# MINIMAL STOCHASTIC COMPLEXITY IMAGE PARTITIONING WITH NON PARAMETRIC STATISTICAL MODEL

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**Abstract**

Image partitioning is an important topic in computer vision and image processing and has numerous applications such as medical or military. The sensors used to obtain these images can thus be of various types and can lead to images corrupted with different noise model. It is therefore important to take into account the physical nature of the images in statistical techniques for image segmentation.

Statistical image segmentation techniques have been extensively studied since the work of Geman and Geman. In particular, Markov Random Fields (MRF) models provide an efficient regularization method but introduce parameters that cannot be easily determined automatically and which can lead to difficult optimization problems. Variational methods for image segmentation have been recently studied but lead to the same limitations as MRF approaches since parameters that cannot be easily determined automatically are present in the criterion to optimize.

The Stochastic Complexity (SC) minimization principle, introduced by Rissanen in 1978 has been early used to address the issue of order model selection. Based on information theory, this principle allows one to estimate the number of needed parameters for parametric description of observed data. This approach consists in minimizing a joint entropy which corresponds to the sum of the number of bits needed to describe the data and the number of bits needed to describe the model.

We propose a general image partitioning method based on a statistical active grid [1]. This technique allows us to estimate the probability density functions (pdf) of the grey levels of the image with step functions. It allows us to take into account the physical origin of the fluctuations of the grey levels without making hypotheses on the pdf family which describes at best the fluctuations. We demonstrate that the partitioning can be obtained by minimizing a criterion without parameter to be tuned by the user and that corresponds to a non parametric statistical approach.

References:

[1] F. Galland *et al.*, "Minimum description length synthetic aperture radar image segmentation," *IEEE IP*, vol. 12, no. 9, pp. 995–1006, 2003.

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