

Visual Analysis and Synthesis with Physically Grounded Constraints



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Goal

Integrate physically grounded constraints (geometry, motion) into patch-based optimization frameworks

Motivation

Image priors work only in 2D image planes

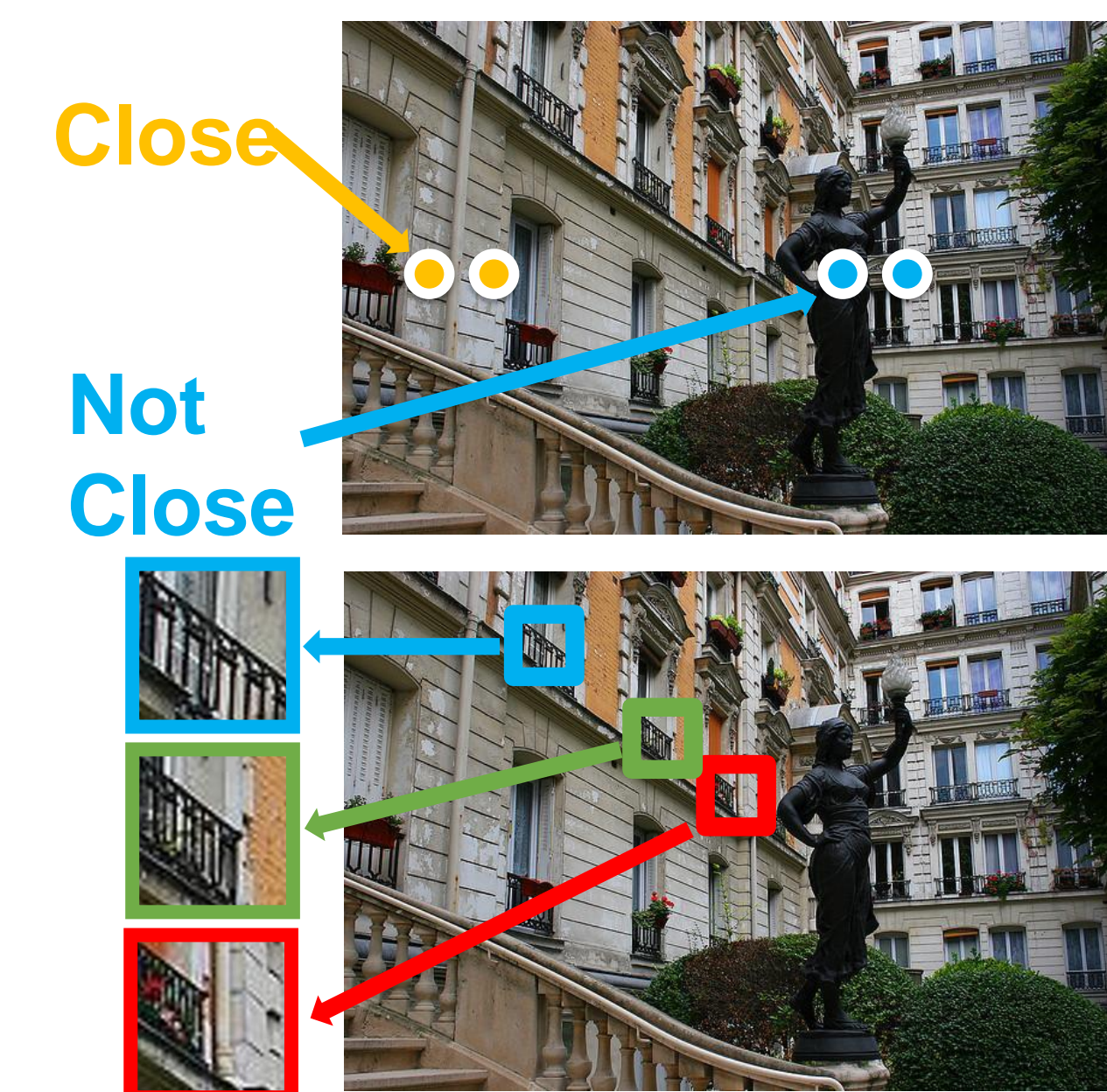
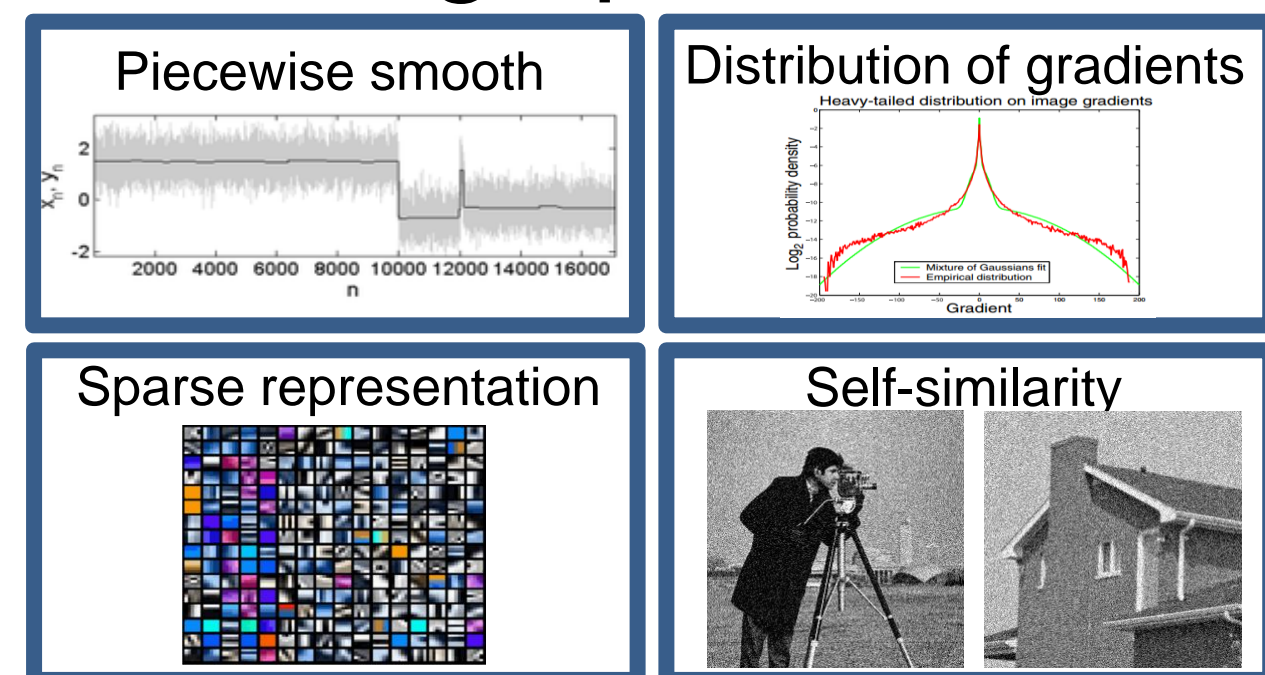
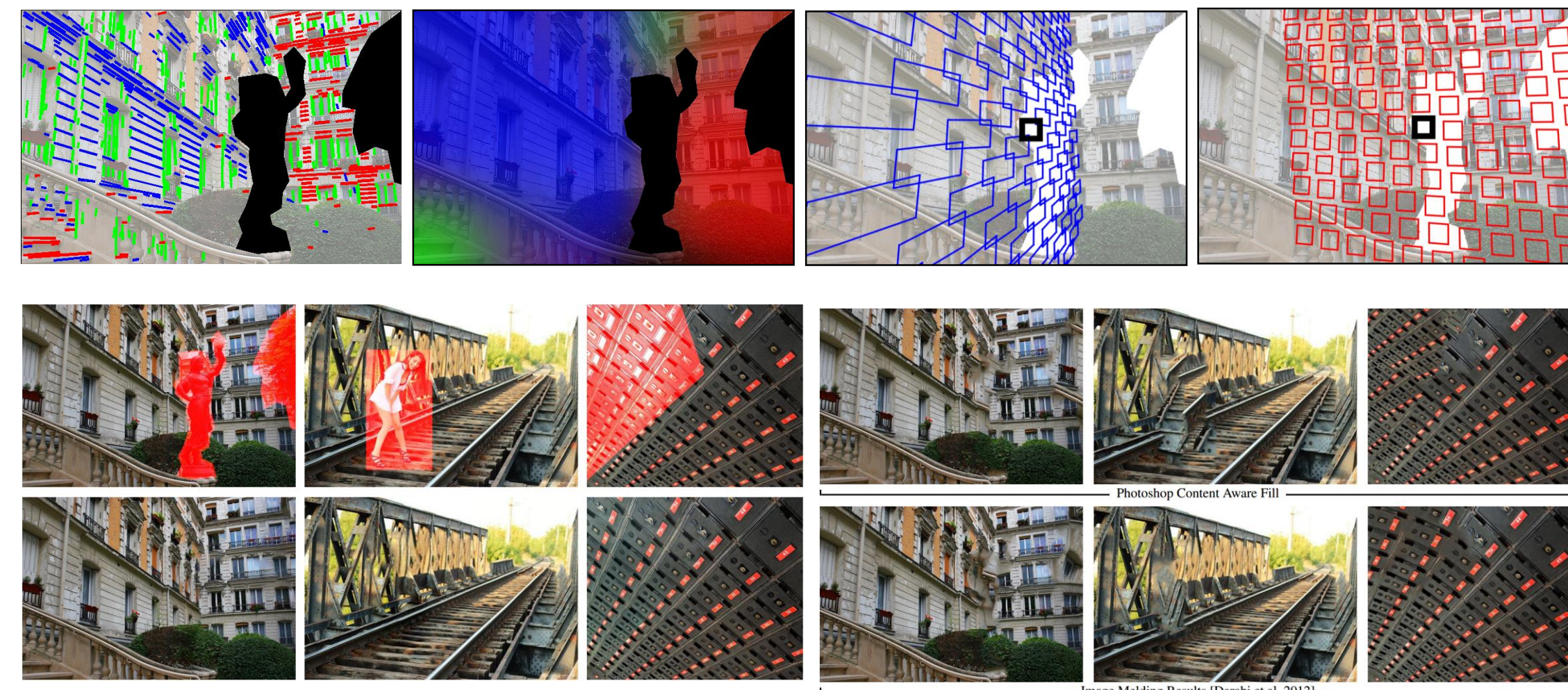


Image Completion

Filling with mid-level guidance

- Planar orientations
- Translational symmetry



Video Completion

Reconstructing appearance and motion

- Dense flow field estimation
- Temporally coherent completion

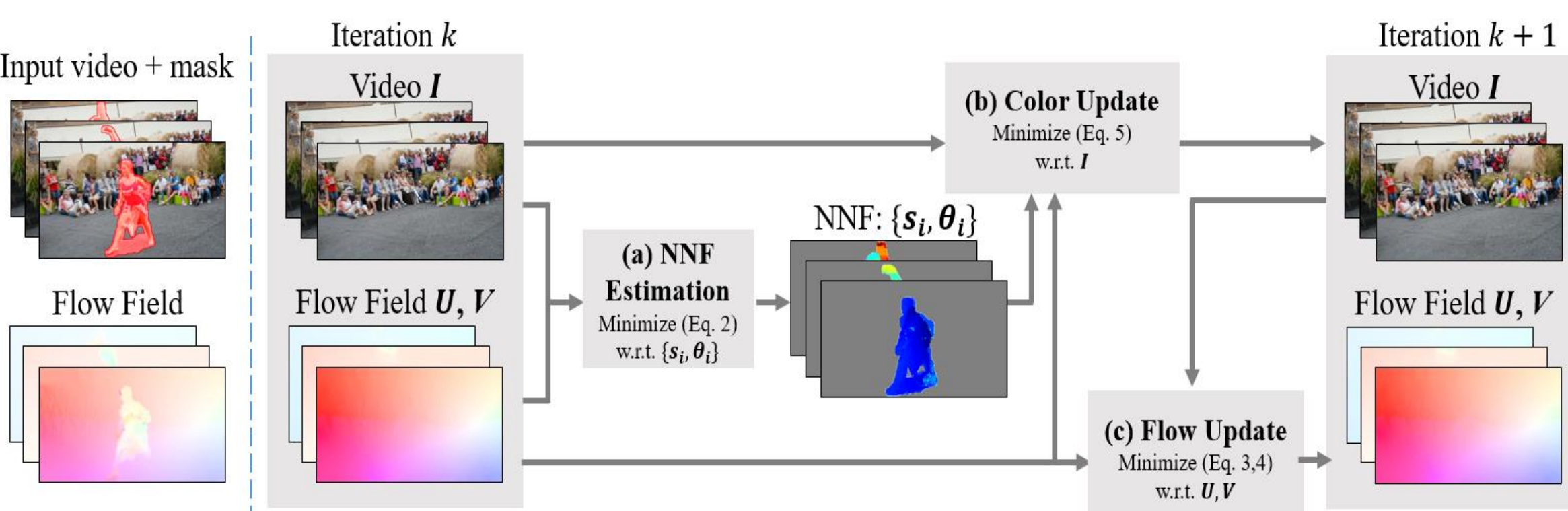
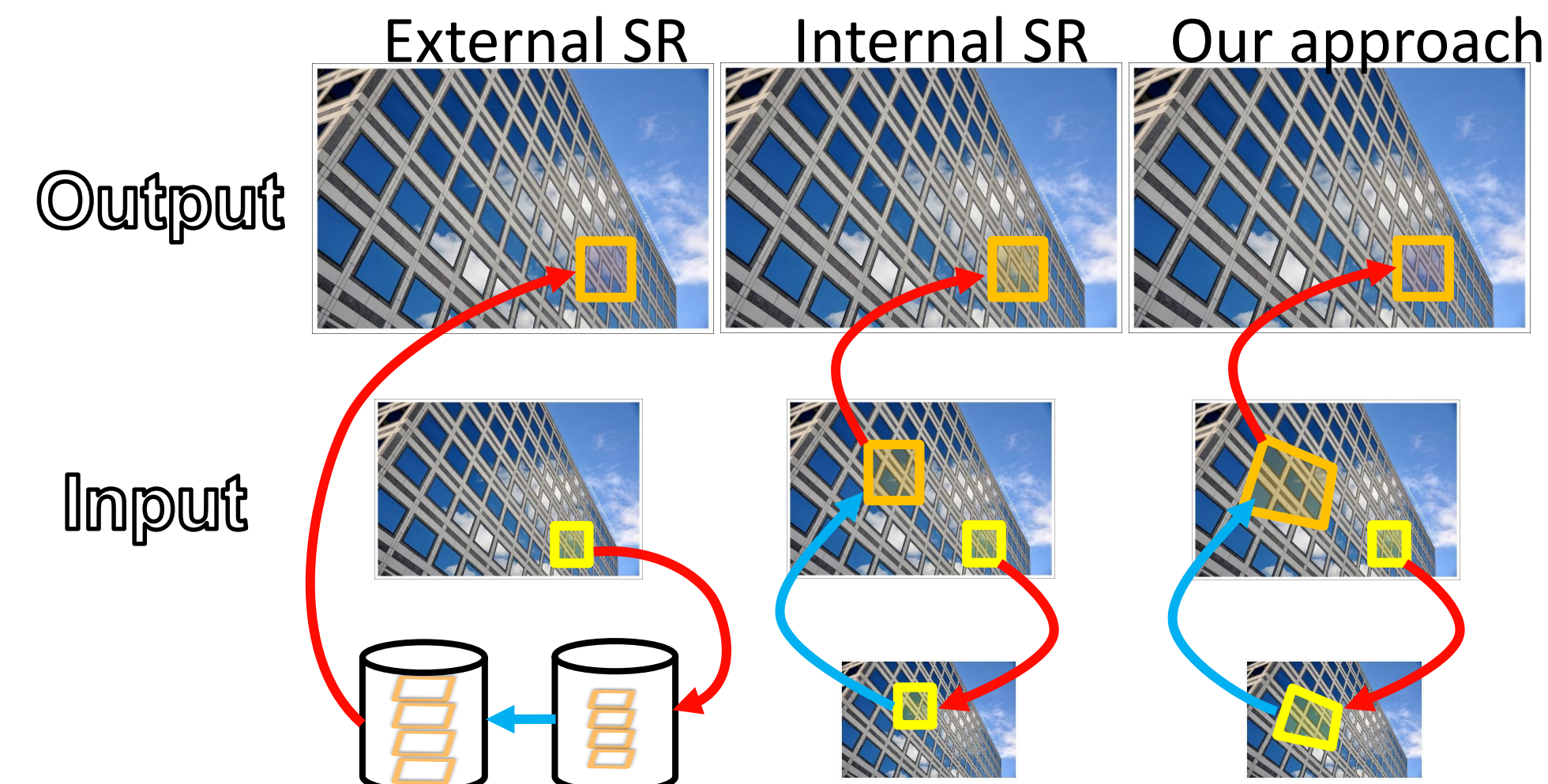


Image Super-Resolution

Super-resolving with transformed self-exemplars

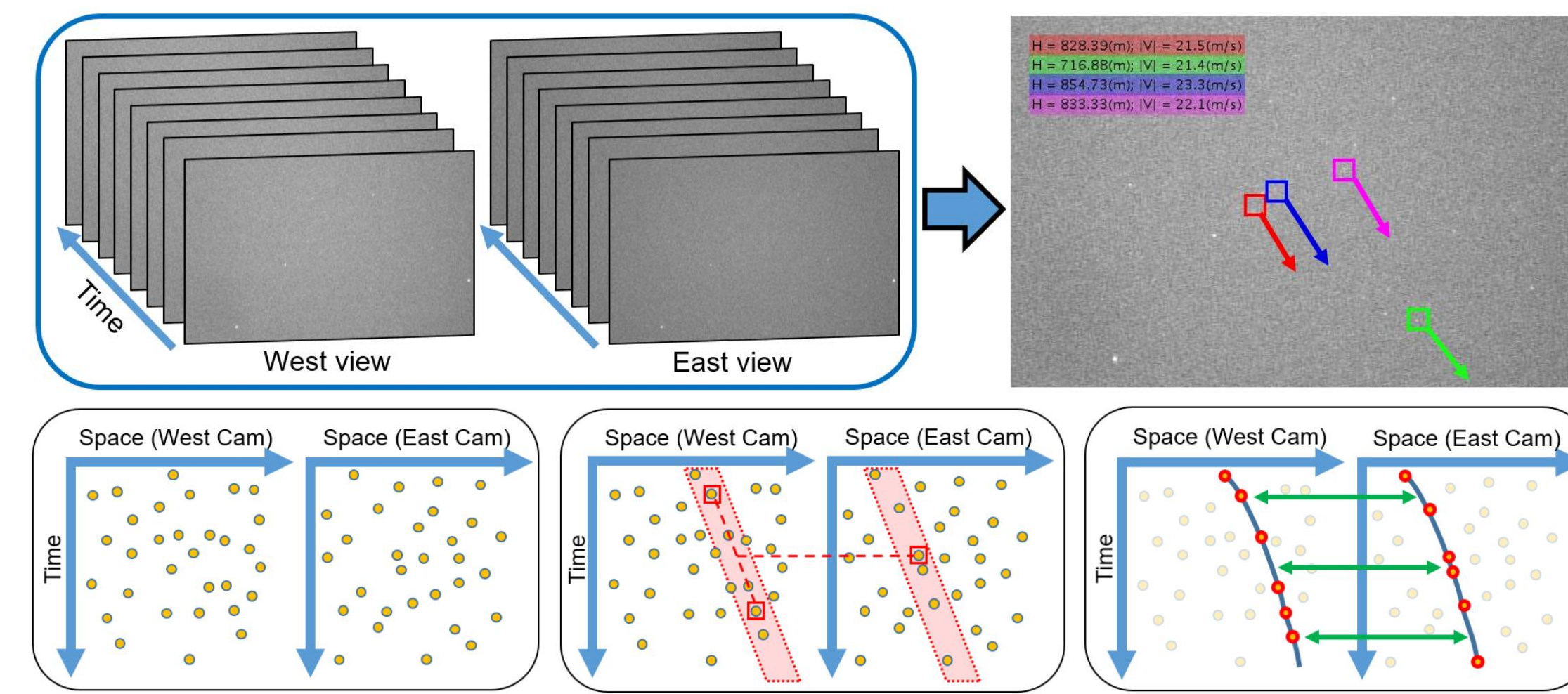
- Compositional transformation models
- Search affine and perspective transformed exemplars



Bird Detection

Detecting trajectories with stereo constraints

- Stereo-based RANSAC
- Trajectory verification with uncertainty handling



Future Directions

- Smarter image/video synthesis and manipulation
- Unsupervised and weakly supervised feature representation learning
- Low shot scene understanding

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