Statistical methods for segmentation and classification of images

The central matter of the present thesis is Bayesian statistical inference applied to classification of images. An initial review of Markov Random Fields relates to the modeling aspect of the indicated main subject. In that connection, emphasis is put on the relatively unknown sub-class of Pickard Random Fields (PRF’s). The properties of this type of random fields are given a specially thorough treatment, including an investigation of a previously unresolved general parameterization issue. Novel insight into the parameterization of discrete versions of these fields is presented. A visual evaluation of the properties of Pickard Random Fields has been enabled by simulations of both continuous and discrete fields. Simulations of a compared Potts model from the traditional MRF theory are also given. Variations of the surveyed Markov Random Fields are used as prior and observation models, respectively, in some presented Bayesian classification techniques. The applied techniques implement either the traditional MAP criterion or the MPM criterion, both from Bayesian decision theory. The latter criterion have previously been shown to have a fast approximate solution when used in combination with a Pickard Random Field modeling of a considered (categorical) image phenomenon. An extension of the fast PRF based classification technique is presented. The modification introduces auto-correlation into the model of an involved noise process, which previously has been assumed independent. The suitability of the extended model is documented by tests on controlled image data containing auto-correlated noise.