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Feature-preserving higher-order geometric evolution problems in image processing.

Recently Tumblin and Turk have devised a fourth order image restoration technique, that includes a coefficient which depends on second derivatives of the image and successfully applied it to real images for contrast enhancement. Bertozzi and Greer have analyzed this in more detail. For image segmentation with active contours, we introduce a curvature-dependent, geometrically intrinsic regularization scheme.

By inducing a local weight, which intrinsically depends on the curve itself one can allow the curve to adjust itself automatically to sharp corners without losing its regularizing properties.

We consider two related different approaches to this problem. Similarly to the LCIS model the problem can be formulated as a gradient flow of a Huber functional depending on the curvature, which switches smoothly from a $L2$ energy near the origin to a $L1$ energy for values. The corresponding gradient flow is similar in nature to the Willmore flow. Another viewpoint that we would like to contrast to the first is the gradient flow of length w.r.t. to a H^{-1} metric that includes a curvature-dependent weight. This flow is very similar to surface diffusion flow, which in fact has many desirable properties for the regularization of active contours. (Received February 27, 2006)