Image Abstraction by Structure Adaptive Filtering

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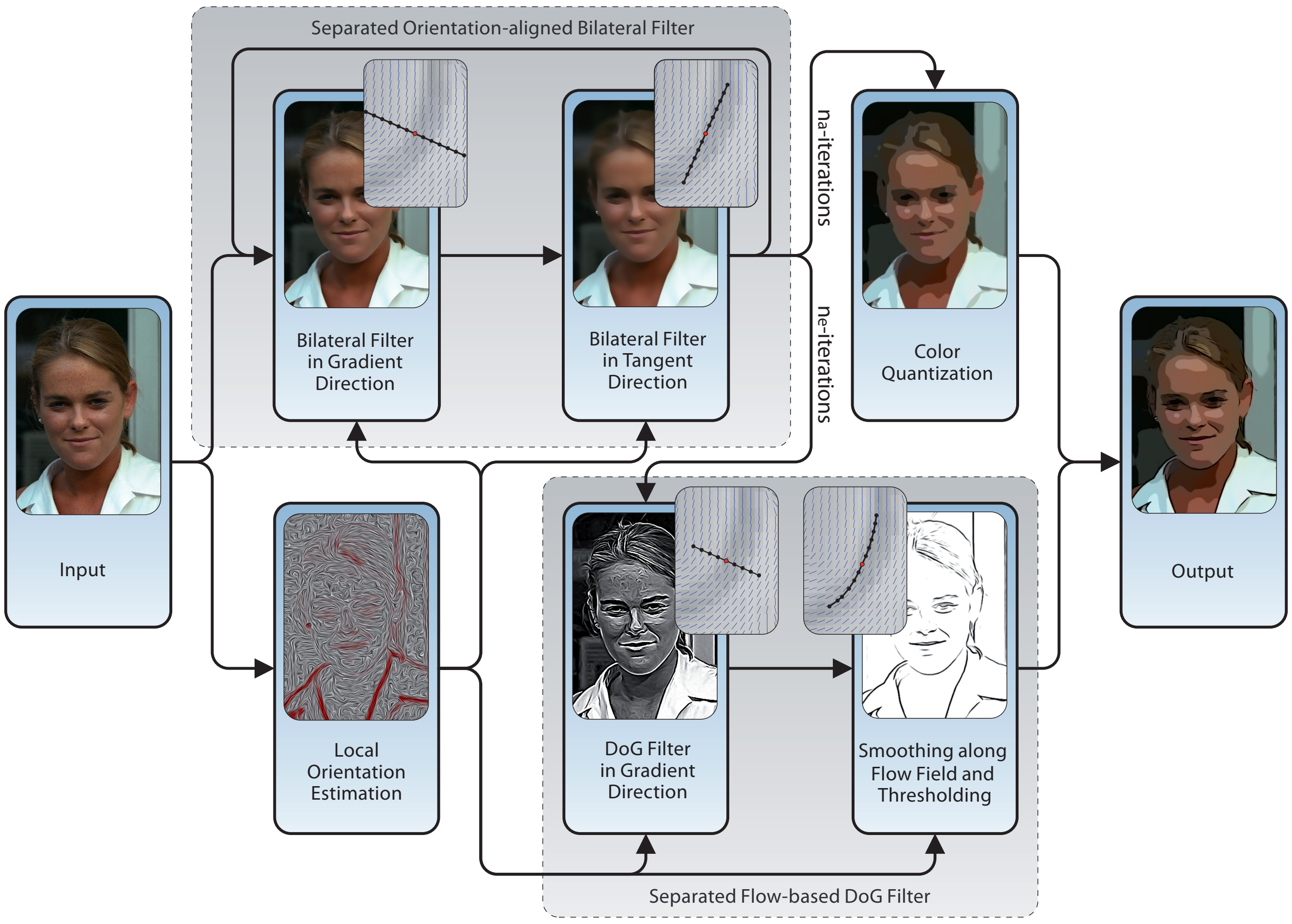

Overview

Photorealistic visualizations used in 3D applications designed for typical desktops usually show high visual information density. In [Kyprianidis and Döllner 2008] we present non-photorealistic image processing techniques to distill the perceptually important information and optimize the content for the limited screen space of small displays. Our method extends the approach of [Winnemöller et al. 2006] to use iterated bilateral filtering for abstraction and difference-of-Gaussians (DoG) for edge extraction by adapting it to the local orientation of the input.

To represent local orientation we construct a smooth tensor field. From the eigenvectors of this tensor field we derive a vector field that has similar characteristics as the edge tangent flow (ETF) of [Kang et al. 2007], but its computation is much less expensive. Besides gradient calculation, only smoothing with a box or Gaussian filter is necessary. In contrast to that, ETF construction requires several iterations of a nonlinear filter with large filter kernel.

The xy-separated bilateral filter [Pham and van Vliet 2005] used by Winnemöller et al. suffers from horizontal and vertical artifacts. These artifacts appear in particular when the filter is applied iteratively. Our approach works by first filtering in direction of the gradient and then filtering the intermediate result in perpendicular direction. When applied iteratively our approach does not suffer from horizontal or vertical artifacts and creates smooth output at curved boundaries.

DoG edges often look frayed and don't reassemble straight line and curve segments very well. To work around this limitation, [Kang et al. 2007] recently introduced the concept of flow-based difference-of-Gaussians which, compared to DoG edges, create more coherent lines. They replaced the DoG filter by a flow-guided anisotropic kernel whose shape is defined by the ETF. Comparable high-quality results can be achieved by a separated implementation with corresponding reduced computational complexity. We first apply a one-dimensional difference-of-Gaussian filter in direction of the gradient and then apply smoothing along the vector field that we derive from the smoothed structure tensor.

References

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