# Augmented reality
# CMIAAR01K 2018-2019
# Assignments

## Assignment 1 - Basic filters

- Implement RGB to YUV conversion.

- Implement YUV to RGB conversion.

- Convert a RGB image to YUV and then the converted image in YUV to RGB and display the initial image and the result (they should look like the same). Display both images in a window.

- Implement the grayscale conversion both in RGB and YUV. Display the original image and the grayscale image in a window.

## Assignment 2 - Image rescaling

Implement a function which allows you to resize an input image with 3 colour components. The function should be able to both scale up and down an image. Implement the function using both the nearest neighbour and the bilinear interpolation techniques.

## Assignment 3 - Image clustering

Implement the K-Means algorithm and apply it to image segmentation. Initialize the centroids by picking random objects from the test set. Take the number $k$ of clusters as input. Visualize the input image and the segmented image on the same window.

**Hints:**

1. Build a class implementing vectors and vector operations seen in class.

2. Build a function that converts a matrix of `Color` into a matrix of vectors.

3. Build a function that picks $k$ distinct random points from the vector matrix.

4. Run the algorithm on the vectors. Take as input the number of clusters. Keep track of what cluster is assigned to each vector.

5. Build the output image by setting the object colours to be the one of their centroid.

# Assignment 4 - Omnidirectional cameras

Implement the unwarping algorithm for an omnidirectional camera. Your function will take an omnidirectional image as input, and output the equivalent perspective image. Assume that you know the radius of the blind spot $r_{in}$, the outer radius $r_{out}$ of the omnidirectional camera, and the coordinates of the centre of the camera $(c_x, c_y)$ in the omnidirectional image. You can find these values for the standard images you should use in N@tschool in the `parameters.txt` file. If you want to add an additional image then you have to measure these values manually with an image editing software.