

User Manual to the FFAST Code Package

BASiCS

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1 Installation

1.1 Required software and packages

- C++ compiler supporting ISO C++ 2011 standard
- FFTW 3 library for computing FFT, website: <http://fftw.org>.

If the required software listed above are not installed, they can be obtained as follows.

1.1.1 Installing required software on Ubuntu

Linux distributions usually come with an installed C++ compiler. If FFTW 3 is not installed, it can be obtained by running the command line command:

```
sudo apt-get install libfftw3-dev libfftw3-doc
```

1.1.2 Installing required software on Mac OS X

Apple has their distribution of developer tools under the software bundle called XCode which is available on AppStore. These tools come with a C++ compiler. If you do not have FFTW 3 we suggest installing it through a package manager such as Homebrew. The following steps can be taken to install the required software.

1. Download XCode, available on AppStore
2. Install Homebrew, website: <http://brew.sh/>
3. Install FFTW 3 through brew, command line: `brew install fftw`

1.2 Building FFAST

Makefile is provided with the distribution and FFAST should compile without a problem by calling **make** from the command line in the same directory of the Makefile.

2 Using the code

The FFAST engine takes an input object and an output object that describes the input/output operations. The implementation of these two can be tailored to application without changing the FFAST engine.

The Makefile compiles an example program **ffast**. It implements an *experiment* and a *customized* mode.

The experiment mode generates random input signals according to the specifications given from the command line and test the performance of FFAST algorithm.

Customized mode takes a file from the command line that stores the signal and outputs the frequency contents to a desired file.

2.1 Arguments

-a

Run experiment

-c

Do not count the number of samples used by FFAST to speed up the algorithm

-n NUM

Signal length

-i NUM

Number of iterations

-f FNAME

Input file name

-z FNAME

Output file name

-g NUM

Minimum magnitude of frequency wanted to be recovered

-k NUM
Number of non-zero frequencies, sparsity

-s NUM
SNR in dB

-d NUM
Number of delays per chain

-e NUM
Number of chains

-l
Use ML decoding, slow search

2.2 Examples

Below we list some example calls for the executable file.

./ffast -help
Display help.

./ffast -a -n 124950 -k 10 -i 30
Run 30 FFAST experiments on randomly generated signals of length 123950 having 10 sparse Fourier spectrum.

./ffast -a -n 124950 -s 10 -k 10 -i 30
Run 30 FFAST experiments on randomly generated signals of length 123950 having an SNR of 10 dB and 10 sparse Fourier spectrum .

./ffast -f inFile.txt -k 40 -z outFile.txt
Run FFAST on input data given in `inFile.txt` to recover 40 sparse spectrum and write the recovered signal in `outFile.txt`.

3 Code structure

config.cpp

This class gets input arguments from the command line and stores the parameters of the algorithm.

input.cpp

This is a template class. Instances of this class should implement a function that will return the value of the signal at a chosen time

index. Two such instances of this class are the `experimentinput.cpp` and `customizedinput.cpp`.

frontend.cpp

This class is where sub-sampling and short discrete time Fourier transforms are done.

backend.cpp

The peeling engine is implemented here.

output.cpp

This is a template class. Instances of this class should implement a function that will get the results from the backend and output. Two instances are `experimentoutput.cpp` and `customizedoutput.cpp`.

ffast.cpp

The class that runs the FFAST engine.

main.cpp

The implementation for the executable file with the experiment and customized modes.