# **Exercise 5: Image classification - Part 2**

#### Introduction

In this exercise, we will perform image classification using regions/superpixels as spatial support, and compute the accuracy of the predictions. Please use the Jupyter Notebook provided to complete this exercise.

#### Info

All parts in the code that require your input for completion are marked with flag "#TODO".

#### **Tasks**

## 1 Setup

Open the file ex5.ipynb (available on Moodle) using Jupyter.

## 2 Extract regions and their features

- 2.1 Download the dataset
- 2.2 For each image in the dataset, compute regions and their features using the fuction implemented in the previous exercise

## 3 Create a training dataset

- 3.1 Read the images from the training set and compute the ideal label for each superpixel (the label that has the largest intersection with each region)
- 3.2 Create an array of targets (groud truth), per region, that joins the targets of all the training images
- 3.3 Create an array of features that joins the features of all the training images

#### 4 Normalize features

4.1 Normalize features by substracting the mean and dividing by the standard deviation

#### 5 Train a Random Forest classifier with default parameters

- 5.1 Create a Random Forest classifier, using the library sklearn
- 5.2 Use the function fit to train the classifier with the normalized features and targets

### 6 Predict classification map

- 6.1 Predict the classification map with the current trained classifier (with default parameters)
- 6.2 Compute the accuracy and confusion matrix on the validation set

#### 7 Compute accuracy and the confusion matrix

7.1 On the images of the validation set, compute the accuracy and the confusion matrix

## 8 Search for good parameter values in the validation set

- 8.1 Compute the accuracy in the validation set for several models trained with different values of n\_estimators and max\_depth
- 8.2 Select the parameters that obtain the best accuracy in the validation set

## 9 Predict classification maps with the best parameters found in the validation set

- 9.1 Train a Random Forest model with the parameters that performed best in the validation set
- 9.2 Compute the accuracy and confusion matrix on the test set
  - **Q** Observing the confusion matrix. Which types of errors do you find in the predictions?

## 10 Visualize predictions

- 10.1 Visualize one of the classification predictions saved on disk
- 10.2 Visualize the ground truth label map that corresponds to the classification prediction that you selected to plot