
scikit-surgerytorch Documentation

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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.

Implemented models:

- [High Resolution Stereo network](#) Inference only, see author's repo for pre trained weights. As at commit [aae0b9b](#).
- [Volume2SurfaceCNN](#) Inference 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



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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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1.1.1 Features

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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

Copyright 2020 University College London. scikit-surgerytorch is released under the BSD-3 license. Please see the [license file](#) for details.

1.1.4 Acknowledgements

Supported by [Wellcome](#) and [EPSRC](#).

1.2 Stereo Reconstruction

1.2.1 High Resolution Stereo

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

```
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*

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

This is for the command line entry point

```
class sksurgerytorch.models.high_res_stereo.toTensorLegacy
```

1.3 Non Rigid Registration

1.3.1 Volume 2 Surface CNN

V2SNet Model Impementation

```
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 Pfeiffer](#), 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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