



A.D. MCCXXIV

## Review report for the PhD Thesis of Mgr. Stanislav Mikeš, entitled "Image Segmentation".

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In this thesis there are several novel scientific results which are of interest for the research community. The proposed texture segmentation algorithms, which are based on GMRF and autoregressive models, and particularly their multiresolution versions, are rather appealing due to the closed mathematical formulation for the parameter estimation. Furthermore there are not so many techniques that address the cluster validation problem jointly with the segmentation itself as actually the proposed methods do. On the other hand, it is particularly noticeable the benchmarking system that has been developed. The Prague benchmark, in fact, is quite different from the other (few) existing systems publicly available, like for instance the Berkeley's one. First of all, it is a region oriented benchmark while the Berkeley's is contour based, hence not suited for region-based segmentation. Furthermore the Prague benchmark has exact references for the evaluation (exact ground truth), while other systems provide only approximate references. Finally as additional unique feature, the Prague benchmark can count on the possibility to test the segmenter robustness with respect to noise.

The above mentioned contributes, and in particular for what concern the benchmarking, are certainly useful to the community. In the frame of image segmentation, the evaluation problem is a critical problem which is far from being addressed. It is widely accepted that for segmentation any accuracy indicator cannot be objective. There are in fact plenty of indicators that often disagree with each other. Therefore it remains open the problem of making somehow order in this jungle of accuracy indicators for segmentation. The merit of the Prague benchmark developers, in this regard, is their effort to make it complete including all possible indicators. All these indicators are also classified for typology and singularly described.

There are many areas where image segmentation, hence the proposed algorithm as well, can be applied. Apart from the remote sensing, medical imaging, cultural heritage and virtual reality, all domains where the proposed solutions have been tested, other possible areas of interest could be also security, image coding, image restoration, just to mention a few.

The overall organization of the thesis can be considered quite good. The content flow is, in fact, quite linear and modular. So the several contributes are easily accessible and sufficiently clearly exposed, with just some uncertainty on English, and in a few cases with missing citations which could have help more the reader. As expected, since one of the output is the benchmark itself, the validation of the proposed techniques has been carried out extensively and rigorously.

Eventually, the thesis demonstrates the capability of the candidate to approach a scientific problem in a systematic and rigorous way, methodologically correct, providing original solutions.

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