IEEE 2014 Winter conference on Applications of Computer Vision

Im2depth: Scalable Exemplar based Depth Transfer

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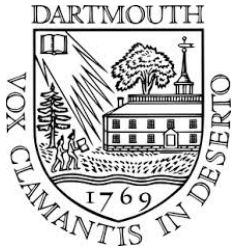
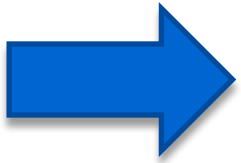
1 

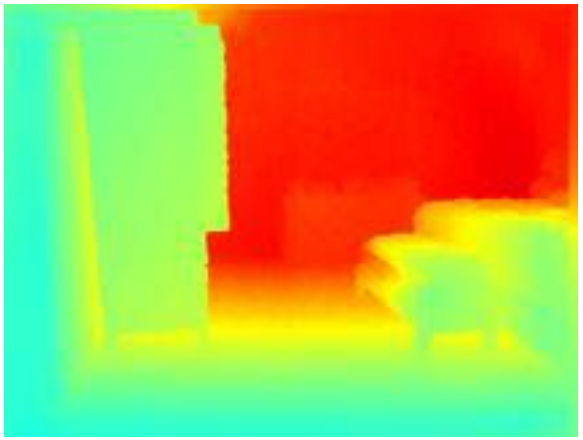
2 ebay research labs

Im2depth: The Problem

Goal: Given a Single Image of an Indoor Scene, We want to perform **Dense Depth Estimation**

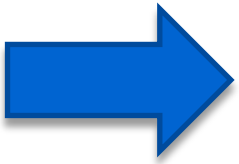
Image



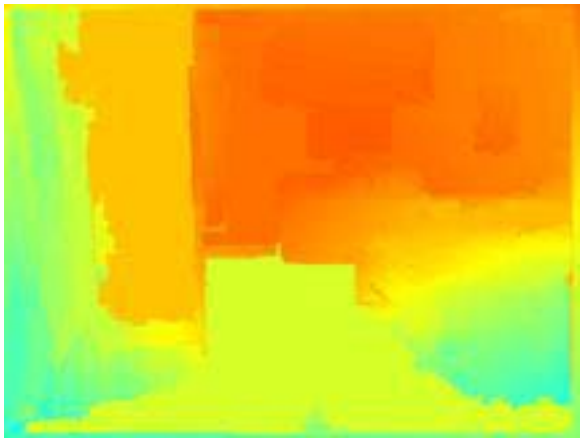


True
Depth Map

Image



Our Method



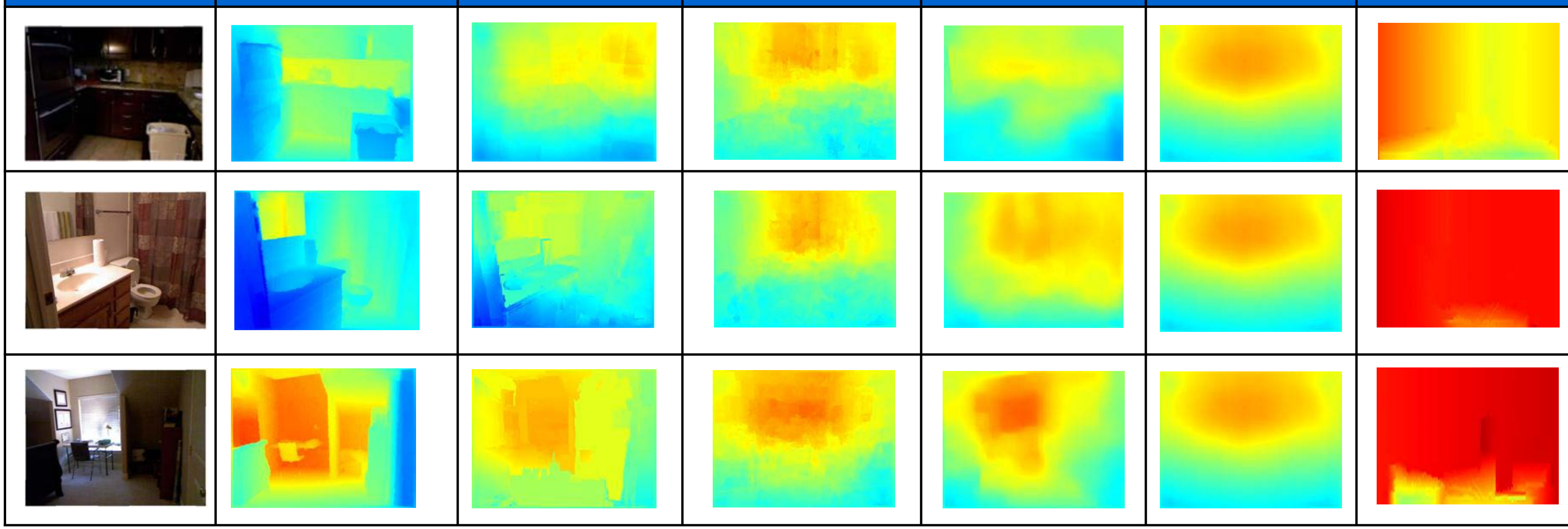
Estimated
Depth Map

Im2depth: First Impressions

Depth Estimation

- Shape
- Absolute Depth

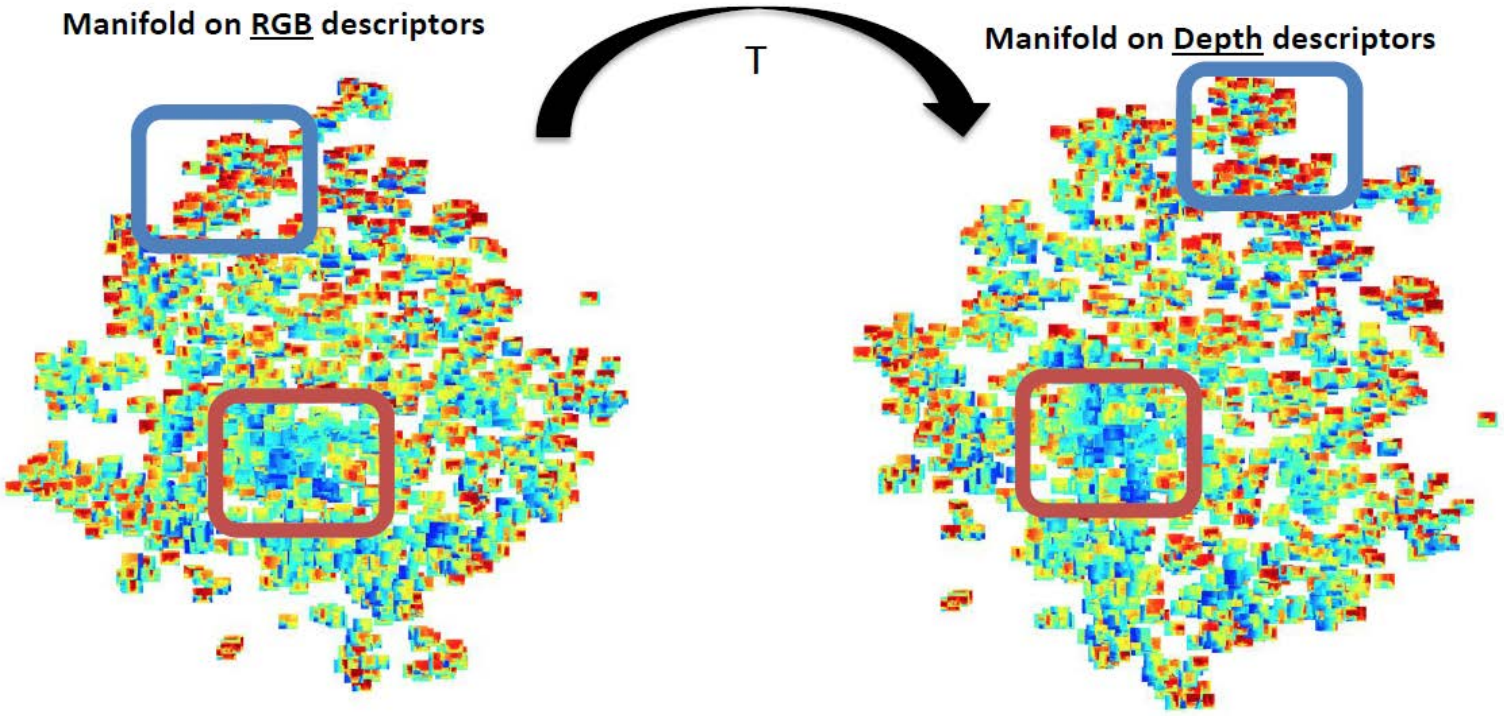
Image	Ground Truth	**Im2Depth**	BU/Google	NPS	Global Prior	Make3D



Im2depth: Intuition

Observation: New **Large Scale RGBD Datasets** can be used to form **data dependent depth transfer** approaches

Observation: Depth Maps share a lot of similarities in **Global Structure**



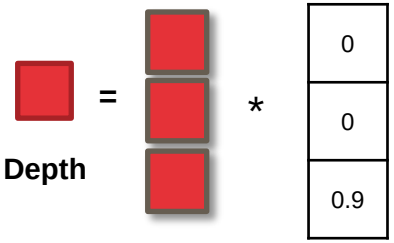
Visualizing Depths
via an Image Space

Visualizing Depths
via a Depth Space

Im2depth: RGB & Depth Spaces

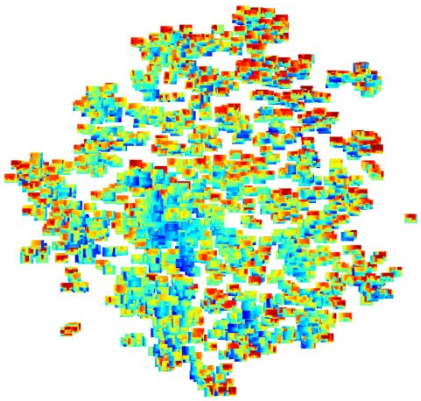
Depth Space

Exploiting Global Structure



Exemplar Basis

Depth Space Descriptor



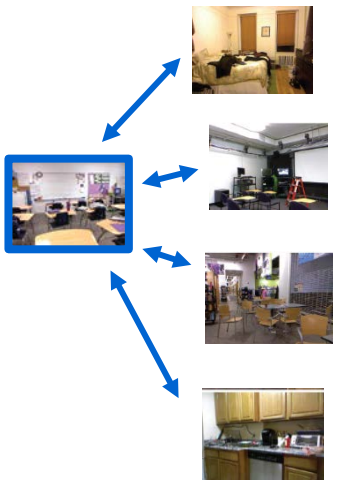
Visualization of Depth Maps via **Depth Space Descriptor**

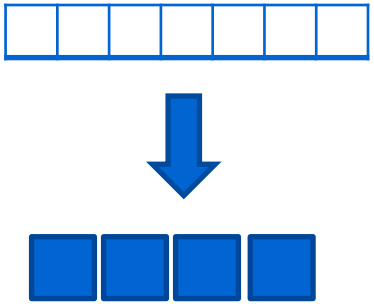
Image Space

Observation: We want an image representation that encodes Global Properties of the Image

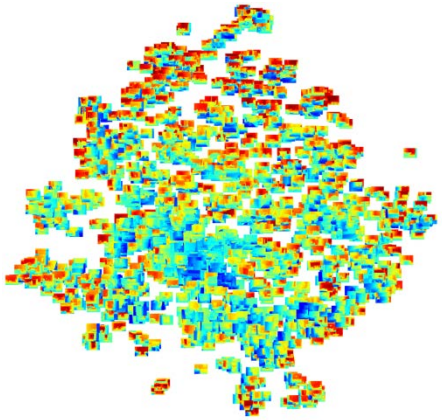
Global Image Feature

Observation: Information from the Neighborhood can be used



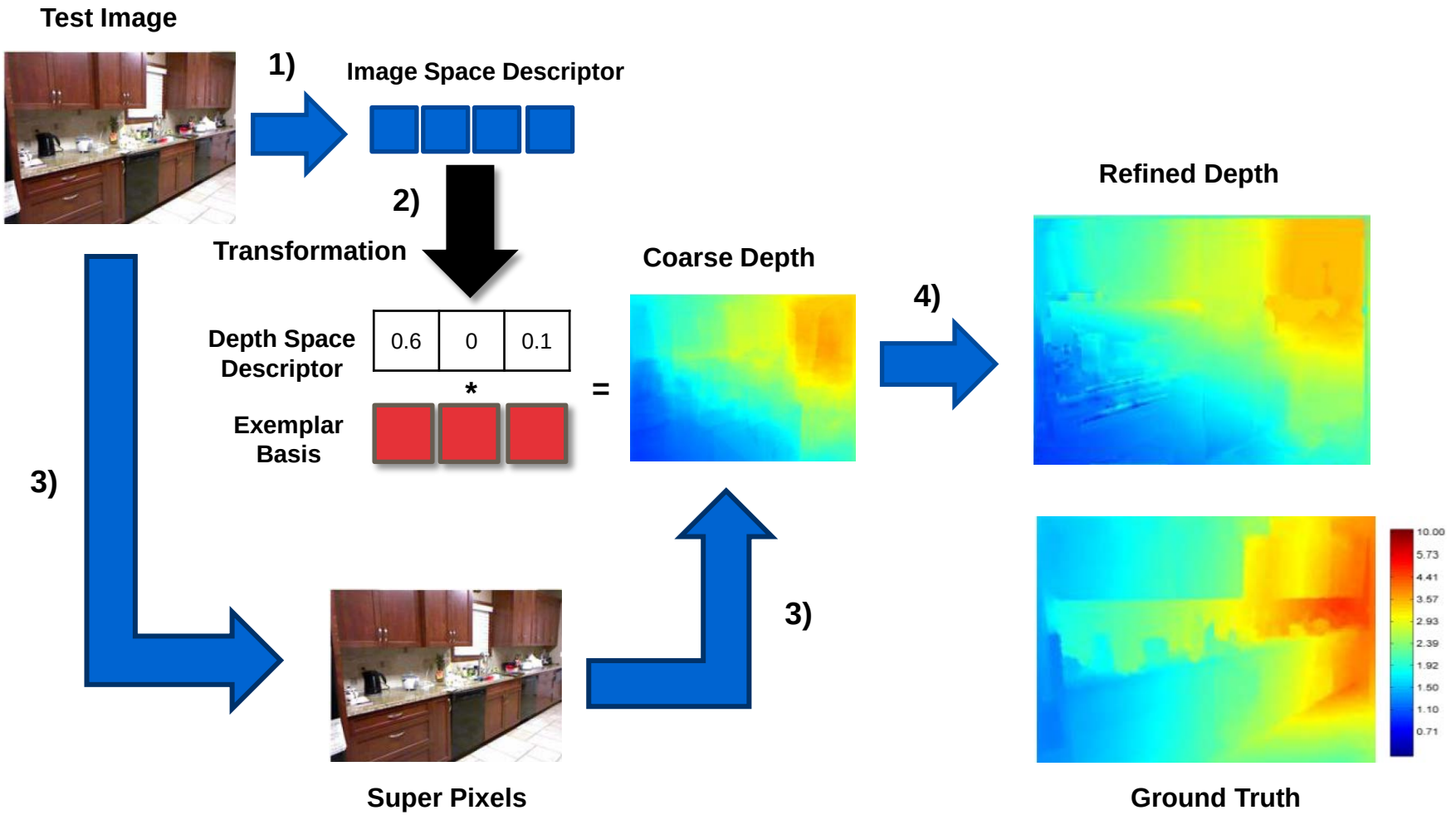


Rich, Compact
Image Space Descriptor



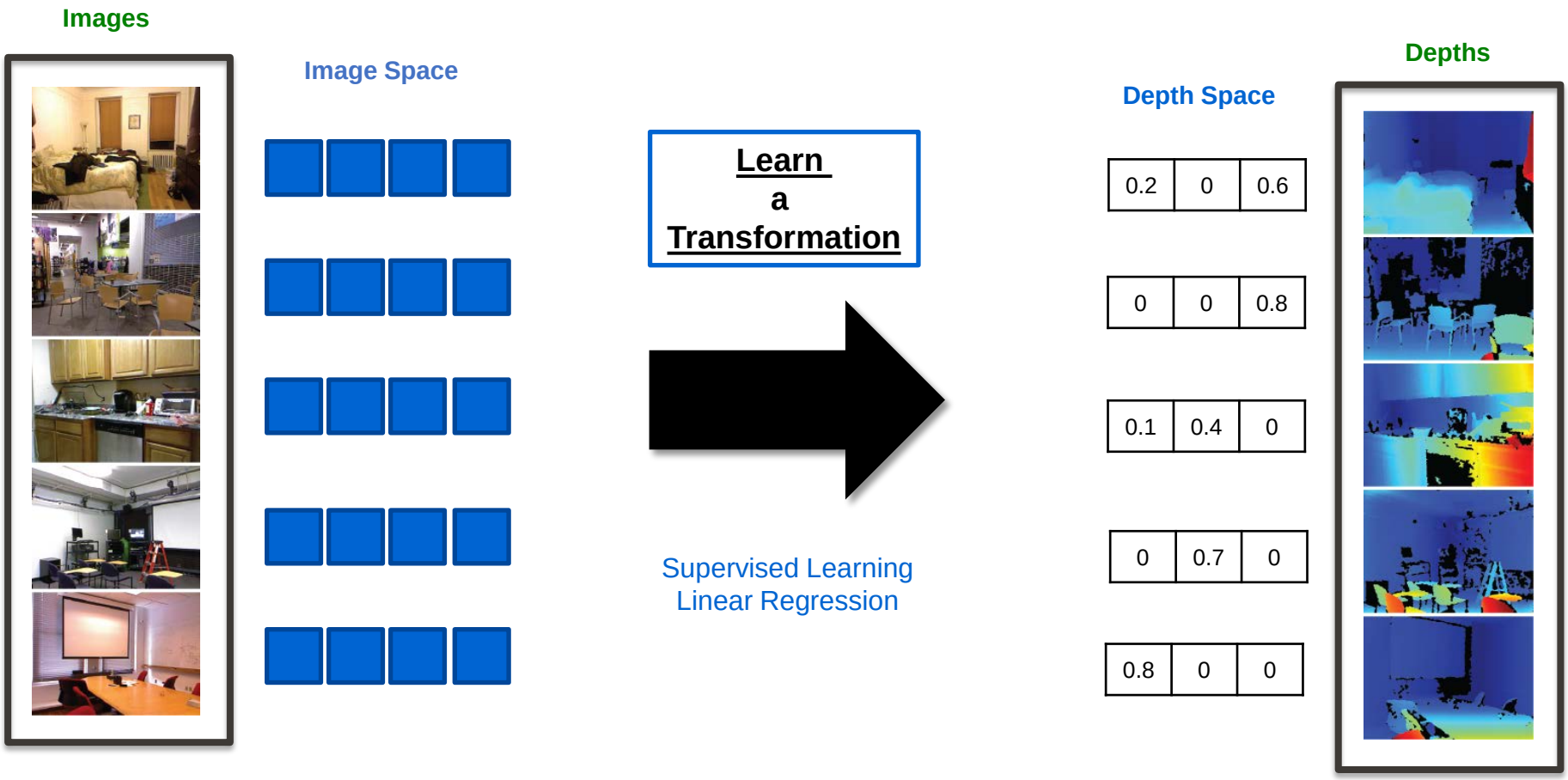
Visualization of Depth Maps via **Image Space Descriptor**

Im2depth: Putting it all Together



Im2depth: Learning a Mapping

Use an RGBD dataset , to learn Transformation between Image Space and Depth Space



Im2depth: Evaluation

Dataset

NYUV2 (RGBD Indoor Scene Dataset)

- **27** Scene Categories
- **464** Distinct Scenes
- **1449** RGBD Examples
  - **1200** Training
  - **249** Testing

Quantitative Results

Methods	L1 Err (m)	NCC Metric	Relative Err	RMS Err	Log10 Err
Proposed	**0.6901**	**0.68529**	**0.2941**	**0.85205**	**0.11241**
BG [10]	0.81695	0.61387	0.33981	1.0092	0.13172
NPS [9]	0.82514	0.6079	0.35482	1.0133	0.13301
GLB	0.90222	0.58058	0.38923	1.0988	0.14415
MK3D [14]	3.4781	0.40379	1.6228	3.9521	0.36463

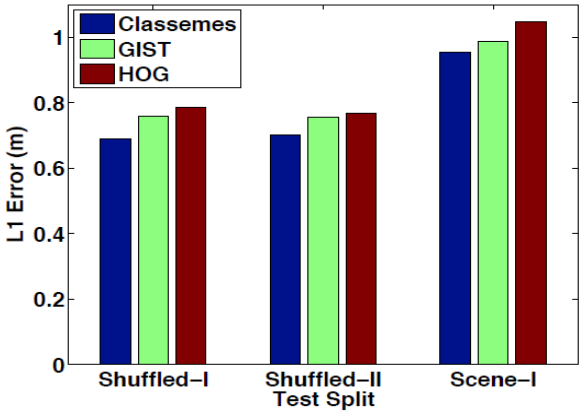
Im2Depth outperforms state of the art methods on all 5 metrics

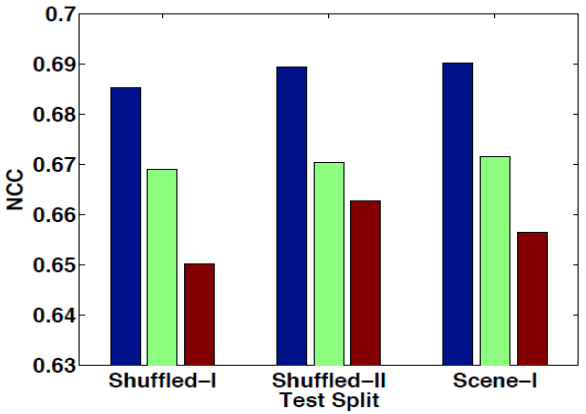
Im2depth: Experiments

Image Space

Objective : Find a Global Image Descriptor that yields the most informative **Image Space**

Conclusion: Classemes is the most informative descriptor

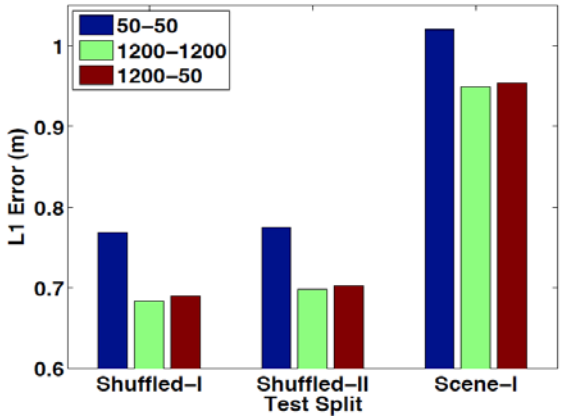


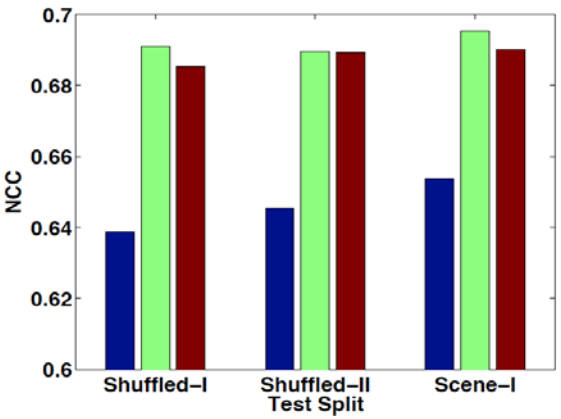


Depth Space

Objective: Finding good size of exemplar dictionaries

Conclusion: Use bigger sized Visual space Dictionaries and smaller Depth Dictionaries.





Im2depth: Conclusions

Dense Depth Estimation Method for Indoor Scenes

- Extremely Fast
- Highly Scalable
- Simple closed form Training
- Closed form Inference
- Well Suited for Mobile (Light-Weight)