

Introduction to PyTorch3D

TTLAB Presentation
Simeon Ramjit (BSc, Eng)

Overview

- PyTorch3D
 - What is it?
 - Why this library was created
 - Features and uses
- PyTorch3D Demonstration
 - Extracting a 3D mesh of a 2D object from a 2D photo

PyTorch3D

- Open sourced library 3D for deep learning developed by facebook AI
- Leverages a new data structure called Meshes which batches heterogeneous meshes in deep learning applications
 - Necessary to handle 3D meshes of different sizes.
 - 3D data is more memory and has greater computation requirements
- Used in:
 - Mesh R-CNN (today's demo)
 - SynSin: End-to-end View Synthesis from a Single Image

PyTorch3D – Why?

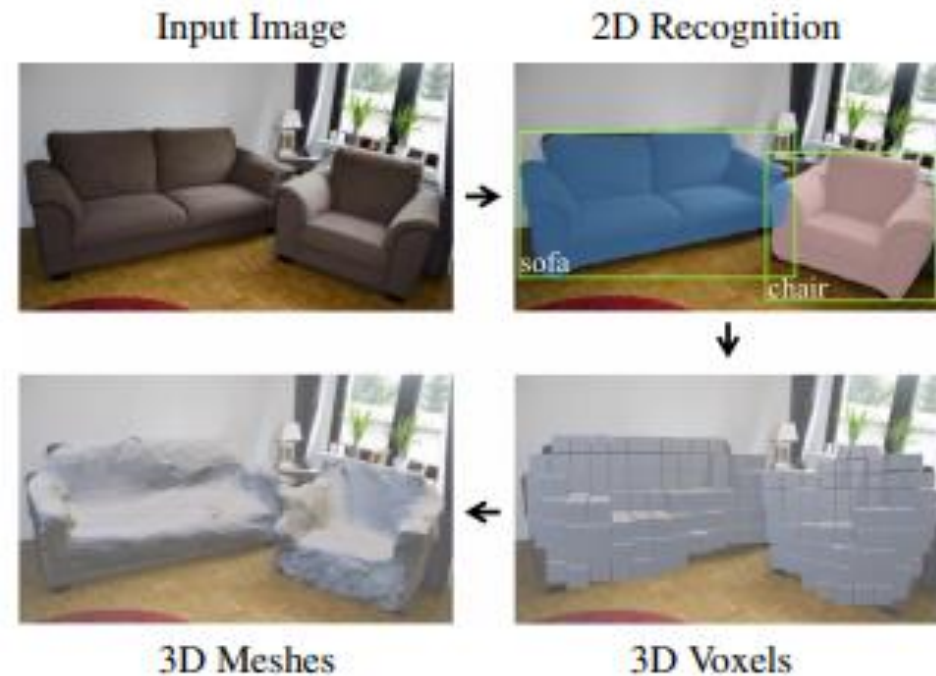
- Powered by PyTorch Tensors
- Traditional operators in computer graphics involve steps that block gradients.
3D operations are differentiable in PyTorch3D
- Several common operators have already been implemented for developers to use:
 - Chamfer
 - Edge Loss
 - Normal consistency
 - Laplacian

Features and uses

- Uses
 - Film, animation, games and medicine
 - Improved robot navigation and AR (clothing try-on visualization)
- Features
 - Can be seamlessly integrated into a deep learning pipeline
 - Differentiable Mesh Renderer with custom additions (lighting and shading)
 - Utilize GPUs for acceleration

Demonstration

- Uses Mesh R-CNN which is powered by Detectron2 and PyTorch3D to detect objects and then extract the 3D mesh.



- Performed on the Google Cloud Platform, not all commands will be applicable

Prerequisites

- PyTorch - <https://pytorch.org/get-started/locally/>
- CUDA (nVIDIA Graphics Card)

PyTorch Build	Stable (1.5.1)		Preview (Nightly)	
Your OS	Linux	Mac	Windows	
Package	Conda	Pip	LibTorch	Source
Language	Python		C++ / Java	
CUDA	9.2	10.1	10.2	None
Run this Command:	<pre>pip install torch===1.5.1 torchvision===0.6.1 -f https://download.pytorch.org/whl/torch_stable.html</pre>			

Steps to install PyTorch3D and dependencies

1. Install Detectron2

```
python -m pip install 'git+https://github.com/facebookresearch/detectron2.git'
```

2. Install PyTorch3D

```
pip install 'git+https://github.com/facebookresearch/pytorch3d.git'
```

3. Install optimizing static compiler

```
pip install -U cython
```

4. Install dependency

```
pip install  
"git+https://github.com/philferriere/cocoapi.git#egg=pycocotools&subdirectory=PythonAPI"
```


Steps to install PyTorch3D

5. Clone MeshR-CNN Repo

```
git clone https://github.com/facebookresearch/meshrcnn.git
```

6. Change directory to downloaded repo

```
cd meshrcnn
```

7. Install packages needed by meshrcnn


```
pip install -e .
```

8. Place image with object in meshrcnn/demo directory

9. Extract mesh

```
python demo/demo.py --config-file configs/pix3d/meshrcnn_R50_FPN.yaml --input demo/table.jpg --  
output output_demo --onlyhighest MODEL.WEIGHTS meshrcnn://meshrcnn_R50.pth
```

Questions?

 1-868-284-0940

 simeonramjit@gmail.com

 github.com/simeon9696/py3d-demo.git



References

- PyTorch3D - <https://pytorch3d.org/>
- Mesh R-CNN - <https://arxiv.org/pdf/1906.02739.pdf>
- C3DPO arxiv.org/pdf/1909.02533.pdf?fbclid=IwAR1_wn6ZSiB4koiThOTToYf_3N8yMxNL2FIGM51lu9IDFO-rjrB9krMsqhM
- Facebook AI - <https://ai.facebook.com/>
- SysSin - <https://arxiv.org/abs/1912.08804>