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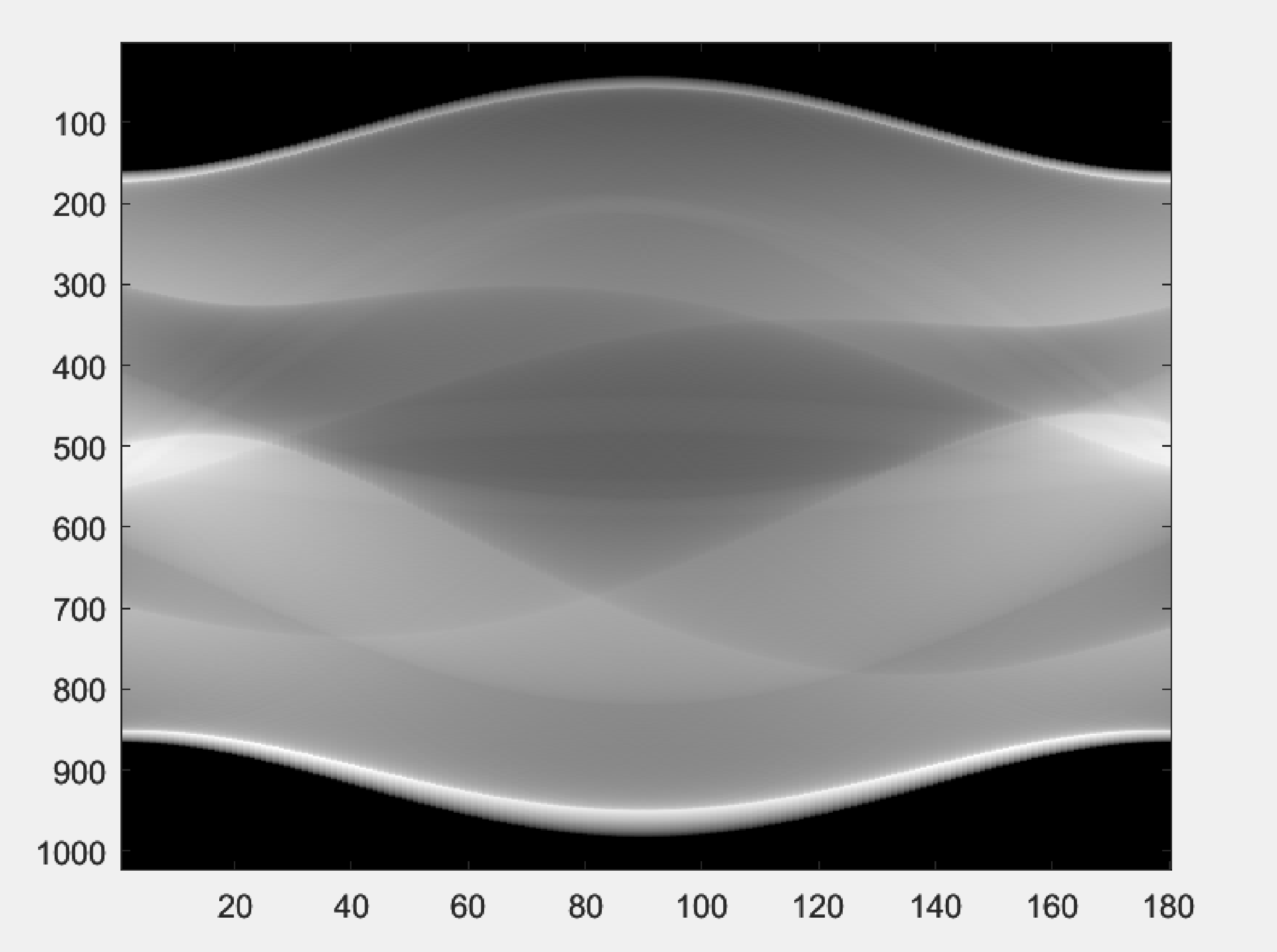
This code below is creating a 2D grayscale image of a modified Shepp-Logan phantom, a commonly used test image in medical imaging, and rotating the image by certain angles. The rotated images are then summed along the vertical axis, resulting in a new image which is displayed in another figure. The final image shows the summation of the modified Shepp-Logan phantom over different rotations.

```
figure(1);
colormap gray;
shepp_logan = phantom('Modified shepp-logan',1024);
imagesc(shepp_logan);
step = 1;
theta =180;
angles = 1:step:theta;
sg = zeros(size(shepp_logan, 1), length(theta));

for i = 1:length(angles)
    sg(:, i) = sum(imrotate(shepp_logan, -angles(i), 'bilinear', 'crop'));
end
figure(2);
imagesc(sg),colormap gray;
```



This code below is creating a 2D grayscale image of a modified Shepp-Logan phantom, a commonly used test image in medical imaging, and using the radon transform to generate projections of the image at different angles. These projections are then passed through a Fourier transform, filtered, and transformed back to the spatial domain. The filtered projections are then added together and rotated to create a backprojected image which is displayed in another figure. The final image shows the backprojected result of the modified Shepp-Logan phantom using the radon transform.

```
figure(1);
colormap gray;
shepp_logan = phantom('Modified shepp-logan',1024);
imagesc(shepp_logan);
step = 1;
theta=180;
angles = 1:step:theta;
Rad_of_Phantom = radon(shepp_logan,angles);
bp = zeros(length(Rad_of_Phantom));
fft_R = fftshift(fft(Rad_of_Phantom, [], 1), 1);
filtproj = ifftshift(fft_R , 1);
Rad_of_Phantom = real(ifft(filtproj, [], 1));
for i = 1:length(angles)
    tmp = repelem(Rad_of_Phantom(:, i), 1, length(Rad_of_Phantom));
    tmp = imrotate(tmp, angles(i), 'bilinear', 'crop');
    bp = bp + tmp;
```

```
end
figure(2);
imagesc(bp),colormap gray;
```

This code below is creating a 2D grayscale image of a modified Shepp-Logan phantom, a commonly used test image in medical imaging, and using the radon transform to generate projections of the image at different angles. These projections are then passed through a Fourier transform, filtered using a Ram-Lak filter, and transformed back to the spatial domain. The filtered projections are then added together and rotated to create a backprojected image which is displayed in another figure. The final image shows the backprojected result of the modified Shepp-Logan phantom using the radon transform and a Ram-Lak filter.

```
figure(1);
colormap gray;
shepp_logan = phantom('Modified shepp-logan',1024);
imagesc(shepp_logan);
step = 1;
theta=360;
angles = 1:step:theta;
Rad_of_Phantom = radon(shepp_logan,angles);
bp = zeros(length(Rad_of_Phantom));
ramlak = abs(linspace(-1, 1, length(Rad_of_Phantom))');
fft_R = fftshift(fft(Rad_of_Phantom, [], 1), 1);
filtproj = ifftshift(fft_R.* ramlak , 1);
Rad_of_Phantom = real(ifft(filtproj, [], 1));
for i = 1:length(angles)
    tmp = repelem(Rad_of_Phantom(:, i), 1, length(Rad_of_Phantom));
    tmp = imrotate(tmp, angles(i), 'bilinear', 'crop');
    bp = bp + tmp;
end
figure(2);
imagesc(bp),colormap gray;
```

BASIC CT RECONSTRUCTION USING BACKPROJECTION

BACK PROJECTION

For Back-projection Reconstruction Algorithm we basically follow 4 main steps:

1. Sinogram of the Image: For Sinogram of the image we use radon function. For a sinogram we select a step (difference in angles) and then angle limit i.e. theta and apply radon transformation on the image.

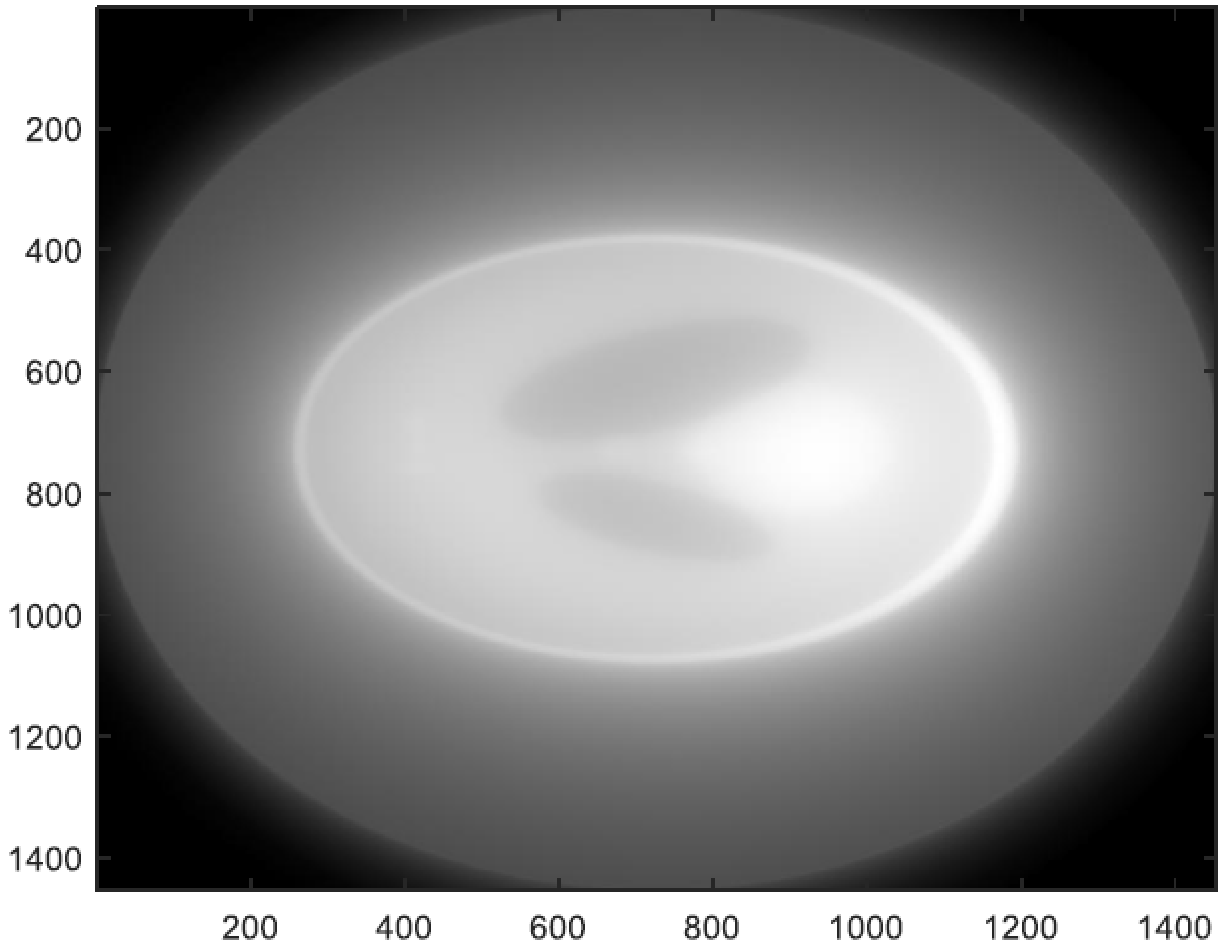
2. Fourier transformation: For derived sinogram of the image we apply 2D Fourier transformation (using fft function) and also 1D Fourier transformation (using fftshift function).

3. Inverse Fourier transformation: The 1D Inverse Fourier transformation (using ifftshift function) is followed by 2D Inverse Fourier transformation (using fft function) on the images.

4. Back projection: The images are back-projected for each angle.

RESULT OF THE BACK PROJECTION

The back projection provides a precise image but blurred. Sometimes it doesn't give proper clarity.

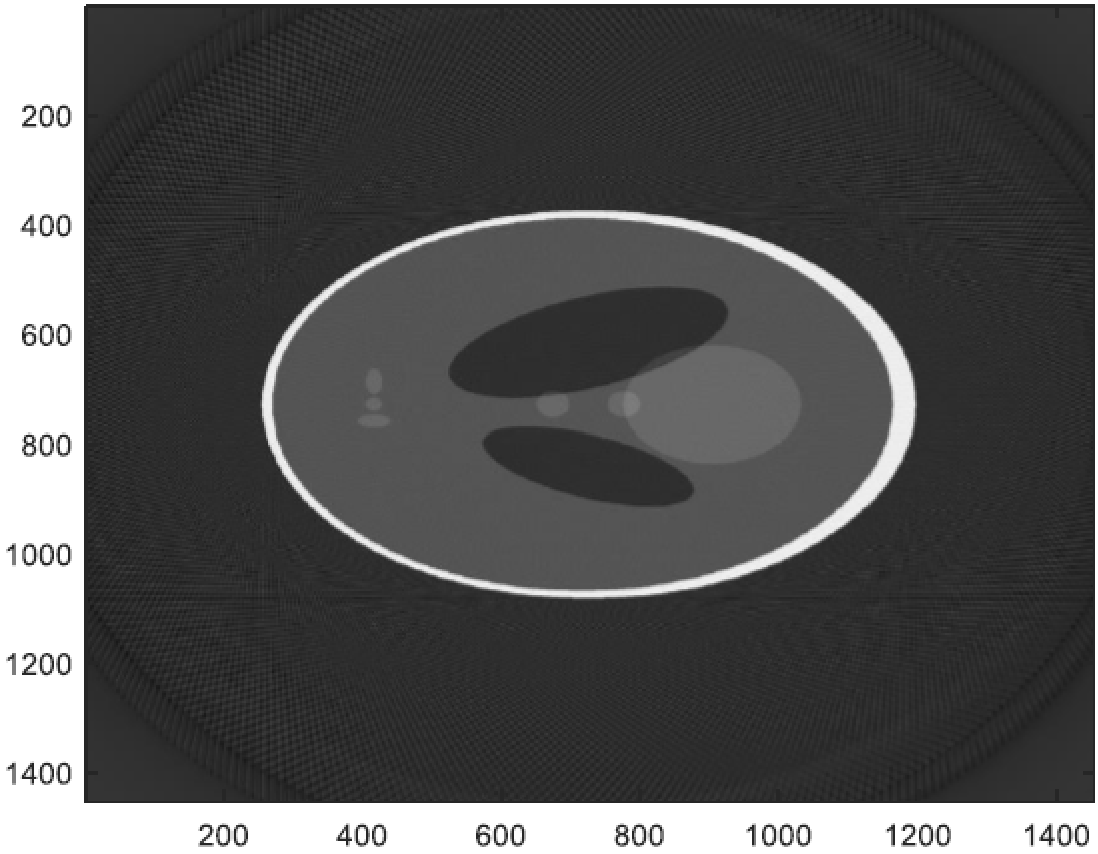


FILTERED BACK PROJECTION

It follows all the steps same as back-projection, but it also improves the clarity of the image. Unlike Back-projection the Filtered Back-projection provides precise and clear image.

RESULT OF THE BACK PROJECTION

For the given below image we have used the Ram-Lack filter which has helped us to give great improvement in the clarity while compared to Back- projection.



To improve the results, several factors can be considered:

1. Increase the number of projections: Increasing the number of projections in the radon transform can result in a better resolution of the final backprojected image.

2. Use a different filter: Different filters can be used to reduce noise and artifacts in the projections, resulting in a clearer backprojected image.

3. Use a different backprojection method: Different backprojection methods can be used to obtain better images, such as the filtered backprojection method.

4. Use a more advanced image reconstruction algorithm: Other image reconstruction algorithms, such as the iterative algorithms, can be used to obtain better results.

By considering these factors, the final backprojected image can be improved.