CSC 445, Spring 2018, Assignment 6

Purpose: Edge Detection

Due: 4:30pm, Thursday, April 12, 2018

Program: Edge Detection

Create a Python script named `assignment6.py` that does the following:

1. Define a function with the signature

   ```
   def make_gaussian_kernel(n):
   ```

   where `n` is the kernel size. The return value of the function is a Gaussian kernel of size `n` × `n`.

2. Define a function with the signature

   ```
   def edge_detection(image, threshold, n):
   ```

   that does the following:

   (a) Smoothes the input image by convolving it with a Gaussian kernel of size `n` × `n` using the `make_gaussian_kernel` function from the previous step to generate the kernel and the input parameter `n`.

   (b) Compute the horizontal component of the gradient by convolving the smoothed image with the kernel $[-101]$.

   (c) Compute the vertical component of the gradient by convolving the smoothed image with the kernel $[-101]^T$.

   (d) Compute the magnitude of the gradient as

   $$\sqrt{\frac{\partial I(x,y)}{\partial x}^2 + \frac{\partial I(x,y)}{\partial y}^2}$$

   where $\frac{\partial I(x,y)}{\partial x}$ is the horizontal component of the gradient and $\frac{\partial I(x,y)}{\partial y}$ is the vertical component of the gradient.

   (e) Compute a binary image by thresholding the image from the previous step with the `threshold` input parameter.

   (f) Return the binary image.

3. Write code that calls the `edge_detection` function on an image of your choosing (include the image file with your submission). Choose values for the threshold and the size of the Gaussian kernel that you think are appropriate and plot the resulting image.

Note: you cannot use any of the pre-existing image processing functions in scipy, you must use the `convolve2d` function to implement your solution. The can be imported into python with the following statement

```
from scipy.signal import convolve2d
```

When performing image convolution be sure to use the `mode='same'` keyword parameter.

Turning in the Assignment

Submit the `assignment6.py` file and your chosen image file to the appropriate folder on D2L.