Rent3D:
Floor-Plan Priors for Monocular Layout Estimation

CVPR 2015 Oral Presentation

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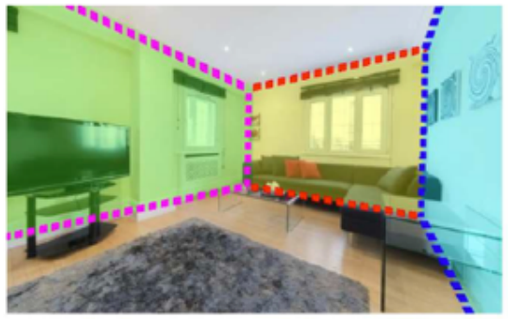
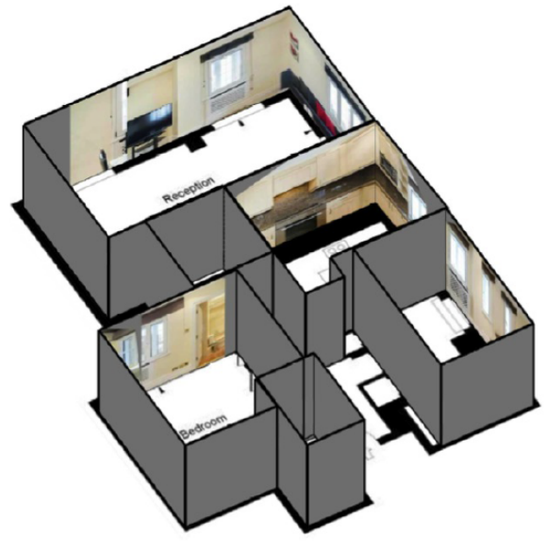
3D Scene Understanding with Floor Plan



Layout estimation

Localization

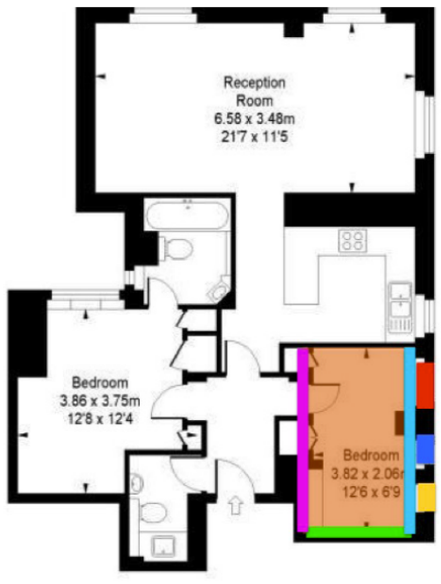


Reconstruction

Graphical Model

$$E(r, c_r, \mathbf{y}) = E_{scene\_type}(r) + E_{layout}(r, c_r, \mathbf{y}) + E_{win}(r, c_r, \mathbf{y})$$

- r : which room the image is taken in
- c_r : within room r, which wall the image is facing
- $\mathbf{y}$: rays representing a room layout

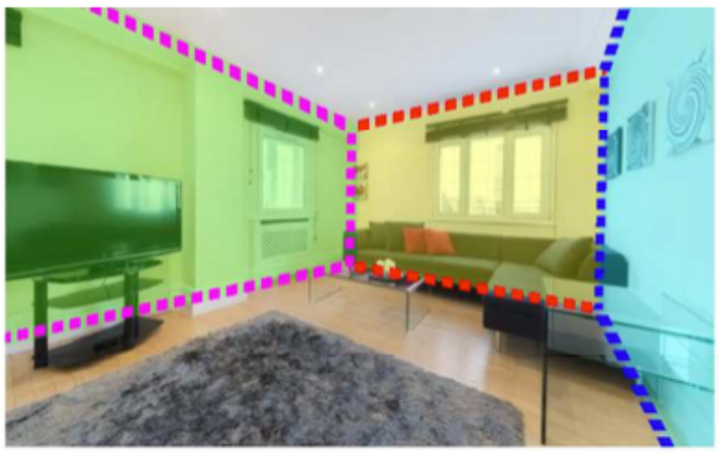


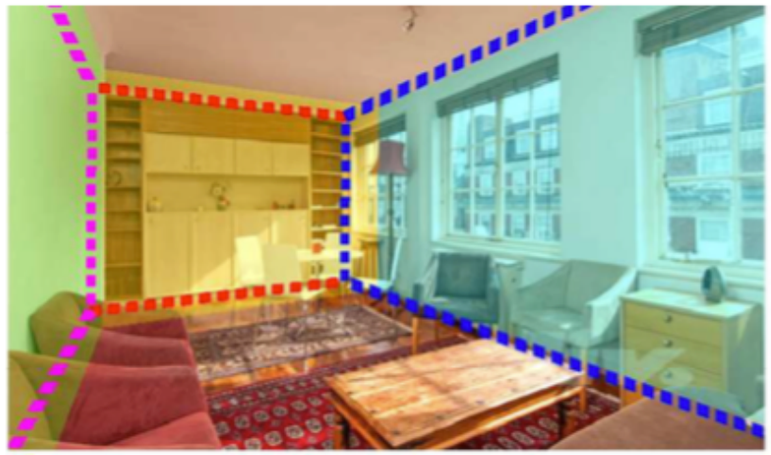
Layout Estimation

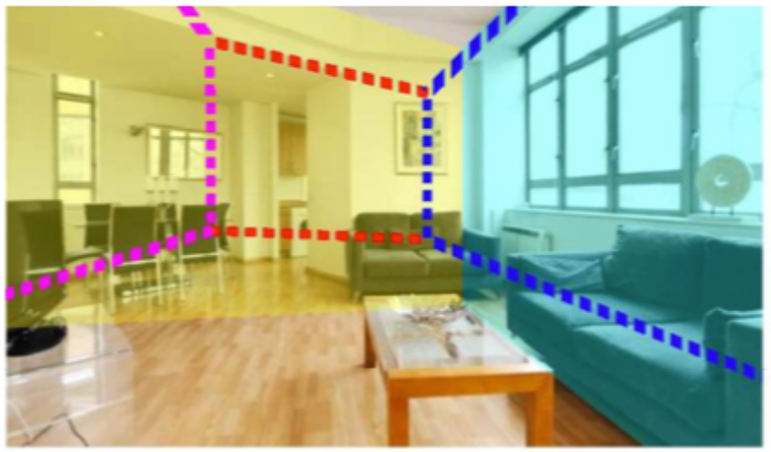
	Layout error	Evaluations	Test time [s]
Schwing'12	13.88	16012.4	0.0208
Ours	**11.81**	**1269.5**	**0.0019**

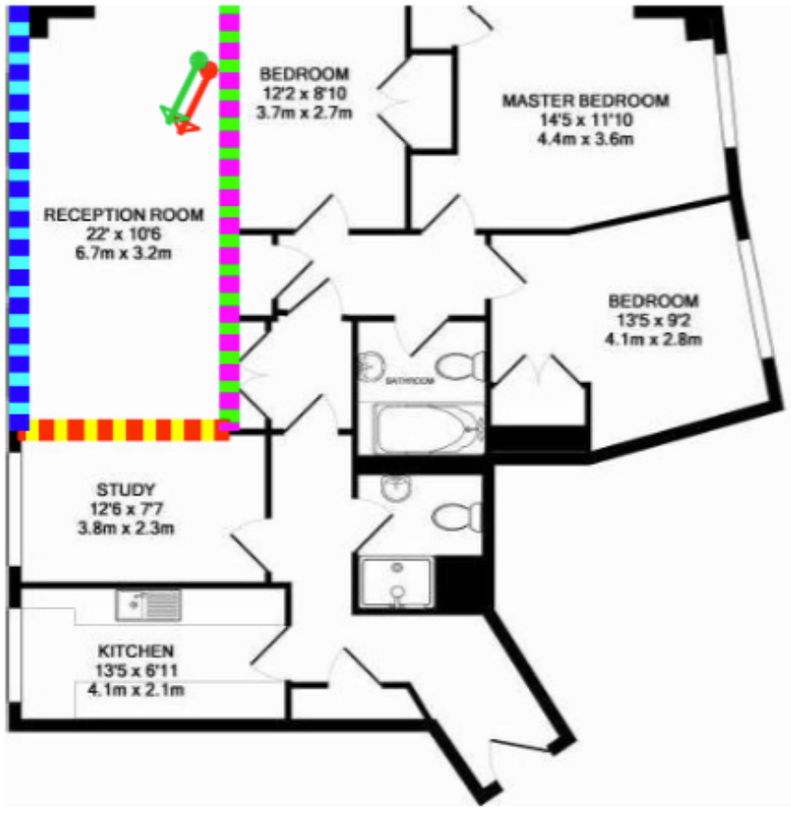
- 2% reduction in error
- 10 times less branching operations
- 10 times speedup

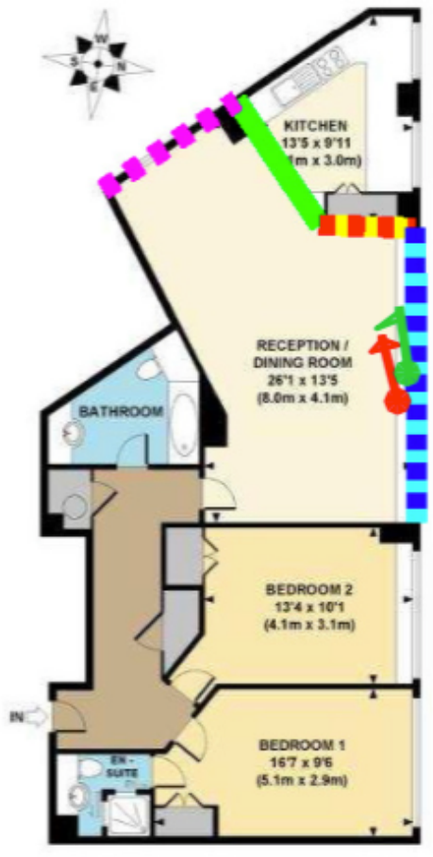
Localization



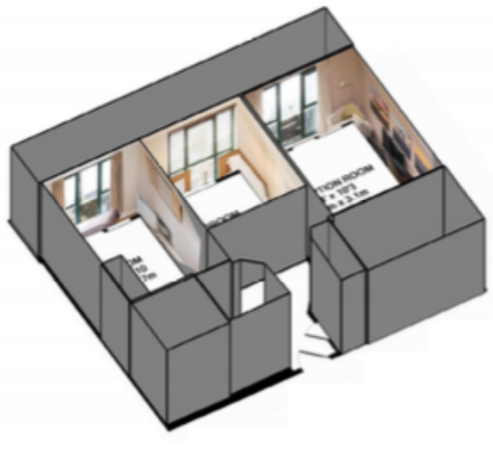








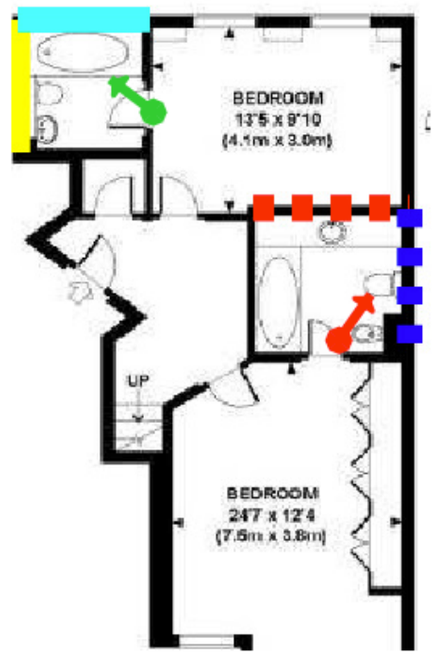
Reconstruction

Window+Aspect	Window+Aspect+Scene	Window+Aspect+Room	Ground truth
			
2 images out of 8 5 walls out of 22	5 images out of 8 11 walls out of 22	5 images out of 7 11 walls out of 19	- -
			
1 image out of 5 3 walls out of 13	2 images out of 5 6 walls out of 13	4 images out of 5 11 walls out of 13	- -

Summary

- Graphical model that jointly solves for room layout estimation and localization by exploiting floor plans

- Real-time inference with Branch and Bound



- Improve layout estimation performance
- Good reconstruction and localization
- Future work: exploiting objects