Faculty of computer science in Helwan University

course name: CS496: Selected CS4

Team number: 2

Student Name (in ARABIC)	Student ID	#
زياد مشهور حسن علي	201900327	1
حامد محمود احمد عبدالهادي سراج	201900257	2
باسل احمد عبدالعزيز	201900214	3
يوسف عبدالعاطي شحاتة عبدالقادر	20180710	4
سلمي خالد محمد الصاوي	201900347	5
اشرقت محمد ابوالعلا محمد	201900156	6

Edge detection using sobel operator and mathematical morphology

Our Dataset:The Berkeley Segmentation Data Set 500 (BSDS500) is a benchmark dataset for image segmentation. It was developed by researchers at the University of California, Berkeley and contains 500 natural images for segmentation. The dataset can be downloaded from the following link:

http://www.eecs.berkeley.edu/Research/Projects/CS/vision/grouping/BSR/BSR_bsds500.tgz

And home page is :

https://www2.eecs.berkeley.edu/Research/Projects/CS/vision/grouping/resources.html

Each image in the dataset is of size 481x321 pixels, and is provided in RGB color space.

The BSDS500 dataset is not a classification dataset, but rather a segmentation dataset. The goal of image segmentation is to partition an image into regions that are visually distinct from each other. The BSDS500 dataset provides ground truth segmentation maps for each image, which can be used to evaluate the performance of segmentation algorithms.

Implementation details:
1. Create gray scale
2. Use gaussian blur
3. Use sobel operator
4. Use mathematical morphology
- Note: The block diagram will be at the end.

Hypermaraters:
We used 2 arrays to decide which parameters to choose from

ksize_range = [3, 5, 7]

threshold_range = [0,10,20,30,25,50,75, 100,125, 150,175,200,225,255]

1. sobel_threshold_value =255*4, ksize =5
2. sobel_threshold_value =100, ksize =3
3. sobel_threshold_value =100*255, ksize =7
4. sobel_threshold_value =1000*255, ksize =9

Evaluations:
1. Mean sum error(MSE):
   a. the closer the number to zero the better
2. Structural Similarity Index (SSim)
   a. The close the number to 1 the better

Conclusion and results

After conducting our experiment on the dataset we reached the conclusion that these parameters[Ksize=3, threshold=150] provided best scores in our evaluation metrics.

- In both cases of mse and ssim which we used to evaluate the scores between the groundthruth and the predicted images
- Best MSE and SSIM scores came from a kernel size =3 and a threshold = 150

After that we started using these parameters on random videos we found to check the results.

```mermaid
flowchart TD
    A[Read Image] --> B[Convert Image to gray scale]
    B --> C[gaussian blur]
    C --> D[Sobel Filter]
    E[Adjust parameter] --> D
    D --> F[Mathematical Morphology]
    F --> G[Evaluate]
    G --> E
    G --> H[Read video]
    H --> I[Process the frames]
    I --> J[Run the frames Through the model]
```

- Read Image
- Convert Image to gray scale
- gaussian blur
- Adjust parameter → Sobel Filter
- Mathematical Morphology
- Evaluate
- Read video
- Process the frames
- Run the frames Through the model