

Light Curve Detrending Software Documentation

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1 Overview

I have written a package of MATLAB software that implements the Trend Filtering Algorithm as well as a variety of modifications meant to improve performance. (For details behind the theory of the algorithm and said modifications, please consult my SURF paper). The purpose of this document is to explain how to run this software. In particular, I will go over the inputs, outputs, and the precise commands necessary to run the essential functions.

2 Essential Functions

The following 3 functions are the essence of the software.

- RunTFA
- RunPDT
- RunKMEANS

The first function runs TFA with the uncertainty correction. The second function runs template optimization using Agglomerative Hierarchical Clustering. The third function runs template optimization using KMEANS clustering.

3 Unpacking Software

Simply unzip `MATLAB-Detrending-Software.zip` and keep the directory structure in tact. The three main subdirectories are: TFA, PDT and KMEANS. In addition, the **Examples** subdirectory contains input and output examples.

4 Inputs

4.1 Light Curves

All light curves processed by this software must be in a space delimited format. The first line of each lightcurve is considered as a header line and is skipped. Further, the first column must contain the time of each brightness measurement (the precise units are irrelevant), the second column must contain the brightness measurement, the third column the measurement uncertainty. Any additional columns are external parameters correlated with systematics. (These external columns are purely optional.) It is essential that all light curves have the same number of measurements, and the dates used for all the light curves match up.

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4.2 Light Curve Lists

To run TFA, one needs two lists of light curve pathnames. The first is a list which contains the pathname for each light curve to be detrended, where each pathname is on a separate line. The second is a list which contains the pathnames to light curves which will be used as template curves. Again, each pathname must be on its own line. To run either of the template optimization schemes, one must input a list of light curve pathnames of potential template light curves, each on a separate line. It is advisable to first narrow down the template set to a number of potential light curves to reduce processing time.

5 Running Software With MATLAB

Start MATLAB. On the top toolbar you will see a line that says "Current Directory". Change the current directory to the Matlab-Detrending-Software directory you've unzipped. Then, go to the appropriate subdirectory: TFA to run TFA, PDT to use the Agglomerative Hierarchical Clustering template optimization, or KMEANS to use KMEANS clustering based template optimization. Once you are in the appropriate subdirectory, type one of the following commands in the Command Window and press enter to run.

- `>> RunTFA('input.txt', 'templates.txt')` Where input is the light curve list file and templates is the template light curve list file, explained in the Input section.
- `>> RunPDT('pot-temps.txt')` Where pot-temps is a light curve list of potential template light curves, explained in the Input section.
- `>>RunKMEANS('pot-temps.txt')` Where pot-temps is a light curve list of potential template light curves, explained in the Input section.

6 Outputs

6.1 TFA

RunTFA produces two output files for each light curve detrended. The first is a .tfa.model file which contains the original brightness values as well as the correction for each brightness value. The second is a coefficient file which contains the coefficients used for each template light curve in the linear combination that makes up the filter function. The output files are written to the subdirectory under TFA called Output. This subdirectory in turn has subdirectories Models and Coefficients, which store the model and coefficient files respectively.

6.2 Template Optimization

The template optimization writes out the resultant template light curves to the subdirectory "Output". In addition, it writes out a master trend list.