

Machine Learning 2015: Project 3 - RCC Classification Report

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December 20, 2015

Experimental Protocol

1 Tools

We used **Matlab** for this project, in particular the *Classification Learner* GUI application from **Matlab's Statistics and Machine Learning Toolbox** to train the final classifier and the *extractLBPFeatures* and *regionprops* functions to extract additional features. Additionally we used an implementation of the *Freeman Chain Code* written by *Alessandro Mannini*.

2 Algorithm

We train a SVM with a linear kernel on the normalized features described below. The *KernelScale* parameter is set to *auto* and we use the default *BoxConstraint* of 1. To prevent overfitting we use 10-fold cross validation.

We used the *Classification Learner* GUI application from **Matlab's Statistics and Machine Learning Toolbox** to train the SVM.

3 Features

Based on [2] and [1] we extracted the following sets of features:

- **PHOG**: pyramid histograms of oriented gradients. These were already provided in the competition data.
- **SIG**: histogram of a 1D representation of a 2D boundary; already provided in the competition data.
- **COLOR**: a collection of color features extracted from the image. It contains 32 bin histograms of grayscale values of foreground and background and 32 bin histograms of grayscale, red, green and blue channels of the whole image.

- **FCC**: freeman chain code of the nucleus border. We used the *chaincode* function written by *Alessandro Mannini*.
- **LBP**: local binary pattern features where extracted with the *extractLBPFeatures* provided by **Matlab**. We used a cell size of 32×32 .
- **PROPS**: additional shape information provided by **Matlab's** *regionprops* function. We used: *Area*, *MajorAxisLength*, *MinorAxisLength*, *Eccentricity*, *EquivDiameter*, *Solidity*, *Extent*, *MeanIntensity*, *MinIntensity* and *MaxIntensity*.

For our final results the **LBP** features were omitted since they lead to worse classification results.

References

- [1] Umberto Castellani Peter Schüffler, Aydin Ulas and Vittorio Murino. A multiple kernel learning algorithm for cell nucleus classification of renal cell carcinoma. In *ICIAP 2011*, 2011.
- [2] Peter J. Schüffler, Thomas J. Fuchs, Cheng Soon Ong, Volker Roth, and Joachim M. Buhmann. Computational tma analysis and cell nucleus classification of renal cell carcinoma. In *Pattern Recognition*, pages 202–211. Springer, 2010.