

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

## EXERCISE 10

26.11.2020-27.11.2020

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. Color distances and slicing

Implement 2 MATLAB functions `sliceCube` and `sliceSphere`, which allow the user to choose a color from an image and suppress all the colors that are sufficiently different from the chosen one.

- The functions should take an image  $I$  and a distance  $dist$  as inputs ( $dist \geq 0$ ).
- Use `impixel` to allow the user to choose a color  $C$ . Note that many pixels can be chosen with one call to `impixel`, in which case it will return a matrix instead of an RGB vector. This case can be handled in different ways, e.g. use the first chosen pixel, or the last one, or average the colors.
- Construct a distance-based image mask. `sliceCube` should use Manhattan distance, while `sliceSphere` uses Euclidean distance:

$$C_{mask} = \begin{cases} 1 & \text{where } |I_R - C_R| + |I_G - C_G| + |I_B - C_B| \leq dist \\ 0 & \text{otherwise} \end{cases}$$

$$S_{mask} = \begin{cases} 1 & \text{where } (I_R - C_R)^2 + (I_G - C_G)^2 + (I_B - C_B)^2 \leq dist^2 \\ 0 & \text{otherwise} \end{cases}$$

**NB:** the variable types are of major importance here, as the range of `uint8` cannot fit the squared values from the above expressions. Perform calculations in `double`.

- Use the masks to suppress dissimilar colors. Suppressed regions can be either left black or get assigned a certain color, e.g. gray (127, 127, 127).

Verify the functions on the images *cheetah.jpg* and *chameleon.jpg*. You can try your own images as well.

### 2. Noise and filtering across different colorspaces

- Load the RGB image *lena.tiff* and convert it to HSI color space with the provided function *rgb2hsi.m*. Display every component of both color spaces in a 2x3 subplot (R, G, B, H, S, I).
- Introduce Gaussian noise (`imnoise`) to the green component alone. Create a new copy of the image with noisy green channel (other channels intact) and display it. Convert the copy to HSI colorspace and display all the components in a subplot. Which of them are affected by the noise and which (if any) are not? Explain the reason.
- Repeat step b), but now add Gaussian noise to all three color components. Are there any differences between the results of this step and step b)? Why/why not?
- Try applying arithmetic mean filtering (`imfilter`, `fspecial`) to remove the noise. Which component(s) should be filtered for best results? Which will damage the image further when filtered? Demonstrate your conclusions for both RGB and HSI colorspaces.