ECE 5256

Project 7: Forward Radon Transform

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1 Part 1

This project investigated the inverse Radon transformation. For this project the input image I used was that of a city (see Fig. 1).

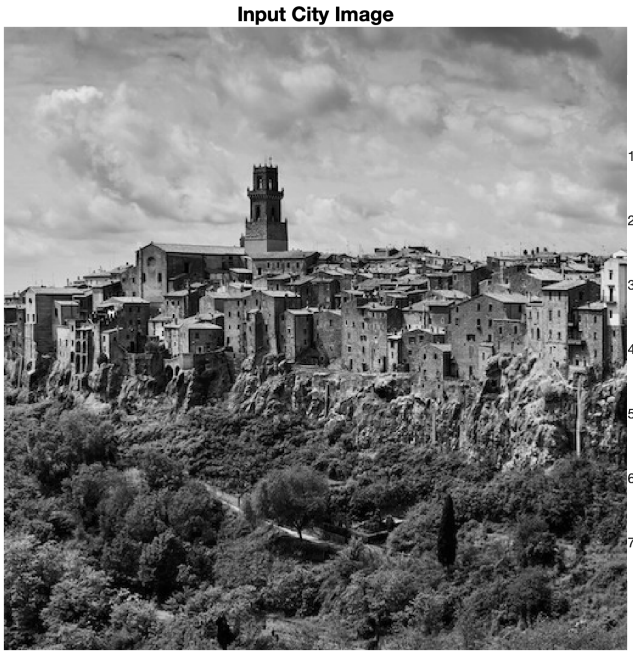

Figure 1: Input image for the Radon transform

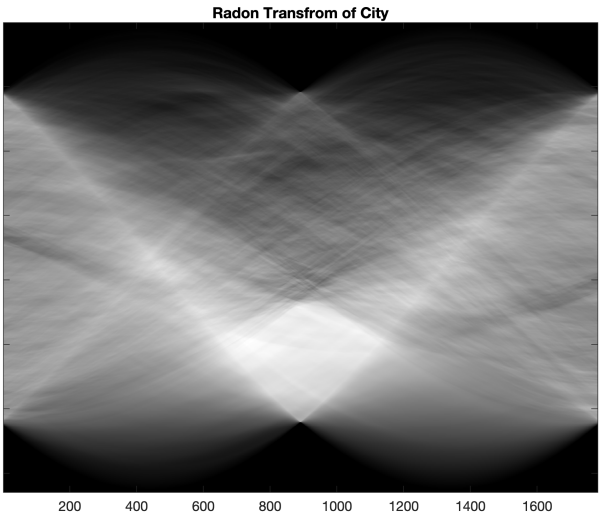

Figure 2: Sinogram of the input image.

I then used the `radon()` command in matlab. For the projection angles were from 1 to 179 in increments of 0.1. This resulted in the Sinogram seen in Fig. 2. From the radon transform I useed the `iradon()` command in matlab to reconstruct the image. This command allows me to interpolate and filter the result. The project was to look at how the MSE changes with diffrent filters and interpolations. The results of this is seen int Table 1. The best result came from the Piecewise Cubic interpolation & Ram-Lak filter.

Interpolation	Filter	MSE
Piecewise Cubic	Ram-Lak	149.745266
Nearest-Neighbor	Shepp-Logan	176.907064
Linear	Hann	312.969684
Cubic Convolution	Cosine	229.622222

Table 1: Mean Squared Error for each of the Interpolation & Filter Combinations

A MATLAB Code

This is the code used for the coding portions of this project.

```
%Housekeeping commands
clear all
close all


%reading in image
City=imread('City.jpeg');
City=cast(im2gray(City),'double');
[M,N]=size(City);
MSEs=[0,0,0,0];%allocating memory for MSE larter
figure
%displaying input image
imagesc(City)
colormap('gray')
axis off image
title('Input City Image')
exportgraphics(gcf,'Input.png','Resolution',300)
angles=1:0.1:179;%projection angles
RCity=radon(City,angles); %radon transform
%displaying Radon transfrom
figure
imagesc(RCity)
xt = xticks;
xtnew=xt./10;
xticklabels(xtnew)
colormap('gray')
title('Radon Transfrom of City')
exportgraphics(gcf,'Radon.png','Resolution',300)

%first reconstuction
Recon=iradon(RCity,angles,"pchip","Ram-Lak");
Recon=Recon(2:M+1,2:N+1);%trimming edges so its same shape
MSE=immse(City,Recon);
MSEs(1)=MSE; %saving MSE
```

```
%Displaying reconstucted image
figure
imagesc(Recon)
colormap('gray')
axis off image
title({'pchip & Ram-Lak','MSE:'+string(MSE)})
exportgraphics(gcf,'pchipRL.png','Resolution',300)

%Second recontruction
Recon=iradon(RCity,angles,"nearest","Shepp-Logan");
Recon=Recon(2:M+1,2:N+1);%trimming edges so its same shape
MSE=immse(City,Recon);
MSEs(2)=MSE;
figure
imagesc(Recon)
colormap('gray')
axis off image
title({'nearest & Shepp-Logan','MSE:'+string(MSE)})
exportgraphics(gcf,'NearSL.png','Resolution',300)

%third reconstucition
Recon=iradon(RCity,angles,"linear","Hann");
Recon=Recon(2:M+1,2:N+1);%trimming edges so its same shape
MSE=immse(City,Recon);
MSEs(3)=MSE;
figure
imagesc(Recon)
colormap('gray')
axis off image
title({'Linear & Hann','MSE:'+string(MSE)})
exportgraphics(gcf,'LinearHann.png','Resolution',300)

%Fourth Reconstuction
Recon=iradon(RCity,angles,"v5cubic","Cosine");
Recon=Recon(2:M+1,2:N+1);%trimming edges so its same shape
MSE=immse(City,Recon);
```

```
MSEs(4)=MSE;
figure
imagesc(Recon)
colormap('gray')
axis off image
title({'v5cubic & Cosine','MSE:'+string(MSE)})
exportgraphics(gcf,'v5CCosine.png','Resolution',300)

%saving MSEs
fout=fopen('MSEs.txt','w');
fprintf(fout,'%f\n',MSEs);
```