The aim of scikit-surgery torch is to provide a home for various pytorch models/examples/utilities that may be useful for Image Guided Surgery.
CHAPTER 1

Features

Implemented models:

- **High Resolution Stereo network** Inference only, see author’s repo for pre trained weights. As at commit aae0b9b.
- **Volume2SurfaceCNN** Inferencece only, see author’s repo for pre trained weights. As at commit 5a656381.
- Models can run on GPU or CPU.
- Example usage in *tests/*.

Source code is available on GitHub.

1.1 scikit-surgerytorch

![weiss](image)

Author: Thomas Dowrick

scikit-surgerytorch is part of the scikit-surgery software project, developed at the Wellcome EPSRC Centre for Interventional and Surgical Sciences, part of University College London (UCL).

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scikit-surgerytorch is NOT meant to be a layer on-top of pytorch or provide a new kind-of platform. The aim is that researchers can learn from examples, and importantly, learn how to deliver an algorithm that can be used by other people out of the box, with just a `pip install`, rather than a new user having to re-implement stuff, or struggle to get someone else’s code running.

Cloning

You can clone the repository using the following command:

```
git clone https://github.com/UCL/scikit-surgerytorch
```

Running tests

Pytest is used for running unit tests:

```
pip install pytest
python -m pytest
```

Linting

This code conforms to the PEP8 standard. Pylint can be used to analyse the code:

```
pip install pylint
pylint --rcfile=tests/pylintrc sksurgerytorch
```

1.1.2 Installing

You can pip install directly from the repository as follows:

```
pip install git+https://github.com/UCL/scikit-surgerytorch
```

Contributing

Please see the contributing guidelines.

Useful links

- Source code repository
- Documentation
1.1.3 Licensing and copyright

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1.1.4 Acknowledgements

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1.2 Stereo Reconstruction

1.2.1 High Resolution Stereo

Module to implement Hierarchical Deep Stereo Matching on High Resolution Images network.

```python
class sksurgerytorch.models.high_res_stereo.HSMNet(max_disp: int = 255, entropy_threshold: float = -1, level: int = 1, scale_factor: float = 0.5, weights=None):
    Class to encapsulate network form ‘Hierarchical Deep Stereo Matching on High Resolution Images’.
    Thanks to Gengshang Yang, for their network implementation.

    Parameters

    • max_disp – Maximum number of disparity levels
    • entropy_threshold – Pixels with entropy above this value will be ignored in the disparity map. Disabled if set to -1.
    • level – Set to 1, 2 or 3 to trade off quality of depth estimation against runtime. 1 = best depth estimation, longer runtime, 3 = worst depth estimation, fastest runtime.
    • scale_factor – Images can be resized before passing to the network, for performance improvements. This sets the scale factor.
    • weights – Path to trained model weights (.tar file)

    predict(left_image: numpy.ndarray, right_image: numpy.ndarray) → numpy.ndarray
    Predict disparity from a pair of stereo images.

    Parameters

    • left_image (np.ndarray) – Left stereo image, 3 channel RGB
    • right_image (np.ndarray) – Right stereo image, 3 channel RGB

    Returns Predicted disparity, grayscale

    Return type np.ndarray
```

This is for the command line entry point

```python
sksurgerytorch.models.high_res_stereo.run_hsmnet_model(max_disp, entropy_threshold, level, scale_factor, weights, left_image, right_image, output_file)
```
class sksurgerytorch.models.high_res_stereo.toTensorLegacy

1.3 Non Rigid Registration

1.3.1 Volume 2 Surface CNN

V2SNet Model Implementation

class sksurgerytorch.models.volume_to_surface.Volume2SurfaceCNN (mask: bool = True, weights: str = None, grid_size: int = 64)

Class to encapsulate network form ‘Non-Rigid Volume to Surface Registration using a Data-Driven Biomechanical Model’.

Thanks to Micha Pfieffer, for their network implementation.

Parameters

• mask (bool) – If true, use masking
• weights (str) – Path to trained model weights (.tar file)

predict (preoperative: numpy.ndarray, intraoperative: numpy.ndarray) → numpy.ndarray
Predict the displacement field between model and surface.

Parameters

• preoperative (np.ndarray) – Preoperative surface/point cloud
• intraoperative (np.ndarray) – Intraoperative surface/point cloud

Returns Displacement field

Return type np.ndarray
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