Exercise 3: Histograms

This exercise contains 3 main parts: 1) Analysis of a histogram, 2) implementation of histogram equalization, and 3) implementation of k-means clustering. I encourage you to implement your own methods to increase your understanding of the algorithms. However, it is also possible to solve the exercises using OpenCV's implementation. Note that these exercises may take quite som time to complete. If time is sparse, I suggest that you complete 1 and then implement either 2 or 3 and then make sure you understand the algorithm in the one you didn't implement.

1) Load legoHouse.jpg and visualize a histogram over the hue channel. Explain what you see. (You can either implement your own function for visualizing histograms or use the provided code on itsLearning)

2) Implement histogram equalization and apply it to either a) the luminance channel, or b) a gray-scaled version of TrinityCampanile3.jpg

3) Implement k-means clustering for data of dimension 1 (each datapoint is a single value). Use your k-means clustering method to cluster the hue channel values of legoHouse.jpg . Estimate the correct number of classes by inspecting the histogram. Verify that you find the desired "peaks" in the histogram.

(Optional:

Load `Astronaut1.jpg`, `Astronaut2.jpg` and `Oring01.jpg`. Compare the color histogram of `Astronaut1.jpg` to that of the other images visually and by means of Pearson's correlation coefficient.

Segment the red spoons in the `BabyFood` image by means of histogram back-projection on the hue plane of the image. Define a suitable roi to define the representative color sample.)

Things to look out for

1)Read the documentation to OpenCV

https://docs.opencv.org/3.4/d3/d63/classcv_1_1Mat.html#aa5d20fc86d41d59e4d71ae93daee9726

Keep in mind that the size identifier used in the at operator cannot be chosen at random. It depends on the image from which you are trying to retrieve the data. The table below gives a better insight in this:

If matrix is of type CV_8U then use Mat.at<uchar>(y,x).

If matrix is of type CV_8S then use Mat.at<schar>(y,x).

If matrix is of type CV_16U then use Mat.at<ushort>(y,x).

If matrix is of type CV_16S then use Mat.at<short>(y,x).

If matrix is of type CV_32S then use Mat.at<int>(y,x).

If matrix is of type CV_32F then use Mat.at<float>(y,x).

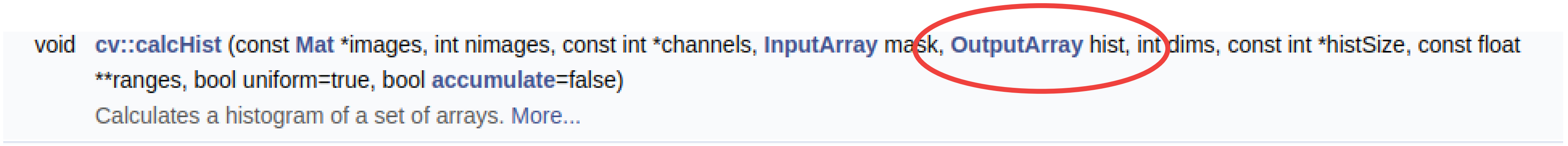
If matrix is of type CV_64F then use Mat.at<double>(y,x).

So if the image is CV_16U you have to use at<ushort>

Things to look out for

Check if uncertain about depth, number of channels or dimensions

Note that histogram.size() outputs (width,height) = (cols,rows)



```
void   cv::calcHist (const Mat *images, int nimages, const int *channels, InputArray mask, OutputArray hist, int dims, const int *histSize, const float
       **ranges, bool uniform=true, bool accumulate=false)
       Calculates a histogram of a set of arrays. More...
```