
Sky Area Documentation

Release 0.1

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Nov 29, 2017

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The `sky_area` package provides utilities to turn samples from probability distributions on the sky (i.e. samples of RA and DEC) into sky maps, computing credible areas of the distribution, calculating the minimum searched area following a greedy algorithm to find an object, and producing [Healpix-pixellated](#) maps that can be used to optimise a search with a known telescope beam.

There are also executable codes, that rely on the [LALInference](#) libraries from the LIGO Scientific Collaboration, for producing various skymaps and credible regions in FITS format.

The algorithm used to turn discrete samples into a probability distribution on the sky is an improved version of the clustering algorithm [X-means](#) that provides more flexibility in the shape of each cluster. The code works hard to ensure that the quoted credible areas are [unbiased](#), so the X% credible area will, on average, enclose X% of the probability mass.

You may want to:

- Compute the credible areas or the area searched under a greedy algorithm for a distribution on the sky represented by discrete samples. Use the `sky_area.sky_area_clustering.ClusteredSkyKDEPosterior` class.
- Automatically produce the above from the output of a LALInference run. Use the executable program `run_sky_area.py`
- Produce a Healpix map that ranks pixels on the sky for a search following the posterior density with a telescope having a known beam size. Use the `sky_area.search.search_map()` function or, from the command-line, the `make_search_map.py` executable.
- Collate a bunch of sky maps, searched areas, and credible areas to produce a cumulative distribution of searched/credible areas from a combined data set of posteriors, as in [Singer, et al.](#) Use the `process_areas.py` executable.
- Compute, as a function of position on the sky, the constraints on the distance of the source. Use the `sky_area.sky_area_clustering.Clustered3DKDEPosterior`.

CHAPTER 1

The `sky_area.sky_area_clustering` Module

CHAPTER 2

The `sky_area.search` Module

CHAPTER 3

Indices and tables

- `genindex`
- `modindex`
- `search`