FULL 3D LAYOUT RECONSTRUCTION FROM ONE SINGLE 360º IMAGE

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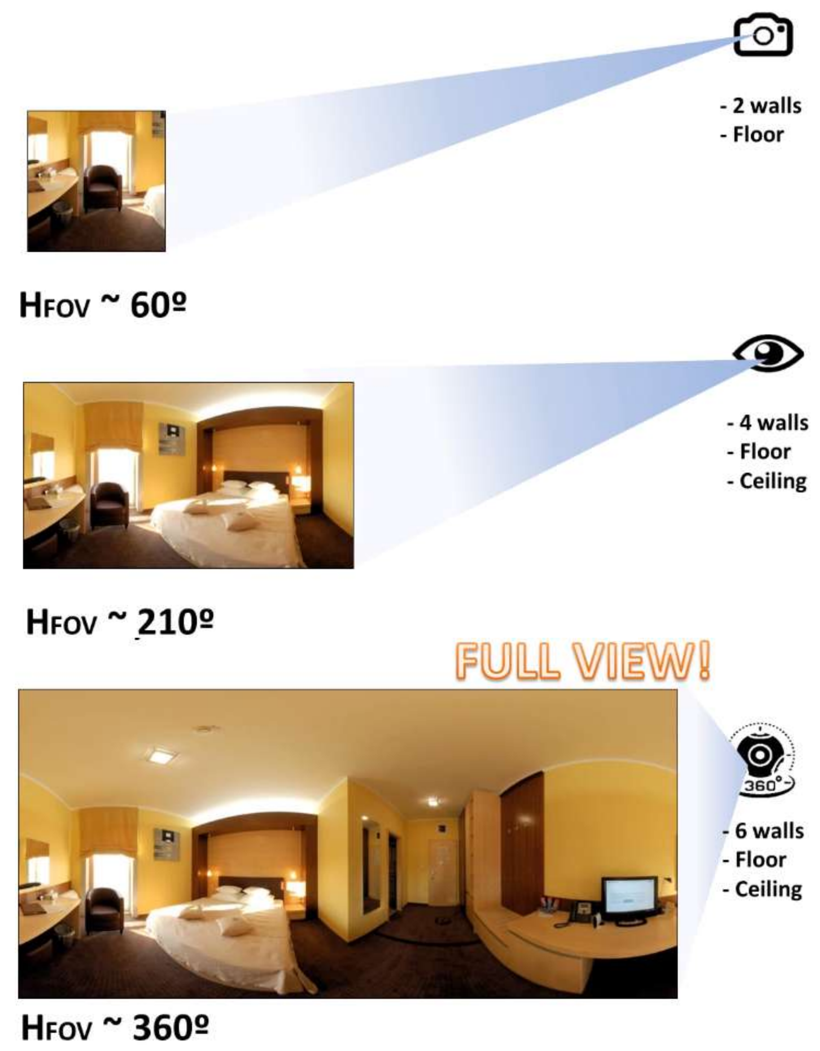
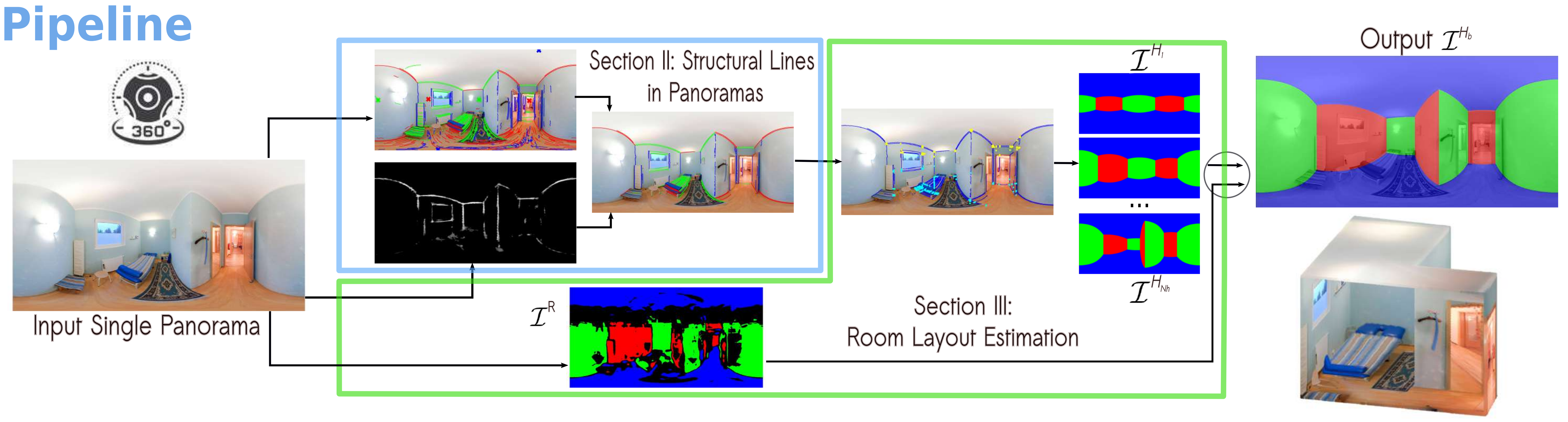
Motivation

Wide field of view



Pipeline



We propose a novel entire pipeline which converts 360º panoramas into flexible, closed, 3D reconstructions of the rooms represented in the images. Key ideas:

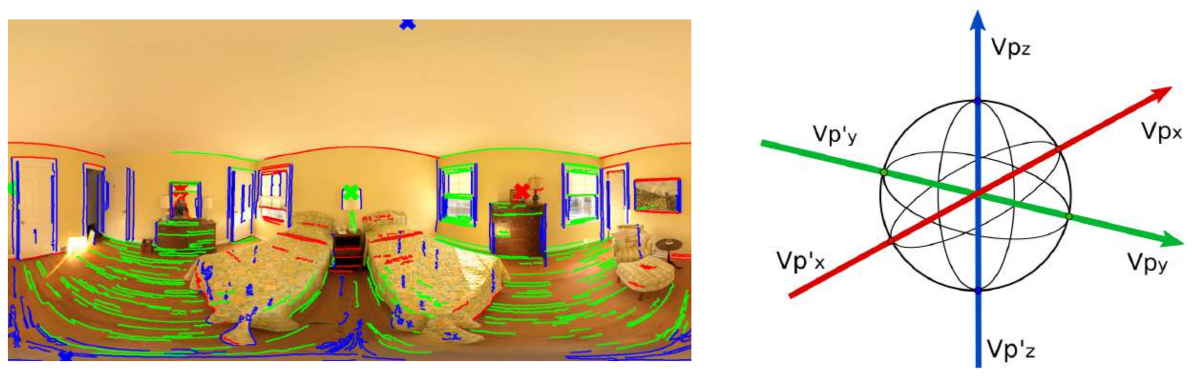
1. Explotation of deep learning techniques combined with geometric reasoning to obtain structural lines.
2. New Normal Map for the hypotheses evaluation step.
3. Final closed, 3D room reconstructions faithful to the actual shapes.

Video

- Scan the QR Code and see our video and paper!

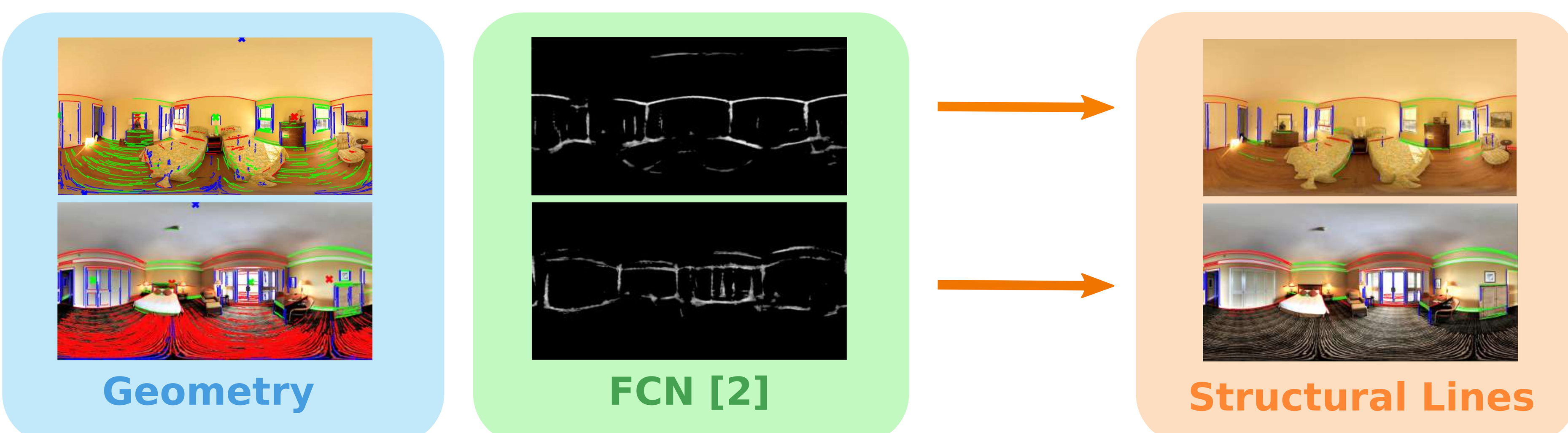
Method

1. Lines and Vanishing Points Estimation



- Manhattan World Assumption
- RANSAC-based algorithm
- Directly on panoramas
- 8 seconds/image

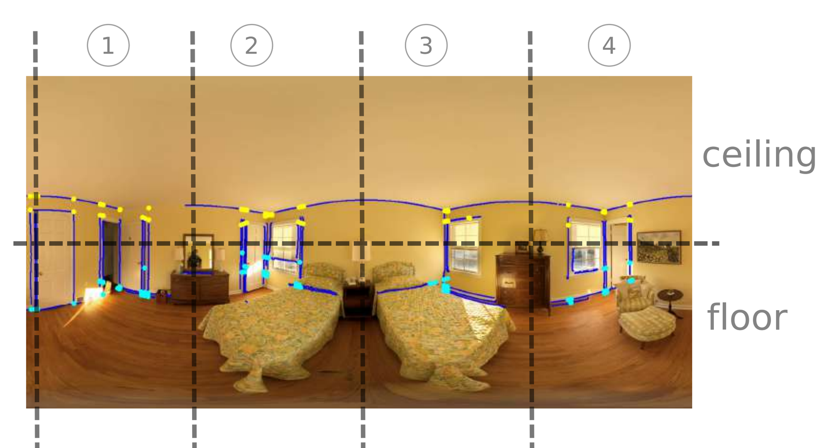
2. Structural Lines: Exploiting Deep Learning



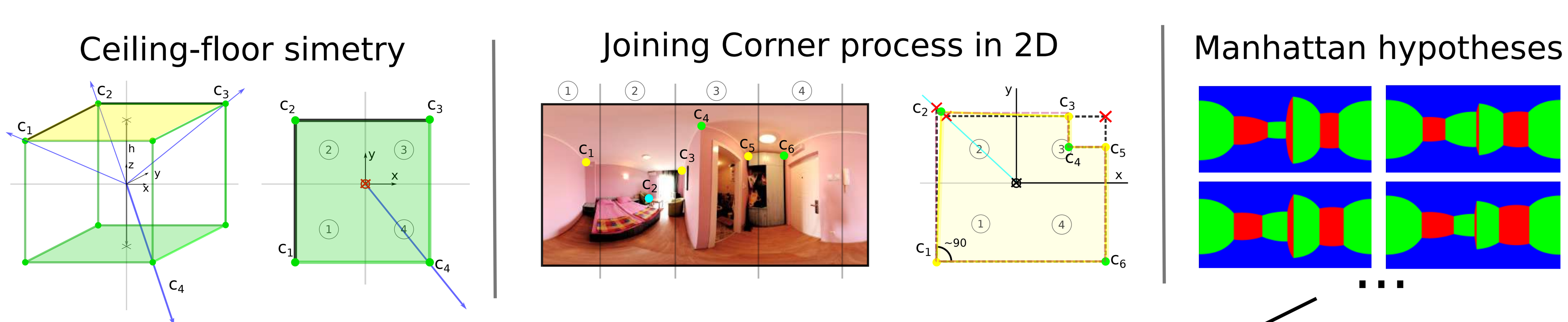
3. Candidate Corners

Intersections from Structural Lines
Classification depending on:

- Their position along the z axis
- Their position in the XY-plane

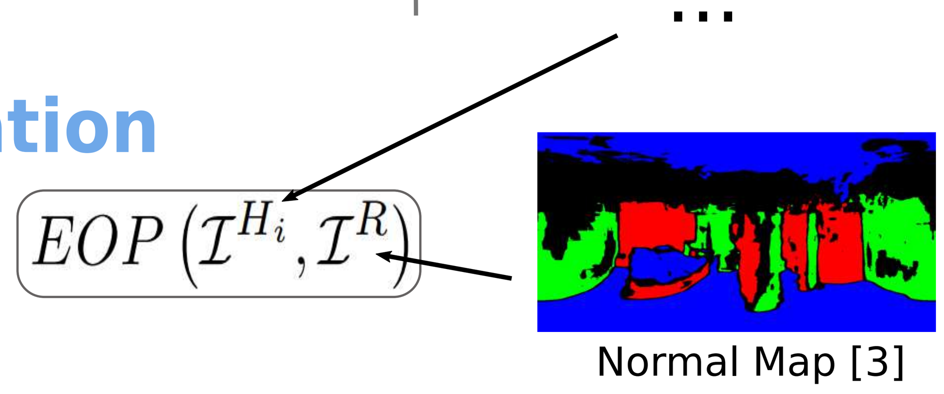


4. Layout Hypotheses Generation



5. Layout Hypotheses Evaluation

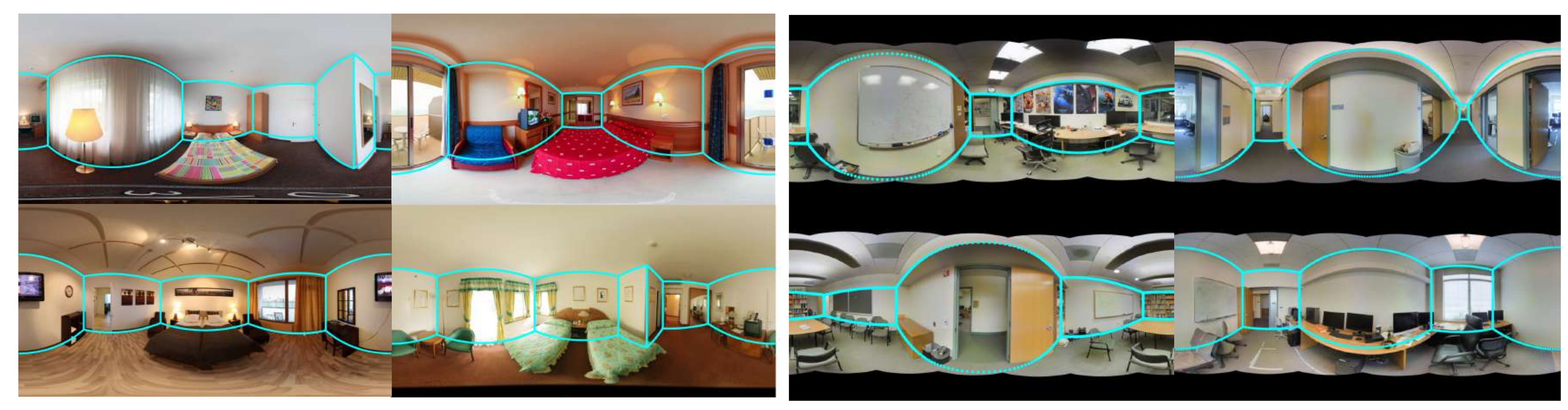
The hypothesis with higher EOP gives the final result



6. Final 3D reconstructions

Evaluation & Conclusions

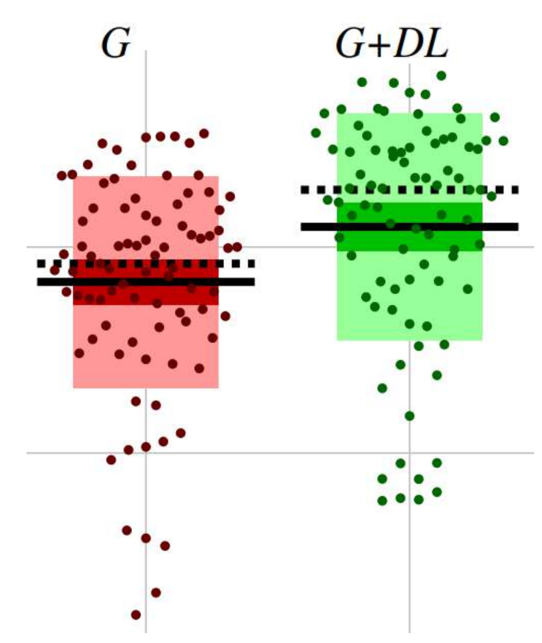
Datasets



SUN360 **EOP = 0.927**   Stanford (2D-3D-S) **EOP = 0.880**

Equally Oriented Pixels ratio

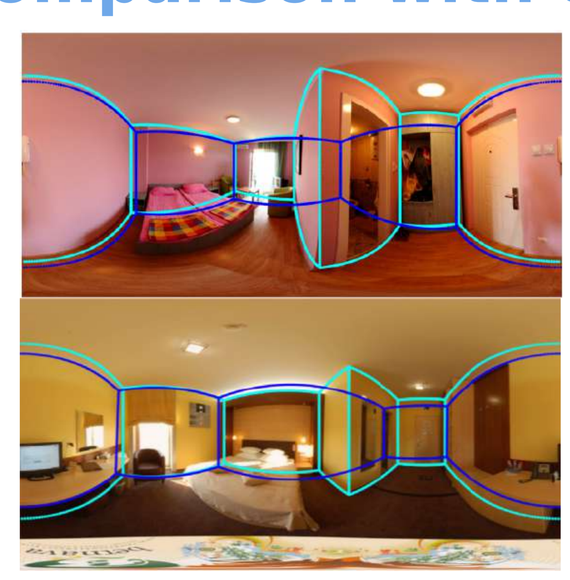
$$EOP\left(\mathcal{I}^{H_i}, \mathcal{I}^{\mathcal{R}}\right) = \frac{1}{M \cdot N} \sum_{x,y,z}^{P} \sum_{i,j}^{M,N} \mathcal{I}^{H_i} \& \mathcal{I}^{\mathcal{R}}$$



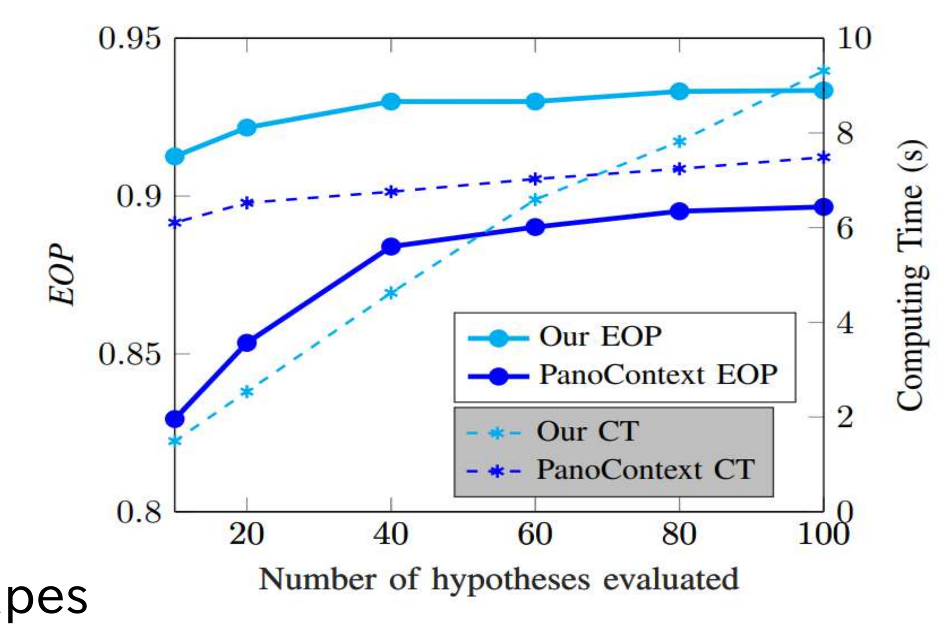
Geometry and Deep Learning combination

We demonstrate the advantages of combining both techniques to get Structural Lines

Comparison with the State of the Art [1] (↑EOP, ↓CT)



We handle more complex shapes



Related work

[1] Y. Zhang, S. Song, P. Tan, and J. Xiao. "PanoContext: A whole-room 3D context model for panoramic scene understanding." ECCV 2014.

[2] A. Mallya and S. Lazebnik. "Learning informative edge maps for indoor scene layout prediction". ICCV 2015.

[3] D. Eigen and R. Fergus. "Predicting depth, surface normals and semantic labels with a common multi-scale convolutional architecture." ICCV 2015

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