SGN-13006 Introduction to Pattern Recognition and Machine Learning
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Exercise 2

These problems are discussed in exercise sessions on Friday 4.9 and Monday 7.9 Start preparing your solutions before the session. During the exercise session you can consult the teacher, and once finished your work, show your solutions to the teacher to get the exercise points.

1. **Feature extraction** (3 points)

   Here, we extract some features from the small ImageNet RGB-images. Use the script `imagenet_tiny5_process.m` to reach the images and edit it for the needs of this exercise. Although the resolution of the tiny ImageNet images (8x8) is very poor, the number of values describing each RGB image is still fairly high: 8x8x3 = 192. To make the number of values describing each image smaller, we extract color histogram features from them. Write a Matlab-function for this feature extraction so that it can be used similarly for the training images and the evaluation images. The function should return the histogram features from one image as a 1xP `vector`, so that the feature vectors from all the training N images can be stacked as a NxP matrix. Thus the histograms from the 3 color channels are concatenated to form 1 vector. The number of histogram slots for each color channel should be given as an input parameter to the function. You can use the Matlab function `histc` for collecting the histograms.

2. **Nearest neighbour classification** (3 points)

   Write a Matlab function for nearest neighbor classification by your self (function `dist` is very useful in that case), or use the ready made functions `fitcnn, predict` of Matlab to perform nearest neighbour classification with RGB-histogram features. Calculate the accuracy of the classification (NrOfCorrect-Classifications/NrOfSamples) and test with different histogram-parameters.

   • What would be the accuracy of purely random guessing of classes?
   • How does the prior probability (what is it?) affect to the accuracy reached by random guessing?
   • How is the performance of this NN compared to random classification?
   • Does the number of slots in RGB-histogram have big effect?