DSP2 SS2018 – Exercise 6.1: Segmentation

1. The new src folder includes all files from the last exercise and two new files:
    - Segmentation.h: declaration of the class for the spatial filter
    - Segmentation.cpp: implementation of the class for the spatial filter
2. The new data folder includes the lena image from the last exercise and three new images:
    - template_1.tiff: is the template image you should be use for the cross correlation
    - template_2.tiff: if you like, you can also test your cross correlation implementation with this template (this is optional)

3. Implement the function "void Segmentation::crossCorrelate(const cv::Mat &input, const cv::Mat &templ, cv::Mat &output)
    - "Input" is the input image
    - "templ" template image, which you have to find in the input image
    - "output" is the result image of cross correlation
    a. At first, think about the number of rows and columns you need for the output image and create the output image accordingly
    b. Implement the cross correlation:
        - Think about the number of for-loops
        - Think about the image ranges (which values do you need for the "for-loops"?)
        - Use the formula given below
        - Write the result to the output image
4. The result image of the cross correlation has the largest value on the matching point between input image and template image. Find this value and draw a rectangle around your matching point in the original image. This is the contour of the template. This way you can see where you found the template in the input image.
    - To find the maximum you can use the function "cv::Point Segmentation::findMaximum(const cv::Mat &input)"
    - Use the function "void Segmentation::drawRect(const cv::Mat &input, cv::Point origin, cv::Size size, cv::Mat &output)" to draw the contour of the template

<u>Appendix: Formula for normalized cross correlation</u>

- Image $g(x, y)$
- Pattern (Template) $p(k, l)$ with $k \leq x, l \leq y$
- Normalized Cross Correlation Function:

$$c(x,y) = \frac{\sum_k \sum_l g(x+k, y+l) p(k,l)}{\sqrt{\sum_k \sum_l g(x+k, y+l)^2} \sqrt{\sum_k \sum_l p(k,l)^2}}$$