# Cartoon Extraction by Improving a TV-$\ell^2$-Regularization Algorithm

Robin Richter
Institute for Mathematical Stochastics, University of Göttingen
robin.richter@mathematik.uni-goettingen.de

Removing texture from an image while preserving sharp edges, to obtain a so-called *cartoon*, is a challenging task in image processing, especially since the term *texture* is mathematically not well defined. In the last years this problem has been approached from various perspectives including variational calculus, wavelet analysis and image diffusion. While in specific scenarios these approaches overlap, each have their strengths and weaknesses. We take advantage of two approaches by inserting a specific wavelet into the updating step of a TV-$\ell^2$-regularization algorithm.

The ROF, or $TV$-$\ell^2$ model of [1] minimizes a functional comprising a $TV$-norm regularization term and a $\ell^2$-norm data fidelity term. It aims at denoising piecewise-constant or -linear images but has considerable drawbacks consisting in a loss of contrast and the occurrence of a stair-casing effect.
By analysing a more recent, iterative algorithm that approximates the ROF model solution given by Wu and Tai in [3], we find that the updating step is a point-wise multiplication with kernel functions. Since these kernels allow for an interpretation as a low-pass and several high-pass filters, we propose, guided by analogy to harmonic analysis, to exchange them with scaling/wavelet kernels. Employing a particular set of wavelets first developed by van de Ville et al. in [2] that mimic the kernels arising from the ROF model, but have better decay properties, leads to good practical results, see Fig. 1.

(a) (b) (c)

Figure 1: Original Barbara image (a), cartoon by the ROF model (b) and by the proposed model (c).

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## References

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