

Image Based Recognition and Classification - DD2427

Exercise 6

Jim Holmström - 890503-7571

April 19, 2012

0.1 run

```
[X,labs,w,h]=LoadData('DDData');
X_test=X(:,1:size(X,2)/2);
labs_test=labs(:,1:size(X,2)/2);
X_train=X(:,size(X,2)/2+1:size(X,2));
labs_train=labs(:,size(X,2)/2+1:size(X,2));

w_d = @(d1) PerceptronLearning(X_train,labs_train,d1);

digits=0:9;

for digit=digits
end

for digit=digits
    w=PerceptronLearning(X_train,labs_train,digit);
    [tp,tn]=TestHyperPlane(X_test,labs_test,digit,w);
    disp(strcat(num2str(digit),',',num2str(tp),',',num2str(tn)));
end
```

0.2 LoadData

```
function [X,labs,w,h]=LoadData(DirName)
    imgs=dir(strcat(DirName,'/*.png'));

    cims=[];
```

```

for it=1:numel(imgs)
    %getting metadata from the filename itself
    info=regexp(imgs(it).name,'(test|train)_digit(\d*)_(\d*)','tokens');
    info=info{1};
    if(numel(info)~=3)
        error(strcat(imgs(it).name,' is malformed filename-format'));
    end
    imgs(it).istest=strcmp(info(1),'test');
    imgs(it).digit=str2num(info{2});
    imgs(it).id=info(3);

    %load the actual data
    imgs(it).name=strcat(DirName,'/',imgs(it).name); %add folder
    imgs(it).data=double(imread(imgs(it).name));
    [imgs(it).w,imgs(it).h]=size(imgs(it).data);
    imgs(it).data=imgs(it).data(:);
    imgs(it).data=(imgs(it).data-mean(imgs(it).data))/std(imgs(it).data);

end
%assuming all images has the same dimension
w=imgs(1).w;
h=imgs(1).h;

X=zeros(size(imgs(1).data,1),numel(imgs)); %preallocate
labs=[imgs.digit];

for it=1:numel(imgs)
    X(:,it)=imgs(it).data;
end

```

0.3 PerceptronLearning

```

function w = PerceptronLearning(X,labs,d1)
    n=0.0001;

    % w=(2.0*rand(size(X,1)+1,1)-1);
    w=[1;1;zeros(size(X,1)-1,1)];

    X=[ones(size(X,2),1),X']';
    y=2*(labs==d1)-1; %the right answers

    for it=1:1024*8

```

```

M=find(sign(w.'*X)~=sign(y)); %missclassified

if(numel(M)==0)
    break;
end
w=w+n*X(:,M)*y(M).';
end

```

0.4 TestHyperPlane

```

function [tp,tn]=TestHyperPlane(X,labs1,d1,w)

X=[ones(size(X,2),1),X']';

y=2*(labs1==d1)-1;
yp=sign(w'*X);

p=find(y==1);
n=find(y==-1);
tp=sum(y(p)==yp(p));
tn=sum(y(n)==yp(n));

```

0.5 Result

```

0,88,873
1,98,896
2,74,826
3,73,852
4,57,847
5,77,827
6,68,851
7,73,869
8,50,795
9,46,839

```

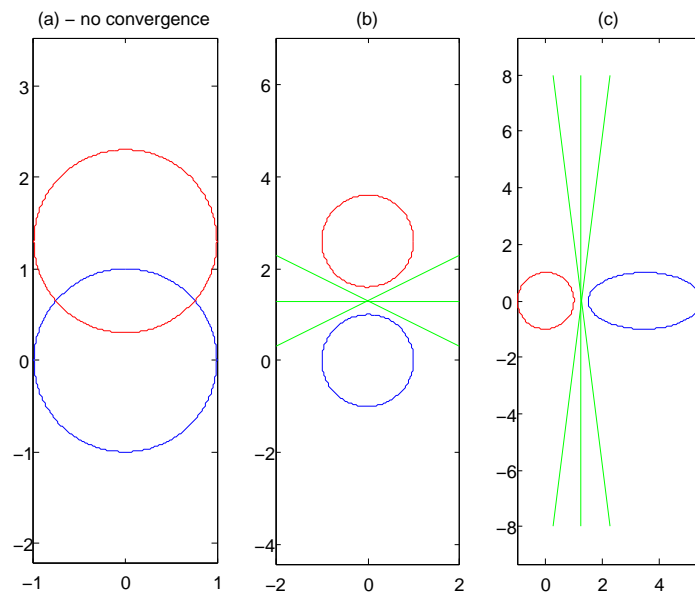


Figure 1: Linear Perceptron

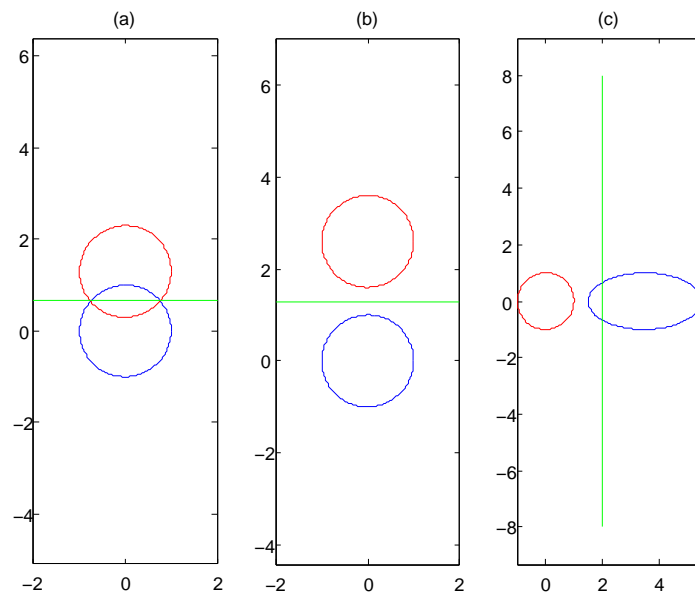


Figure 2: Minimum Square