Physically based indoor scene analysis

MAX-PLANCK-GESELLSCHAFT

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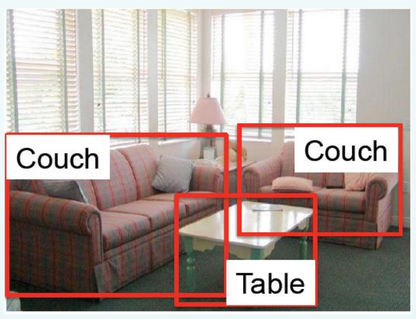
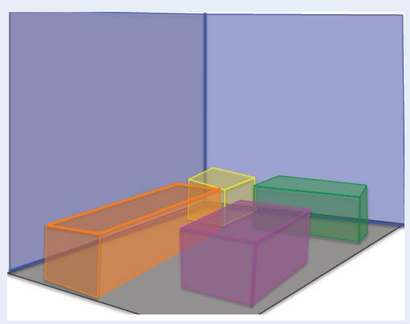
Problem Statement

Input: Single image of an indoor scene



Standart 2D object detector



Geometry based analysis

Output:

- Structure of the room (position of the walls, ceiling and floor)
- Objects in the scene, modelled as boxes / clutter pixels

Investigated problems (but not fully solved)

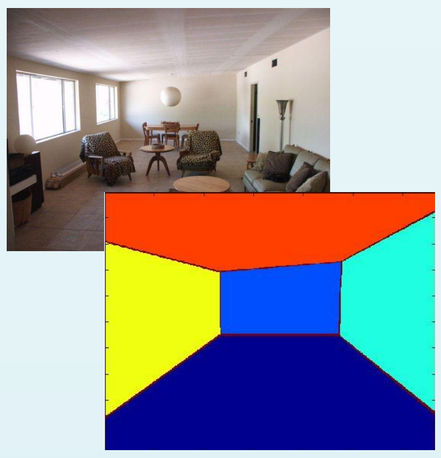
- Light position and type
- Textures of the surfaces

Main focus of our current work

Applications: refurnishing/redecorating the room (adding/deleting objects, furniture, materials of the surfaces), generating an empty room, relighting the room

Estimating different physical components

Standart geometry model:



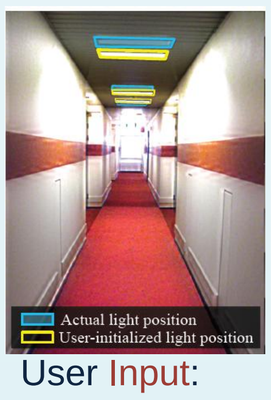
Room is represented as a box, each pixels is classified as left wall, right wall, middle wall, ceiling, floor (additionally: clutter), first proposed in Hedau et al. 2009

Light estimation:

Input Image

User Input: Geometry

(Karsch et al. 2011)



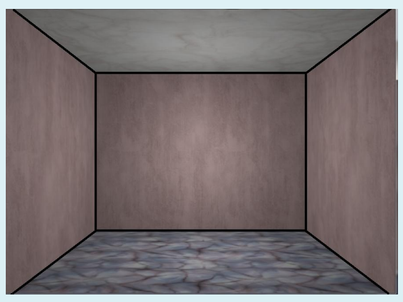
User Input: Initial position of the light

Automatically detested: Albedo

Output: position of the light

Experiments with artificial data:

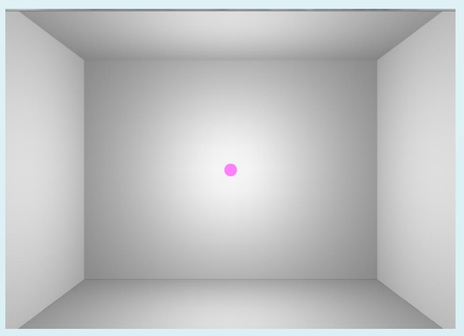
Generated Input Image



Known Geometry

Known Surfaces materials

Output: Position and type of the light (it's easy to compare to Ground truth)



Intended result

Join all the elements into one model for the analysis of real images:
1) find pixels belonging to walls/ceiling/floor
2) estimate simultaneously geometry of the scene, material of the surfaces, light position

References

- Rendering Synthetic objects into Legacy Photographs, K. Karsch, V. Hedau, D. Forsyth, D. Hoiem, Siggraph 2011
- Recovering the spatial layout of cluttered rooms, V. Hedau, D. Hoiem, D. Forsyth ICCV 2009