Overview

Problem
What is the best pixel subset to consider during template-based tracking?

Solution
- Considering the subset verifying the assumption of linearity of the pixel intensity with respect to the motion parameters (made during the derivation of the tracking algorithm) improves the tracking performances [Matas et al., ICGVIP 2006].
- However, the search for the optimal subset results in a combinatorial explosion when the templates are large.
- We propose a simple algorithm that efficiently extracts linear or quadratic subsets in large templates. These subsets are able to cope with high inter-frame motions.

Results
1. Reducing the number of pixels considered improves the efficiency of the tracking algorithm.
2. The algorithm provides very reliable subsets: with less than 30% of the template, it is possible to double the convergence frequency for high inter-frame motions.

Extraction Algorithm

Basic Ideas
- A linear subset converges in one iteration using the IC algorithm.
- A quadratic subset converges in one iteration using the ESM algorithm.
- Both linear and quadratic subsets are stable under the union operation.

Proposed Algorithm

- Considering the subset verifying the assumption of linearity of the pixel intensity with respect to the motion parameters (made during the derivation of the tracking algorithm) improves the tracking performances [Matas et al., ICGVIP 2006].
- However, the search for the optimal subset results in a combinatorial explosion when the templates are large.
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Convergence Frequency

First row: results obtained with the IC algorithm; second row: results obtained with the ESM algorithm; left column: without noise; right column: in the presence of noise.

Real-time Template-based Tracking

- Quadratic subsets extraction
- Pixel number reduction to 30 %
- Processing time around 30s

The book is tracked correctly despite partial occlusions, changes in scale, and oblique viewing angles. The teapot is stable, showing that the pose is estimated accurately.