BayeSED Documentation

Release V1.0

Nov 10, 2018

User Guide

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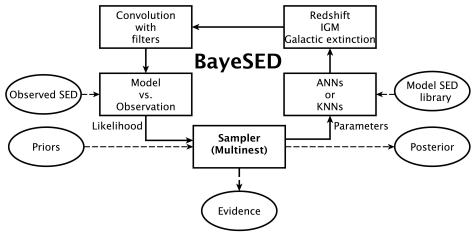
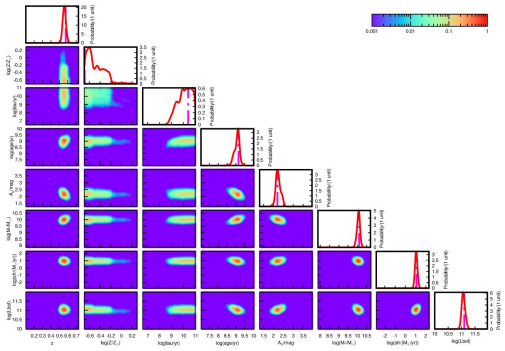

Convolution with filters
Redshift IGM Galactic extinction
BayeSED
Observed SED
Model vs. Observation
ANNs or KNNs
Model SED library
Likelihood
Parameters
Priors
Sampler (Multinest)
Posterior
Evidence

CHAPTER 1

Bayesian parameter estimation



1.1 DOWNLOAD

- `git clone -b V1.0 --depth=1 https://bitbucket.org/hanyk/bayesed BayeSED`
- `git clone -b V1.0 --depth=1 git@bitbucket.org:hanyk/bayesed.git BayeSED`
- https://bitbucket.org/hanyk/bayesed/get/V1.0.tar.bz2

1.2 USAGE

```
./bayesed (openmpi v1.8.
↪8 is required for mpirun) [OPTIONS] -i inputfile

OPTIONS:

-a, --ann ARG1[,
↪ARGn]                Select  ann model by name

↪       e.g. -a bc03_pr_exp_ch_calzetti,iscalable

-h, -help, --help,
↪ --usage           Display usage instructions

-i, --input ARG
↪ Input file containing observed photometric SEDs

↪  e.g. -i observation/ULTRAVISTA/ULTRAVISTA0.txt

-k, --knn ARG1[,
↪ARGn]                Select knn model by name
```

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```
                                                e.
↪g. -k bc03_pr_exp_ch_calzetti,iscalable,k,f_run

-s, --sampler ARG                   File␣
↪containing sampling parameters for MultiNest
                ␣
↪                   e.g. -s sampler.in (default)

-t, --template ARG1[,ARGn]␣
↪         Use template SED with the given name
        ␣
↪                           e.g. -t M82,iscalable

--confidence_level ARG  ␣
↪           e.g. --confidence_level 0.5 (default)

--cosmology ARG1[,ARGn] ␣
↪           e.g. --cosmology 70,0.7,0.3 (default)

--filters ARG        ␣
↪               e.g. --filters filter/filters.txt

--filters_selected ARG              e.g.
↪ --filters_selected filter/filters_selected.txt

--IGM ARG1[,ARGn]                   --IGM <0|1|2>
                                    Select␣
↪the model for intergalactic medium attenuation
                      ␣
↪             0 for nothing , 1 for Madau (1995)␣
↪model (default), 2 for Meiksin (2006) model

--load_priors ARG              ␣
↪    load priors from .hist files for all objects
                 ␣
↪                e.g.: --load_priors priors_root

--npc ARG ␣
↪                         No. of pcs to be output
        ␣
↪                          e.g.: --npc 3(default)

--nzbin ARG                         Number␣
↪of bins used to sample the prior of redshift.
            ␣
↪                       e.g. --nzbin 10 (default)

--NfilterPoints ARG ␣
↪               e.g. --NfilterPoints 30 (default)

--outdir ARG ␣
↪                      output dir for all results
                 ␣
↪                e.g. --ourdir result/ (default)

--output_model_absolute_magnitude␣
↪  output model absolute magnitude of best fit
```

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```
                        --output_model_apparent_magnitude␣
                        ↪  output model apparent magnitude of best fit

                        --output_model_flux␣
                        ↪                output model flux of best fit

                        --pca_
                        ↪model ARG                      name of .pca file

                        ↪       e.g.: --pca_model bc03_pr_exp_ch_calzetti

                        --save_bestfit
                        ↪   Save the best fitting result for every object

                        --save_posteriori_sample
                        ↪      Save the posterior sample for every object

                        --save_priors
                        ↪      save priors as .hist files for all objects

                        --save_summary
                        ↪                  Save the file for every object

                        --sys_err ARG1[,ARGn]
                        ↪ Minimum fractional error/errors for all filters
                                                          e.g. -
                        ↪-sys_err 0 (default) or --sys_err 0.5,0.1,..,0.5

                        --test_priors
                        ↪                    test priors by set loglike=0
```

1.3 EXAMPLES

./bayesed -k bc03_pr_exp_ch_calzetti,1,3,1 –filters observation/ULTRAVISTA/filters.txt –filters_selected observation/ULTRAVISTA/filters_selected.txt -i observation/ULTRAVISTA/ULTRAVISTA0.txt

1.4 FAQs

1. **Q: What is the unit of photometric data in the input data file?** A: The photometric data in the input data file must be flux and flux error in unit of uJy.
2. **Q: Is there any particular requirement for the order of data in the input file?** A: The order of data in the input file must be consistent with the order of filters used in "–filters_selected observation/ULTRAVISTA/filters_selected.txt" with "iused=1". Here, "iused=1" means there are data for the given filter in the input data file, but you can use it or not in the fitting by setting iselected=1 or 0. For example, in the example input file, we have used 30 filters, as

shown by the first line "# ULTRAVISTA0 30 0". The name of used filters is shown in the second line of the input file. So, the order of filters in observation/ULTRAVISTA/filters_selected.txt" ("Ks H J Y 8.0micron 5.8micron 4.5micron 3.6micron z+ i+ r+ Vj g+ Bj u* IA484 IA527 IA624 IA679 IA738 IA768 IA427 IA464 IA505 IA574 IA709 IA827 FUV NUV 24micron") is the same as that in the input file("Ks eKs H eH J eJ Y eY ch4 ech4 ch3 ech3 ch2 ech2 ch1 ech1 zp ezp ip eip rp erp V eV gp egp B eB u eu IA484 eIA484 IA527 eIA527 IA624 eIA624 IA679 eIA679 IA738 eIA738 IA767 eIA767 IB427 eIB427 IB464 eIB464 IB505 eIB505 IB574 eIB574 IB709 eIB709 IB827 eIB827 fuv efuv nuv enuv mips24 emips24").

3. **Q: If some of the galaxies in the catalog don't have data in a certain band, what should**
   A: You can indicate the absence of data by setting the flux and flux error to -99.

4. **Q: Where can I find the stellar mass of the best fit model of each galaxy?**
   A: The estimation of all parameters is in a *.bayesed file. For any parameter of the model, the code gives many estimations (e.g., mass/Msol^{mean} mass/Msol^{sigma} mass/Msol^{MAL} mass/Msol^{MAP} mass/Msol^{median} mass/Msol^{lowerq} mass/Msol^{upperq}). "mass/Msol^{MAL}" is the stellar mass of the best fit model.

5. **Q: How to obtain photo-z with BayeSED?** A: Set the range of allowed redshift by z_min and z_max for each galaxy in the input file. Here, different galaxy may have different z_min and/or z_max. If you have your estimation of redshift, you can set z_min=z_max="your z_photo or z_spec".

6. **Q: What is "E(B-V)" in the input file?** A: It is about the dust extinction of the Milky Way. If it has been considered in your data, just set it to be 0.

7. **Q: There are some additional columns in the input file. Are they necessary?**
   A: No. The input file allow some additional informations about the galaxy in columns behind the columns for the flux and flux err. These informations will be copied to the output *.bayesed file.

CHAPTER 2

Copyright and Licensing

Copyright (C) 2014 Yunkun Han, hanyk@ynao.ac.cn

BayeSED is made freely available under the MIT license.

If you use BayeSED in your research, please cite our papers (Han, Y., & Han, Z. 2012, ApJ, 749, 123; Han, Y., & Han, Z. 2014, ApJS, 215, 2).

CHAPTER 3

Changelogs

Version 1.0 - Aug. 2014