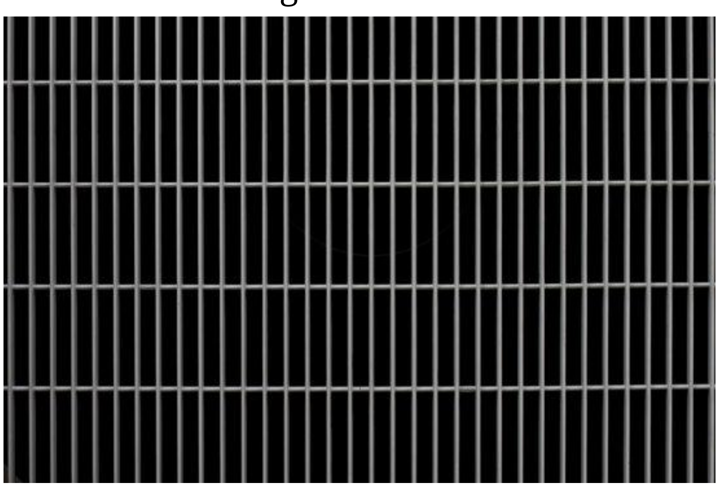
We know that to calculate the autocovariance of an image we can replace the pixel (i,j) with R(i,j). The function R(i,j) can be obtained by the code given below.

```
#calculating R(t1,t2)
def rt(image,n,x,y):
#     temp=[[0]*(n-x)]*(n-y)
    sum=0

    for i in range(n-y):
        for j in range(n-x):
            sum+=(image[i][j])*(image[y+i][x+j])

    return float(sum/float((n+x)*(n+y)))
```

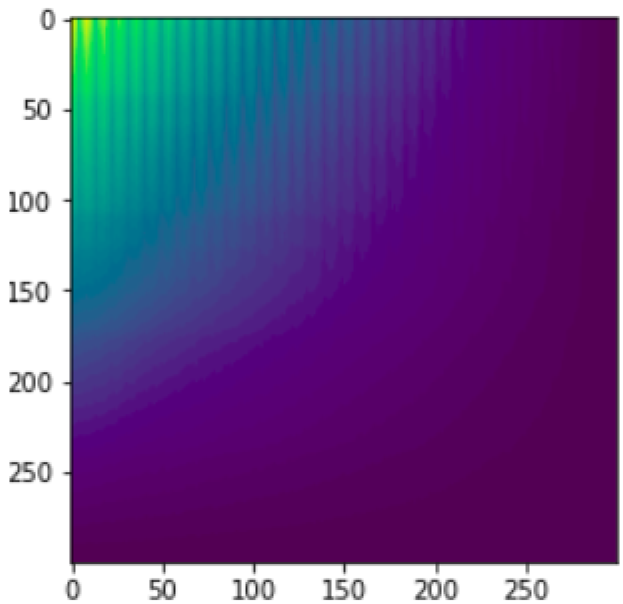
We can get the autocovariance of any image by running this over every pixel.

```
autoCovMat1=image1bw
h,w=image1bw.shape
for i in range(h):
    for j in range (w):
        autoCovMat1[i][j] = rt(image1bw,h,j,i)
```

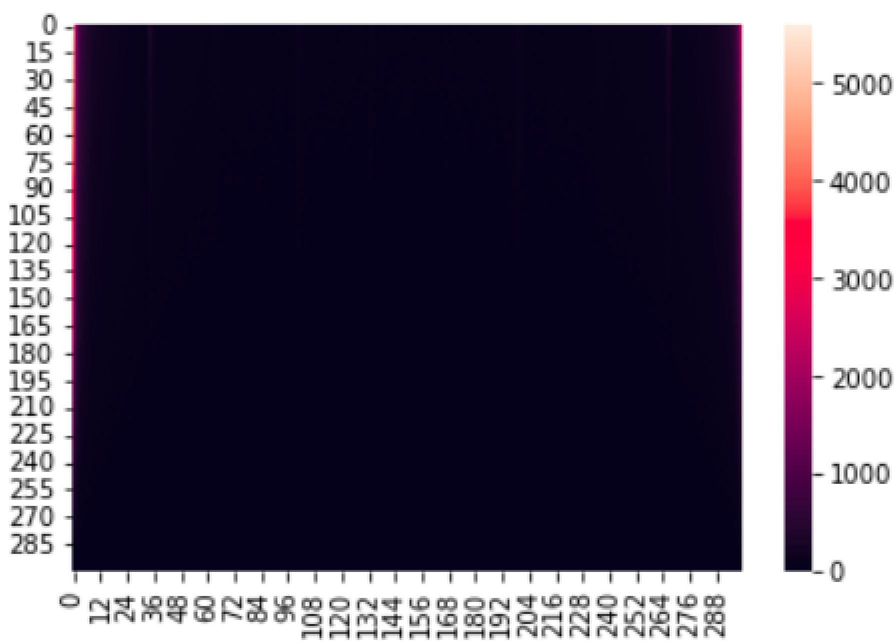
Consider the image below.



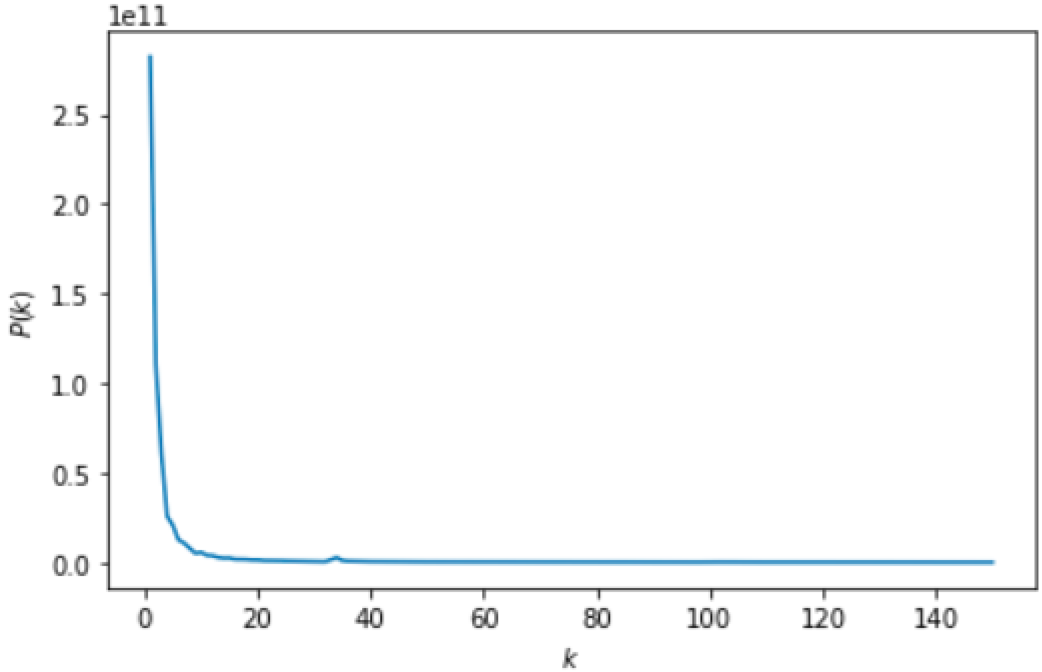
To find the autocavariance of this grating image, convert it to grayscale and run the autocovariance function.



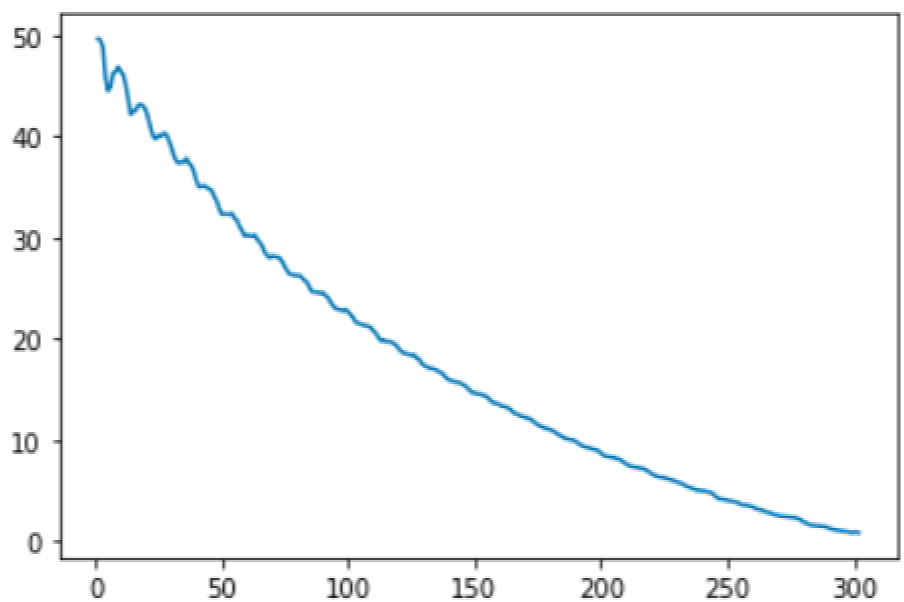
If we calculate the fourier transform of this image we get the following heatmap



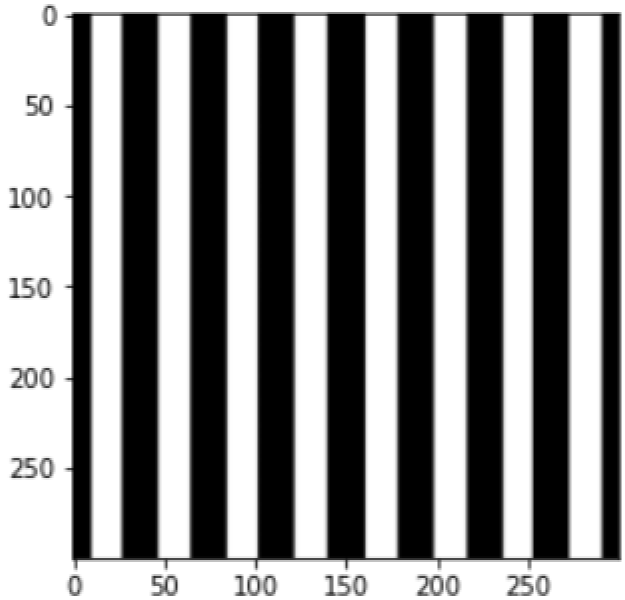
If we plot the psd for this fourier transform heatmap we get



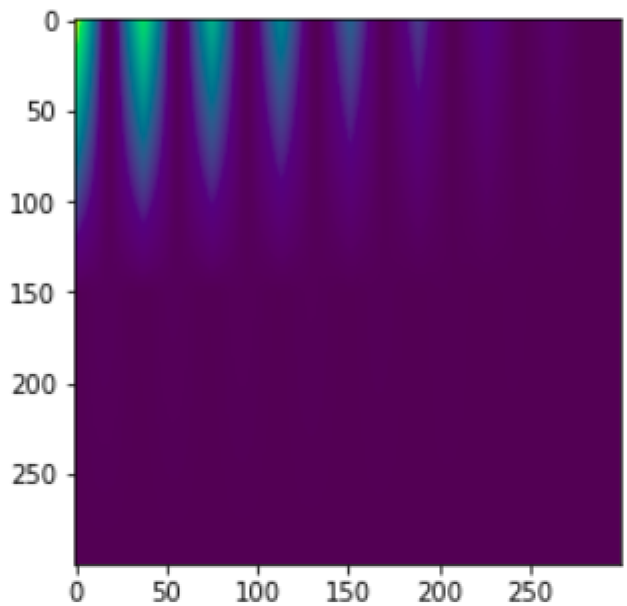
The average radial intensity for this fourier transform is



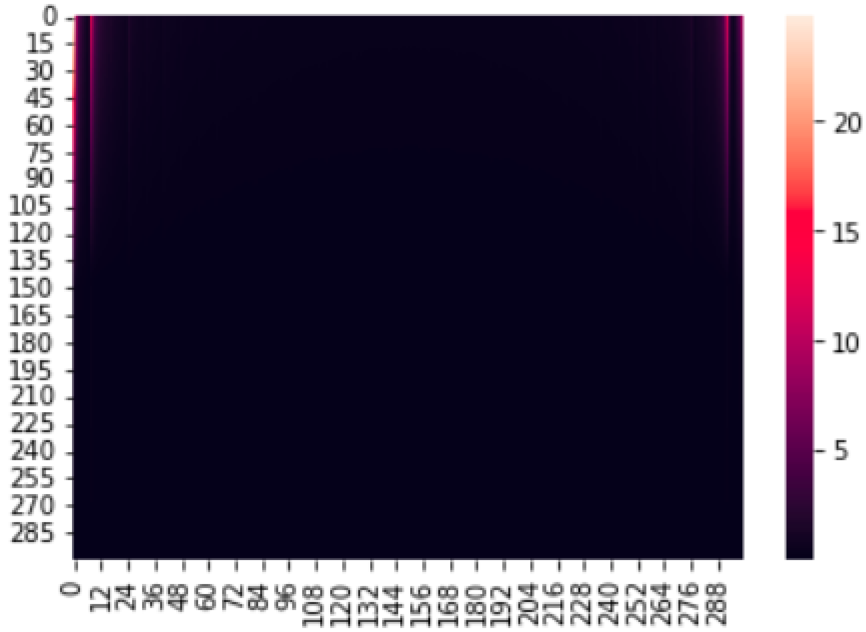
Now consider the image,



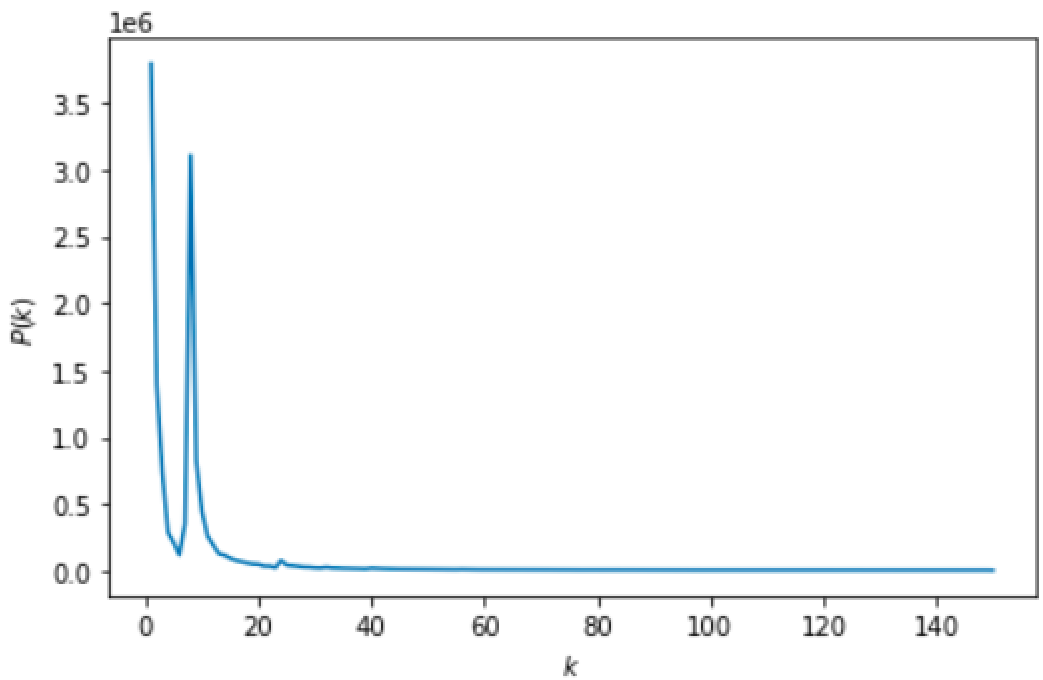
Convert this to grayscale and run the autocovariance function. We get,



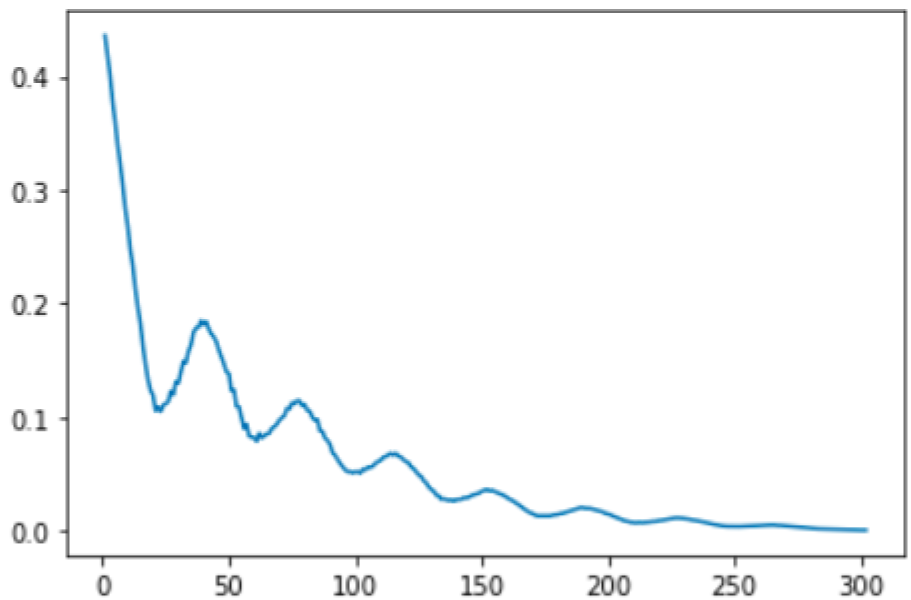
The fourier transform heatmap of this image is



The psd for this heatmap is



And the average radial structure for this is,



0.4
0.3
0.2
0.1
0.0
0
50
100
150
200
250
300