Canny Edge Detector

How to run the code

If you are using python3 you need the following command

```
python3 CannyEdgeDetector.py param.json
```

There are certain package needed to run the code.

```
from PIL import Image
from scipy import ndimage
import numpy as np
import matplotlib.pyplot as plt
import argparse
from pathlib import Path
import json
from skimage import filters
```

I compare my method with the skimage package method of doing hysteresis threshold. My method is relatively slow but easy to implement which can be futher improved by keeping track of the edges.

params file

All the parameter of the algorithm is specified in the param.json file. This is an example:

```
{
  "image": "Test.png",
  "sigma": 1.8,
  "highThresholdRatio" : 0.3,
  "lowThresholdRatio" : 0.15,
  "uselibrary" : "True",
  "saveoutput" : "True"
}
```

- The image path should be put in "image" item
- The "sigma" is used to blur the image before do sobel operation.
- The parameter of hysteresis threshold is specified in "highThresholdRatio" and

"lowThresholdRatio"

- If "uselibrary" is "True", algorithm will use the skimage library to do the faster hysteresis threshold operation, otherwise is a slower recursive method implemented by me.
- If "saveoutput" is "True", the image file will be output to the "result" folder.

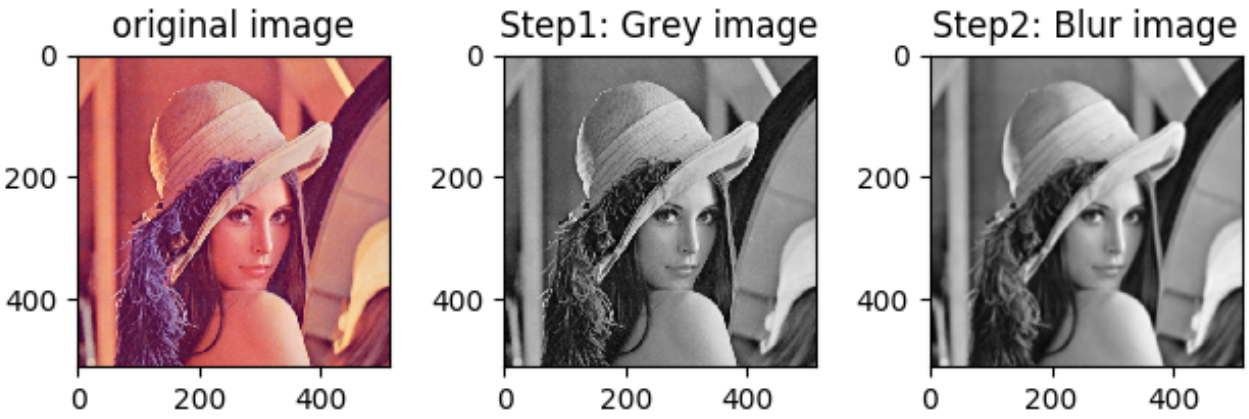
Test result

result1

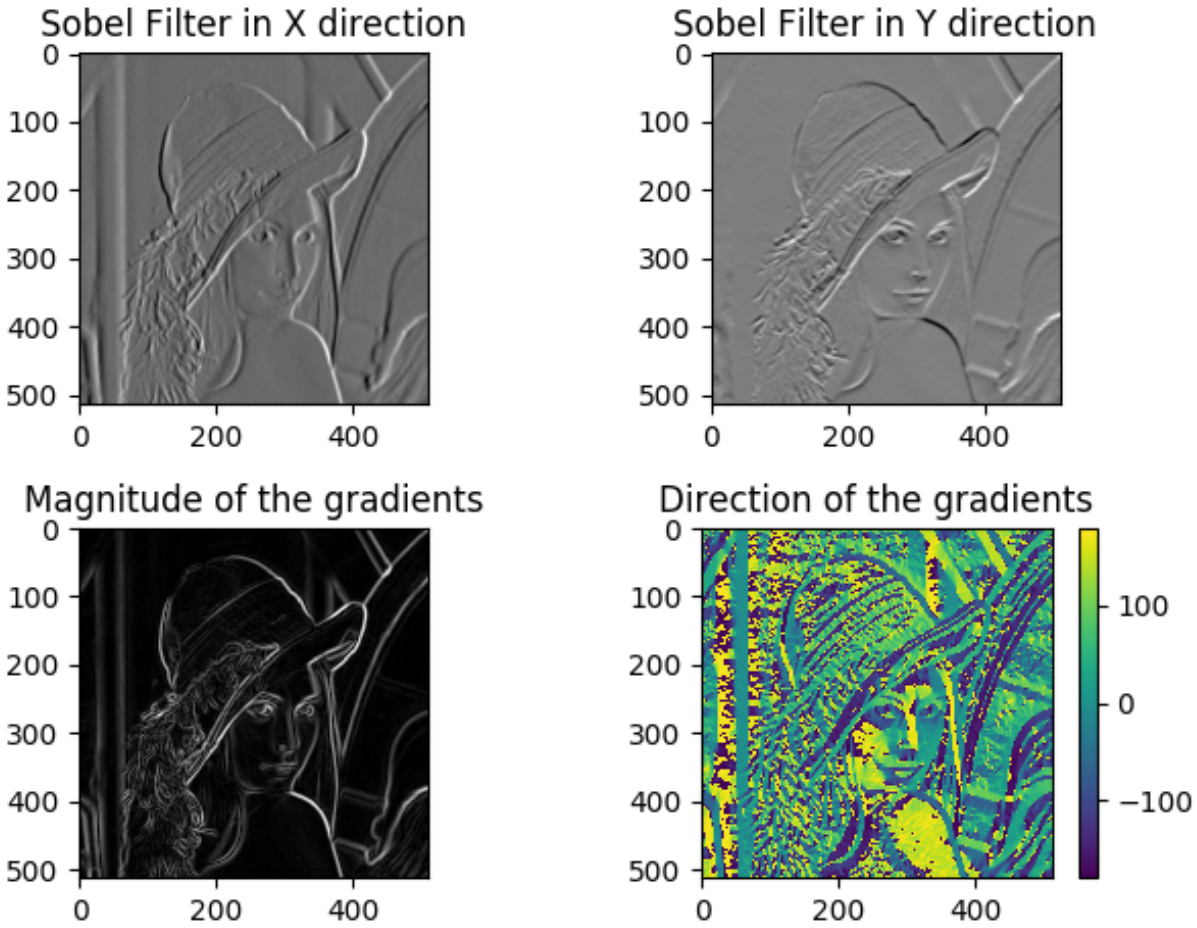
```
{
  "image": "Test.png",
  "sigma": 1.8,
  "highThresholdRatio" : 0.3,
  "lowThresholdRatio" : 0.15,
  "uselibrary" : "True",
  "saveoutput" : "True"
}
```

Using Lena 512*512 as input

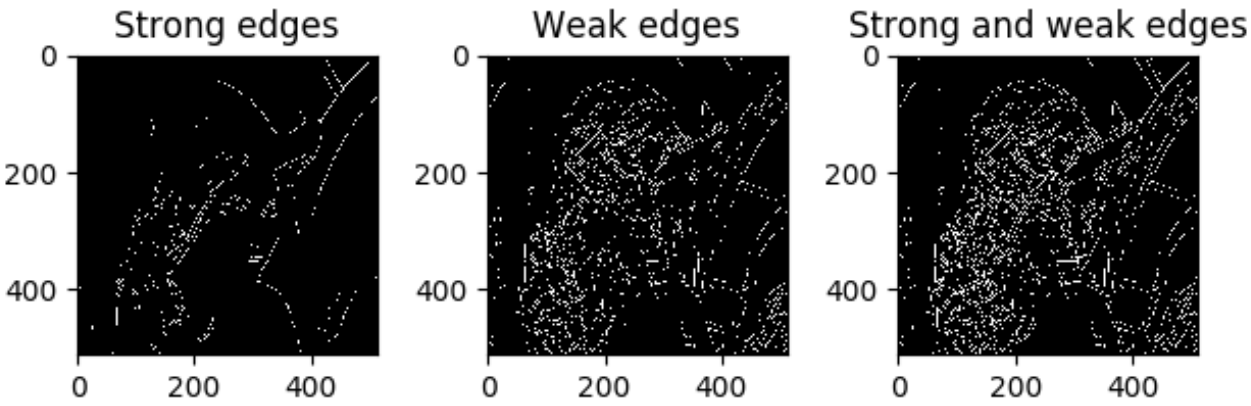
First change it into greyscale image and using gaussian kernel to blur it.

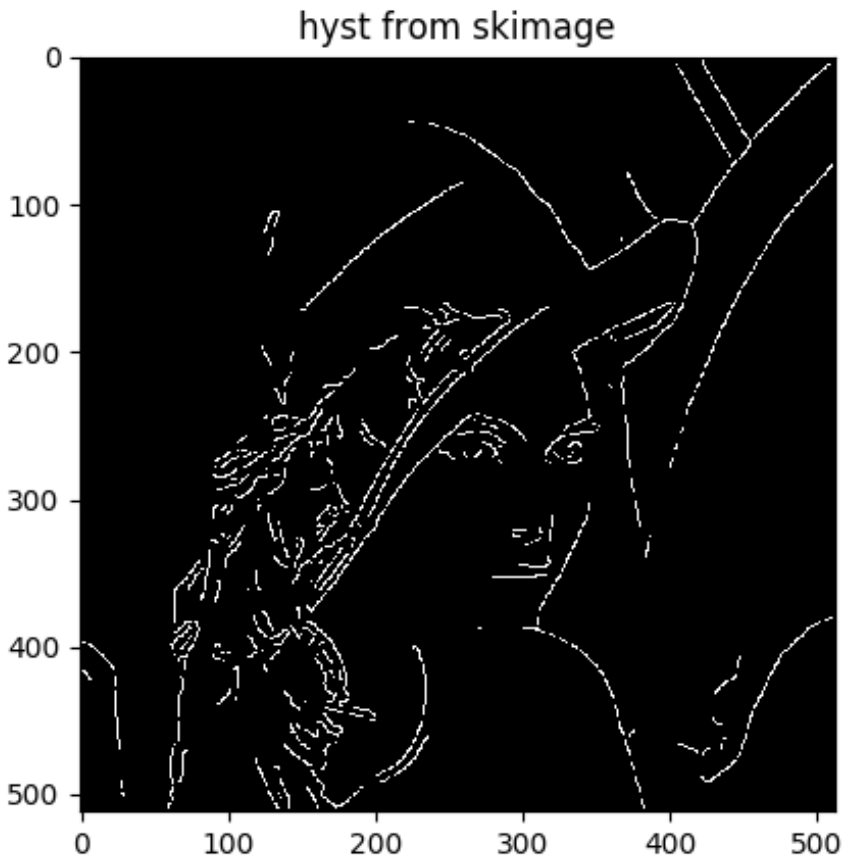


We do a sobel edge detection on it and calculate the magnitude and direction of the gradient



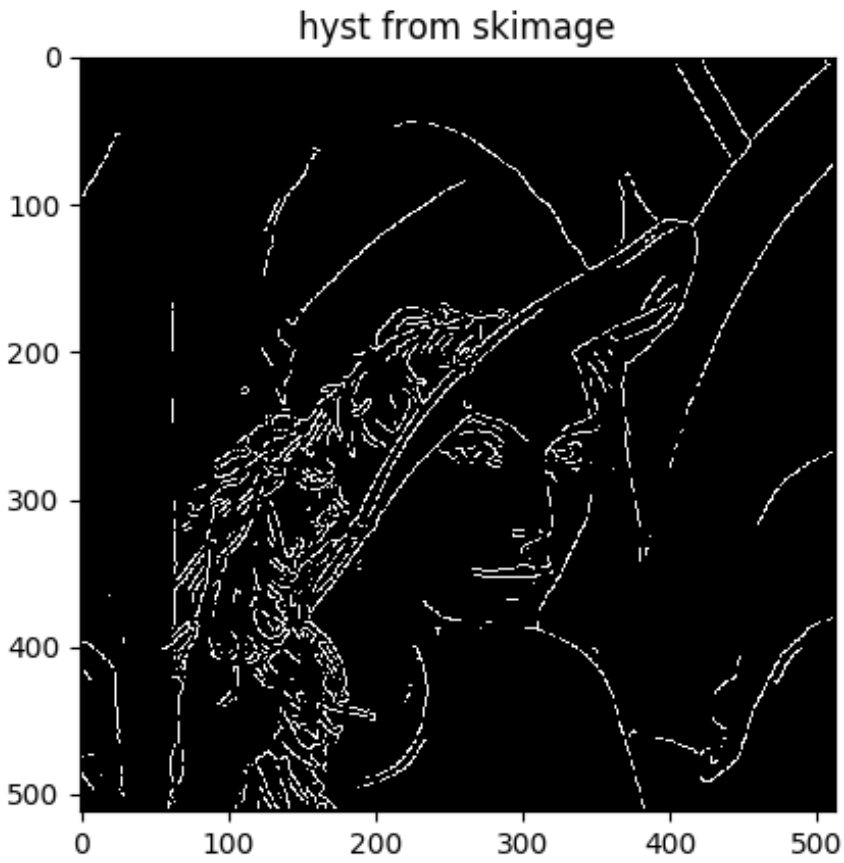
Applying hysteresis threshold using parameter specified in the param.json


Strong edges
Weak edges
Strong and weak edges
0
200
400
0
200
400



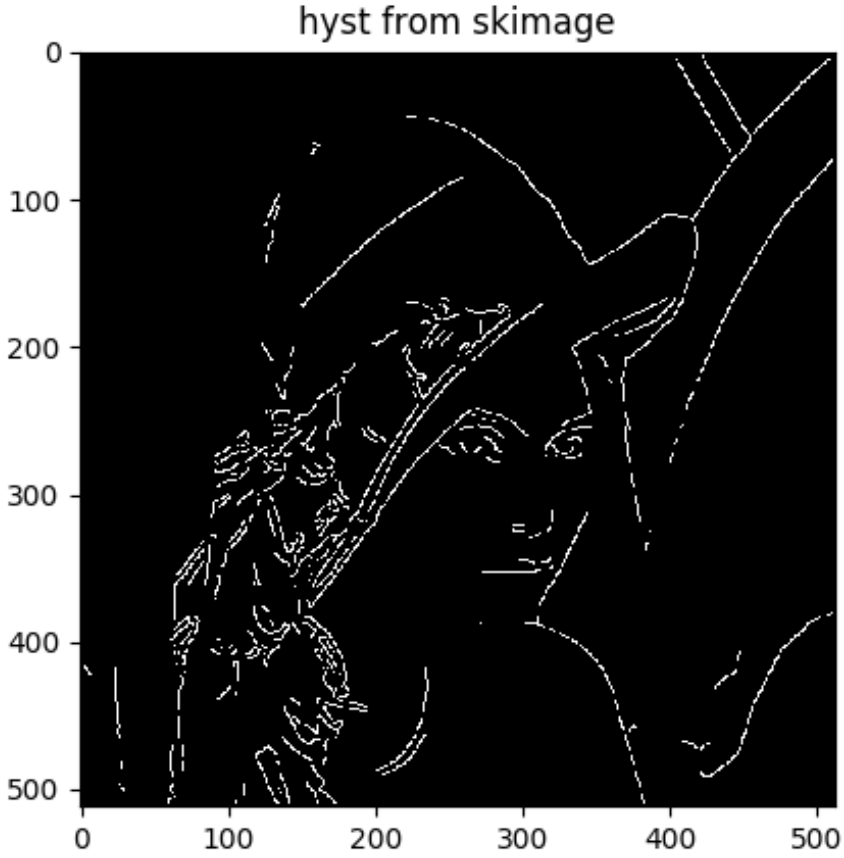
Result 2


```
{
  "image": "Test.png",
  "sigma": 1.4,
  "highThresholdRatio" : 0.2,
  "lowThresholdRatio" : 0.15,
  "uselibrary" : "True",
  "saveoutput" : "True"
}
```



Increase the highThresholdRatio and decrease the lowThresholdRatio, we get:

```
{
  "image": "Test.png",
  "sigma": 1.4,
  "highThresholdRatio" : 0.3,
  "lowThresholdRatio" : 0.10,
  "uselibrary" : "True",
  "saveoutput" : "True"
}
```


hyst from skimage
0
100
200
300
400
500
0
100
200
300
400
500