BLG477E

Multimedia Computing

Homework 02

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1 Environment

I used Microsoft Visual Studio 2013 and OpenCV 2.4.11 for the homework. I used Microsoft Visual Studio in Debug Mode for Win32. After running the program it wants an image's name from the user. This image must be in the "images" folder inside the project folder. After the program wants low and high Thresholding values from the user for Hysteresis Thresholding function. Then, program show 3 image to user which are listed at below.

- Original Image
- Otsu Segmentation Image
- K-Means Clustering Image

Program also shows threshold values of image's channels for both method.

2 Explanation of the Algorithms

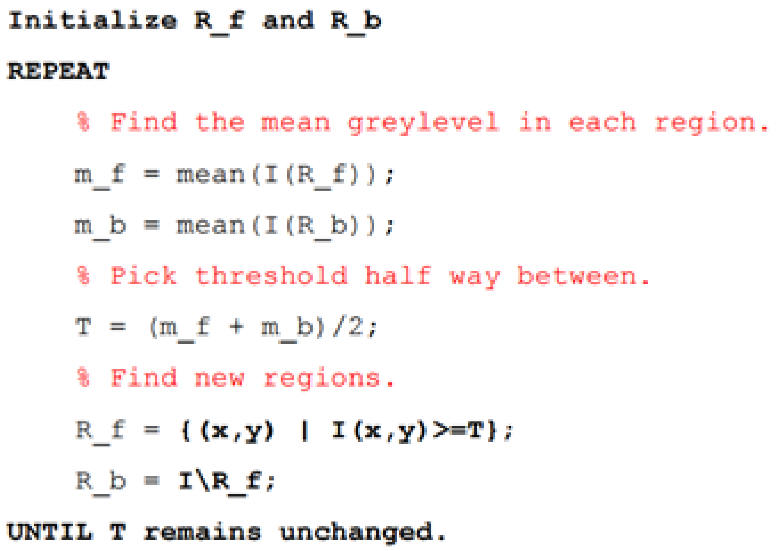
2.1 Otsu's Segmentation Algorithm

In this method, I use code that is shown at below, for finding Otsu threshold value. I find threshold values of all channels then used them on given image. Finally I combined them with using AND operator.

```
vector<int> GetImageHistogram(Mat _image , int _channel){
    float _totalPixelNumber = _image.rows * _image.cols;
    float _globalMax = 0;
    float _thresholdIndex = 0;

    for (int i = 0; i < 256; i++) {
        float w0 = 0;
        float w1 = 0;
        float m0 = 0;
        float m1 = 0;
        for (int j = 0; j < 256; j++){
            if (j < i){
                w0 = w0 + _imageHistogram[j];
                m0 = m0 + j*(_imageHistogram[j] / _totalPixelNumber);
            }
            else{
                w1 = w1 + _imageHistogram[j];
                m1 = m1 + j*(_imageHistogram[j] / _totalPixelNumber);
            }
        }

        if (w0 != 0 && w1 != 0){
            m0 = m0 / w0;
            m1 = m1 / w1;
        }

        float _localMax = w0*w1*(m0 - m1)*(m0 - m1);
        if (_localMax > _globalMax){
            _globalMax = _localMax;
            _thresholdIndex = i;
        }
    }
    return _thresholdIndex;
}
```

2.2 K-Means Clustering Algorithm

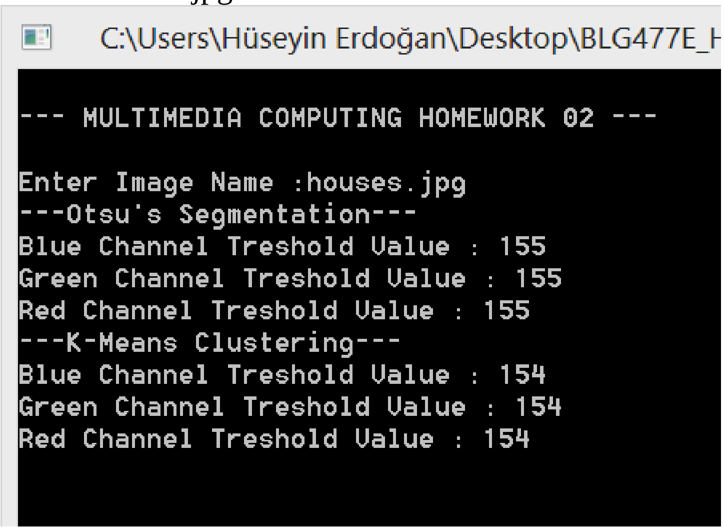
In this algorithm, I used pseudo code that is shown at below. I find threshold values for all channels of an image. Then used them on given image and combined result images with using AND operator like Otsu method. In this method 128 is selected as beginning threshold value for all images.



```
Initialize R_f and R_b
REPEAT
    % Find the mean greylevel in each region.
    m_f = mean(I(R_f));
    m_b = mean(I(R_b));
    % Pick threshold half way between.
    T = (m_f + m_b)/2;
    % Find new regions.
    R_f = {(x,y) | I(x,y)>=T};
    R_b = I\R_f;
UNTIL T remains unchanged.
```

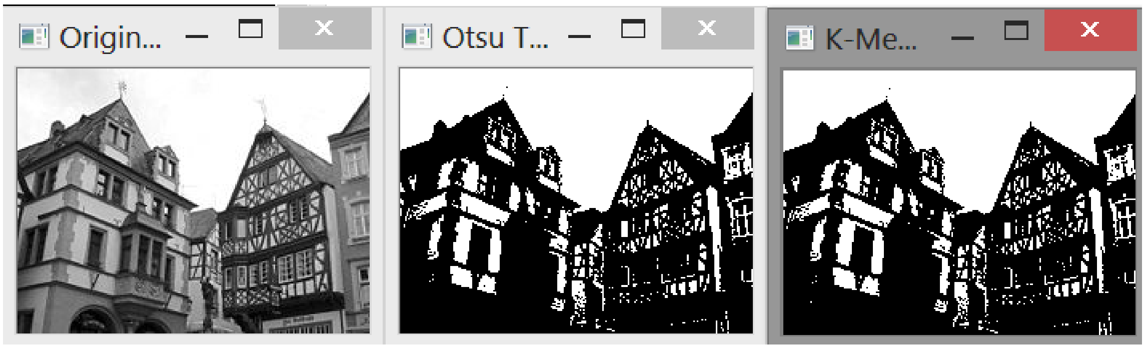
3 Results of the Algorithms

- houses.jpg

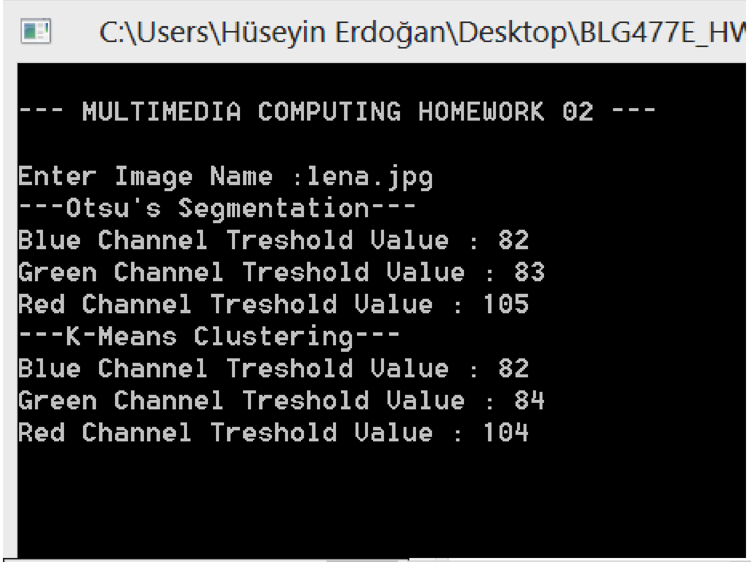


C:\Users\Hüseyin Erdoğan\Desktop\BLG477E_H

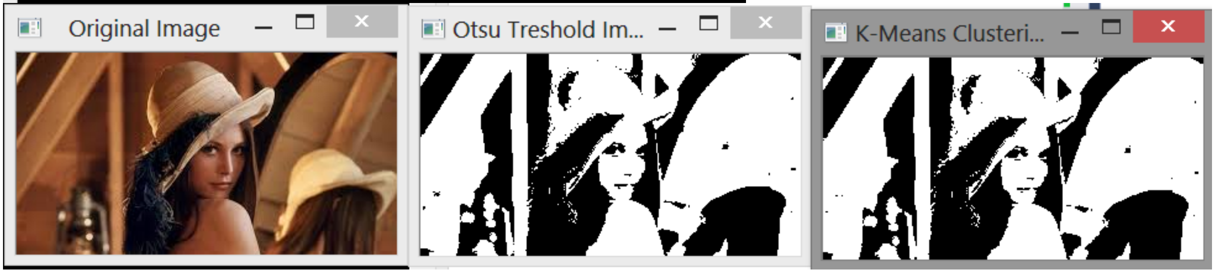
```
--- MULTIMEDIA COMPUTING HOMEWORK 02 ---

Enter Image Name :houses.jpg
---Otsu's Segmentation---
Blue Channel Treshold Value : 155
Green Channel Treshold Value : 155
Red Channel Treshold Value : 155
---K-Means Clustering---
Blue Channel Treshold Value : 154
Green Channel Treshold Value : 154
Red Channel Treshold Value : 154
```



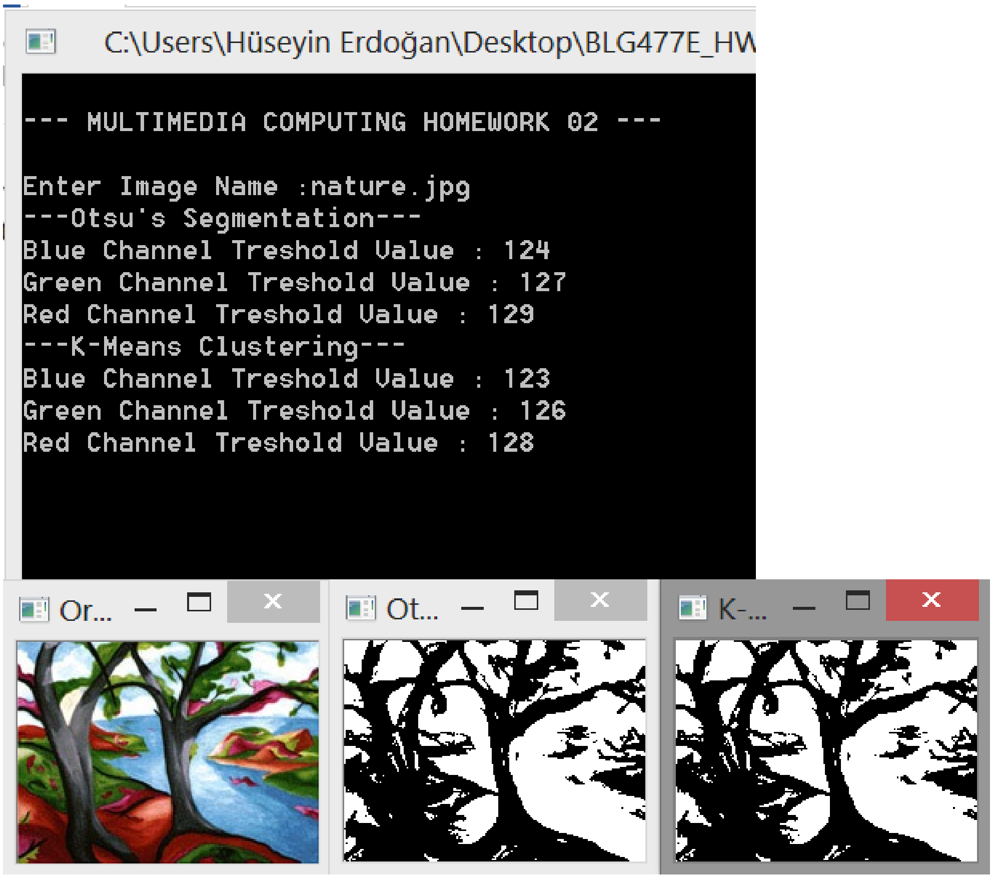
- lena.jpg



```
--- MULTIMEDIA COMPUTING HOMEWORK 02 ---

Enter Image Name :lena.jpg
---Otsu's Segmentation---
Blue Channel Treshold Value : 82
Green Channel Treshold Value : 83
Red Channel Treshold Value : 105
---K-Means Clustering---
Blue Channel Treshold Value : 82
Green Channel Treshold Value : 84
Red Channel Treshold Value : 104
```

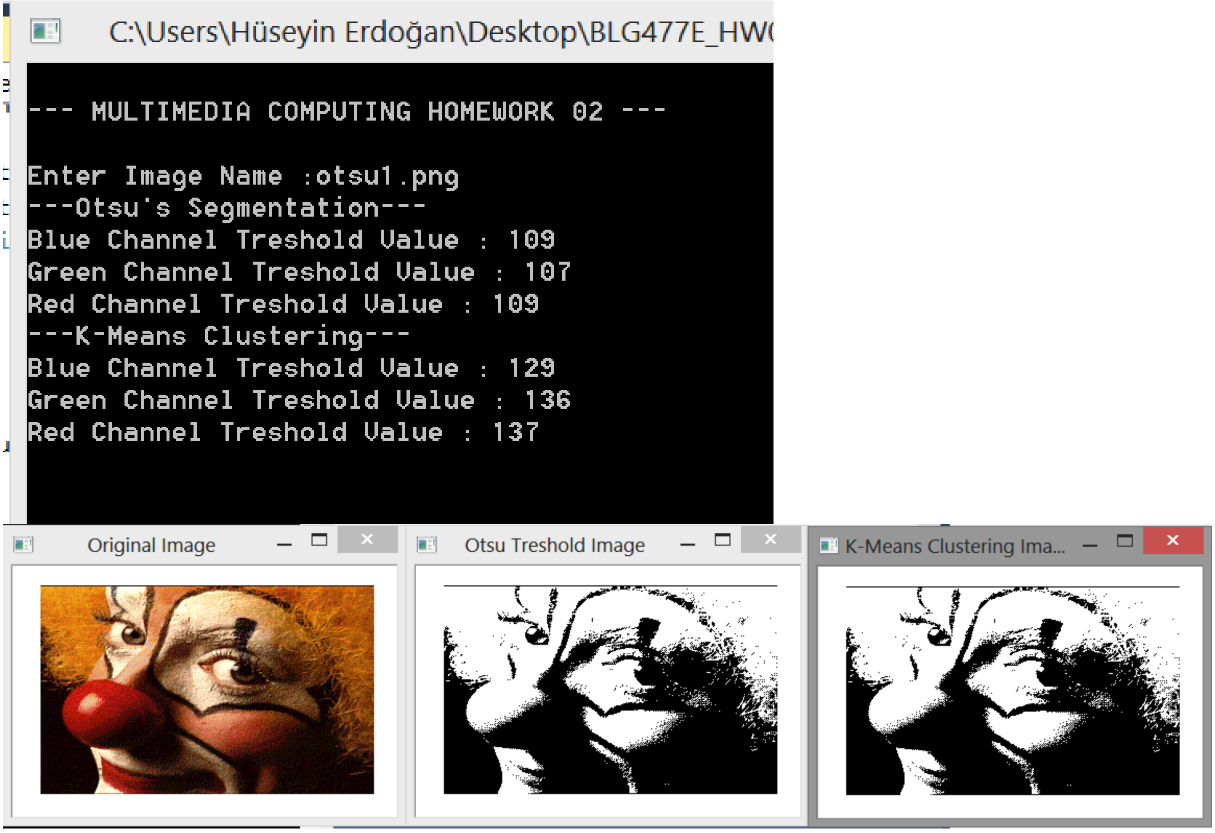


- nature.jpg



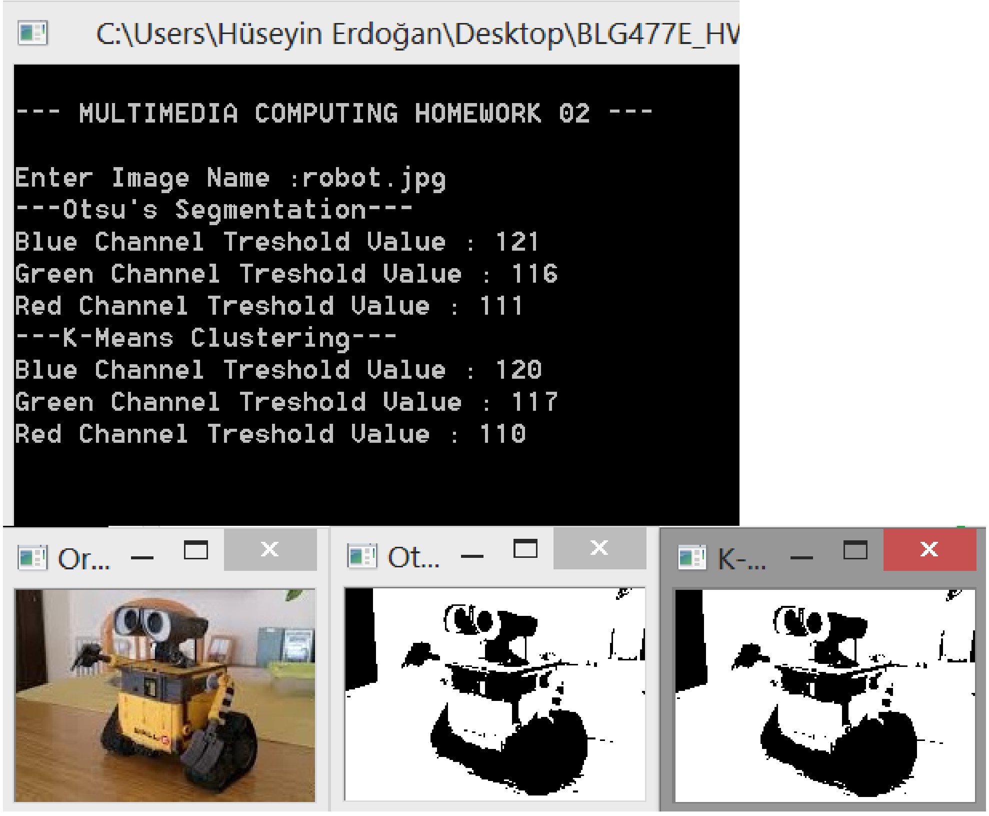
```
--- MULTIMEDIA COMPUTING HOMEWORK 02 ---

Enter Image Name :nature.jpg
---Otsu's Segmentation---
Blue Channel Treshold Value : 124
Green Channel Treshold Value : 127
Red Channel Treshold Value : 129
---K-Means Clustering---
Blue Channel Treshold Value : 123
Green Channel Treshold Value : 126
Red Channel Treshold Value : 128
```

- otsu1.png


C:\Users\Hüseyin Erdoğan\Desktop\BLG477E_HW
Original Image
Otsu Treshold Image
K-Means Clustering Ima...

```
--- MULTIMEDIA COMPUTING HOMEWORK 02 ---

Enter Image Name :otsu1.png
---Otsu's Segmentation---
Blue Channel Treshold Value : 109
Green Channel Treshold Value : 107
Red Channel Treshold Value : 109
---K-Means Clustering---
Blue Channel Treshold Value : 129
Green Channel Treshold Value : 136
Red Channel Treshold Value : 137
```

- robot.jpg



```
--- MULTIMEDIA COMPUTING HOMEWORK 02 ---

Enter Image Name :robot.jpg
---Otsu's Segmentation---
Blue Channel Treshold Value : 121
Green Channel Treshold Value : 116
Red Channel Treshold Value : 111
---K-Means Clustering---
Blue Channel Treshold Value : 120
Green Channel Treshold Value : 117
Red Channel Treshold Value : 110
```