EXPERIMENT NO. 8

Aim: Use Gabor filter to highlight edges

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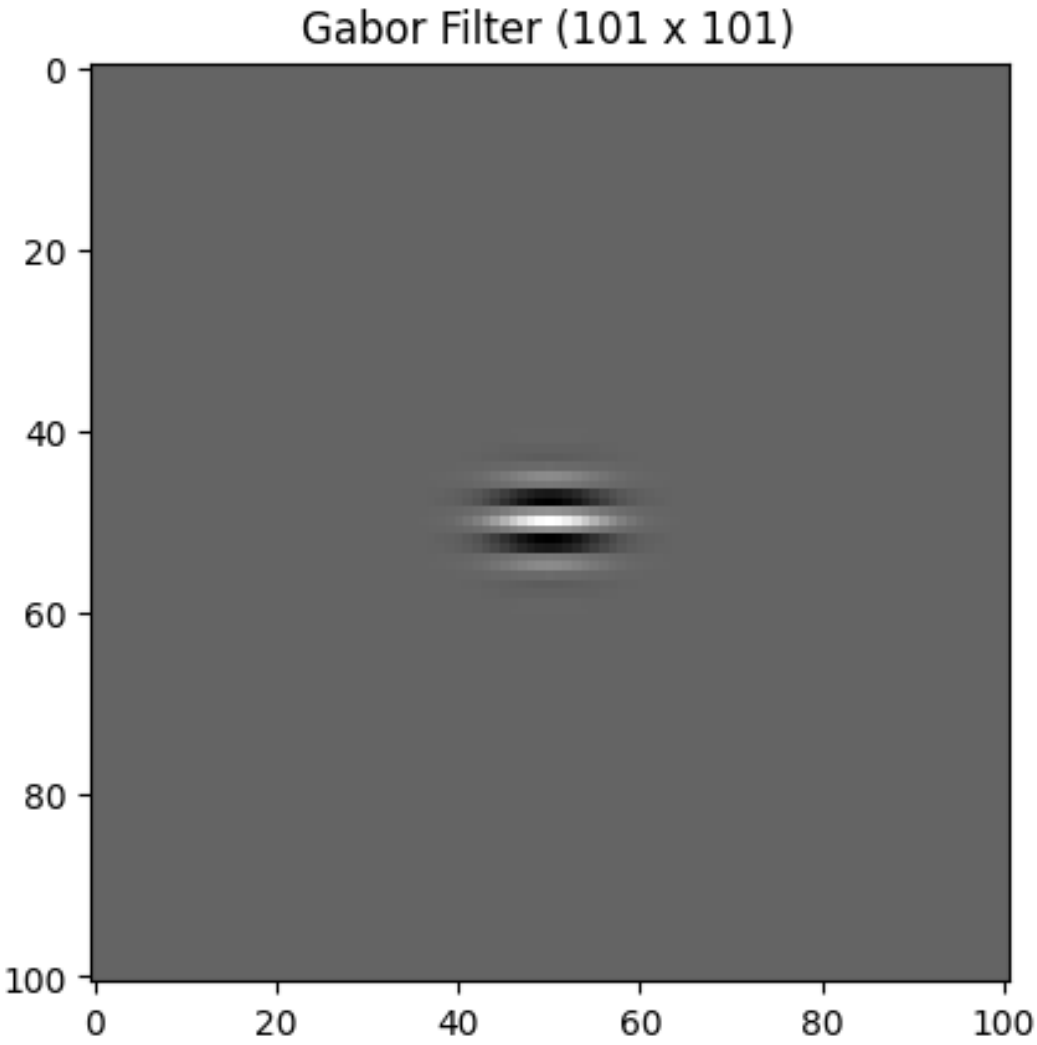
In [54]:
```
import cv2
import numpy as np
import matplotlib.pyplot as plt
```

Task 1: Generate Gabor filter with a set of parameters

In [55]:
```
SIZE = 101
SIGMA = 3
THETA = np.pi / 2
LAMBDA = 5
GAMMA = 0.7
PSI = 0
```

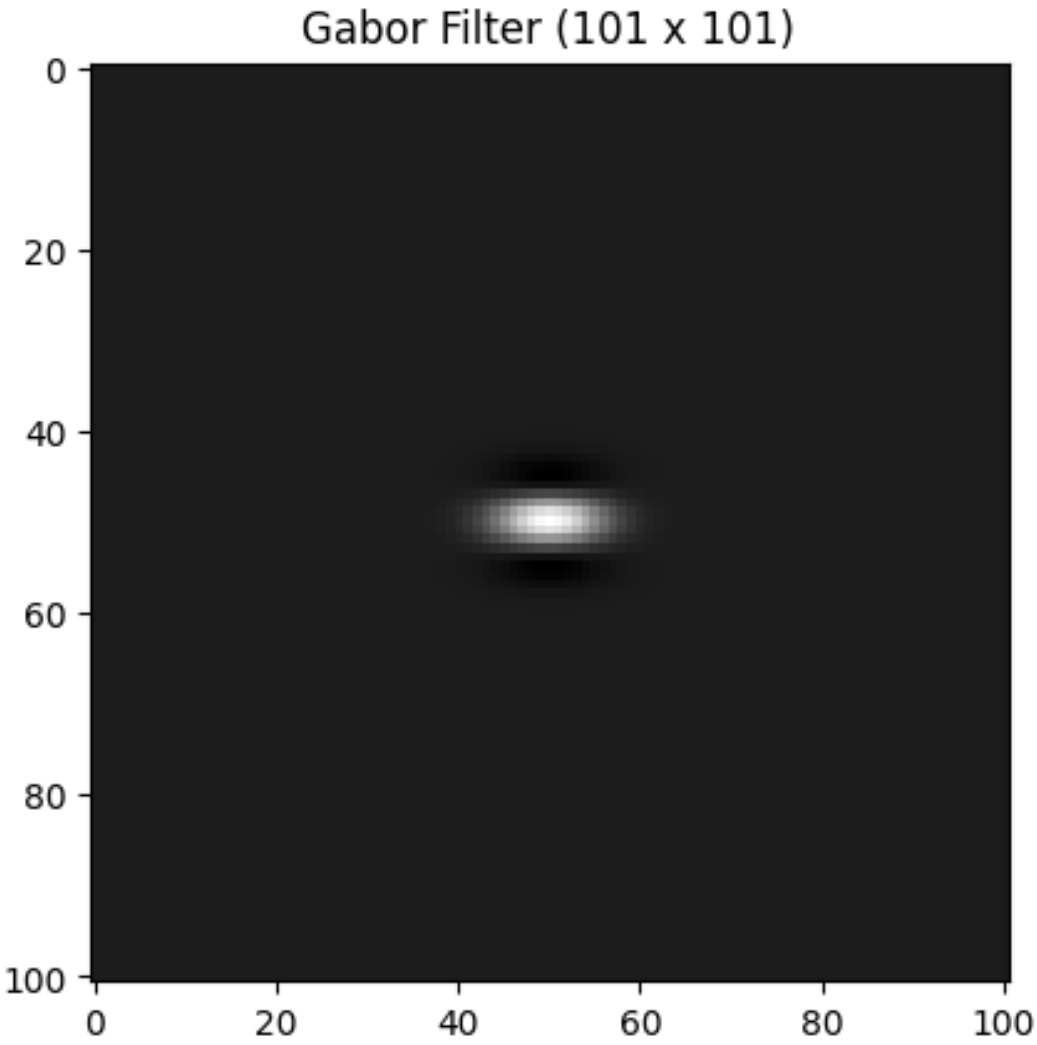
In [56]:
```
gaborFilter = cv2.getGaborKernel((SIZE, SIZE), SIGMA, THETA, LAMBDA, GAM
plt.imshow(gaborFilter, cmap="gray")
plt.title(f"Gabor Filter ({SIZE} x {SIZE})")
```

Out[56]:
```
Text(0.5, 1.0, 'Gabor Filter (101 x 101)')
```



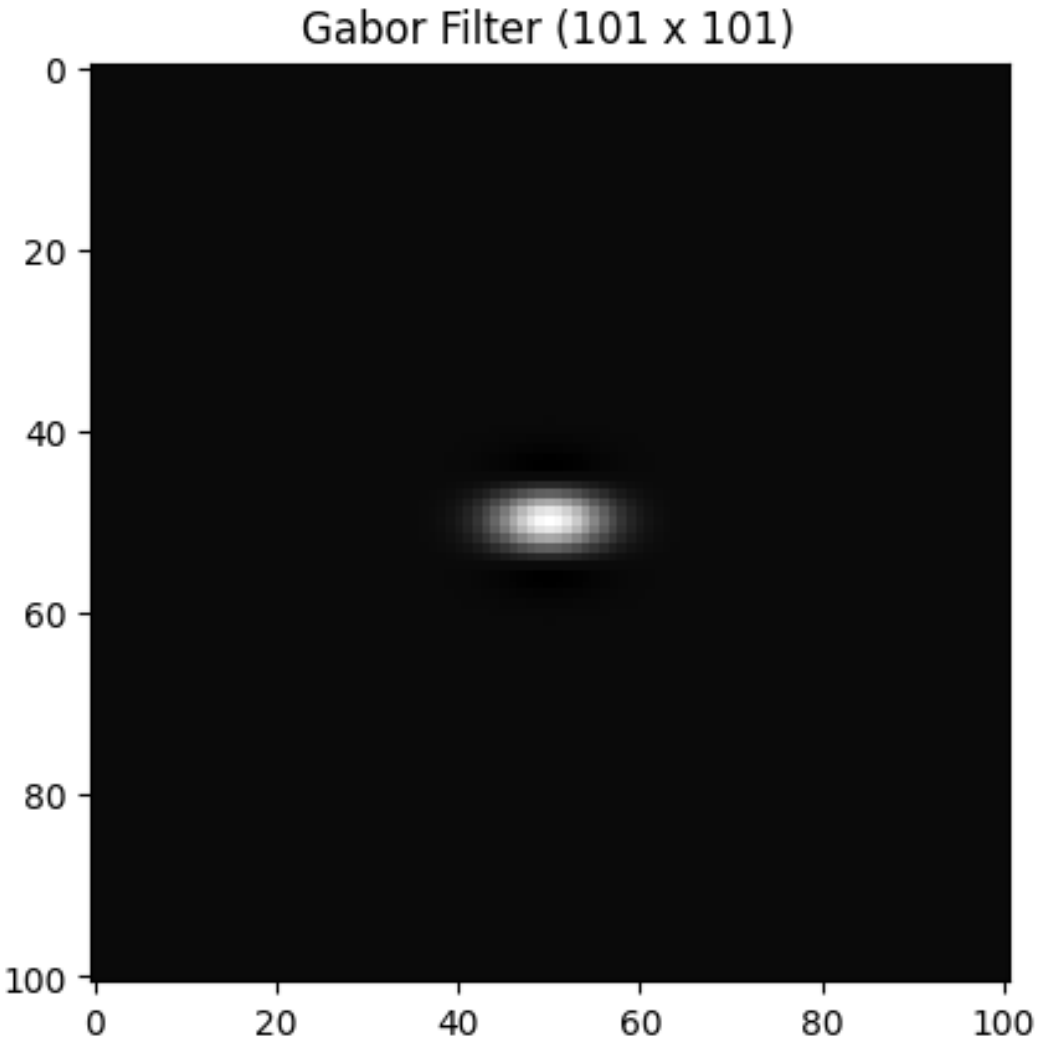
In [57]:
```
LAMBDA=15
gaborFilter = cv2.getGaborKernel((SIZE, SIZE), SIGMA, THETA, LAMBDA, GAM
plt.imshow(gaborFilter, cmap="gray")
plt.title(f"Gabor Filter ({SIZE} x {SIZE})")
```

Out[57]:
```
Text(0.5, 1.0, 'Gabor Filter (101 x 101)')
```



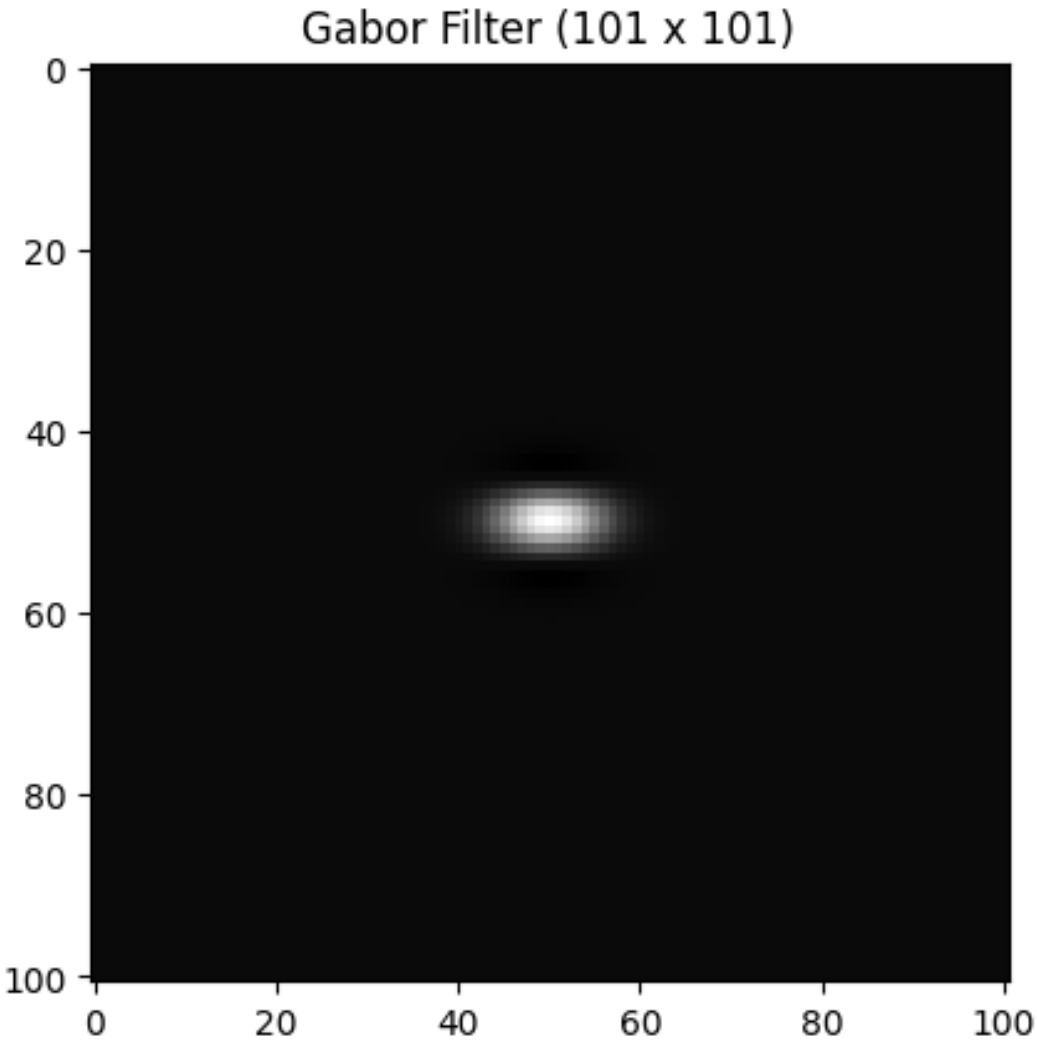
In [58]:
```
LAMBDA=20
gaborFilter = cv2.getGaborKernel((SIZE, SIZE), SIGMA, THETA, LAMBDA, GAM
plt.imshow(gaborFilter, cmap="gray")
plt.title(f"Gabor Filter ({SIZE} x {SIZE})")
```

Out[58]:
```
Text(0.5, 1.0, 'Gabor Filter (101 x 101)')
```



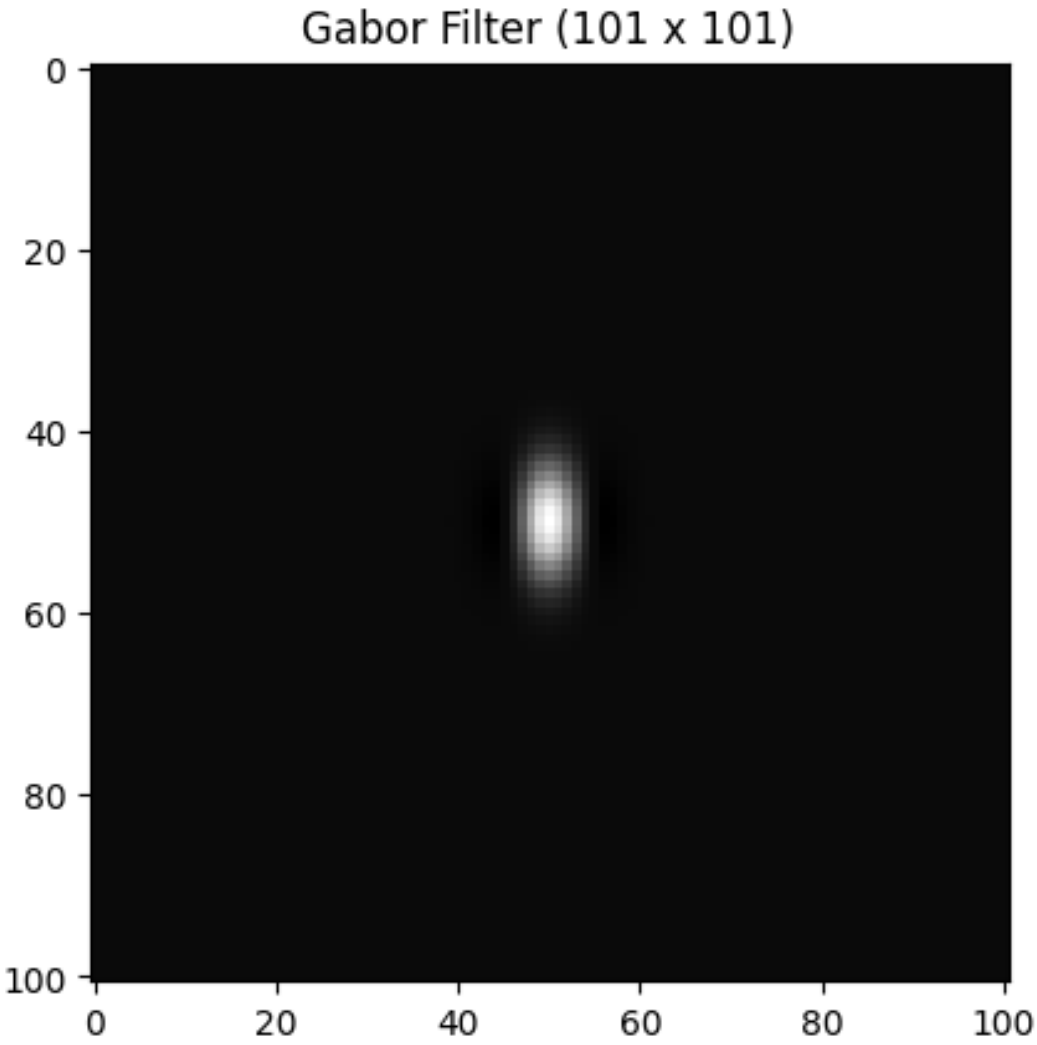
In [59]:
```
THETA=np.pi / 2
gaborFilter = cv2.getGaborKernel((SIZE, SIZE), SIGMA, THETA, LAMBDA, GAM
plt.imshow(gaborFilter, cmap="gray")
plt.title(f"Gabor Filter ({SIZE} x {SIZE})")
```

Out[59]:
```
Text(0.5, 1.0, 'Gabor Filter (101 x 101)')
```



In [60]:
```
THETA=0
gaborFilter = cv2.getGaborKernel((SIZE, SIZE), SIGMA, THETA, LAMBDA, GAM
plt.imshow(gaborFilter, cmap="gray")
plt.title(f"Gabor Filter ({SIZE} x {SIZE})")
```

Out[60]:
```
Text(0.5, 1.0, 'Gabor Filter (101 x 101)')
```

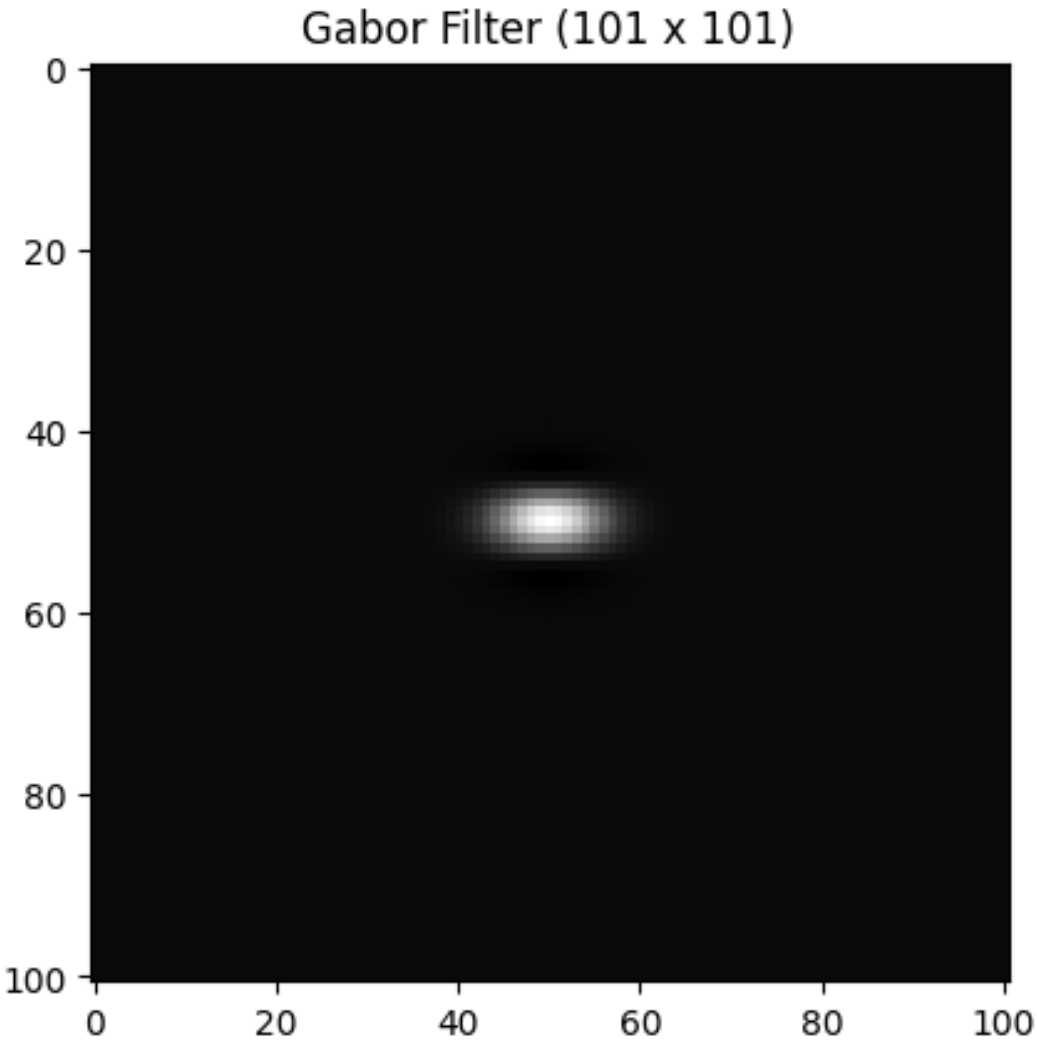


Task 2: Change parameter values and observe the effect

In [61]:
```
SIZE = 101
SIGMA = 3
THETA = np.pi / 2
LAMBDA = 20
GAMMA = 0.7
PSI = 0
```

In [62]:
```
gaborFilter = cv2.getGaborKernel((SIZE, SIZE), SIGMA, THETA, LAMBDA, GAM
plt.imshow(gaborFilter, cmap="gray")
plt.title(f"Gabor Filter ({SIZE} x {SIZE})")
```

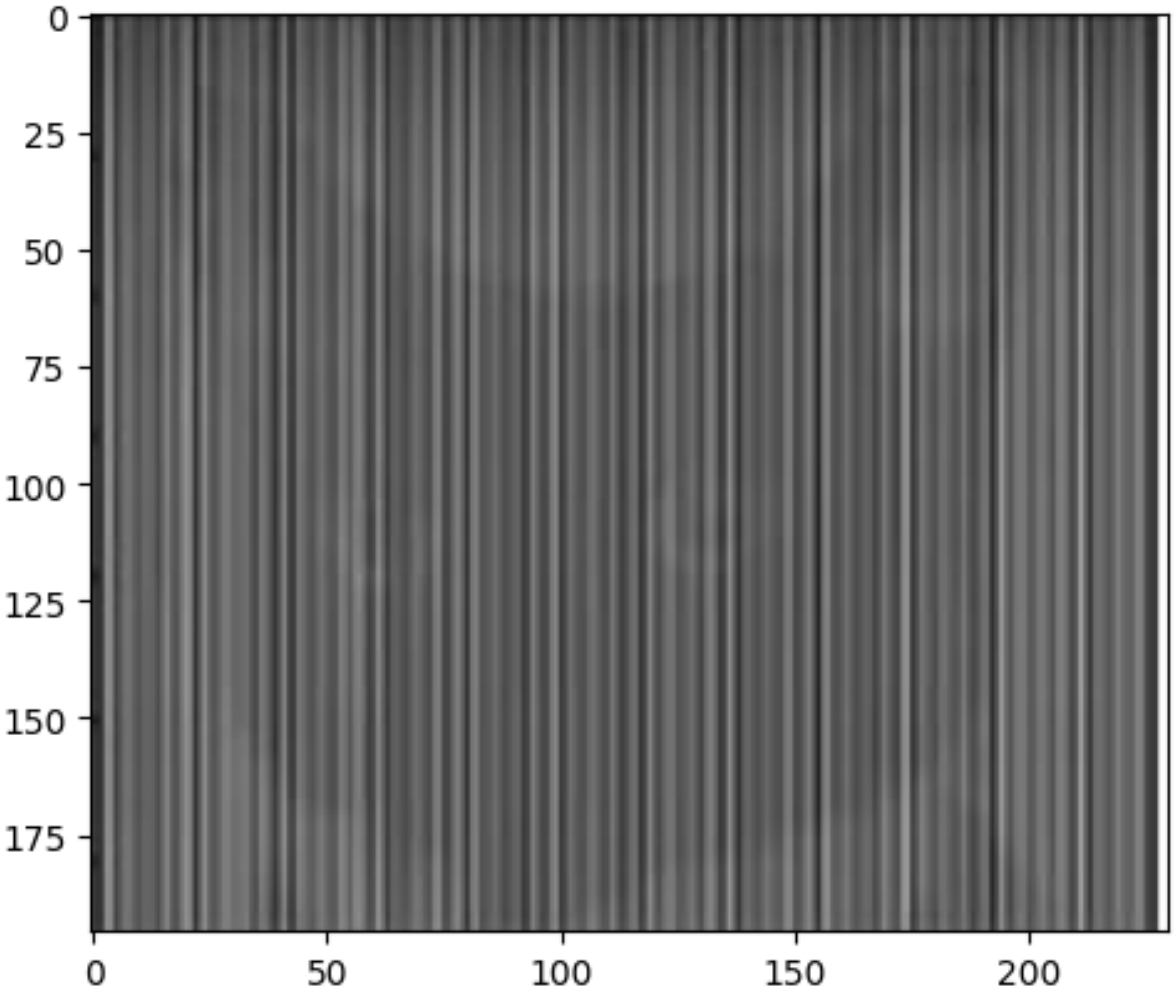
Out[62]:
```
Text(0.5, 1.0, 'Gabor Filter (101 x 101)')
```



Task 3: Apply a gabor filter to extract hidden image from the given image

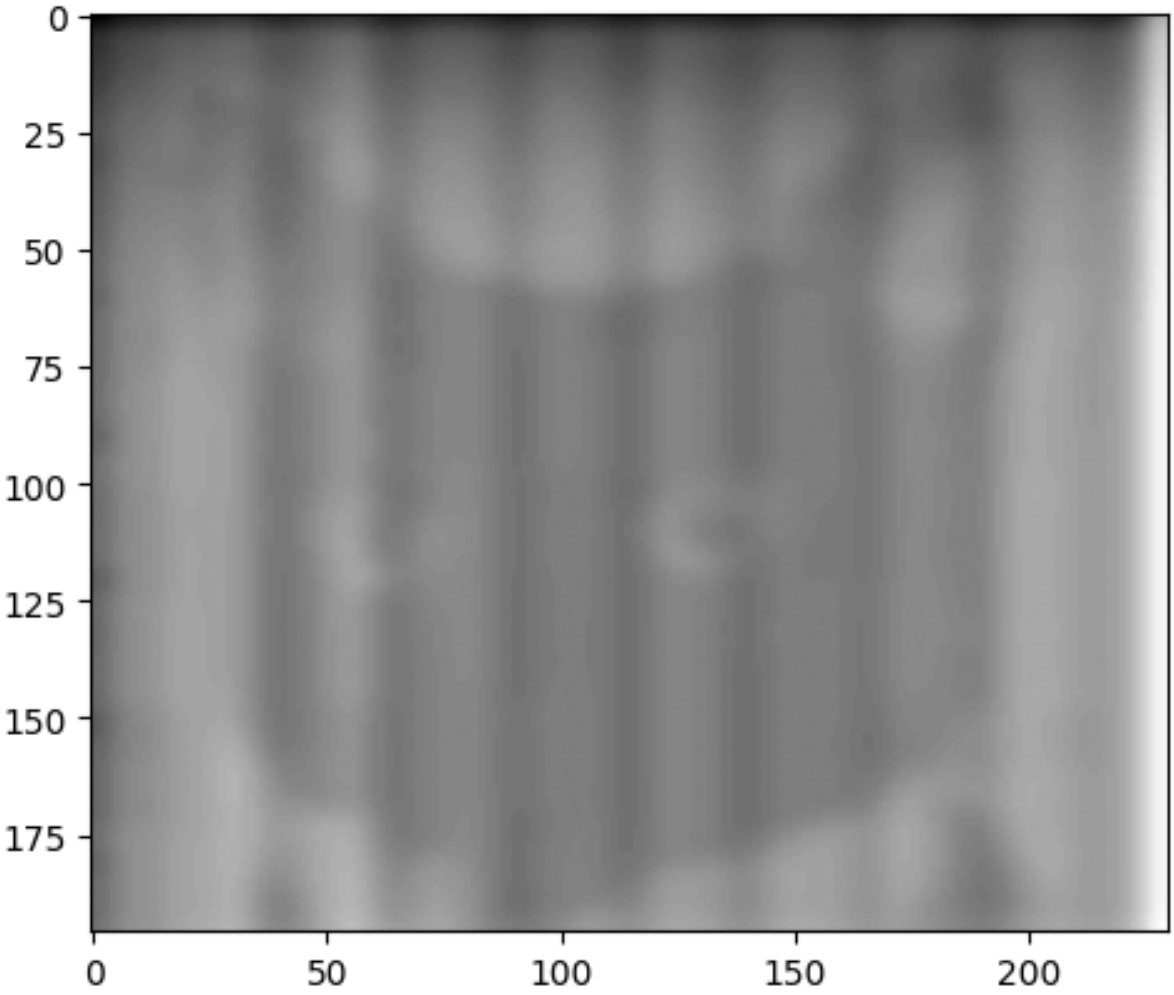
In [63]:
```
img1 = cv2.imread("hidden_image.JPG", 0)
plt.imshow(img1, cmap="gray")
```

Out[63]:
```
<matplotlib.image.AxesImage at 0x7b06702866d0>
```



In [64]:
```
gaborFilter = gaborFilter / gaborFilter.sum()
filteredImg = cv2.filter2D(img1, -1, gaborFilter)
plt.imshow(filteredImg, cmap="gray")
```

Out[64]: <matplotlib.image.AxesImage at 0x7b0670101610>



Task 4: Apply a set of filters to highlight edgesin different directions

In [65]:
```
img2 = cv2.imread("elephant.jfif")
```

In [66]:
```
img2_g = cv2.cvtColor(img2, cv2.COLOR_BGR2GRAY)
```

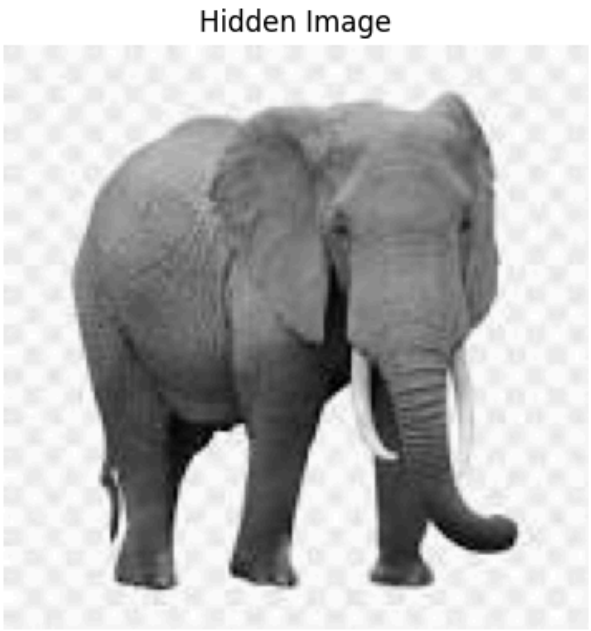
In [67]:
```
filters = []
num_filters = 16
SIZE = 31
SIGMA = 2
LAMBDA = 5
GAMMA = 0.5
PSI = 0

for THETA in np.arange(0, np.pi, np.pi / num_filters):
    f = cv2.getGaborKernel((SIZE, SIZE), SIGMA, THETA, LAMBDA, GAMMA, PS
    f = f / f.sum()
    filters.append(f)
```

In [68]:
```
img2_f = np.zeros_like(img2_g)

for f in filters:
```

```
  img = cv2.filter2D(img2_g, -1, f)
  np.maximum(img2_f, img, img2_f)
```

In [69]:
```
plt.figure(figsize=(10,10))
plt.subplot(1, 2, 1)
plt.axis('off')
plt.imshow(img2_g, cmap='gray')
plt.title('Hidden Image')

plt.subplot(1, 2, 2)
plt.axis('off')
plt.imshow(img2_f, cmap='gray')
plt.title('Filtered Image')
```

Out[69]: `Text(0.5, 1.0, 'Filtered Image')`



Conclusion:

- Gabor filter of size 101X101 is constructed using the following parameters sigma=5, lambda=5, theta=0, gamma=0.5, psi=0.5
- If lambda value is increased from 2 to 15, number of peaks of sine wave captured by the filter is reduced. This type of filter is useful to highlight several edges of the image.
- By increasing the ellipticity, from 0 to 0.75, the length of each vertical stripe reduces proportionally, this filter is used to highlight edges.
- The given filter is used to indentify the edges in different direction by changing the orientation of the filter in the corresponding angles.
- The face of the animal is recovered from the image using the following parameters of gabor filter: kSize=101, sigma=3, theta=np.pi/2, lambdaValue=20, gamma=0.7, psi=0

- The given image elephant has several images in different direction. Highlight these edges 16 gabor filters in different orientations are used and output of filter image is the one which gives the maximum of all the filters.