

TextureFusion

High-quality Texture Acquisition for Real-time RGB-D Scanning

CVPR 2020 Oral

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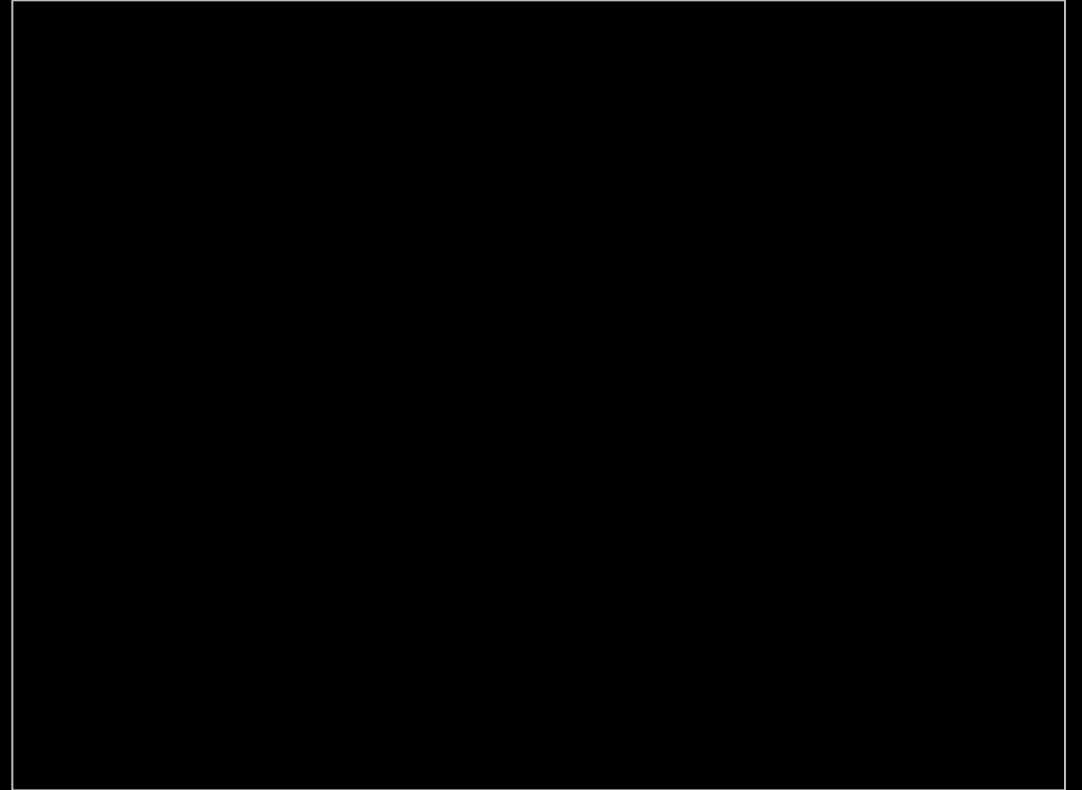
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High-quality texture acquisition for real-time RGB-D scanning



Voxel representation

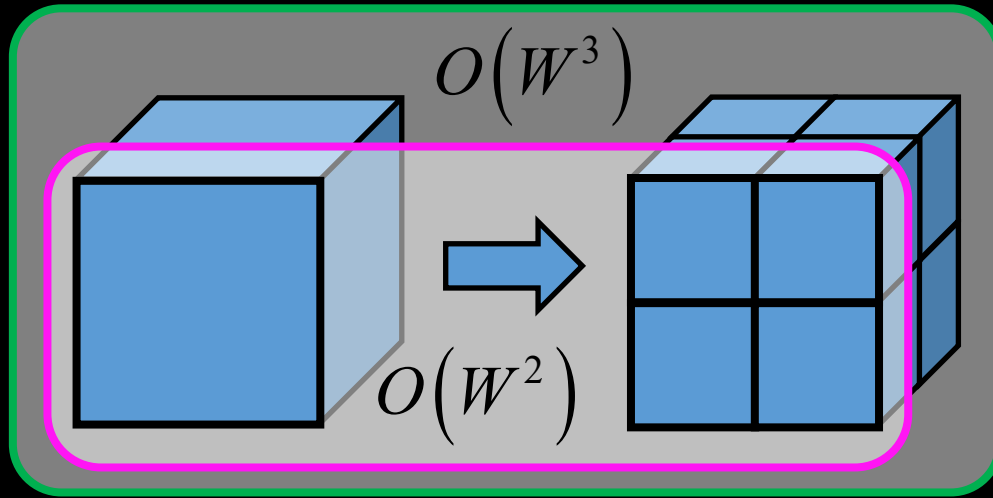


TextureFusion (ours)

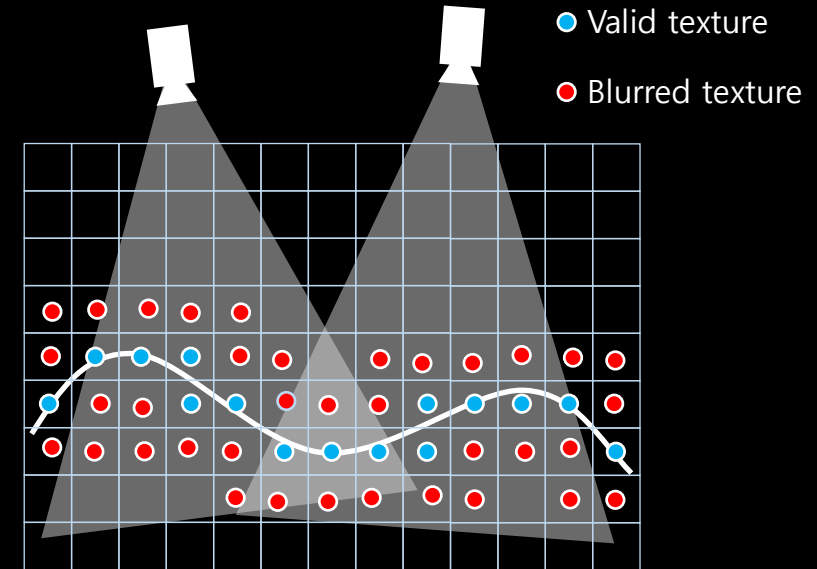
Per-voxel color representation



Color per voxel*



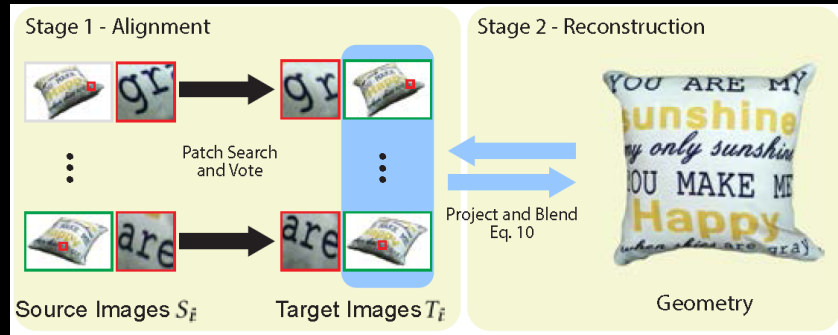
**Higher resolution
→ lower performance**



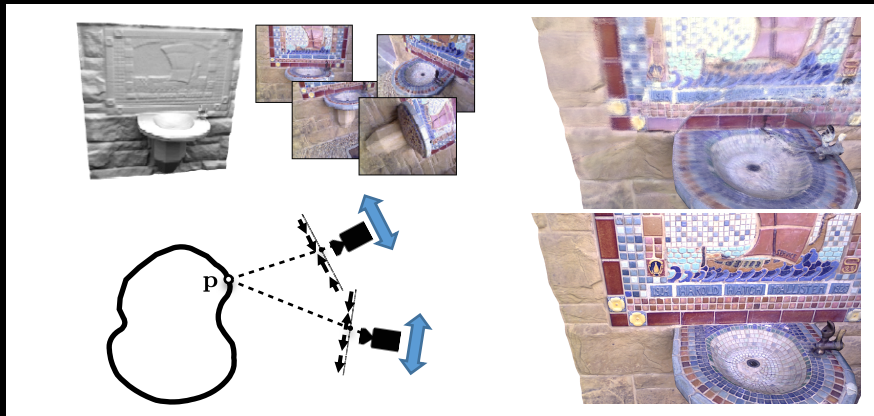
Blurriness of texture

*: Figure from Oechsle, Michael, et al. "Texture fields: Learning texture representations in function space." *Proceedings of the IEEE International Conference on Computer Vision*. 2019.

Traditional texture mapping



Patchmatch based optimization
[Bi et al. 2017]



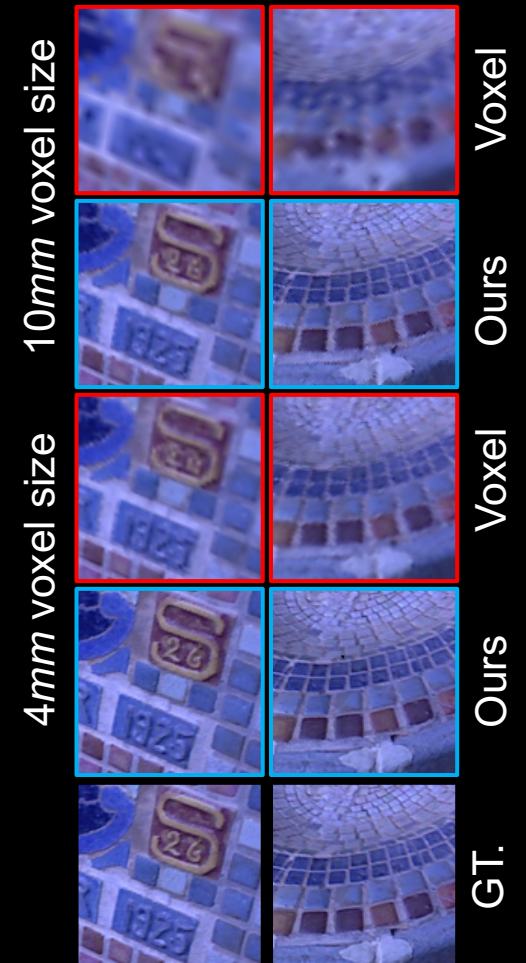
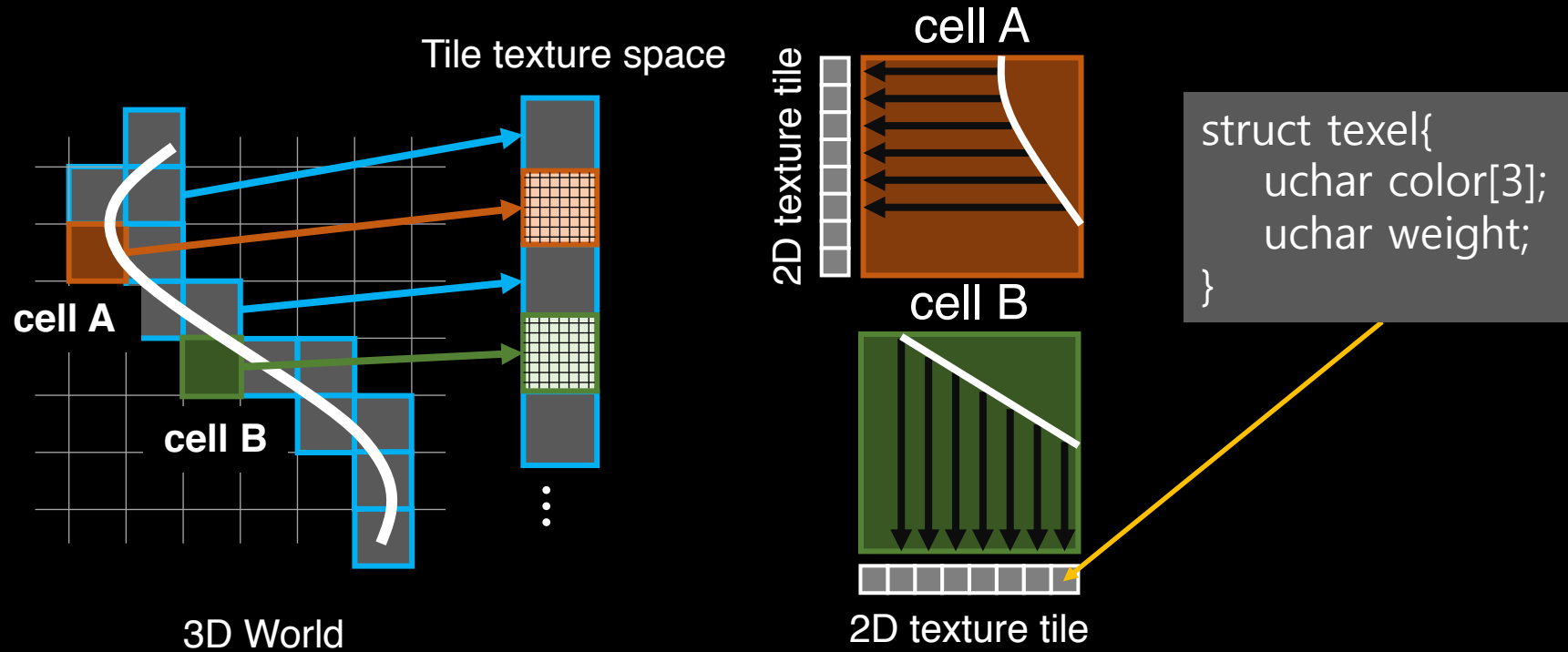
Color optimization
[Zhou and Koltun 2014]

- Two-fold reconstruction process
- Global optimization of multiple views
- **Real-time computation impossible!**

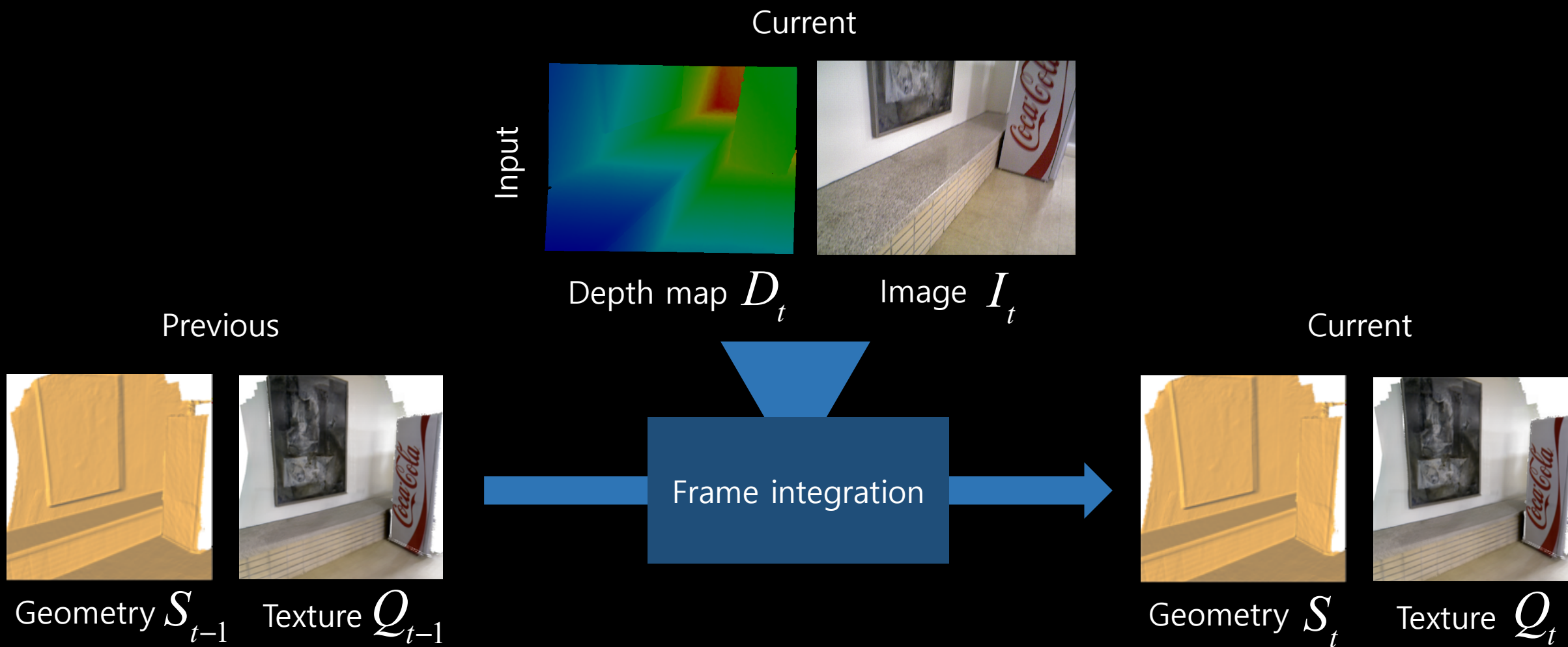
Key insight

- Keep 2D topology of texture without meshing in **REAL-TIME!**

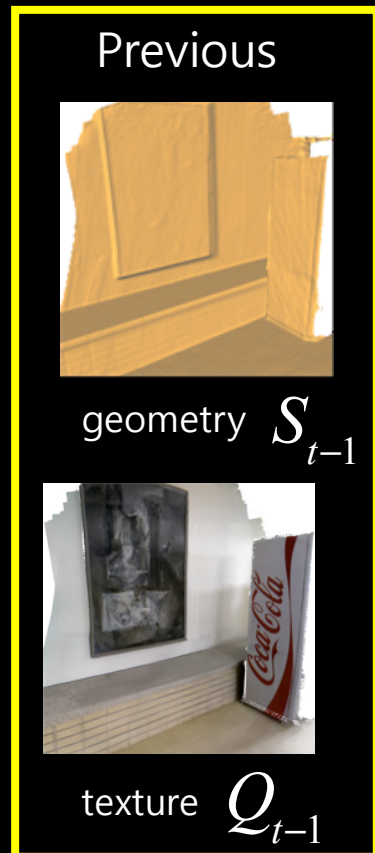
Tile-based texture data structure



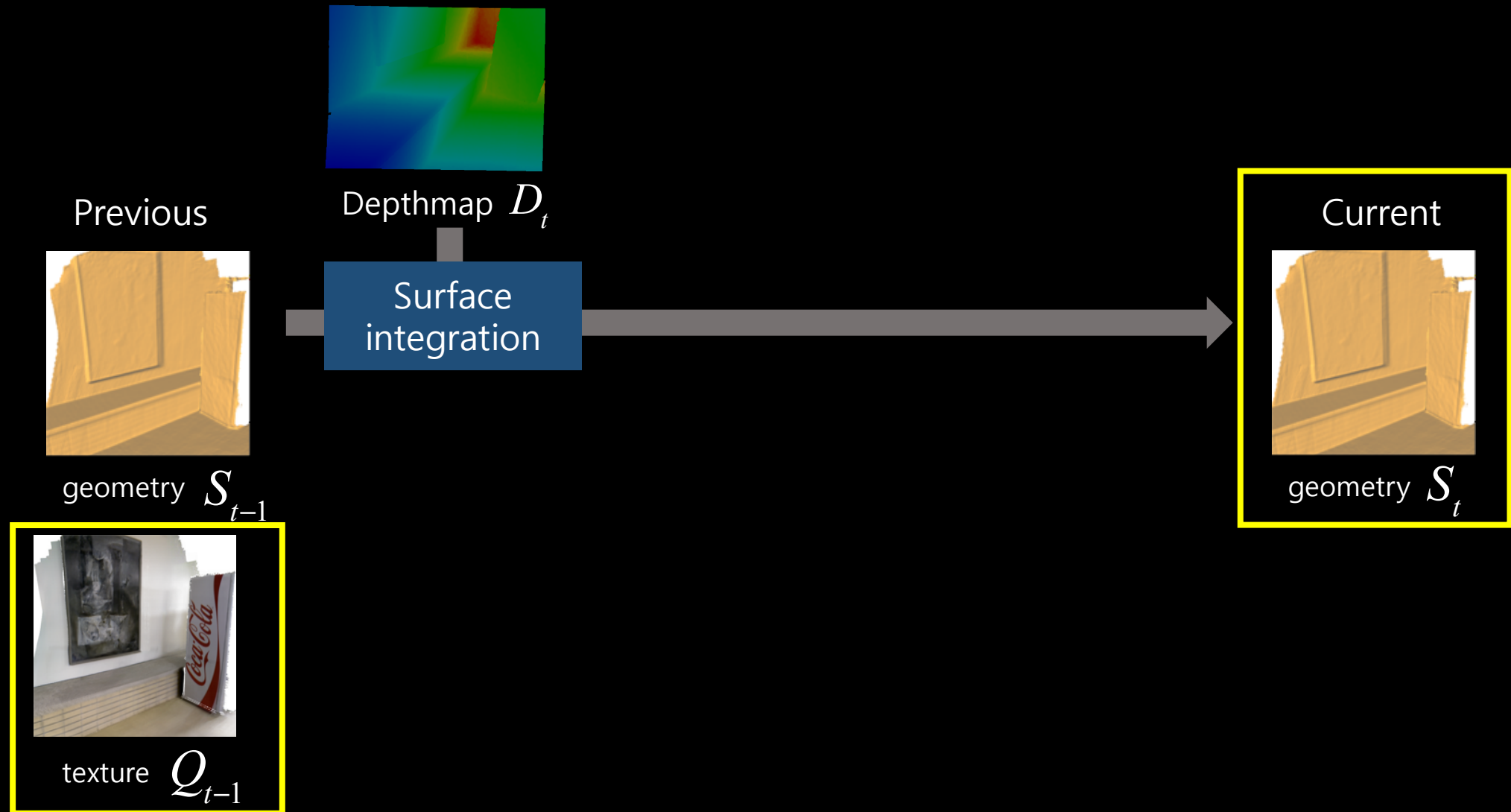
Real-time texture integration framework



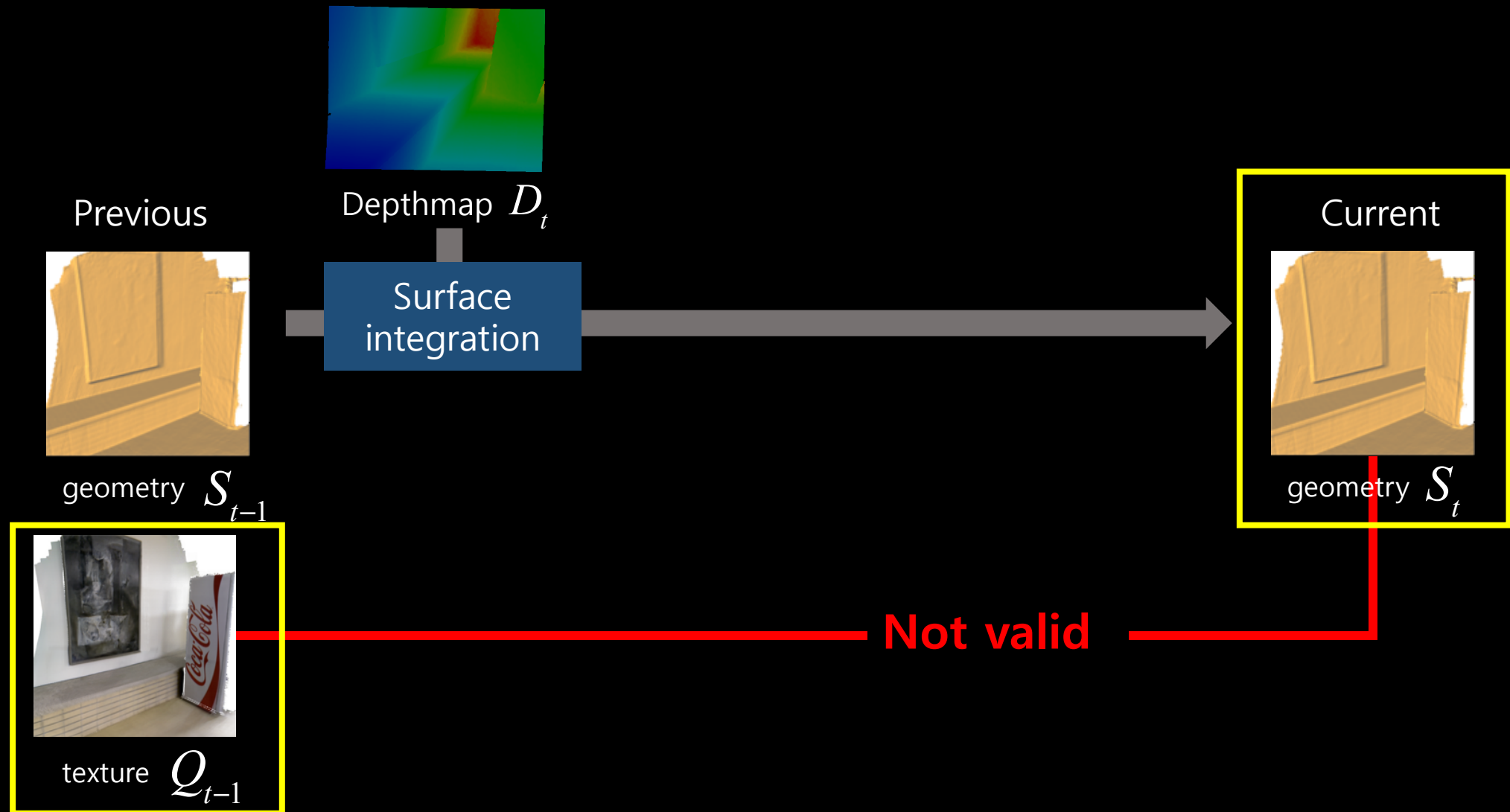
Real-time texture integration framework



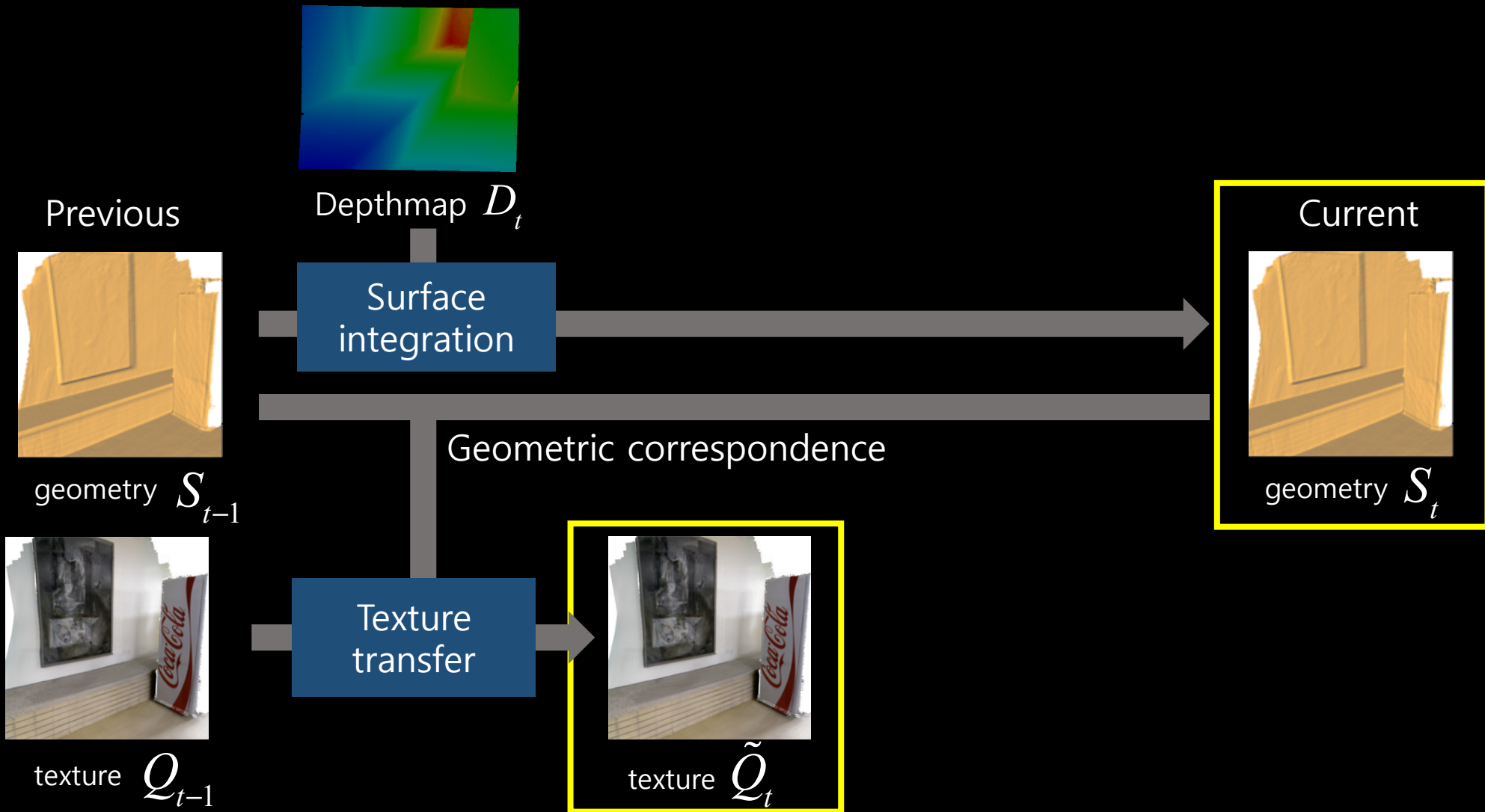
Real-time texture integration framework



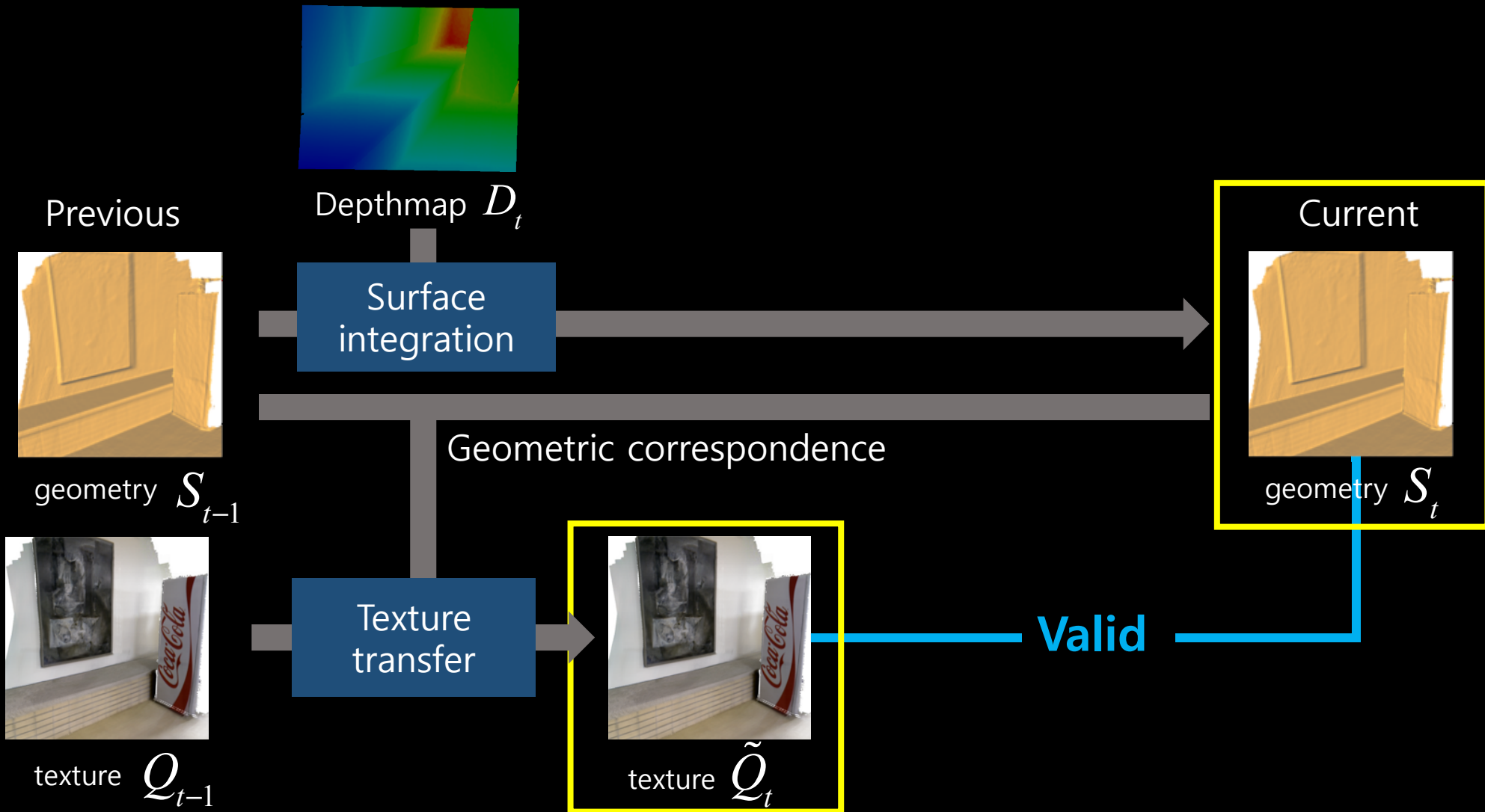
Real-time texture integration framework



Real-time texture integration framework



Real-time texture integration framework



Texture-image misalignment

- Camera pose estimation using the geometric information
- Not guarantee the photometric consistency of the integrated texture map

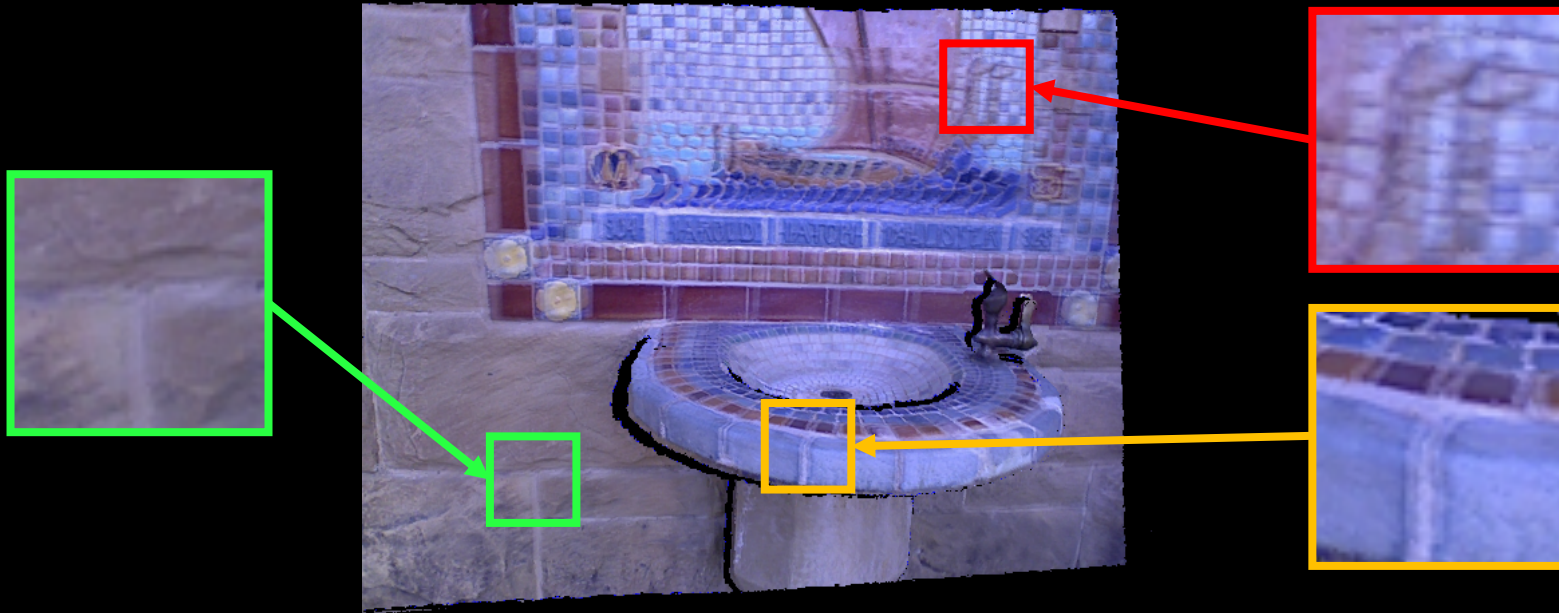
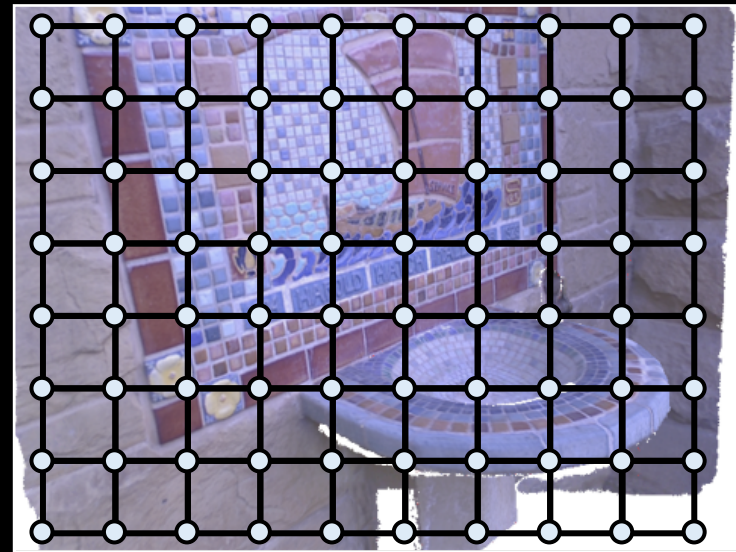
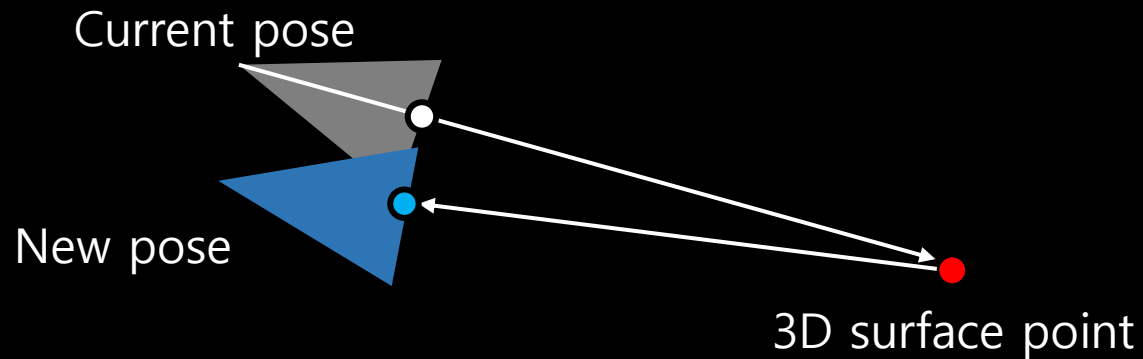


Image projection without warp

Texture-image correspondence search

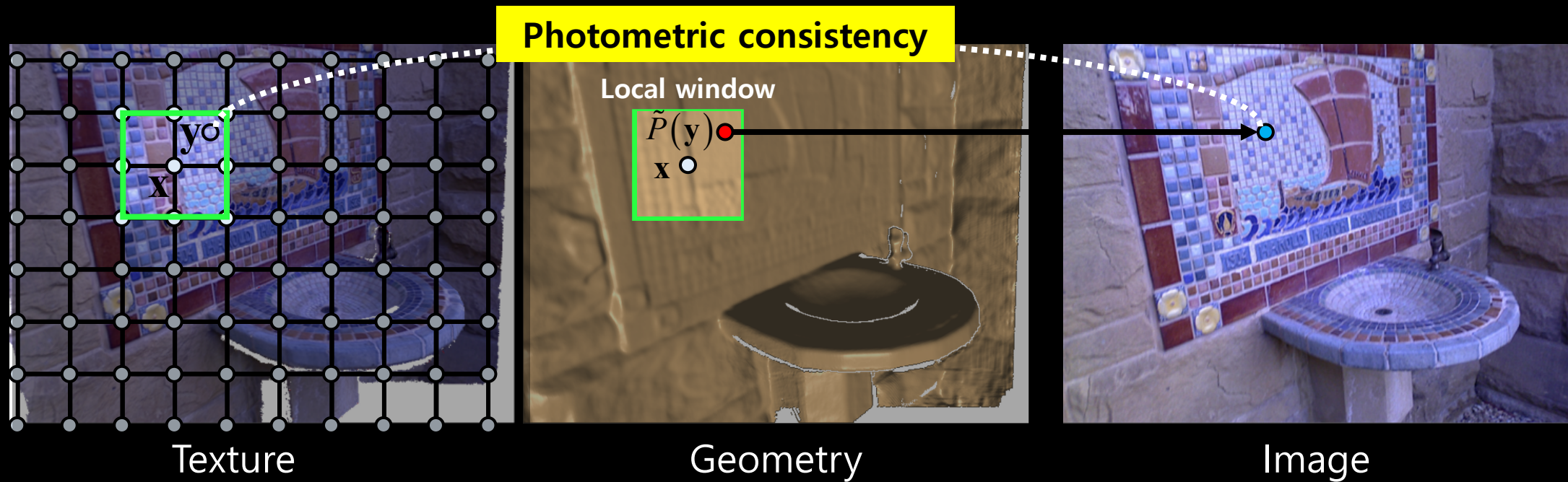
- Estimate a spatially-varying camera motion field



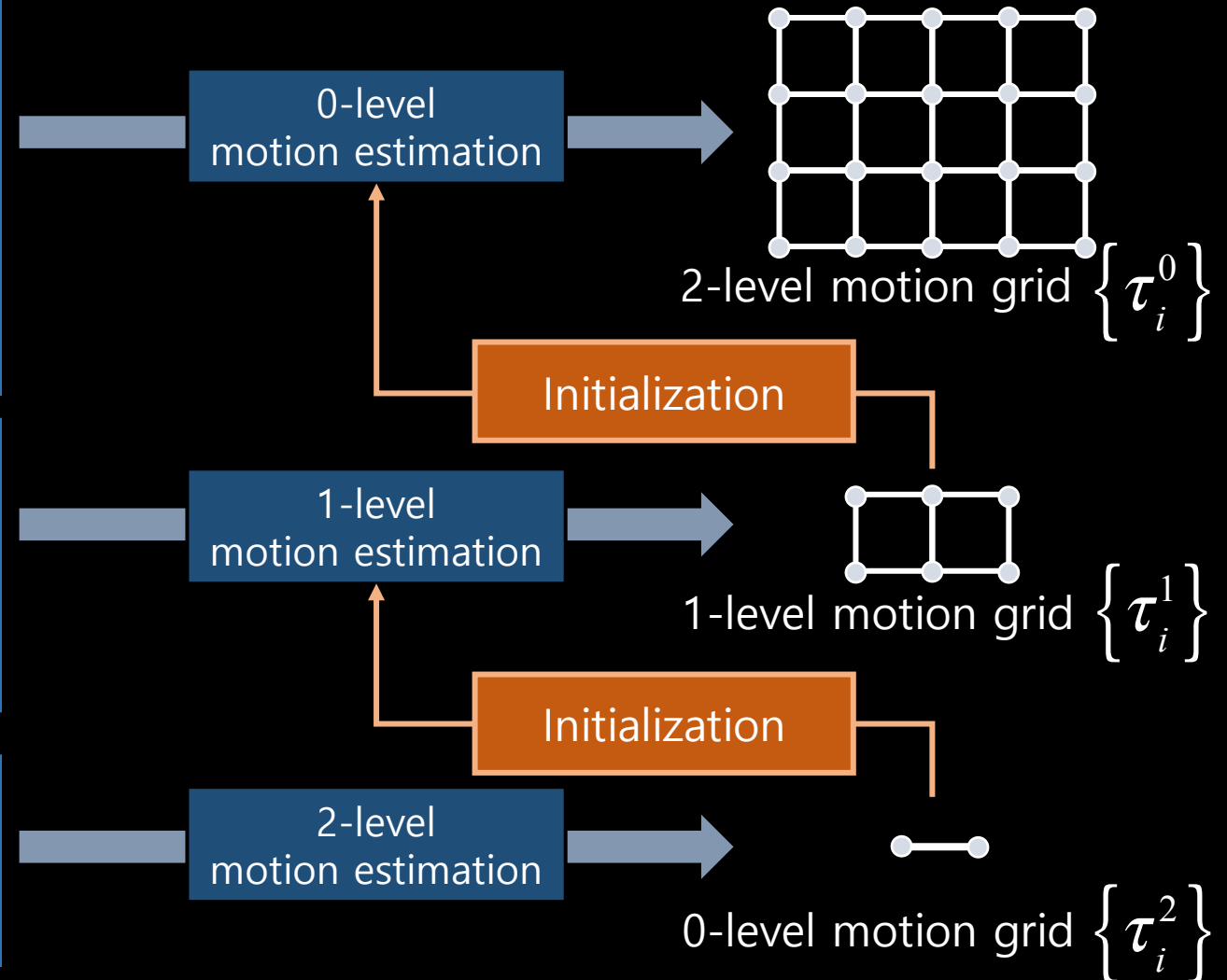
Camera motion grid

Spatially-varying perspective correction

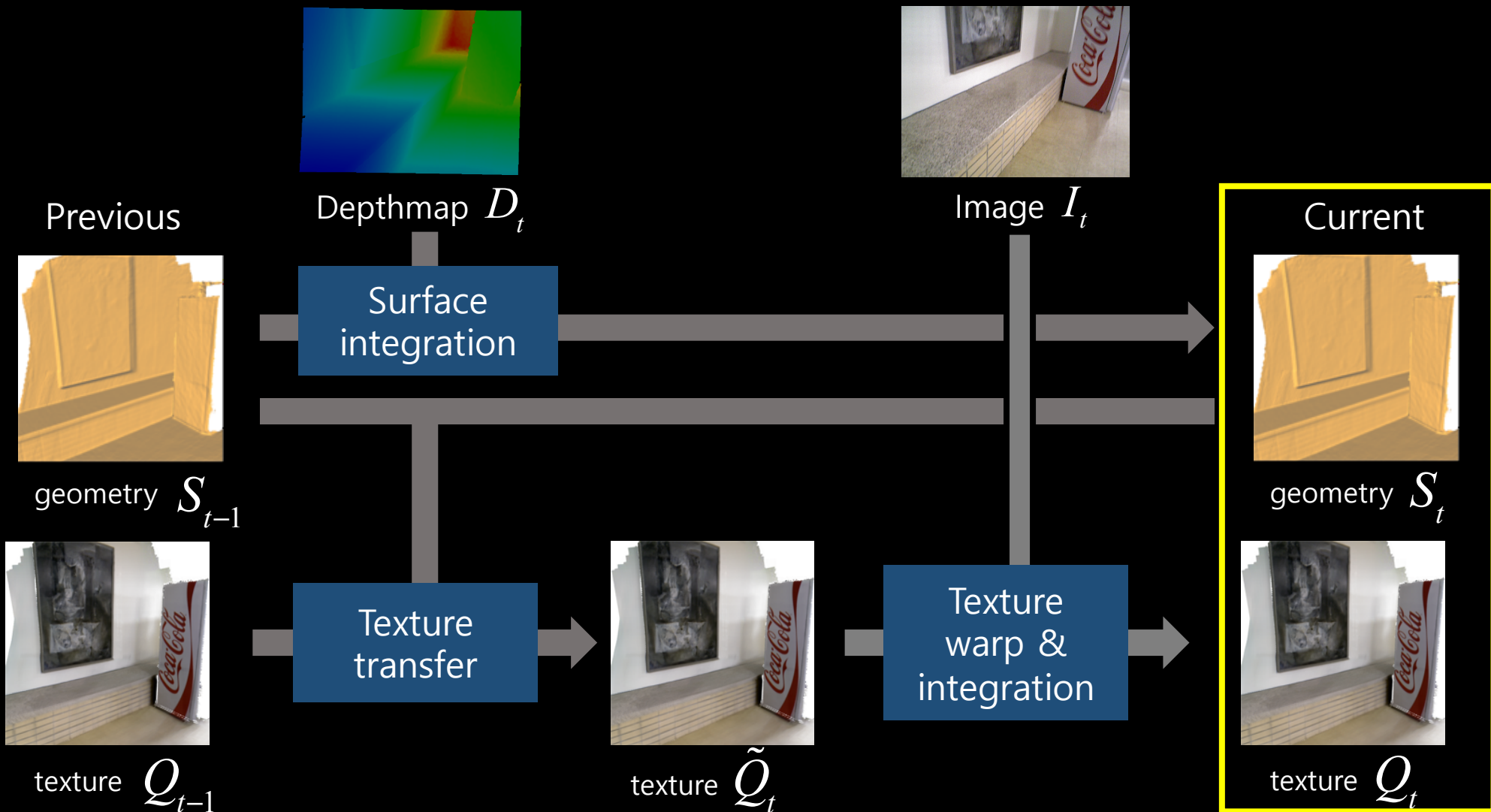
- Maximize the photometric consistency of local 3D surface patches in the current texture map



Hierarchical optimization of motion field

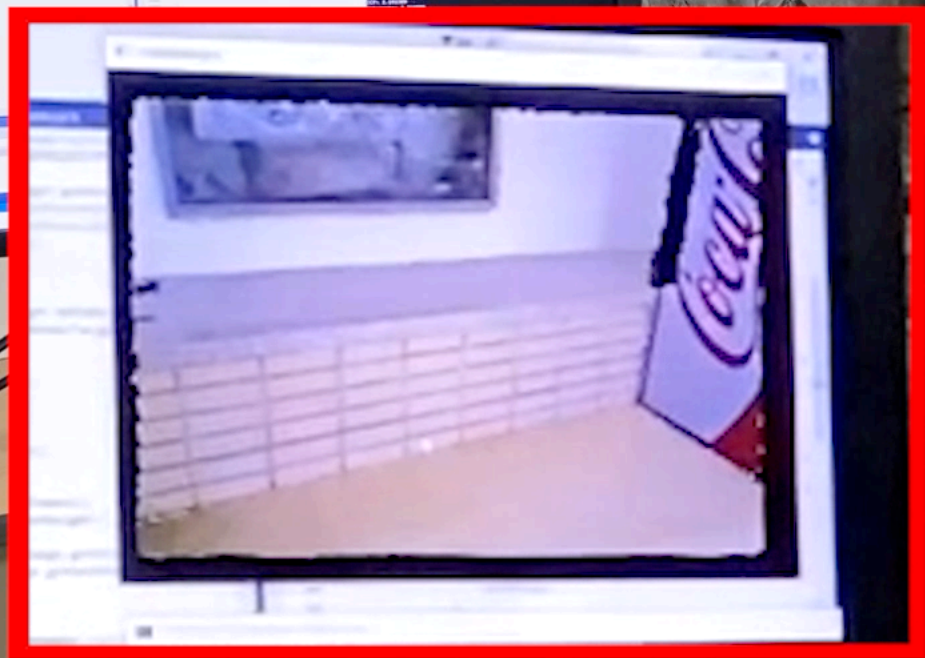


Real-time texture integration framework



FPS:25.43

Closeup

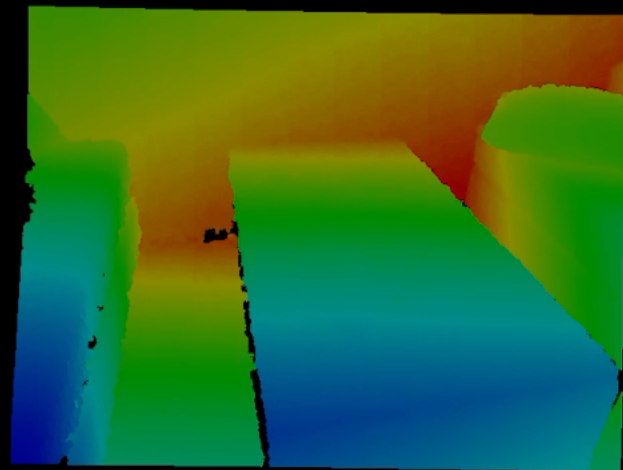


Real-time RGB-D scanning with our texture fusion

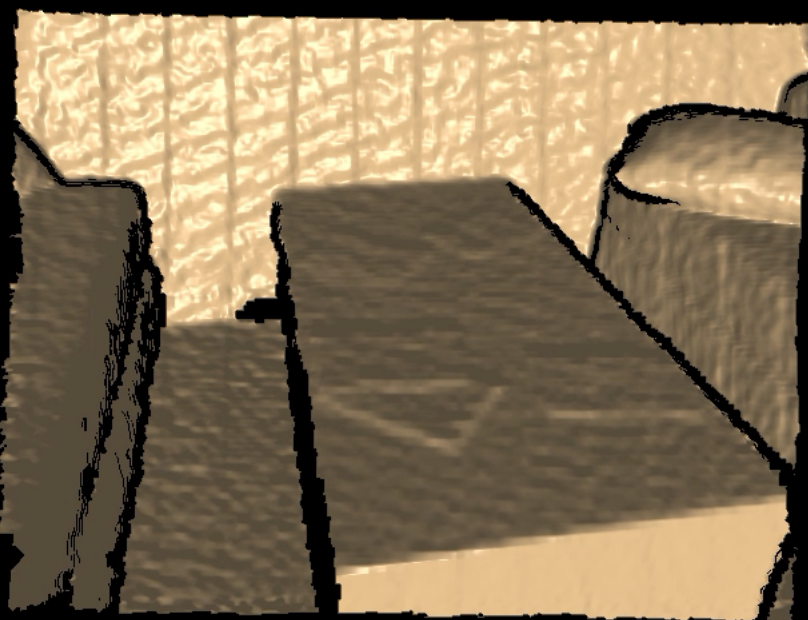
FPS:35.38



RGB



Depth

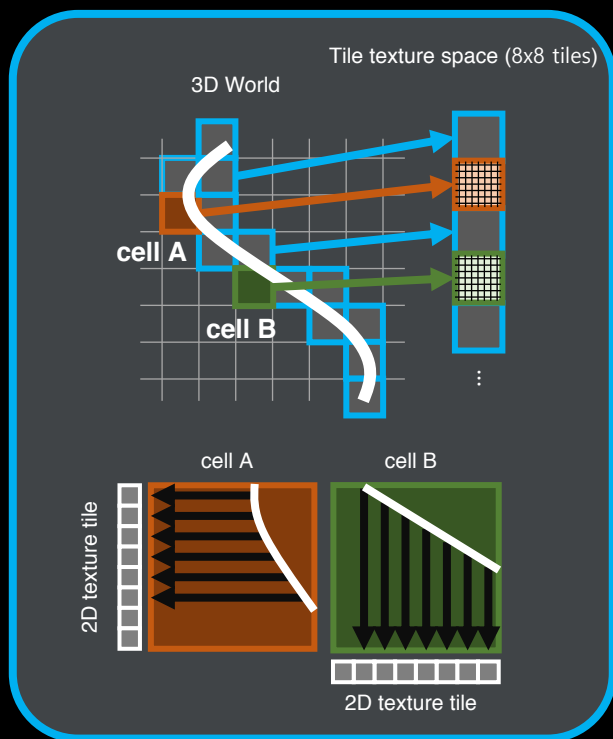


Geometry

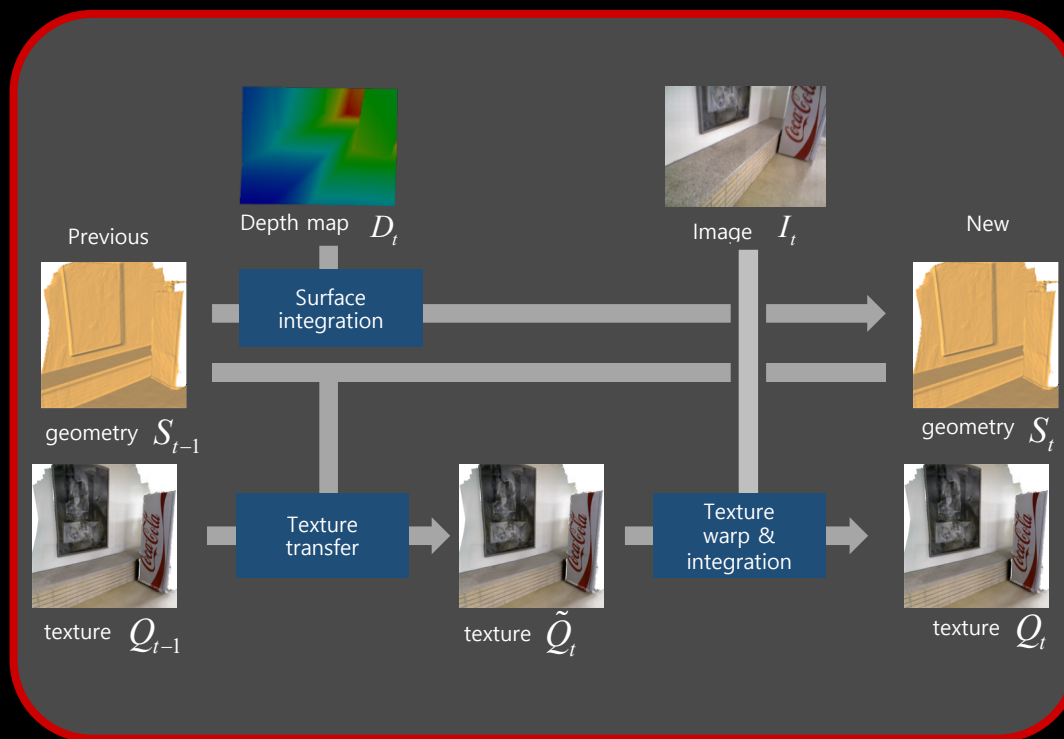


Our texture-fusion rendering

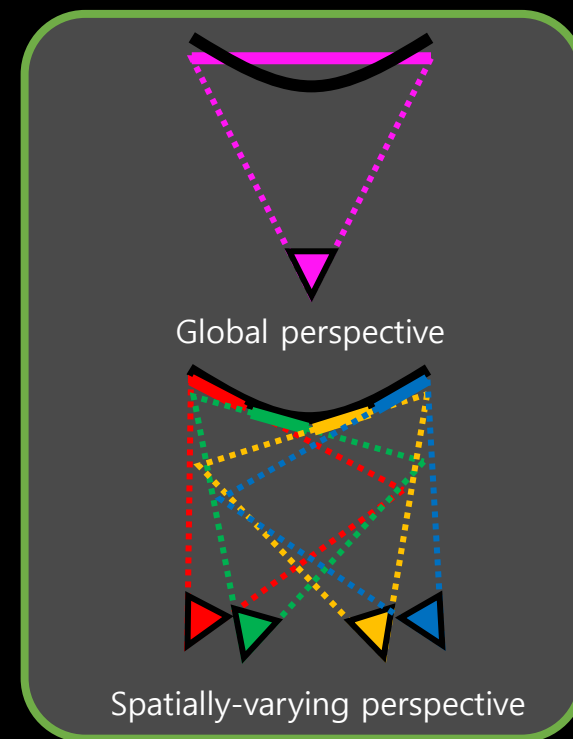
Conclusions



Tile-based texture data structure



Texture reconstruction framework



Spatially-varying perspective warp

Code available: <https://github.com/KAIST-VCLAB/texturefusion>