platelib Documentation

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Emil Dandanell Agerschou

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ONE

INTRODUCTION

1.1 Summary

platelib is an attempt to make common tasks when working with kinetic platereader, especially amyloid aggregation, data easy and compatible with Python.

1.2 Disclaimer

The state of this repository is one of very early development, the code is not elegant, there most likely are bugs so **Use with caution!**

1.3 Read the docs

A brief overview is given below, for more detailed information see the docs directory and subfolders, or even better have a look at the source :)

CHAPTER

TWO

INSTALLATION

2.1 Prerequisites

- python
- pip
- git (optional)

2.2 Download

Either download the source distribution directly or use:

```
git https://github.com/edager/platelib
```

2.3 Install

Go to directory where the platelib source file is (`platelib/dist/` if `git` was used) and run the following in the terminal:

```
pip install platelib-X.X.tar.gz
```

Where `X.X` should be replaced by the version that was downloaded.

2.4 Upgrade

Go to directory where the platelib source file is (`platelib/dist/` if `git` was used) and run the following in the terminal:

```
pip install --upgrade platelib-X.X.tar.gz
```

Where `X.X` should be replaced by the version that was downloaded.

2.5 Uninstall

Simply go to the terminal and run:

```
pip uninstall platelib
```

CHAPTER

THREE

SUPPORT

- **For questions related to usage:**
  - Stack Overflow using the tags `python` and `platelib`
- **For questions related to bugs or enhancements:**
  - GitHub using the issue system

CHAPTER

FOUR

COOKBOOK

4.1 Reading in data

The main functionality of `platelib` is the `read_plate` function that allows for reading in platereader data from kinetic experiments into a common framework namely into the `Plate_data` class.

If an equal number of replicates per sample were prepared this can be specified (default is `3`):

```
p = read_plate('path/to/file', replicates=5)
```

It can be specified which direction the replicates were loaded onto the plate where `'hori'` (horizontal) means towards increasing numbers and `'vert'` is towards increasing letters (default is `'hori'`):

```
p = read_plate('path/to/file', rep_direction='vert')
```

NOTE that the replicates have to be next to each other!

Alternatively it can be specified which wells contains replicates:

```
p = read_plate('path/to/file', named_samples=[['B03', 'D07'], ['B02', 'E06', 'G12']]
```

Data from Tecan platereaders can be read in as (default is `'bmg'`):

```
p = read_plate('path/to/file', platereader='tecan')
```

NOTE that this functionality has not been fully tested yet!

As well as from BMG platereaders either where the data has prior been transposed `True` such that well data are in column format or in row format `False` (default is `True`):

```
p = read_plate('path/to/file', transposed=False)
```

Note that it's automatically detected if several measurements (*e.g.*) were made per time-point (see *Accessing data*)

The time unit can also be specified which as either `'seconds'`, `'minutes'`, `'hours'`, or `'days'` will carry along into indexes if exported and to unit of x-axis if plotted (default is `'hours'`):

```
p = read_plate('path/to/file',time_unit='days')
```

4.2 Accessing data

The `Plate_data` class allows for different ways of accessing the data

Through index:

```
p[1]
```

Through index slice:

```
p[::3]
```

Through well name:

```
p['B02']
```

Through list of well names:

```
p[['B02','C03','D04']]
```

Retrieved as a pandas.DataFrame with wellnames as column names and time points as index:

```
df = Plate_data.to_a_dataframe()
```

Or as a (C)omma (S)eperated (V)aribles file with the first line being (time unit +) well names and the first column are the time points:

```
Plate_data.to_a_csv('path/to/file.csv')
```

4.3 Plotting data

The data is plotted according to replicates, and subtitles can be added (default is *None*):

```
p.plot(titles=['condition 1', 'conditions 2'])
```

It can be specified whether all plots should have its own y-axis, whether all plots should have the same (default is *True*):

```
p.plot(sharey='False')
```

If several measurements were made per time-point it can be specified whether all measurements should be plotted or not (default is *True*):

```
p.plot(plot_multi='False')
```

CHAPTER

FIVE

PLATELIB

5.1 platelib package

5.1.1 Submodules

5.1.2 platelib.fitfun module

platelib.fitfun.**exp_rise**(*t*, *a*, *b*, *k*)

platelib.fitfun.**fit_fun**(*func, df, bounds=([0, 0, 0, 0], [1, 50, 10, 65])*)

class platelib.fitfun.**fit_plate**(*data*, *replicates*, *multi_chrom*)
Bases: *platelib.plateread.Plate_data*

platelib.fitfun.**gauss**(*x*, *amp*, *cen*, *sigma*)
basic gaussian

platelib.fitfun.**gauss_dataset**(*params*, *i*, *x*)
calc gaussian from params for data set i using simple, hardwired naming convention

platelib.fitfun.**linear**(*t*, *a*, *b*)

platelib.fitfun.**objective**(*params*, *x*, *data*)
calculate total residual for fits to several data sets held in a 2-D array, and modeled by Gaussian functions

platelib.fitfun.**quadratic**(*t*, *a*, *b*, *c*)

platelib.fitfun.**sigmoid**(*x*, *y0*, *L*, *k*, *x_half*)

platelib.fitfun.**sigmoidal_auto**(*t*, *a*, *b*, *k*)

5.1.3 platelib.plateread module

class platelib.plateread.**Plate_data**(*data*, *replicates*, *multi_chrom*)
Class for containing data from a platereader assay.

Parameters

- **data** – Pandas DataFrame with time points as index and wells as columns
- **replicates** – Positive integer of replicates, assuming equal number of replicates of all samples

plot(*titles=None*, *sharey=True*, *plot_multi=True*, *return_fig=False*)
Plots the number of samples i.e. replicates/wells in the data set.

Parameters

- **titles** – List-like object of subtitles
- **sharey** – Bool, if True all y-axis limits will be identical, if False y-axis limits are given by matplotlib defaults.
- **plot_multi** – Bool, if several different measurements are present per time point, only plot the first one, if False plots all of the values.
- **return_fig** – Bool, if True returns a figure object, if False only plot the data

to_a_csv(*path*, *one_per_multi_c=False*)
Returns the data as a pandas dataframe with times as indexes

Parameters

- **path** – String of path to store output
- **one_per_multi_c** – Bool, if 'True' one measurement per dataframe will be exported otherwise all will be exported in one file.

to_a_dataframe(*one_per_multi_c=False*)
Returns the data as a list of pandas dataframe(s) with times as indexes

Parameters **one_per_multi_c** – Bool, if 'True' one measurement per dataframe will be exported, if False all will be exported in one dataframe.

platelib.plateread.**named_order**(*named_samples*, *df*)
Reorder dataframe columns according to the specified order, returns dataframe and list of replicates.

Parameters

- **named_samples** – List of lists, one list per samples containing all replicates
- **df** – Pandas DataFrame

platelib.plateread.**read_plate**(*filename*, *replicates=3*, *rep_direction='hori'*, *time_unit='hours'*, *named_samples=[]*, *platereader='bmg'*, *transposed=True*)
Reads in data from a CSV file from a BMG or Tecan platereader and returns a platedata object.

:param filename:String, path to filename :param replicates: Positive integer, The number of replicates per sample. :param rep_direction: String, directions replicates is in. Only 'hori' and 'vert' are accepted directions where 'hori' if replicates are going from left to rigth 'vert' from replicates going from top to bottom. :param time_unit: String, time unit one would like to have, accepted values are: 'seconds','minutes','hours','days' :param named_samples: List of lists, where each list should correpond to a sample and contain all replicates of it :param platereader: String, The plate reader used to collect the data. Only 'bmg' and 'tecan' are accepted platereaders :param transposed: Bool, specifies wether the wells are in column (True) or row format (False).

platelib.plateread.**read_tecan**(*filename*)
Reads in untransposed data from a tecan platereader and returns a pandas DataFrame object.

Parameters **filename** – String, path to filename

platelib.plateread.**read_transposed_bmg**(*filename*)
Reads in transposed data from a BMG platereader and returns a pandas DataFrame object.

Parameters **filename** – String, path to filename.

platelib.plateread.**read_untransposed_bmg**(*filename*)
Reads in untransposed data from a BMG platereader and returns a pandas DataFrame object.

Parameters **filename** – String, path to filename.

platelib.plateread.**search_start**(*filename*)
Find start of data region and returns the line number by finding the line that starts with "Well".

Parameters **filename** – String, path to filename.

platelib.plateread.**to_time_units**(*df*, *time_unit*)
Convert the index a dataframe into the time unit specified, returns dataframe.

Parameters

- **df** – Pandas DataFrame
- **time_unit** – String, allowed values are 'seconds' ,'minutes','hours', and 'days'.

platelib.plateread.**vert_order**(*replicates*, *df*)
Reorder dataframe column to vertical order, returns dataframe.

Parameters

- **replicates** – List of positive integer number of replicates.
- **df** – Pandas DataFrame

5.1.4 Module contents

CHAPTER

SIX

CONTRIBUTE

Contributions are more than welcome, please raise an issue on the github page highlighting the bug/extension/compatibilities before doing a pull request.

6.1 More tools

Apart from the tools listed in *Installation* the following is needed:

- Unix-like system
- git
- pandoc

6.2 Building

You have made some wicked cool changes to the source code or the documentation that you want to share with the world, awesome!

Now there's just a few steps before they can be incorporated into the platelib master branch

6.2.1 Changing the version number

The versioning scheme of platelib should be done in reasonable accordance with the so called Semantic versioning where X.Y.Z should be read as MAJOR.MINOR.PATCH.

The version number has to be changed in the two files `setup.py` and `docs/source/conf.py`

6.2.2 Create new source distribution

Go to the docs folder and run:

```
./full_make.sh
```

If no errors occurred it can be uploaded to your local branch and a pull request can be made.

6.3 Planned improvements

This is as much a wish-list as literally planned improvements:

- Plotting
  - Plotting of data from several plates in some sensible way.
- Fitting
  - Local fitting of traces in plate
  - Global fitting of traces in plate
- Statistical analysis
  - Goodness-of-fit
  - Variance along traces, among replicates, and between conditions
- Python 3.X compatibility
- PyPI availability

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