Resources and future directions for you to start research
Data and code

https://holistic-3d.github.io/iccv19
https://github.com/holistic-3d/holistic-3d-resources

- Datasets with holistic 3D annotations.
- By us and others.
- With code for many.
L-CNN — End-to-End Wireframe Parsing

This repository contains the official PyTorch implementation of the paper: Yichao Zhou, Haozhi Qi, Yi Ma. "End-to-End Wireframe Parsing." ICCV 2019.

Introduction

L-CNN is a conceptually simple yet effective neural network for detecting the wireframe from a given image. It outperforms the previous state-of-the-art wireframe and line detectors by a large margin. We hope that this repository serves as an easily reproducible baseline for future researches in this area.

Main Results

Qualitative Measures

<table>
<thead>
<tr>
<th>LSD</th>
<th>AFM</th>
<th>Wireframe</th>
<th>L-CNN</th>
<th>Ground Truth</th>
</tr>
</thead>
</table>
Wireframe parsing code/data

- ShanghaiTech Wireframe Dataset
  5000 training images
  500 testing images

- Synthetic SceneCity Urban 3D (SU3) Dataset
  230 synthetic cities with high-level CAD annotation
  20000 training images
  300 testing images

- L-CNN: Effective end-to-end wireframe parsing algorithm
  State-of-the-art line detector and wireframe parser on datasets such as ShanghaiTech, SU3, York Urban.
ShanghaiTech Dataset Results

(a) LSD [2]  (b) AFM [3]  (c) Wireframe [1]  (d) L-CNN  (e) Ground Truth
Synthetic SceneCity Urban 3D (SU3) Dataset Results
LIFULL HOME'Sデータセット（旧名称: HOME'Sデータセット）

国立情報学研究所が株式会社LIFULL（旧社名 株式会社ネクスト）から提供を受けて研究者に提供しているデータセットです。

データ概要

不動産・住宅情報サイトLIFULL HOME'Sに掲載されたデータです。

- 貸物件スナップショットデータ（2015年9月時点、貸物件データ+画像データ）
  全国約533万件についての貸料、面積、立地（市区町村、郵便番号、築年数、築年数）、間取り、建物構造、諸設備などのデータと、各物件に対する間取り图や室内写真など約8,300万枚の画像データです。IDはユニーク番号に変更済みで、特定の物件に絡付く属性は含んでおりません。貸物件データはCSV形式のファイルで約1.6GBです。画像データは最大幅120ピクセル×縦120ピクセルのJPEG形式で、単一ファイルで約2100GBとなります。画像のメタデータには「玄関」「キッチン」といった画像の種別や、一部にはフリーテキストによる説明が付与されています。

- 高精度間取り図画像データ（貸物件スナップショットデータに対応）
- 5M raster floorplan images.
- 80M perspective RGB images.
- Various metadata for real estate business.
- 870 annotated vector-graphics floorplans.
- English version of the website and forms soon.
Floorplan reconstruction dataset 1/2

- Google Tango phone
- 155 RGBD videos
- Floorplan annotations
Floorplan reconstruction dataset 2/2

- Panorama RGBDs for 100 houses
- From Beike (real production)
- Floorplan annotations
Floorplan reconstruction dataset 2/2

- Panorama RGBDs for 100 houses
- From Beike (real production)
- Floorplan annotations
Problems with data-driven approaches

- Manual annotation of structure instances is extremely tedious, inefficient, and error-prone
Problems with data-driven approaches

What people think AI is about

The reality
Problems with data-driven approaches

- Each work only annotates a single type of structure
  - Lacks consistency
  - Ignores the strong relationships among different types of structure
Structured3D: A Large Photo-realistic Dataset for Structured 3D Modeling

Structured3D is a large-scale photo-realistic dataset containing 3.5K house designs (a) created by professional designers with a variety of ground truth 3D structure annotations (b) and generate photo-realistic 2D images (c).

People

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Acknowledgements

We would like to thank Kujiale.com for providing the database of house designs and the rendering engine.
Structured3D

- Original house designs created by professional designers
Design philosophy of Structured3D

A unified “primitive + relationship” representation

- Exploits the relationships among different structures
- Great potential of extension capabilities
Design philosophy of Structured3D

- Automatic generation of ground truth annotations
Design philosophy of Structured3D

- Automatic generation of ground truth annotations
Design philosophy of Structured3D

- Automatic generation of ground truth annotations
Design philosophy of Structured3D

- Photo-realistic 2D rendering
<table>
<thead>
<tr>
<th>Datasets</th>
<th>#Scenes</th>
<th>#Rooms</th>
<th>#Frames</th>
<th>Annotated structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>PlaneRCNN [12]</td>
<td>-</td>
<td>-</td>
<td>100,000</td>
<td>planes</td>
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<tr>
<td>Wireframe [9]</td>
<td>-</td>
<td>-</td>
<td>5,462</td>
<td>wireframe (2D)</td>
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<tr>
<td>SUN Primitive [27]</td>
<td>-</td>
<td>-</td>
<td>785</td>
<td>cuboids, other primitives</td>
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<tr>
<td>LSUN Room Layout [33]</td>
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<td>n/a†</td>
<td>5,396</td>
<td>cuboid layout</td>
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<tr>
<td>PanoContext [31]</td>
<td>-</td>
<td>n/a†</td>
<td>500 (pano)</td>
<td>cuboid layout</td>
</tr>
<tr>
<td>LayoutNet [34]</td>
<td>-</td>
<td>n/a†</td>
<td>1,071 (pano)</td>
<td>cuboid layout</td>
</tr>
<tr>
<td>Realtor360* [29]</td>
<td>-</td>
<td>n/a†</td>
<td>2,573 (pano)</td>
<td>Manhattan layout</td>
</tr>
<tr>
<td>Raster-to-Vector [14]</td>
<td>870</td>
<td>-</td>
<td>-</td>
<td>floorplan</td>
</tr>
<tr>
<td>Structured3D</td>
<td>3,500</td>
<td>21,835</td>
<td>196,515</td>
<td>“primitive + relationship”</td>
</tr>
</tbody>
</table>
Design philosophy of Structured3D

- Teach machine to achieve holistic, human-level understanding of the 3D environments

We want your feedback!

structured3d-dataset.org
Open research questions

- More global structure understanding (symmetry, repetitions)
- Unsupervised, weakly-supervised, self-supervised…
- Multi-view input (vs single view or 3D)
- Representation encompassing holistic structural information
Summary

Recognition reunites with reconstruction (junctions, wireframe, floorplan, shape-grammar)

Towards 3D reconstruction at the human perception level

Huge impacts in modeling (construction)
Please check our website (https://holistic-3d.github.io/iccv19)

ICCV 2019 Tutorial
Holistic 3D Reconstruction: Learning to Reconstruct Holistic 3D Structures from Sensorial Data
Monday, October 28, 2019 - AM
Room 300, COEX Convention Center, Seoul, Korea

Overview
The perception of holistic scene structures, relationships in a scene, plays a critical role for understanding the environment. Humans process these relationships relatively early and accurately. The perception of holistic scene structures, relationships in a scene, plays a critical role for understanding the environment. Humans process these relationships relatively early and accurately.
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