

Use of MultiNest from Monte Python

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- Nested sampling was developed by J. Skilling (2004)
- MultiNest is coded in Fortran90 by F. Feroz, M.P. Hobson et al (arXiv:0809.3437, arXiv:0704.3704, arXiv:1306.2144)
- PyMultiNest is a python wrapper for Multinest by J. Buchner (arXiv:1402.0004)

Short review of MultiNest

MultiNest is most useful for

- Estimating the evidence \Rightarrow model comparison
- Quickly estimating a covariace matrix
- First aproach to a likely complicated likelihood
 - Complicated shape/degeneracies
 - Multiple modes
 - ...

MultiNest is not so useful/efficient for

- Parameter estimation
- Large number of parameters

A word of warning: your priors must be bound!
(unlike with MCMC's)

This is because NS aims to compute $E = \int \mathcal{L}(\mathcal{D}|\theta)|\pi(\theta) d\theta$

How to call it

As simple as

```
python /path/to/MontePython.py run -m NS -p [...] -o chain_folder
```

The resulting pure MultiNest files are written to `chain_folder/NS/`

The next thing to do is to analyse it:

```
python /path/to/MontePython.py info chain_folder/NS
```

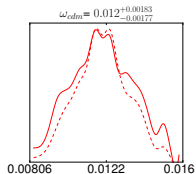
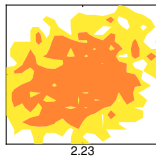
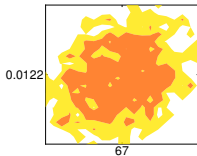
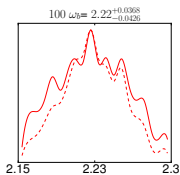
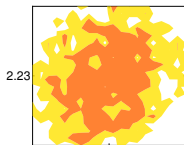
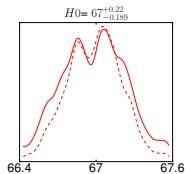
Mono-modal A chain file is created in the `chain_folder`, which can be analysed as if it came from an MCMC sampling.

```
python /path/to/MontePython.py info chain_folder/
```

Multi-modal Subfolders `mode_#` are created under `chain_folder`, each containing the corresponding samples in a chain file, plus a new `log.param` file with the limits for the parameters appropriately cropped.

```
python /path/to/MontePython.py info chain_folder/mode_#
```

Example: 3-modal gaussian – mode 1



Original

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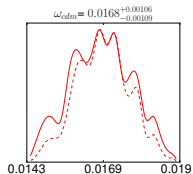
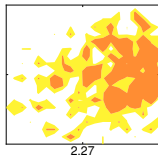
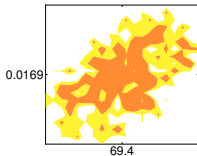
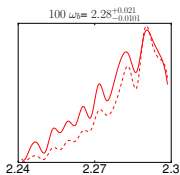
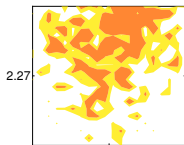
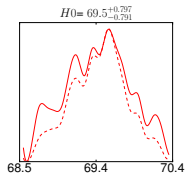
BestFit:

67.0, 2.225e-2, 0.0120

CovMat:

0.1,	2e-5,	2e-4
2e-5,	2e-7,	2.4e-7
2e-4,	2.4e-7,	5e-6

Example: 3-modal gaussian – mode 2



Original

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BestFit:

69.5, 2.300e-2, 0.0170

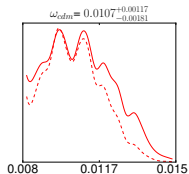
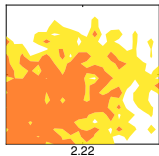
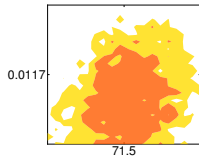
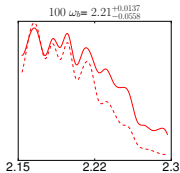
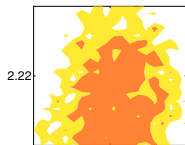
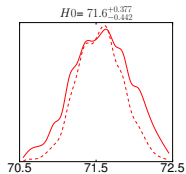
CovMat:

0.3, 2e-5, 3.5e-4

2e-5, 1.2e-7, 1.4e-7

3.5e-4, 1.4e-7, 2e-6\\

Example: 3-modal gaussian – mode 3



Original

=====

BestFit:

71.5 2.180e-2 0.0100

CovMat:

0.2	5.5e-5	3e-4
5.5e-5	4e-7	5e-7
3e-4	5e-7	5e-6

Some parameters of the sampler

Parameters are passed to MultiNest in the command line as `--NS_[option] [value]`

- `n_live_points` Amount of points carried around during every iteration. Increase it for a large number of parameters.
- `evidence_tolerance` Stopping condition: minimal difference in $\log E$ between steps. Decrease it for a more precise calculation of the evidence.
- `multimodal` Perform mode separation (default: off)
- `mode_tolerance` Increase it if you get many insignificant modes
- `clustering_params param1 param2 ...` Parameters used for the mode separation