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Image segmentation by polygonal Markov fields

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Abstract This paper advocates the use of multi-coloured polygonal Markov fields for model-based image segmentation. The formal construction of consistent multi-coloured polygonal Markov fields by Arak–Clifford–Surgailis and its dynamic representation are specialised and adapted to our context. We then formulate image segmentation as a statistical estimation problem for a Gibbsian modification of an underlying polygonal Markov field, and discuss the choice of Hamiltonian. Monte Carlo techniques, including novel Gibbs updates for the Arak model, to estimate the model parameters and find an optimal partition of the image are developed. The approach is applied to image data, the first published application of polygonal Markov fields to segmentation problems in the mathematical literature.

Keywords Arak process · Dynamic representation · Image segmentation · Gibbsian modification · Gibbs sampler · L_p misclassification rate · Multi-coloured polygonal Markov field