Digital Curvature Flow

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IHP Winter School: The Mathematics of Imaging.

January 7, 2019

Perimeter

Perimeter

Curvature

Perimeter Curvature Tangent

Perimeter Curvature

Tangent

Perimeter

Denoising

Curvature

Tangent

Perimeter Curvature

Tangent

Denoising Segmentation

Perimeter Curvature Tangent

Denoising Segmentation Stereo



Curvature

Tangent

Denoising

Segmentation

Stereo

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[El-Zehiry, 2010]



Data term



[El-Zehiry, 2010]



Data + Perimeter term



[El-Zehiry, 2010]



Data + Curvature term



[El-Zehiry, 2010]

Curvature discretizations are not suited for digital data

Curvature discretizations are not suited for digital data



[Roussillon, 2011]

Curvature discretizations are not suited for digital data



[Roussillon, 2011]

Curvature discretizations are not suited for digital data



[Roussillon, 2011]

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Multigrid convergent estimators

Multigrid convergent estimators



[Coeurjolly, 2013]

Multigrid convergent estimators



[Coeurjolly, 2013]

$$\hat{\kappa}_{R,h}(x_i) = rac{3}{R^3} \Big(rac{\pi R^2}{2} - \widehat{Area}(B_{R,h}(x_i) \cap D_h) \Big)$$

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Shape Evolution

Shape Evolution



Shape Evolution



































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Multigrid convergent estimator and optimization framework;

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Evolution model regularizes with respect to curvature.

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Evolution model regularizes with respect to curvature.

Drawbacks

Multigrid convergent estimator and optimization framework;

Evolution model regularizes with respect to curvature.

Drawbacks

Too local. The model is uncapable to complete regions.

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Thank you for your attention!

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References

[EI-Zehiry, 2010] N. Y. El-Zehiry and L. Grady. Fast global optimization of curvature.

[Roussilon, 2011] T. Roussillon and J.-O. Lachaud. Accurate curvature estimation along digital contours with maximal digital circular arcs.

[Coeurjolly, 2013] D. Coeurjolly, J.-O. Lachaud, and J. Levallois. Integral based curvature estimators in digital geometry.