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# Surfel Based Geometry Reconstruction

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## Problem:

In data acquired by scanning (Fig 1), sampled points are almost never on the discontinuities, which aggravates reconstruction of sharp features.

## Solution:

- Represent the scanned surface as the collection of small planar patches, surfels, associated with each data point.
- Define a MRF-based prior on the set of surfels, optimize, and retrieve the surface.

## Surfel representation:

- Corresponds well to the data creation process.
- Sidesteps the problem of dealing with triangulation, which is often arbitrary.

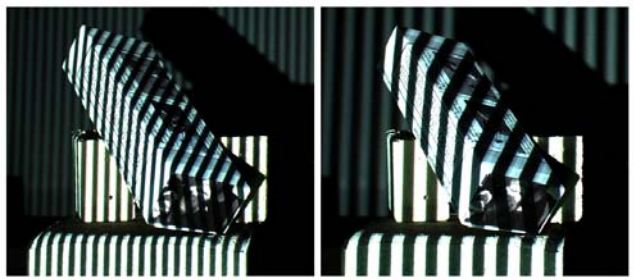

**Figure 1:** A set of photographs used for obtaining a structured-light scan of a cardboard box.

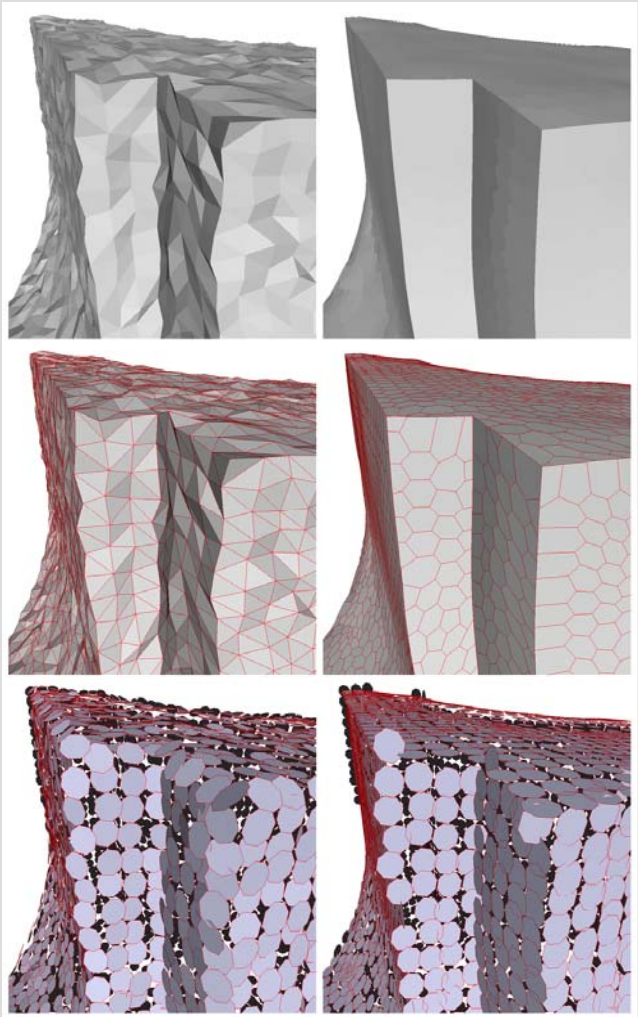

**Figure 2:** A reconstruction of a model corrupted by the Gaussian noise. Two renderings of the input mesh and the initial surfel configuration on the left. On the right the corresponding views on the reconstructed surface and the optimized surfel configuration.

## Method:

- Associate a planar patch (a surfel) to each vertex or a point (Fig.2).
- Formulate an interaction for a pair of neighboring surfels based on:
  - parallelism (depends on surfel orientations),
  - overlap (depends on a local distance between surfels).
- Maximize parallelism and overlap in a piecewise-smooth fashion.
- Retrieve the surface as a dual mesh, by estimating the intersections of surfels.

## Results:

Using the surfel representation we can recover the sharp features from the noisy scans with great accuracy (Fig 3).

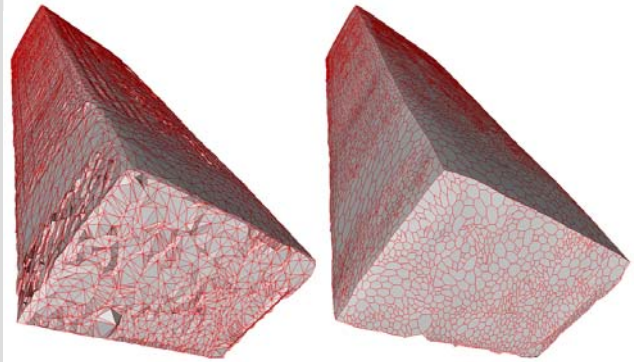

**Figure 3:** A reconstruction of the object in Fig.1.