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► **To cite this version:**

Alexandrina Orzan, Adrien Bousseau, Pascal Barla, Joëlle Thollot. Multi-scale shape manipulations of photographs. The 34th International Conference and Exhibition on Computer Graphics and Interactive Techniques: SIGGRAPH, Aug 2007, San Diego, United States. inria-00526632

**HAL Id: inria-00526632**

**<https://inria.hal.science/inria-00526632>**

Submitted on 20 Oct 2010

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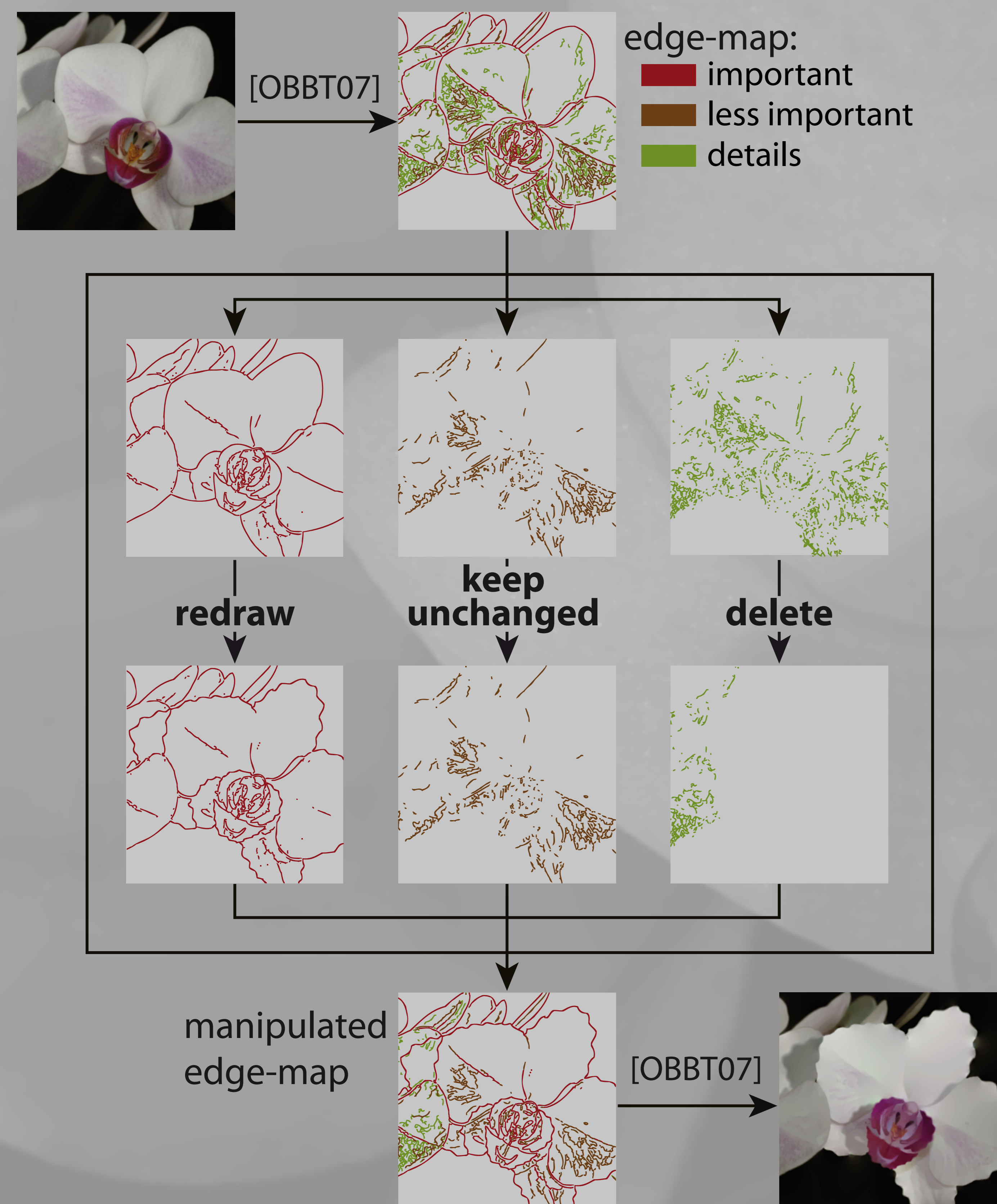
# Multi-scale Shape Manipulation of Photographs

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## Goal

Manipulate the shape of objects in photographs, while still preserving their original visual aspect.

## Our Approach



## Contributions

- A hierarchy of edges extracted from the image, where each level can be edited separately.
- A tool for shape manipulation based on this hierarchy.

We use the Gaussian Scale Space theory to analyze the input image. The result is a hierarchical edge-map, where additional information is attached to each edge: its importance, its gradient direction and magnitude, and its blur. This method was described in our NPAR07 paper [OBBT07].

The user can easily edit the augmented edge map. She can select and group levels from the hierarchical edge map according to their importance. For each selected group, she can either **remove** some edges or **redraw** them.

The redrawn edges update their gradient direction, but they recover the gradient magnitude and blur information from the original edges. To do this, we match manipulated and original edges by using a **distance field**.

All modified edge groups combined together form the manipulated edge-map, which is the output of the 2nd step. Contrary to the previous method by Elder et al. [EG01], we can delete edges at separate levels; moreover, we can also modify their shape.

We finally reconstruct a new image out of the manipulated edge-map. To this end, we solve a Poisson equation using the attached gradient and blur information, as described in [OBBT07].

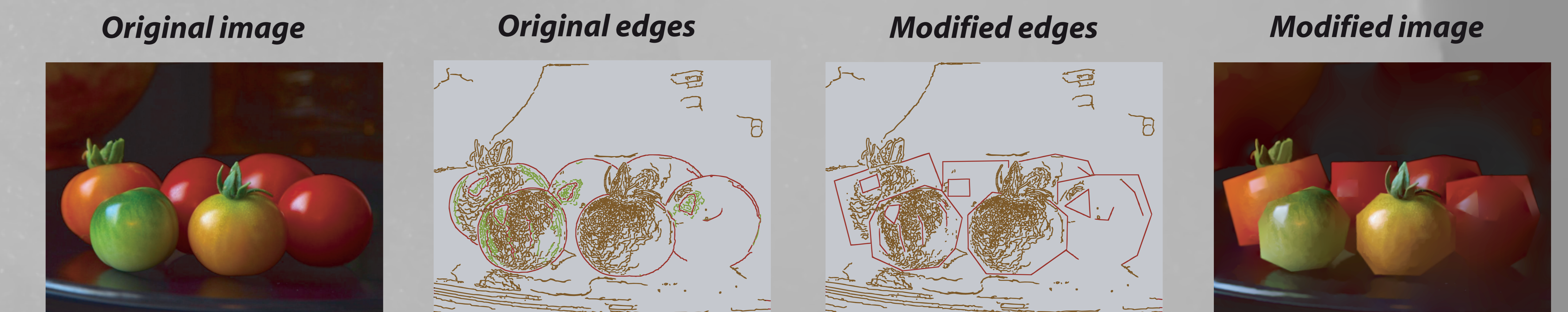
## Future Work

- Create a richer manipulation tool.
- Improve the correspondence between original and redrawn edges.
- Improve the reconstruction from manipulated edges.

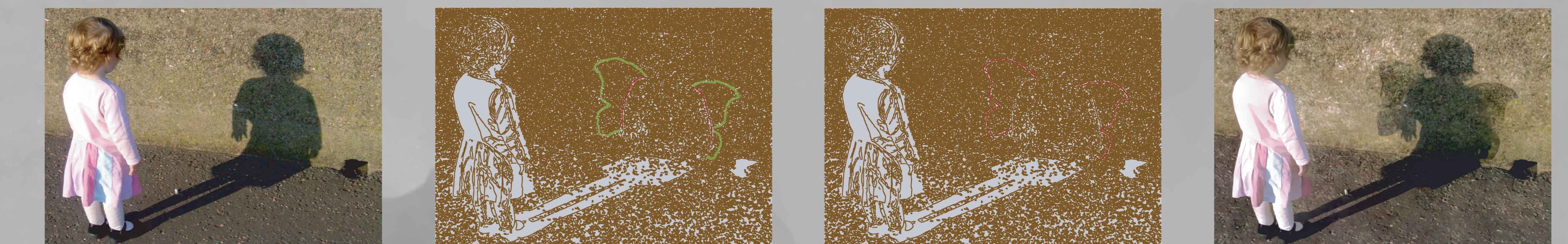
## References

- [OBBT07] Orzan, A., Bousseau, A., Barla, P., and Thollot, J. 2007. Structure-preserving Manipulation of Photographs. *NPAR*
- [EG01] Elder, J.H and Goldberg, R.M. 2001. Image Editing in the Contour Domain. *PAMI* 23, 3, 291-296

## Results



**Tomatoes:** each fruit shape is modified by removing some "texture" lines, and redrawing the tomato contour as well as its highlight in a rectilinear way that gives the modified image a somewhat cubist style.



**Girl's shadow:** fairy wings are added to the little girl's shadow by simply drawing them on the wall and removing edges around the arms of the silhouette. Note how the wall texture is seamlessly integrated in the shadow region thanks to our Poisson-based approach.



**Building:** some windows of the left facade are either removed or their shape is slightly modified (their frame is rounded). The resulting modified image successfully reproduces the overall appearance of the building.

## Contact

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