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Project1

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```
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```

Preexplainations

This program computes 1 set of 4 RSS from

```
%each of the four BS
% For the project, you need to augment the program:
% 1. Implement the handoff algorithms that use
%RSS1,2,3,4 as inputs
% 2. Include a loop so that you can have 100
%sets of the 4 RSS
% (Hint: RSS of different sets only differ due to the
% random variable of shadow fading)
% 3. In the loop store variable data between iterations
% that will be used to make the final histograms/PDFs
```

Clear Recent Data

```
clc;
```

```
close all;
clear;

% addpath('D:\Mobile Communications\Project1')
%add the path for the rest of session
```

Initialization

Declare the various variables used for...

```
%distances and compute RSS
R = 250; %distance of block
L = 2 * R;
speed = 1; %Speed of mobile host
sample_time = 0.1; %sampling time
step_distance = speed * sample_time;
g = 150;
min_distance = sqrt(g); %first point
max_distance = L - sqrt(g); %last point
d1 = [min_distance:step_distance:max_distance];
d2 = L - d1;
d3 = abs(R - d1);
d4 = abs(R - d1);
Ns = length(d1);
Th = -68; %Threshold
H = 5; %Hysteresis
```

Part 1: Computations independant of the

```
%random variable
% for shadow fading
Pt = 20;
Po = 38;
grad1 = 2;
grad2 = 2;
alpha = exp(-1/85);
sigma1 = sqrt(8);
sigma2 = sqrt(sigma1^2 * (1 - alpha^2));
RSS01 = Pt - Po - (10 * grad1 * log10(d1) + ...
    10 * grad2 * log10(d1/g));
RSS02 = Pt - Po - (10 * grad1 * log10(d2) +...
    10 * grad2 * log10(d2/g));
RSS_corner = Pt - Po - (10 * grad1 * log10(R)...
    + 10 * grad2 *log10(R/g));
RSS03 = RSS_corner - (10 * grad1 * log10(d3)...
    + 10 * grad2 *log10(d3/g));
RSS04 = RSS_corner - (10 * grad1 * log10(d4) ...
    + 10 * grad2 *log10(d4/g));
for i=1:Ns %for the first point
    if d3(i) < min_distance
            RSS03(i) = RSS_corner;
    end;
```

```
    if d4(i) < min_distance
            RSS04(i) = RSS_corner;
    end;
end;
```

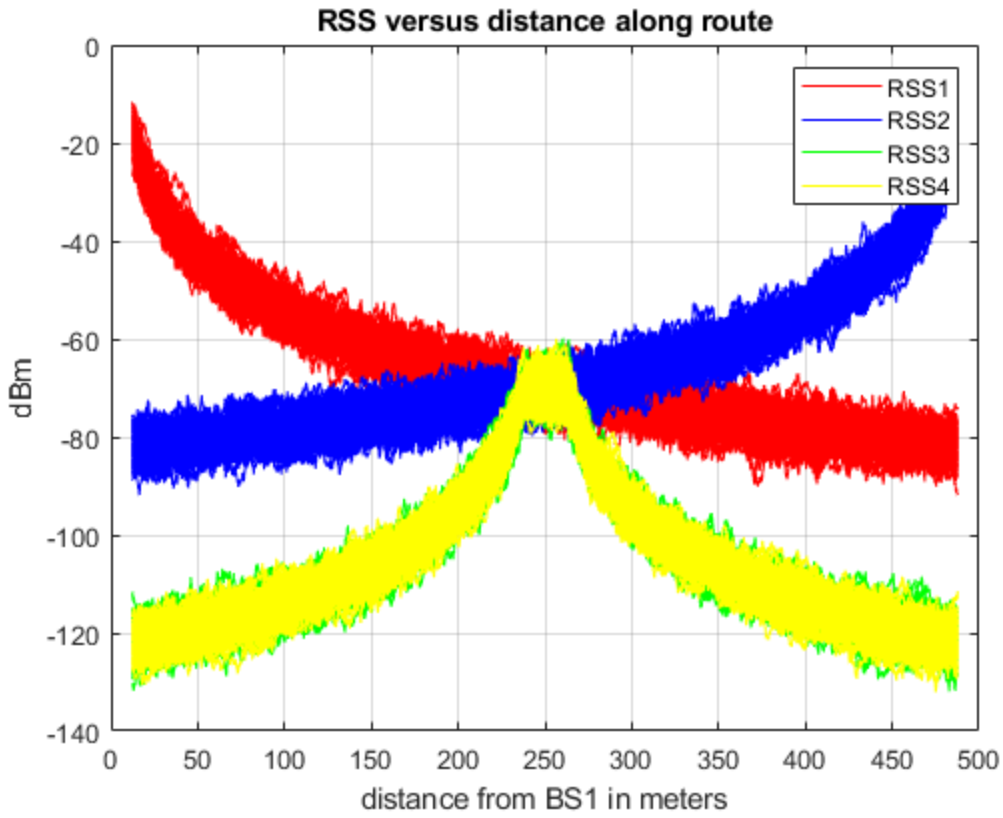
Part 2: Adding the random variable for

shadow fading to 100 RSS datas

```
iter = 100; %number of iterations
RSS1=zeros(iter,Ns);RSS2=zeros(iter,Ns);%preallocation
RSS3=zeros(iter,Ns);RSS4=zeros(iter,Ns);%preallocation
%the loop for 100 datas
for i = 1 : iter
    s1(1) = sigma1 * randn(1);
    s2(1) = sigma1 * randn(1);
    s3(1) = sigma1 * randn(1);
    s4(1) = sigma1 * randn(1);
    for j=2:Ns
       s1(j) = alpha * s1(j-1) + sigma2 * randn(1);
       s2(j) = alpha * s2(j-1) + sigma2 * randn(1);
       s3(j) = alpha * s3(j-1) + sigma2 * randn(1);
       s4(j) = alpha * s4(j-1) + sigma2 * randn(1);
    end;
    RSS1(i,:) = RSS01 + s1;
    RSS2(i,:) = RSS02 + s2;
    RSS3(i,:) = RSS03 + s3;
    RSS4(i,:)= RSS04 + s4;
end
```

Plot the RSS values obtained

```
clc;
figure(1)
RSS11 = plot(d1, RSS1,'r');
hold on;
RSS22 = plot(d1, RSS2,'b');
hold on;
RSS33 = plot(d1, RSS3,'g');
hold on;
RSS44 = plot(d1, RSS4,'y');hold off
legend([RSS11(1),RSS22(1),RSS33(1)...
    ,RSS44(1)],'RSS1','RSS2','RSS3','RSS4')
grid on;
title('RSS versus distance along route')
xlabel('distance from BS1 in meters');
ylabel('dBm');
axis([0 500 -140 0])
```



Algorithm Section

As we`ve seen, 100 RSS 1 -4 datas are ready let`s write the rest of detection code

a - Simple RSS

```
BS_Simp=zeros(iter,Ns); %BaseStation of
% each pont
for i=1:iter
    BS_cur=1; %Current BaseStation Index
    for j=1:Ns
        RSS=[RSS1(i,j) RSS2(i,j) RSS3(i,j)...
            RSS4(i,j)]; %Temporary variable for saving
        % RSS in each loop
        [Mx,IndMx]=max(RSS); %Saving maximum
        % and index of RSS
        if IndMx ~= BS_cur
           BS_cur=IndMx; %check if current basestation
           %is equal to maximum Basestation [Power]
        end
       BS_Simp(i,j)=BS_cur; %Updating the maximum
        %basestation
    end
end
```

HandOff Locations

```
HandOff=zeros(iter,Ns);%HandOff Locations
 for i=1:iter
        for j=2:Ns
            if BS_Simp(i,j) ~= BS_Simp(i,j-1)
                %Anytime BS power changed, We must
                % have HandOff
                HandOff(i,j)=1;
            end
        end
 end
```

b - RSS with Threshold

```
clc;
BS_thrsh = zeros(iter,Ns) ;%Preallocation
for i = 1 : iter
    BS_cur =1; %Current BaseStation Index
    for j=1:Ns
        RSS=[RSS1(i,j) RSS2(i,j) RSS3(i,j)...
            RSS4(i,j)]; %Temporary variable for saving
        % RSS in each loop
        [Mx,IndMx]=max(RSS); %Saving maximum
        % and index of RSS
        if IndMx ~= BS_cur
            if RSS(BS_cur) <= Th
               BS_cur = IndMx; %check if current ...
               %basestation
               %is less than Threshold Basestation...
               %[Power]
            end
        end
        BS_thrsh(i,j)=BS_cur; %Updating the maximum
        %basestation
    end
end
```

HandOff Threshold

```
HandOffThresh=zeros(100,Ns);%HandOff
    %with Threshold Locations
for i = 1 : iter
    for j=2:Ns
        if BS_thrsh(i,j) ~= BS_thrsh(i,j-1)
            %Anytime BS power changed, We must
            % have HandOff
            HandOffThresh(i,j)=1;
        end
    end
end
```

c - RSS with Hysteresis

```
clc;
BS_Hyst = zeros(iter,Ns); %Preallocation
for i = 1 : iter
    BS_cur =1; %Current BaseStation Index
    for j=1:Ns
        RSS=[RSS1(i,j) RSS2(i,j) RSS3(i,j)...
            RSS4(i,j)]; %Temporary variable for saving
        % RSS in each loop
        [Mx,IndMx]=max(RSS) ; %Saving maximum
        % and index of RSS

        if IndMx ~= BS_cur ...
            && RSS(BS_cur) + H <= Mx - H
               BS_cur = IndMx; %check if current ...
               %basestation
               %is less than Hystersis plus Basestation...
               %[Power]
        end
        BS_Hyst(i,j)=BS_cur; %Updating the maximum
        %basestation
    end
end
```

HandOff Hysteresis

```
HandOffHyst=zeros(iter,Ns);%HandOff
    %with Hysteresis Locations
for i = 1 : iter
    for j=2:Ns
        if BS_Hyst(i,j) ~= BS_Hyst(i,j-1)
            %Anytime BS power changed, We must
            % have HandOff
            HandOffHyst(i,j)=1;
        end
    end
end
```

d - RSS with Hysteresis and Threshold

```
clc;
BS_HTh = zeros(iter,Ns); %Preallocation
for i = 1 : iter
    BS_cur =1; %Current BaseStation Index
    for j=1:Ns
        RSS=[RSS1(i,j) RSS2(i,j) RSS3(i,j)...
            RSS4(i,j)]; %Temporary variable for saving
        % RSS in each loop
        [Mx,IndMx]=max(RSS) ; %Saving maximum
        % and index of RSS
```

```
            if IndMx ~= BS_cur ...
                && RSS(BS_cur) + H <= Mx - H && ...
                        RSS(BS_cur)<= Th
                    BS_cur = IndMx;
            end
            BS_HTh(i,j) = BS_cur;
        end
    end
```

HandOff Hyst with Threshold

```
HandOffHystTher=zeros(iter,Ns);%HandOff
    %with Threshold and Hysteresis Locations
for i = 1 : iter
    for j=2:Ns
        if BS_HTh(i,j) ~= BS_HTh(i,j-1)
            %Anytime BS power changed, We must
            % have HandOff
            HandOffHystTher(i,j)=1;
        end
    end
end
```

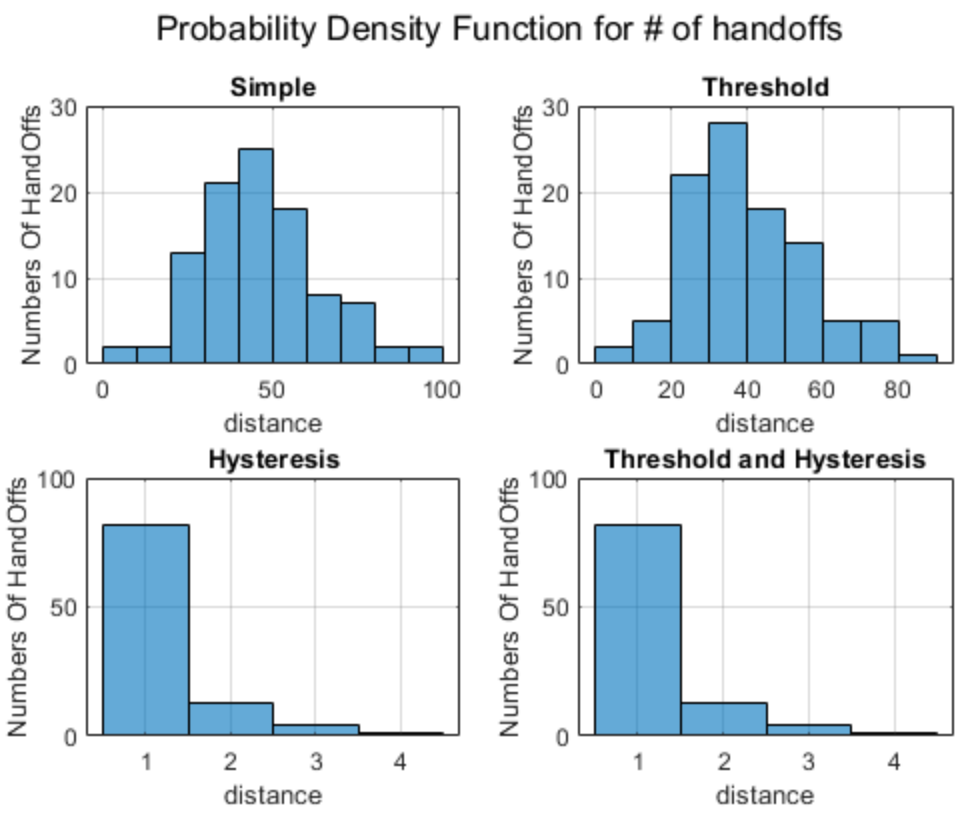
CalCulating PDF for # of HandOff s

Summation on 2nd Dimension to Get Nums

```
clc;
H_SimpNum = sum(HandOff,2);
H_OffHystNum = sum(HandOffHyst,2);
H_HystTherNum = sum(HandOffHystTher,2);
H_TherNum = sum(HandOffThresh,2);
HH = [H_SimpNum,H_TherNum,H_OffHystNum,H_HystTherNum...
    ];
Name =  {'Simple', 'Threshold', 'Hysteresis', 'Threshold and
 Hysteresis'};
```

Plotting PDF for # of HandOff s

```
clc
figure(2)
sgtitle('Probability Density Function for # of handoffs')
for i = 1 : 4
    subplot(2,2,i)
    histogram(HH(:,i))
    title(Name(i))
    grid on;
    xlabel("distance")
    ylabel("Numbers Of HandOffs")
%     axis([0 110 0 50])
end
```



CalCulating PDF for Location of HandOff s

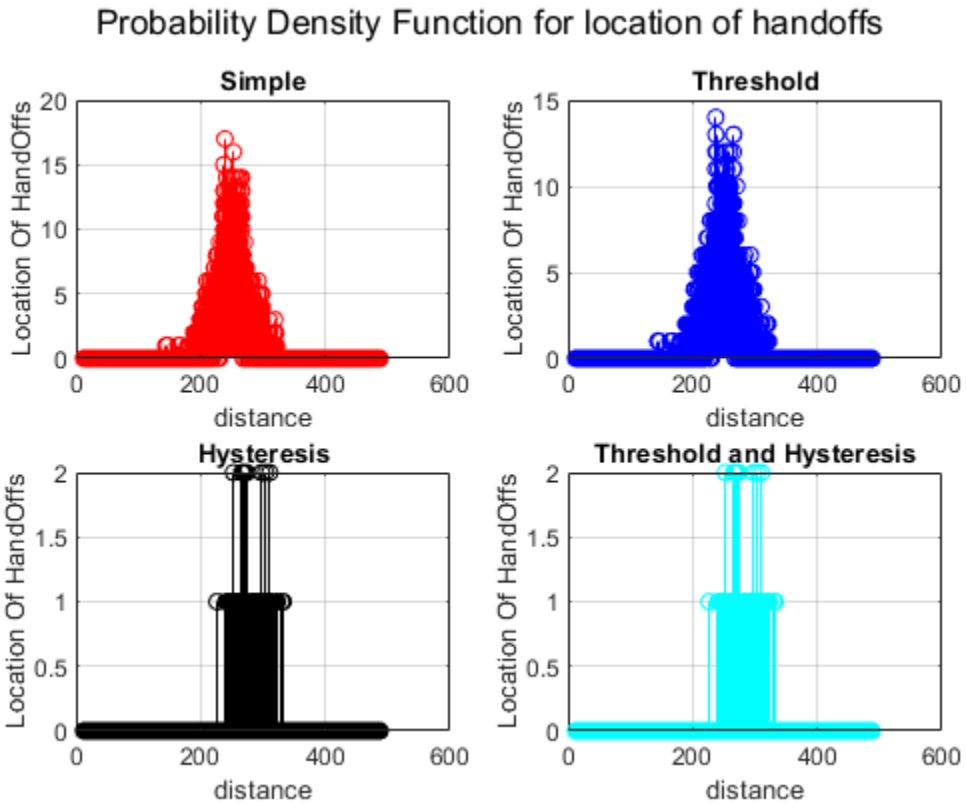
Summation on 1st Dimension to Get Locations

```
clc;
H_Simploc = sum(HandOff,1);
H_OffHystloc = sum(HandOffHyst,1);
H_HystTherloc = sum(HandOffHystTher,1);
H_Therloc = sum(HandOffThresh,1);
HL = zeros(4,4756);
HL(1,:) = H_Simploc;
HL(2,:) = H_Therloc;
HL(3,:) = H_OffHystloc ;
HL(4,:) = H_HystTherloc;
Name =  {'Simple', 'Threshold', 'Hysteresis', ...
    'Threshold and Hysteresis'};
Color =  {'r', 'b', 'k', 'c'};
```

Plotting PDF for # of HandOff s

```
clc
figure(3)
sgtitle('Probability Density Function for location of handoffs') ;
for i = 1 : 4
    subplot(2,2,i)
```

```
    stem(d1',HL(i,:),'color',Color{i})
    title(Name(i))
    grid on;
    xlabel("distance")
    ylabel("Location Of HandOffs")
%     axis([0 110 0 50])
end
```



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