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CSC 229- Homework Assignment #4

```
clc; clear all; close all;  
mean_a = 5;  
mean_v = 10;  
sigma_a = 2;  
sigma_v = 1;
```

A) Randomly draw an auditory measurement x_A and a visual measurement x_V

```
xa = normrnd(mean_a, sigma_a);  
xv = normrnd(mean_v, sigma_v);
```

```
s = [-10:0.2:30];  
la = normpdf(xa, s, sigma_a);  
lv = normpdf(xv, s, sigma_v);
```

B) Plot the corresponding elementary likelihood functions

```
figure()  
%subplot(1,2,1)  
plot(s,la)  
%subplot(1,2,2)  
hold on  
plot(s,lv)
```

C) Calculating combined likelihood

```
% Calculating combined likelihood  
l_comb = la .* lv;  
%figure()  
hold on  
%title('Combined likelihood and posterior')  
plot(s,l_comb)
```

D) Normalizing combined likelihood

```
%Normalizing combined likelihood  
l_norm = l_comb ./ sum(l_comb);  
l_norm = l_norm ./ 0.2;  
hold on  
plot(s,l_norm)  
legend('la', 'lv', 'combined likelihood', 'posterior')
```

E) Computing MAP

```
[~, y] = max(l_norm);  
map_est = s(y);
```

F) Calculating MAP using equation

```
[~, y] = max(l_norm);  
map_est = s(y);
```

%Calculating MAP using equation

```
map_eq = ((xa/sigma_a^2) + (xv/sigma_v^2)) / ((1/sigma_a^2) + (1/ sigma_v^2));
```

```
fprintf('Estimated map is %f and empirical map is %f\n', map_est, map_eq);
```

G) Multiple experiments

```
num_exps = 100;  
xas = normrnd(mean_a, sigma_a, [1,num_exps]);  
xvs = normrnd(mean_v, sigma_v, [1,num_exps]);
```

```
maps = zeros(1,num_exps);  
for i = 1:num_exps  
    la = normpdf(xas(i), s, sigma_a);  
    lv = normpdf(xvs(i), s, sigma_v);  
    l_comb = la .* lv;  
    l_norm = l_comb ./ sum(l_comb);  
    l_norm = l_norm ./ 0.2;  
    [~, y] = max(l_norm);  
    maps(i) = s(y);  
end
```

```
figure()  
scatter([1:1:num_exps],maps)
```

```
avg_map = mean(maps);
```

H) Calculating MAP using equation

%Calculating MAP using equation

```
map_emp = ((mean_a/sigma_a^2) + (mean_v/sigma_v^2)) / ((1/sigma_a^2) + (1/ sigma_v^2));
```

```
fprintf('Estimated map is %f and empirical map is %f\n', avg_map, map_emp);
```

I) Plotting histogram

%Plotting histogram

```
figure()  
hist(maps)
```

J) Relative auditory bias

```
%Relative auditory bias  
abs = zeros(1,num_exps);  
for i = 1:num_exps  
    abs(i) = (maps(i) - xas(i)) / (xvs(i) - xas(i));  
end
```

PLOTS:

Output:

Estimated map is 9.200000 and empirical map is 9.139578

Estimated map is 8.854000 and empirical map is 9.000000



