PD");
```

```
legend({"ROC", "Opt.Pt. [PF, PD]=[0.15, 0.80].
 Thr.=3.7254"}, 'Location', 'southeast');

[pn, n] = ksdensity(no_target); % pn = probability density, n =
 increment over range of data
[pt, t] = ksdensity(target); % pt = probability density, t = increment
 over range of data
figure;
hold on;
grid on;
plot(n, pn);
plot(t, pt);
title("Estimated Densities")
xlabel("input data");
ylabel("estimated pdf");
axis([0 20 0 0.4])

x = 0:0.001:thr(2);
p = polyfit(t,pt,20);
p1 = polyval(p,x);
area(x,p1);

x = thr(2):0.001:6.0;
p = polyfit(n,pn,20);
p1 = polyval(p,x);
area(x,p1);

p = polyfit(n,pn,20);
p1 = polyval(p,thr(2));
plot(thr(2), p1, "g*")
legend("target absent", "target present", "PM", "PF", "Thr=3.7254");
```


Data - Wan
PD
PF
ROC
Opt.Pt. [PF, PD]=[0.15, 0.80]. Thr.=3.7254


Estimated Densities
estimated pdf
input data
target absent
target present
PM
PF
Thr=3.7254

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