

Mobile Augmented Reality based 3D Snapshots

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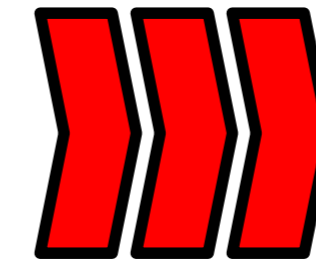
John Collomosse, Yi-Zhe Song
University of Bath



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3D Reconstruction



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3D Snapshotting

Challenges:

- Triangulation of complex surface structures
- Reduction of complexity for real-time rendering on mobile phones

Workflow: Automatic 3D reconstruction from multiple photographs

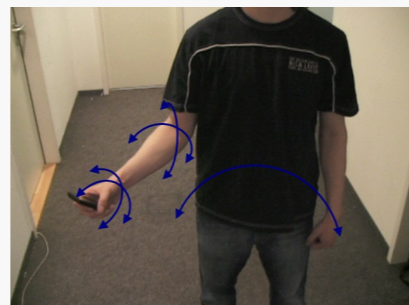
- Step 1: SIFT feature detection
- Step 2: Fundamental matrix estimation via MAPsac
- Step 3: Addition of more features to obtain dense point cloud
- Step 4: Construct mesh via Delauney triangulation
- Step 5: Use patches of original photographs as textures
- Step 6: Simplify mesh via graph cut

Mobile AR Viewer

Tracking

Challenges:

- Restricted field-of-view for typical phone lenses
- Rapid movements and arbitrary viewpoints



Approach:

- Optical square-markers model anchors in the scene
- Additional pixel flow algorithm to extend viewable area
 - Compute rot. axis and angular velocity from marker pose
 - Provide camera rotation when marker becomes invisible
- Exponential smoothing filter to reduce jitter

User Interface

Challenges:

- Placement of virtual objects in scene
- Support for common operations: translate, lift, rotate, scale
- Single-handed interaction
- Integration of touch display

Flexible interaction concepts:

- Classic: Touch display / button toolbar
- Flow-based: Easy object placement using phone movements

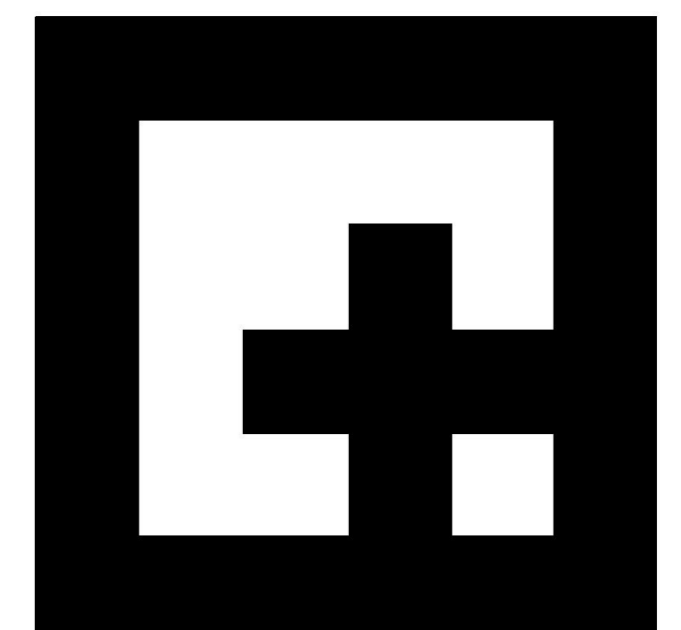
User Study and Results

A user study was performed with 8 test subjects.

Task: Place and inspect virtual objects in domestic environment!

Results:

- Described solution runs smoothly at ~10 FPS (~75 % load for rendering with 1125 triangles)
- Optical square-marker tracking alone is not robust enough
 - need to keep marker always in field of view
 - Loss of pose during fast movements
- The combination of square markers (as anchors) with the pixel flow tracking algorithm highly increases user satisfaction.
- Drift from pixel-flow algorithm is not considered as disturbance, unlike loss of tracking
- Lag from exponential smoothing filter is more acceptable than jitter



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