

MATLAB Assignment 2

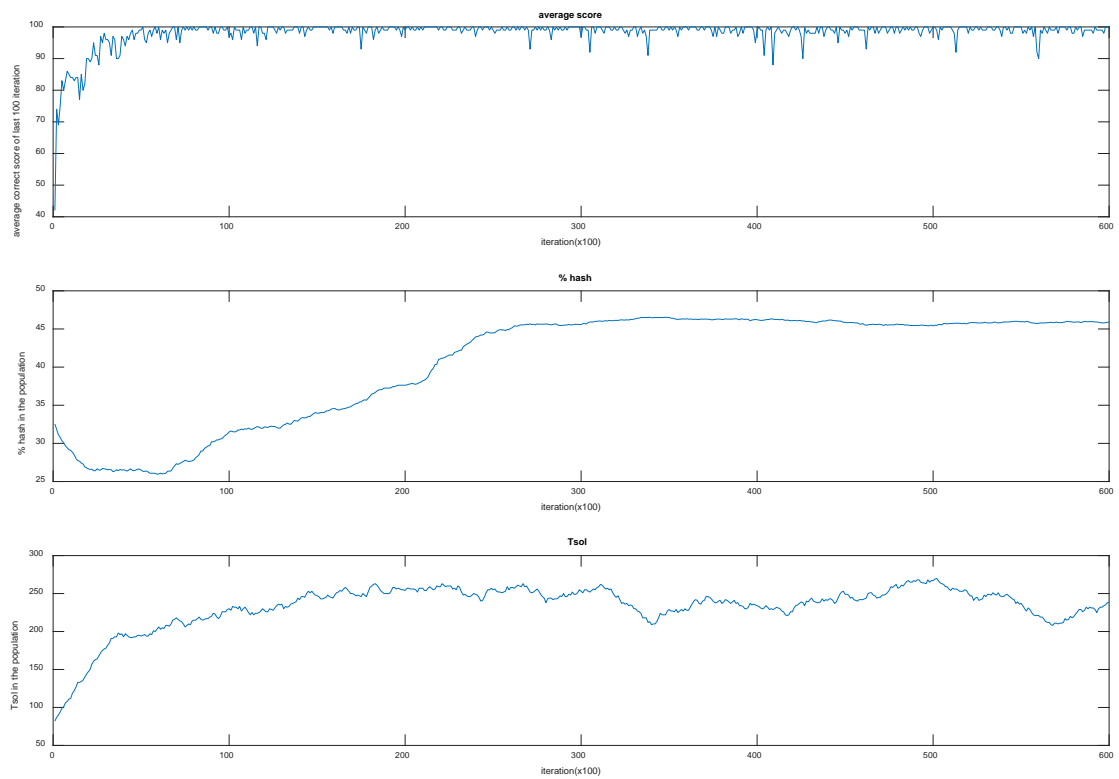
ECEN-674

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MATLAB output:



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0	1	7	0	0	7	0	0	3
0	0	1	0	0	7	0	0	1
0	1	7	0	1	7	0	0	2
0	0	0	0	7	1	0	0	1
1	0	0	0	1	1	1	0	1

1	0	7	0	1	0	0	0	1
1	0	7	1	1	0	0	0	1
0	0	0	1	1	7	1	0	1
1	1	1	7	7	1	1	0	1
0	1	7	0	0	1	1	0	1
1	0	1	7	1	1	0	0	1
1	0	7	0	0	0	0	0	1

MATLAB Code:

```
clear all;
close all;

A = 2;
D = 2^A;
Out = 1;

dec = (0:(2^(A+D)-1))';
bin = de2bi(dec, 'left-msb');
env = zeros(size(bin,1),size(bin,2)+1);
env(1:size(bin,1),1:size(bin,2)) = bin;
for i=1:D
    ind1 = (i-1)*2^D+1;
    ind2 = i*2^D;
    env(ind1:ind2,end)=bin(ind1:ind2,A+i);
end
env = env(randperm(size(env, 1)), :);

n = 400;

pop = zeros(n,A+D+Out+1);
S=100;
R=1000;
pop(:,end) = pop(:,end) + S;
hash = 7;
```

```

alphabet=[0,1,hash];

for i=1:n
    for j=1:A+D+Out
        if j==A+D+Out
            pop(i,j) = alphabet(randi(2,1));
        else
            pop(i,j) = alphabet(randi(3,1));
        end
    end
end

total_ite = 60000;
Cext = 0.005;
Ctax = 0.85;
Cbid = 0.1;
C = 8;
ite = 0;
Pc = 0.6;
Pm = 0.001;
total_corect = 0;
indx1=1;
while ite <= total_ite
    if mod(ite,10000)==0
        env = env(randperm(size(env, 1)), :);
    end
    for i=1:size(env,1)
        msg = env(i,:);
        m = match(msg,pop,hash);
        [pop,corect] =
clearinghouse(pop,m,Cext,Ctax,Cbid,R,msg,hash);
        ite = ite+1;
        total_corect = total_corect + corect;
        if mod(ite,25)==0
            pop = ga(pop,Pc,Pm,hash);
        end
        if mod(ite,100)==0
            avg_score(indx1) = total_corect;
            percent_hash(indx1) = count_hash(pop,hash);
            Tsol(indx1) = noOfCorrectSol(pop,hash);
            indx1 = indx1+1;
            total_corect = 0;
        end
        if mod(ite,5000)==0
            sol_count = count_sol(pop);
        end
    end
end

```

```

end

figure(1)
subplot(311)
plot(avg_score)
title('average score')
subplot(312)
plot(percent_hash)
title('percent hash')
subplot(313)
plot(Tsol)
title('Tsol')

```

```

function y = match(msg,pop,hash)
n = size(pop,1);
y = ones(n,1);
for j=1:n
    classifier = pop(j,:);
    for i=1:length(msg)-1
        if msg(i) ~= classifier(i) && classifier(i) ~= hash
            y(j) = 0;%no match
            break;
        end
    end
end
end
end

```

```

function [y,correct] =
clearinghouse(pop,m,Cext,Ctax,Cbid,R,msg,hash)
correct = 0;
n = size(pop,1);
Ebid = zeros(n,1);
for i=1:n
    if m(i) == 1
        Ebid(i) = pop(i,end)*Cbid + randn - 0.5;
    end
end
[ma, mai]=max(Ebid);
for i=1:n
    if (i==mai)
        if pop(i,length(msg)) == msg(end)
            pop(i,end) = (1-Cext-Ctax-
Cbid)*pop(i,end)+R*(1+8*noOfHash(pop(i,:),hash)/6);
            correct = 1;
        else

```



```

        pop(i,end) = (1-Cext-Ctax-Cbid)*pop(i,end);
    end
elseif m(i) == 1
    pop(i,end) = (1-Cext-Ctax)*pop(i,end);
else
    pop(i,end) = (1-Cext)*pop(i,end);
end
end
y = pop;
end

```

```

function n=noOfHash(classifier,hash)
n=0;
for i=1:length(classifier)-2
    if hash == classifier(i)
        n = n+1;
    end
end
end
end

```

```

function new_pop = ga(pop,pc,pm,hash)
n = size(pop,1);
new_pop = pop;
f = pop(:,end);
f = f/sum(f);
f = cumsum(f);
tem_pop = zeros(2,size(pop,2));
k=1;
tindx=zeros(2,1);

tem = find((rand<=f)==1);
i1 = tem(1);
parent1 = pop(i1,:);
while 1
    tem = find((rand<=f)==1);
    i2 = tem(1);
    parent2 = pop(i2,:);
    if i1~=i2 % && parent1(end-1) == parent2(end-1)
        break;
    end
end
child(1,:) = parent1;
child(2,:) = parent2;
if rand <= pc
    l = size(pop,2)-2;

```

```

    s = randi(1-1,1,1);
    child(1,:) = [parent1(1:s) parent2(s+1:end)];
    child(2,:) = [parent2(1:s) parent1(s+1:end)];
    child(1,end) = (1/3)*(parent1(end)+parent2(end));
    child(2,end) = (1/3)*(parent1(end)+parent2(end));
    new_pop(i1,end)=(2/3)*new_pop(i1,end);
    new_pop(i2,end)=(2/3)*new_pop(i2,end);
end

child = mutation(child,pm,hash);

ff = new_pop(:,end);
[mm,i1] = min(ff);
ff(i1) = ff(i1)+max(ff);
[mm,i2] = min(ff);

new_pop(i1,:)=child(1,:);
new_pop(i2,:)=child(2,:);
end

```

```

function new_pop = mutation(pop,pm,hash)
l = size(pop,2)-2;
alphabet1=[1,hash];
alphabet2=[0,hash];
alphabet3=[0,1];

for i=1:size(pop,1)
    for j=1:l
        if rand <= pm
            if pop(i,j) == 0
                pop(i,j) = alphabet1(randi(2,1));
            elseif pop(i,j) == 1
                pop(i,j) = alphabet2(randi(2,1));
            else
                pop(i,j) = alphabet3(randi(2,1));
            end
        end
    end
end
new_pop=pop;
end

```

```

function y = noOfCorrectSol(pop,hash)

n=size(pop,1);
y = 0;
for i=1:n
    classifier = pop(i,:);
    sol = 0;
    if classifier(1) == 0 && classifier(2) == 0 &&
classifier(3)==classifier(7)
        sol = 1;
    elseif classifier(1) == 0 && classifier(2) == 1 &&
classifier(4)==classifier(7)
        sol = 1;
    elseif classifier(1) == 1 && classifier(2) == 0 &&
classifier(5)==classifier(7)
        sol = 1;
    elseif classifier(1) == 1 && classifier(2) == 1 &&
classifier(6)==classifier(7)
        sol = 1;
    elseif classifier(1) == 0 && classifier(2) == hash &&
classifier(3)==classifier(7) && classifier(4)==classifier(7)
        sol = 1;
    elseif classifier(1) == hash && classifier(2) == 0 &&
classifier(3)==classifier(7) && classifier(5)==classifier(7)
        sol = 1;
    elseif classifier(1) == 1 && classifier(2) == hash &&
classifier(5)==classifier(7) && classifier(6)==classifier(7)
        sol = 1;
    elseif classifier(1) == hash && classifier(2) == 1 &&
classifier(4)==classifier(7) && classifier(6)==classifier(7)
        sol = 1;
    elseif classifier(1) == hash && classifier(2) == hash &&
classifier(3)==classifier(7) && classifier(4)==classifier(7) &&
classifier(5)==classifier(7) && classifier(6)==classifier(7)
        sol = 1;
    end
    y = y+sol;
end
end

```

```

function y=count_sol(pop)

k=1;
while ~isempty(pop)
    classifier = pop(1,:);
    s = sum(classifier(1:7)==pop(:,1:7),2);
    indx = find(s==7);
    total_s = sum(pop(indx,end));
    total_copy = length(indx);
    pop(indx,:)=[];
    classifier(end) = total_s;
    y(k,:)= [classifier total_copy];
    k = k+1;
end
y=sortrows(round(y),8,'descend');

end

```

```

function y=count_hash(pop,hash)
n=size(pop,1);
total_hash = 0;
for i=1:n
    classifier = pop(i,:);
    total_hash = total_hash + noOfHash(classifier,hash);
end
y = (total_hash*100)/(6*n);
end

```