TesseRACt Documentation

Release 0.1.1

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Contents

Contents:

CHAPTER 1

Introduction

The tesseract package is designed to compute concentrations of simulated dark matter halos from volume info for particles generated using Voronoi tesselation. This technique is advantageous as it is non-parametric, does not assume spherical symmetry, and allows for the presence of substructure. For a more complete description of this technique including a comparison to other techniques for calculating concentration, please see the accompanying paper Lang et al. (2015).

This package allows users to:

- perform Voronoi tessellation through access to qhull routines
- measure particle distribution properties like concentration using different techniques including tessellation
- replicate the performance test presented in Lang et al. (2015)

CHAPTER 2

Installation

TesseRACt can be installed from either PyPI or from the source distribution.

2.1 Installing from PyPI

The easiest way to install TesseRACt is using `pip`. If you have administrative privleges on the target machine, this is done using:

```
$ pip install tesseract
```

If you do not have admin privleges, simply install it locally using:

```
$ pip install tesseract --user
```

The TesseRACt package can then be updated to the most recent stable release using:

```
$ pip install tesseract --upgrade
```

2.2 Installing from the Source Distribution

The most recent TesseRACt source distribution can be obtained by either downloading or cloning the repository from Bitbucket. Using Mercurial this is done by issuing the following command:

```
$ hg clone https://[username]@bitbucket.org/[username]/tesseract
```

where `[username]` should be replaced with your Bitbucket username. The Bitbucket repository is currently private. If you would like access to this repository, please contact Meagan Lang.

Once you have the TesseRACt source distribution, move into the distribution directory:

```
$ cd tesseract
```

and use the standard Distutils command to build and install the distribution:

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

If you do not have administrative privleges, this can be done using:

```
$ python setup.py install --user
```

2.3 Testing the Install

To test that everything was installed propertly. From the python prompt, import TesseRACt:

```
>>> import tesseract
```

and try to access the documentation:

```
>>> help(tesseract)
```

Additional tests can be found in `tests`.

2.4 The First Import

The first time you run `import tesseract`, a few things will happen. First, a user config file `.tessrc` will be created in your home directory. This file is used to control different aspects of TesseRACt which are explained in The Config File. Second, you will be prompted to enter a directory in which qhull will be installed. This directory will be added to the user configuration file, which can be changed at any time if you move qhull.

CHAPTER 3

The Config File

The TesseRACt user config file *.tessrc* is created in your home directory when TesseRACt is first imported. It is initialized from the default configuration file *default_config.ini* and can be edited at any time to change different TesseRACt aspects. However, the default configuration file should NOT be edited directly in case new functionality is added. Any options not provided in *.tessrc* are initialized to the values in *default_config.ini*.

For additional details on configuration file syntax, please see the documentation for the ConfigParser package.

3.1 General Options

outputdir Path to directory where TesseRACt output should be saved. If not provided, output will be saved in the current working directory.

3.2 NFW Options

Options for controlling how NFW profile parameters are computed.

default-rhoc The default value used for the critical density of the universe in units of *Msol kpc**-3*. (*1.1845e2 Msol kpc**-3* by default)

default-delta The default value used to define the virial over-density. This is used to calculate the virial radius and mass of a halo. (200 by default)

3.3 Test Options

Options for controlling the examples provided.

snapshot-format Code specifying the format of the test halo snapshots. This should not be edited unless you convert the test halo snapshots into another snapshot format. (0 by default)

halodir Directory containing test halo snapshots. If not provided, it is assumed to be the directory within the TesseRACt distribution.

copydir Directory containing copies of the test halo snapshots initialized with different random number seeds. As these snapshots are not provided with the public distribution, this option should not be used.

avail-conc List of concentrations of the test halo snapshots. The current version of TesseRACt includes test halos with concentrations of 5, 10, 25, and 50.

default-series String specifying test series that should be run by default when *examples.run_series* is called. ('conc' by default)

avail-series List of available test series. TesseRACt currently supports the following series which are described in the Examples section below: conc, oblate, prolate, triax, npart, substr_mass, substr_rsep, substr_conc, and substr_rho0.

nfw-methods List of methods for calculating NFW parameters that are used for each test by default. (voronoi, fit, rhalf, and vpeak by default)

default-conc Default concentration used for tests (10 by default)

default-subm Default mass of subhalo used for substructure tests in terms of the parent halo's virial mass (0.1 by default)

default-subr Default radius that subhalo is placed at for substructure tests in terms of the parent halo's virial radius (0.5 by default)

default-subc Default concentration of subhalo used for substructure tests. (50 by default)

default-subrho Default density of subhalo used for substructure tests in terms of the parent halo's central concentration (0.5 by default)

default-ellip Default ellipticity of halo for test which vary triaxiality. (0.5 by default)

3.4 qhull Options

Options for controlling qhull.

install-dir The directory under which qhull should be installed. This is initialized the first time that the TesseRACt package is imported. If this does not point to a valid qhull installation, TesseRACt will be unable to perform the Voronoi tessellation.

CHAPTER 4

Code

CHAPTER 5

Indices and tables

- genindex
- modindex
- search