

CS 567 (HW5)

Sparsh Agarwal

9075905142

Q1

```

% figure
img=PorkyPig;
img=round(img/4.0);
% colormap(gray)
% image(img)

% Bilinear stuff
newimg=zeros(1200,1200);
for i=1:1200
    for j=1:1200
        si=round(i/4.0);
        sj=round(j/4.0);
        if si > 0 && si < 300 && sj > 0 && sj < 300
            rho=img(si,sj);
            newimg(i,j)=rho;
        end
    end
end
% figure
% colormap(gray)
% image(newimg)

angle=-20;
rotmat=zeros(2,2);
rotmat(1,1)=cos(angle*pi/180);
rotmat(1,2)=-sin(angle*pi/180);
rotmat(2,1)=sin(angle*pi/180);
rotmat(2,2)=cos(angle*pi/180);
rotmat=transpose(rotmat);
shift=zeros(2,1);
shift(1,1)= 600;
shift(2,1)= 600;

% oldpix=zeros(2,1);
newpix=zeros(2,1);
rhoMat=zeros(2,2);

for i=1:1200
    for j=1:1200
        newpix(1,1)=i;
        newpix(2,1)=j;
        oldpix=round(rotmat*(newpix-shift)+shift);
        pivot00i=floor(oldpix(1,1)/(1200/300));
        pivot00j=floor(oldpix(2,1)/(1200/300));
        if pivot00i > 1 && pivot00i < 300 && pivot00j > 1 && pivot00j < 300
            rho00=img(pivot00i,pivot00j);
            rho01=img(pivot00i,(pivot00j+1));
            rho10=img((pivot00i+1),pivot00j);
            rho11=img((pivot00i+1),(pivot00j+1));
            rhoMat(1,1)=rho00;
            rhoMat(1,2)=rho01;
            rhoMat(2,1)=rho10;
            rhoMat(2,2)=rho11;
            denx=mod(i,(1200/300));
            deny=mod(j,(1200/300));
            leftVect=([(1-deny/(1200/300)),(deny/(1200/300))]');
            rightVect=transpose([(1-denx/(1200/300)),(denx/(1200/300))]');
            newimg(i,j)=leftVect*rhoMat*rightVect;
        end
    end
end

% NN stuff

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```

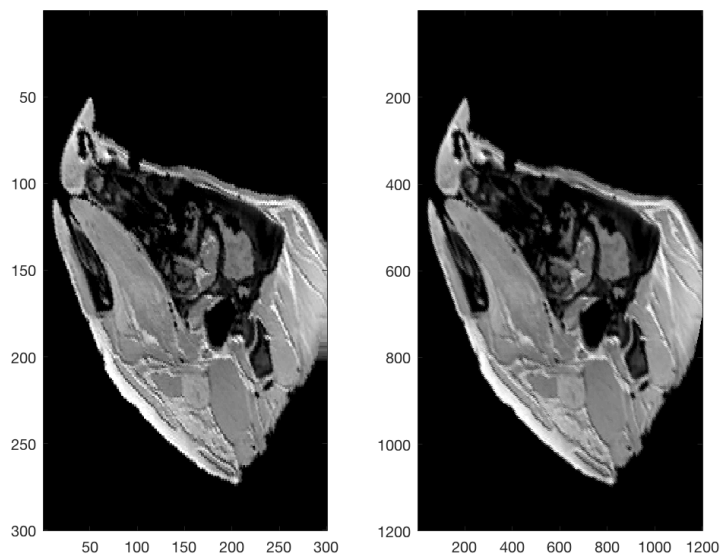
angle=-20;
rotmat=zeros(2,2);
rotmat(1,1)=cos(angle*pi/180);
rotmat(1,2)=-sin(angle*pi/180);
rotmat(2,1)=sin(angle*pi/180);
rotmat(2,2)=cos(angle*pi/180);
rotmat=transpose(rotmat);
shift=zeros(2,1);
shift(1,1)= 150;
shift(2,1)= 150;

oldpix=zeros(2,1);
newpix=zeros(2,1);
roting=zeros(300,300);

rho=0;
for i=1:300
    for j=1:300
        newpix(1,1)=i;
        newpix(2,1)=j;
        oldpix=round(rotmat*(newpix-shift)+shift);
        if (oldpix(1,1) > 0) && (oldpix(1,1) < 300) && (oldpix(2,1) > 0) && (oldpix(2,1) < 300)
            rho=img(oldpix(1,1),oldpix(2,1));
        end
        roting(i,j)=rho;
    end
end

% Result plot
figure
subplot(1,2,1)
colormap(gray)
image(roting)
subplot(1,2,2)
colormap(gray)
image(newimg)

```



Q2.

```

clear;
file_path = '/Users/sparshagarwal/OneDrive/Spring 2018/CS 567/AMIP_II_CD/LessonData/9_Registration/';
ctimg= double(imread(sprintf('%s/CT.jpg', file_path)));
t1img=double(imread(sprintf('%s/T1.jpg', file_path)));

hist_variable=zeros(1,256);
for i=1:388
    for j=1:388

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        hist_variable(1,ctimg(i,j)+1) = hist_variable(1,ctimg(i,j)+1) + 1;
    end
end

HCT = 0;
for i=1:256
    if hist_variable(1,i)~=0
        p = hist_variable(1,i)./(size(ctimg,1)*size(ctimg,2));
        HCT = HCT + -1*p*log(p);
    end
end

HCT

```

HCT = 2.8000

```

hist_variable=zeros(1,256);
for i=1:388
    for j=1:388
        hist_variable(1,timg(i,j)+1) = hist_variable(1,timg(i,j)+1) + 1;
    end
end

HT1 = 0;
for i=1:256
    if hist_variable(1,i)~=0
        p = hist_variable(1,i)./(size(timg,1)*size(timg,2));
        HT1 = HT1 + -1*p*log(p);
    end
end

HT1

```

HT1 = 2.0022

```

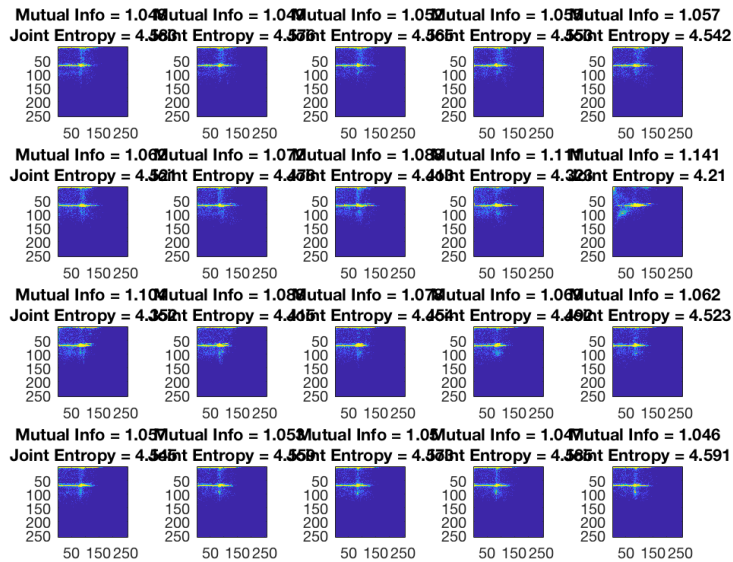
hist_variable=zeros(1,256);
figure
for angle=-90:10:100
    rotimg=zeros(388,388);
    rotmat=zeros(2,2);
    rotmat(1,1)=cos(angle*pi/180);
    rotmat(1,2)=-sin(angle*pi/180);
    rotmat(2,1)=sin(angle*pi/180);
    rotmat(2,2)=cos(angle*pi/180);
    invrotmat=transpose(rotmat);
    oldpix=zeros(2,1);
    newpix=zeros(2,1);
    shift=transpose([194,194]);
    for i=1:388
        for j=1:388
            newpix(1,1)=i;
            newpix(2,1)=j;
            oldpix=round((invrotmat*(newpix-shift))+shift);
            if (oldpix(1,1) > 0) && (oldpix(1,1) < 388) && (oldpix(2,1) > 0) && (oldpix(2,1) < 388)
                rotimg(i,j)=timg(oldpix(1,1),oldpix(2,1));
            end
        end
    end
    hist_variable=zeros(256,256);
    for i=1:388
        for j=1:388
            rho1=ctimg(i,j)+1;
            rho2=rotimg(i,j)+1;
            hist_variable(rho1,rho2)=hist_variable(rho1,rho2)+1;
        end
    end
    Hjoint = 0;
    for i=1:256
        for j=1:256
            if hist_variable(i,j)~=0
                p = hist_variable(i,j)./(size(ctimg,1)*size(ctimg,2));

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        Hjoint = Hjoint + -1*p*log(p);
    end
end
mutinfo = (HCT+HT1)./Hjoint;
m = 4;
s = 4;
hist_variable = 63*1./(1+exp(-1*(hist_variable-m)/s));
subplot(4, 5, (angle/10)+10)
imagesc(hist_variable)
title(sprintf('Mutual Info = %.4g \n Joint Entropy = %.4g ', mutinfo, Hjoint));
axis('square')
end

```



Q3.

```

% KNN illustration

test = load('/Users/sparshagarwal/OneDrive/Spring 2018/CS 567/Medical-Imaging/HW 5/train.txt', '-ascii');
train = load('/Users/sparshagarwal/OneDrive/Spring 2018/CS 567/Medical-Imaging/HW 5/train.txt', '-ascii');

% train(1,1)
% imagesc(reshape(train(1,2:end), 16,16)')
train_feat(:, :) = train(:, 2:257);
train_labels(:) = train(:, 1);
test_feat(:, :) = test(:, 2:257);
test_labels(:) = test(:, 1);

k = 5;

npairs = length(test_labels);
ntrain = size(train_feat, 1);

pred = zeros(npairs, 1);

for i=1:npairs
    dist = sqrt(sum((ones(ntrain, 1)*test_feat(i, :)-train_feat).^2, 2));
    [reord, ord] = sort(dist);
    knn=train_labels(ord(1:k));
    for j = 1:10
        p_g(j) = mean(knn == j-1);
    end
    [sorted_prob, digit] = sort(p_g, 'descend');
    pred(i) = digit(1,1)-1;
end
match = test_labels' == pred;

```

```
for i = 1:10
    accuracy(i) = mean(match(test_labels == i-1));
end

figure
bar(0:9,accuracy)
```

