

## Cover letter

Paper 0084: Layered Analysis of Irregular Facades via Symmetry Maximization

Dear reviewers:

This paper was previously submitted to SIGGRAPH Asia 2012 (paper ID: 0298) under the title: *Generative History of Irregular Facades via Symmetry Breaking*.

The reviewers from the last round all recognized the novelty of the problem and the “intriguing” and “inspiring” ideas that the paper contains. However, issues were raised on algorithm initialization, evaluation of results, details about the applications, and clarify of presentation.

In addition to addressing these issues, we have repositioned the paper in terms of its contributions and significantly improved the technical aspects of the paper.

The major changes and improvements include:

- We now emphasize that the key contribution of our paper is the *layered* and *hierarchical* analysis of *irregular* façade structures. This is reflected in the new title, abstraction, and introduction.
- We are deemphasizing “generative history”. We recognize the inherent ambiguity in the term --- it is difficult for an expert in architecture, let alone casual users, to understand what it means (reviewer comment) or to evaluate it.
- We have strengthened the importance of perceptual principles in motivating our symmetry-driven approach; see Section 1.
- The key technical contribution is formulating and solving the analysis problem as *symmetry maximization*. Compared to our last submission, we now have a clearly defined objective function (equation (1) and (5) in the paper) for the optimization: to maximize the sum of symmetry of the substructures obtained during the hierarchical decomposition.
- We have changed the previous greedy optimization scheme to one based on genetic programming, which leads to improved results; see Section 6.
- We have reworked the candidate selection scheme, especially for layering, which allows a large set of layering candidates to be considered. This enriches the solution space and leads to improved results; see Section 3.3.
- We have developed an interactive tool to extract the initial set of boxes and element groups semi-automatically. Please see demonstration in the accompanying video. Our experiments did confirm that results from existing

automatic schemes on irregular facades are less than satisfactory. The tool allows us to analyze a richer set of structures than before.

- The introduction and technical sections are almost entirely re-written to improve clarity: important terms are all defined, e.g., grid = regular rectangular grid, atomic element, element group, etc.; more technical details are provided.
- In terms of applications and results (please see updated video for demonstrations):
  - We have expanded the test dataset from 170 façade images to 600. For example, the retrieval tests and façade exploration are both applied to the full dataset.
  - We added façade retargeting (reviewer suggestion).
  - Structural retrieval results are improved with a new tree-to-tree distance.
  - Editing and retargeting results with image content are now shown in real time thanks to improved autonomy of the instantiation process.
- In terms of evaluation, we added additional comparative study and comparison to baseline approaches (reviewer suggestion):
  - Retrieval results are now compared with two state-of-the-art approaches on appearance-based facade retrieval. We could not find an existing competing structure-based façade retrieval algorithm.
  - We added evaluation of our symmetry-driven structural decomposition using a user study.
  - The approach is compared with two baseline methods: one based on maximizing partial reflectional symmetry [Podolak et al. 2006, Simari et al. 2006], and one based on graph cut segmentation.

Thank you,

The authors.