

# COM-SGN.110 Introduction to Image and Video Processing

## EXERCISE 11

05.12.2022 – 08.12.2022

The tasks should be completed and presented to TA during the lab session. **Do not forget to upload your solutions to Moodle!** Questions about exercises should be addressed to the TA personally, through Moodle messages or via email, which can be found on the Moodle page of the course.

### 1. YUV to RGB transformation

```
YuvToRgb = [1 0 1.402 ;  
            1 -0.34413 -0.71414;  
            1 1.772 0 ];
```

- Load the file *yuvdata.mat* to the MATLAB workspace. Note the sizes of the variables and compare them to the given dimensions of the image (`rows*cols`). Is there a difference? Why/why not?
- Reshape the components *yy*, *uu* and *vv* to the given image size (`reshape`), upsampling as necessary (`imresize`). Display the components in a 1x3 subplot to verify the result.
- Center the *U* and *V* components around zero by subtracting 127 (note the data type).
- Flatten and concatenate the components for conversion to RGB:  
`YUV=cat(2,Y(:),U(:),V(:)).`
- Perform the transformation from YUV to RGB with the matrix given above:  
`RGB=YuvToRgb*YUV'.`
- Reshape each component back to the image size and produce the RGB image. Show the result via `imshow`.

### 2. Chrominance subsampling

- Load the RGB image *lena.tiff* and convert it to YCbCr colorspace (use built-in function `rgb2ycbcr`). Display *Y*, *Cb* and *Cr* in a 1x3 subplot.
- Perform subsampling of the chrominance components, following each of the formats described in the lecture material: 4:2:2, 4:1:1, 4:2:0. Separately also perform subsampling on the luminance component, following the format 4:1:1. (Hint: you can use MATLAB indexing with a given step size to avoid for-loops.)
- Upsample the same components back to the original resolution (`imresize`), recombine them and convert the images back to RGB (`ycbcr2rgb`). Show the five RGB images (the original and 4 subsampled ones) together on a subplot. Is there a perceptible difference?
- Calculate the mean squared error values of the subsampled images with respect to the original (`immse`). Does the result support your previous conclusion?