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# **dask-ndmeasure Documentation**

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# CHAPTER 1

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## dask-ndmeasure

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A library for computing N-D measurements on labeled Dask Arrays

- Free software: BSD 3-Clause
- Documentation: <https://dask-ndmeasure.readthedocs.io>.

## 1.1 Features

- TODO

## 1.2 Credits

This package was created with [Cookiecutter](#) and the [dask-image/dask-image-cookiecutter](#) project template.





### 2.1 Stable release

To install `dask-ndmeasure`, run this command in your terminal:

```
$ pip install dask-ndmeasure
```

This is the preferred method to install `dask-ndmeasure`, as it will always install the most recent stable release.

If you don't have `pip` installed, this [Python installation guide](#) can guide you through the process.

### 2.2 From sources

The sources for `dask-ndmeasure` can be downloaded from the [Github repo](#).

You can either clone the public repository:

```
$ git clone git://github.com/dask-image/dask-ndmeasure
```

Or download the [tarball](#):

```
$ curl -OL https://github.com/dask-image/dask-ndmeasure/tarball/master
```

Once you have a copy of the source, you can install it with:

```
$ python setup.py install
```



## CHAPTER 3

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### Usage

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To use dask-ndmeasure in a project:

```
import dask_ndmeasure
```



## 4.1 `dask_ndmeasure` package

`dask_ndmeasure.center_of_mass` (*input*, *labels=None*, *index=None*)

Find the center of mass over an image at specified subregions.

**Parameters**

- **input** (*ndarray*) – N-D image data
- **labels** (*ndarray*, *optional*) – Image features noted by integers. If `None` (default), all values.
- **index** (*int or sequence of ints*, *optional*) – Labels to include in output. If `None` (default), all values where non-zero `labels` are used.

The `index` argument only works when `labels` is specified.

**Returns** `center_of_mass` – Coordinates of centers-of-mass of `input` over the `index` selected regions from `labels`.

**Return type** `ndarray`

`dask_ndmeasure.extrema` (*input*, *labels=None*, *index=None*)

Find the min and max with positions over an image at specified subregions.

**Parameters**

- **input** (*ndarray*) – N-D image data
- **labels** (*ndarray*, *optional*) – Image features noted by integers. If `None` (default), all values.
- **index** (*int or sequence of ints*, *optional*) – Labels to include in output. If `None` (default), all values where non-zero `labels` are used.

The `index` argument only works when `labels` is specified.

**Returns** **minimums, maximums, min\_positions, max\_positions** – Values and coordinates of minimums and maximums in each feature.

**Return type** tuple of ndarrays

`dask_ndmeasure.histogram(input, min, max, bins, labels=None, index=None)`

Find the histogram over an image at specified subregions.

Histogram calculates the frequency of values in an array within bins determined by `min`, `max`, and `bins`. The `labels` and `index` keywords can limit the scope of the histogram to specified sub-regions within the array.

#### Parameters

- **input** (*ndarray*) – N-D image data
- **min** (*int*) – Minimum value of range of histogram bins.
- **max** (*int*) – Maximum value of range of histogram bins.
- **bins** (*int*) – Number of bins.
- **labels** (*ndarray, optional*) – Image features noted by integers. If `None` (default), all values.
- **index** (*int or sequence of ints, optional*) – Labels to include in output. If `None` (default), all values where non-zero `labels` are used.

The `index` argument only works when `labels` is specified.

**Returns** **histogram** – Histogram of `input` over the `index` selected regions from `labels`.

**Return type** ndarray

`dask_ndmeasure.label(input, structure=None)`

Label features in an array.

#### Parameters

- **input** (*ndarray*) – An array-like object to be labeled. Any non-zero values in `input` are counted as features and zero values are considered the background.
- **structure** (*ndarray, optional*) – A structuring element that defines feature connections. `structure` must be symmetric. If no structuring element is provided, one is automatically generated with a squared connectivity equal to one. That is, for a 2-D `input` array, the default structuring element is:

```
[[0, 1, 0],
 [1, 1, 1],
 [0, 1, 0]]
```

#### Returns

- **label** (*ndarray or int*) – An integer ndarray where each unique feature in `input` has a unique label in the returned array.
- **num\_features** (*int*) – How many objects were found.

`dask_ndmeasure.labeled_comprehension(input, labels, index, func, out_dtype, default, pass_positions=False)`

Compute a function over an image at specified subregions.

Roughly equivalent to `[func(input[labels == i]) for i in index]`.

Sequentially applies an arbitrary function (that works on array\_like input) to subsets of an n-D image array specified by `labels` and `index`. The option exists to provide the function with positional parameters as the second argument.

**Parameters**

- **input** (*ndarray*) – N-D image data
- **labels** (*ndarray, optional*) – Image features noted by integers. If None (default), all values.
- **index** (*int or sequence of ints, optional*) – Labels to include in output. If None (default), all values where non-zero `labels` are used.  
The `index` argument only works when `labels` is specified.
- **func** (*callable*) – Python function to apply to labels from input.
- **out\_dtype** (*dtype*) – Dtype to use for result.
- **default** (*int, float or None*) – Default return value when a element of `index` does not exist in `labels`.
- **pass\_positions** (*bool, optional*) – If True, pass linear indices to `func` as a second argument. Default is False.

**Returns** `result` – Result of applying `func` on `input` over the `index` selected regions from `labels`.

**Return type** `ndarray`

`dask_ndmeasure.maximum(input, labels=None, index=None)`

Find the maxima over an image at specified subregions.

**Parameters**

- **input** (*ndarray*) – N-D image data
- **labels** (*ndarray, optional*) – Image features noted by integers. If None (default), all values.
- **index** (*int or sequence of ints, optional*) – Labels to include in output. If None (default), all values where non-zero `labels` are used.

The `index` argument only works when `labels` is specified.

**Returns** `maxima` – Maxima of `input` over the `index` selected regions from `labels`.

**Return type** `ndarray`

`dask_ndmeasure.maximum_position(input, labels=None, index=None)`

Find the positions of maxima over an image at specified subregions.

For each region specified by `labels`, the position of the maximum value of `input` within the region is returned.

**Parameters**

- **input** (*ndarray*) – N-D image data
- **labels** (*ndarray, optional*) – Image features noted by integers. If None (default), all values.
- **index** (*int or sequence of ints, optional*) – Labels to include in output. If None (default), all values where non-zero `labels` are used.

The `index` argument only works when `labels` is specified.

**Returns** `maxima_positions` – Maxima positions of `input` over the `index` selected regions from `labels`.

**Return type** ndarray

`dask_ndmeasure.mean(input, labels=None, index=None)`

Find the mean over an image at specified subregions.

**Parameters**

- **input** (*ndarray*) – N-D image data
- **labels** (*ndarray, optional*) – Image features noted by integers. If None (default), all values.
- **index** (*int or sequence of ints, optional*) – Labels to include in output. If None (default), all values where non-zero labels are used.

The index argument only works when labels is specified.

**Returns** means – Mean of input over the index selected regions from labels.

**Return type** ndarray

`dask_ndmeasure.median(input, labels=None, index=None)`

Find the median over an image at specified subregions.

**Parameters**

- **input** (*ndarray*) – N-D image data
- **labels** (*ndarray, optional*) – Image features noted by integers. If None (default), all values.
- **index** (*int or sequence of ints, optional*) – Labels to include in output. If None (default), all values where non-zero labels are used.

The index argument only works when labels is specified.

**Returns** medians – Median of input over the index selected regions from labels.

**Return type** ndarray

`dask_ndmeasure.minimum(input, labels=None, index=None)`

Find the minima over an image at specified subregions.

**Parameters**

- **input** (*ndarray*) – N-D image data
- **labels** (*ndarray, optional*) – Image features noted by integers. If None (default), all values.
- **index** (*int or sequence of ints, optional*) – Labels to include in output. If None (default), all values where non-zero labels are used.

The index argument only works when labels is specified.

**Returns** minima – Minima of input over the index selected regions from labels.

**Return type** ndarray

`dask_ndmeasure.minimum_position(input, labels=None, index=None)`

Find the positions of minima over an image at specified subregions.

**Parameters**

- **input** (*ndarray*) – N-D image data
- **labels** (*ndarray, optional*) – Image features noted by integers. If None (default), all values.



- **index** (*int or sequence of ints, optional*) – Labels to include in output. If None (default), all values where non-zero labels are used.

The `index` argument only works when `labels` is specified.

**Returns** `minima_positions` – Maxima positions of input over the `index` selected regions from labels.

**Return type** `ndarray`

`dask_ndmeasure.standard_deviation` (*input, labels=None, index=None*)

Find the standard deviation over an image at specified subregions.

**Parameters**

- **input** (*ndarray*) – N-D image data
- **labels** (*ndarray, optional*) – Image features noted by integers. If None (default), all values.
- **index** (*int or sequence of ints, optional*) – Labels to include in output. If None (default), all values where non-zero labels are used.

The `index` argument only works when `labels` is specified.

**Returns** `standard_deviation` – Standard deviation of input over the `index` selected regions from labels.

**Return type** `ndarray`

`dask_ndmeasure.sum` (*input, labels=None, index=None*)

Find the sum over an image at specified subregions.

**Parameters**

- **input** (*ndarray*) – N-D image data
- **labels** (*ndarray, optional*) – Image features noted by integers. If None (default), all values.
- **index** (*int or sequence of ints, optional*) – Labels to include in output. If None (default), all values where non-zero labels are used.

The `index` argument only works when `labels` is specified.

**Returns** `sum` – Sum of input over the `index` selected regions from labels.

**Return type** `ndarray`

`dask_ndmeasure.variance` (*input, labels=None, index=None*)

Find the variance over an image at specified subregions.

**Parameters**

- **input** (*ndarray*) – N-D image data
- **labels** (*ndarray, optional*) – Image features noted by integers. If None (default), all values.
- **index** (*int or sequence of ints, optional*) – Labels to include in output. If None (default), all values where non-zero labels are used.

The `index` argument only works when `labels` is specified.

**Returns** `variance` – Variance of input over the `index` selected regions from labels.

**Return type** `ndarray`



Contributions are welcome, and they are greatly appreciated! Every little bit helps, and credit will always be given. You can contribute in many ways:

## 5.1 Types of Contributions

### 5.1.1 Report Bugs

Report bugs at <https://github.com/dask-image/dask-ndmeasure/issues>.

If you are reporting a bug, please include:

- Your operating system name and version.
- Any details about your local setup that might be helpful in troubleshooting.
- Detailed steps to reproduce the bug.

### 5.1.2 Fix Bugs

Look through the GitHub issues for bugs. Anything tagged with “bug” and “help wanted” is open to whoever wants to implement it.

### 5.1.3 Implement Features

Look through the GitHub issues for features. Anything tagged with “enhancement” and “help wanted” is open to whoever wants to implement it.

### 5.1.4 Write Documentation

dask-ndmeasure could always use more documentation, whether as part of the official dask-ndmeasure docs, in docstrings, or even on the web in blog posts, articles, and such.

### 5.1.5 Submit Feedback

The best way to send feedback is to file an issue at <https://github.com/dask-image/dask-ndmeasure/issues>.

If you are proposing a feature:

- Explain in detail how it would work.
- Keep the scope as narrow as possible, to make it easier to implement.
- Remember that this is a volunteer-driven project, and that contributions are welcome :)

## 5.2 Get Started!

Ready to contribute? Here's how to set up *dask-ndmeasure* for local development.

1. Fork the *dask-ndmeasure* repo on GitHub.
2. Clone your fork locally:

```
$ git clone git@github.com:your_name_here/dask-ndmeasure.git
```

3. Install your local copy into an environment. Assuming you have conda installed, this is how you set up your fork for local development (on Windows drop *source*). Replace “<some version>” with the Python version used for testing.:

```
$ conda create -n dask-ndmeasureenv python="<some version>"
$ source activate dask-ndmeasureenv
$ python setup.py develop
```

4. Create a branch for local development:

```
$ git checkout -b name-of-your-bugfix-or-feature
```

Now you can make your changes locally.

5. When you're done making changes, check that your changes pass flake8 and the tests, including testing other Python versions:

```
$ flake8 dask_ndmeasure tests
$ python setup.py test or py.test
```

To get flake8, just conda install it into your environment.

6. Commit your changes and push your branch to GitHub:

```
$ git add .
$ git commit -m "Your detailed description of your changes."
$ git push origin name-of-your-bugfix-or-feature
```

7. Submit a pull request through the GitHub website.

## 5.3 Pull Request Guidelines

Before you submit a pull request, check that it meets these guidelines:

1. The pull request should include tests.
2. If the pull request adds functionality, the docs should be updated. Put your new functionality into a function with a docstring, and add the feature to the list in README.rst.
3. The pull request should work for Python 2.7, 3.4, 3.5, and 3.6. Check [https://travis-ci.org/dask-image/dask-ndmeasure/pull\\_requests](https://travis-ci.org/dask-image/dask-ndmeasure/pull_requests) and make sure that the tests pass for all supported Python versions.

## 5.4 Tips

To run a subset of tests:

```
$ py.test tests/test_core.py
```



## CHAPTER 6

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### Credits

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#### 6.1 Development Lead

- John Kirkham, Howard Hughes Medical Institute <kirkhamj@janelia.hhmi.org>

#### 6.2 Contributors

None yet. Why not be the first?





## CHAPTER 7

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