Gaussian Process V0.1

May 11, 2021

[210]:
```
import numpy as np
import matplotlib.pyplot
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib as mpl
import matplotlib.ticker as mticker
import matplotlib.dates as mdates
import datetime
from tqdm import tqdm

mpl.rcParams['legend.frameon'] = False
mpl.rcParams['figure.autolayout'] = True
mpl.rcParams['figure.dpi'] = 500
# mpl.rcParams['axes.spines.right'] = False
# mpl.rcParams['axes.spines.top'] = False


plt.rcParams.update({
    "text.usetex": True,
    "font.family": "sans-serif",
    "font.sans-serif": ["Helvetica"]})

plt.rcParams.update({
    "text.usetex": True,
    "font.family": "serif",
    "font.serif": ["Palatino"],
})


def utkarshGrid():
    plt.minorticks_on()
    plt.grid(color='grey',
             which='minor',
             linestyle=":",
             linewidth='0.1',
             )
    plt.grid(color='black',
```

```
            which='major',
            linestyle=":",
            linewidth='0.1',
            )
```

[211]:
```
import sys
# !{sys.executable} -m pip install GPy
# !{sys.executable} -m pip install --upgrade pip
import GPy
```

[212]:
```
from collections import defaultdict
from pathlib import Path

path = "/Users/utkarsh/PycharmProjects/SURP2021/bns_m3_3comp"

resd = defaultdict(list)
for file in Path(path).iterdir():
    with open(file, "r") as file_open:
        resd["file_name"].append(file.name)
#         resd["text"].append(pd.read_csv(file_open))
        resd["text"].append(file_open.read())
raw_data = pd.DataFrame(resd)

raw_data
```

[212]:
```
                                          file_name  \
0    nph1.0e+06_mejdyn0.001_mejwind0.130_phi45.txt
1    nph1.0e+06_mejdyn0.010_mejwind0.050_phi15.txt
2    nph1.0e+06_mejdyn0.001_mejwind0.010_phi75.txt
3    nph1.0e+06_mejdyn0.005_mejwind0.090_phi75.txt
4    nph1.0e+06_mejdyn0.020_mejwind0.110_phi60.txt
..                                             …
193   nph1.0e+06_mejdyn0.005_mejwind0.110_phi0.txt
194   nph1.0e+06_mejdyn0.001_mejwind0.090_phi0.txt
195   nph1.0e+06_mejdyn0.020_mejwind0.070_phi0.txt
196  nph1.0e+06_mejdyn0.010_mejwind0.050_phi30.txt
197  nph1.0e+06_mejdyn0.001_mejwind0.130_phi60.txt

                                                  text
0    11 \n500 \n100 0.0 20.0 \n1.000e+02 0.0000e+00…
1    11 \n500 \n100 0.0 20.0 \n1.000e+02 0.0000e+00…
2    11 \n500 \n100 0.0 20.0 \n1.000e+02 0.0000e+00…
3    11 \n500 \n100 0.0 20.0 \n1.000e+02 0.0000e+00…
4    11 \n500 \n100 0.0 20.0 \n1.000e+02 0.0000e+00…
..                                                 …
193  1 \n500 \n100 0.0 20.0 \n1.000e+02 0.0000e+00 …
194  1 \n500 \n100 0.0 20.0 \n1.000e+02 0.0000e+00 …
```

```
195   1 \n500 \n100 0.0 20.0 \n1.000e+02 0.0000e+00 …
196   11 \n500 \n100 0.0 20.0 \n1.000e+02 0.0000e+00…
197   11 \n500 \n100 0.0 20.0 \n1.000e+02 0.0000e+00…

[198 rows x 2 columns]
```

[213]:
```
single_file = path + "/"+  raw_data.file_name[0]
# print(single_file)
simple_data = pd.read_csv(single_file, header = None, names = ["data"])
simple_data
```

[213]:
```
                                                   data
0                                                   11
1                                                  500
2                                          100 0.0 20.0
3     1.000e+02 0.0000e+00 0.0000e+00 0.0000e+00 0.0…
4     3.000e+02 0.0000e+00 0.0000e+00 0.0000e+00 0.0…
…                                                    …
5498  9.910e+04 0.0000e+00 0.0000e+00 0.0000e+00 0.0…
5499  9.930e+04 0.0000e+00 0.0000e+00 0.0000e+00 0.0…
5500  9.950e+04 0.0000e+00 0.0000e+00 0.0000e+00 0.0…
5501  9.970e+04 0.0000e+00 0.0000e+00 0.0000e+00 0.0…
5502  9.990e+04 0.0000e+00 0.0000e+00 0.0000e+00 0.0…

[5503 rows x 1 columns]
```

[214]:
```
Nobs = float(simple_data.data.iloc[0])
Nwave = float(simple_data.data.iloc[1])
Ntime = list(map(float, simple_data.data.iloc[2].split())) # (number of time␣
↪bins), t_i (days), t_f (days)
data = simple_data.iloc[3:].reset_index(drop = True)
data["data"] = data["data"].apply(lambda x: list(map(float, x.split())))
print(data.columns)
print(Nobs, Nwave, Ntime)
data
```

```
Index(['data'], dtype='object')
11.0 500.0 [100.0, 0.0, 20.0]
```

[214]:
```
                                                   data
0     [100.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0…
1     [300.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0…
2     [500.0, 4.9554e-06, 3.7469e-07, 0.0, 1.0496e-3…
3     [700.0, 6.1511e-05, 1.0477e-05, 2.4387e-07, 2…
4     [900.0, 0.00015529, 4.6095e-05, 1.5146e-06, 2…
…                                                    …
5495  [99100.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0…
```

```
5496  [99300.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0…
5497  [99500.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0…
5498  [99700.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0…
5499  [99900.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0…

[5500 rows x 1 columns]
```

[215]:
```
data.loc[:, 'wavelength'] = data.data.map(lambda x: x[0])
data["data"] = data["data"].apply(lambda x: x[1:])
```

[218]:
```
data.index.name = "iwave"
data.head(5)
```

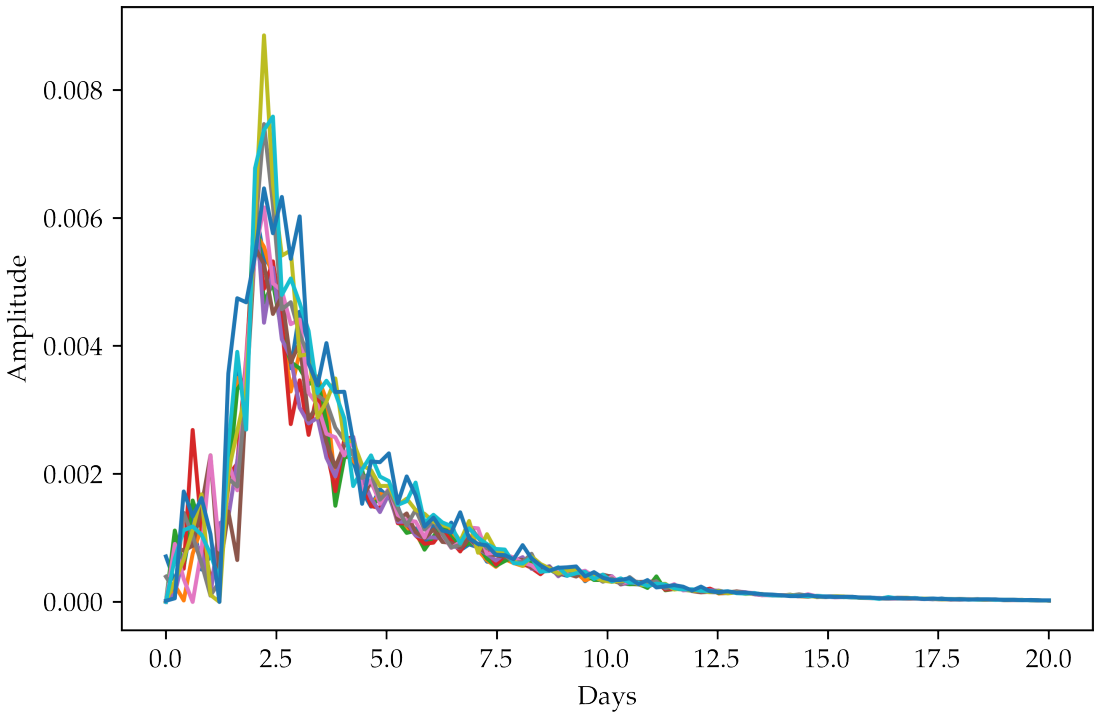
[218]:

iwave	data	wavelength
0	[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, …	100.0
1	[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, …	300.0
2	[4.9554e-06, 3.7469e-07, 0.0, 1.0496e-303, 6.1…	500.0
3	[6.1511e-05, 1.0477e-05, 2.4387e-07, 2.1385e-2…	700.0
4	[0.00015529, 4.6095e-05, 1.5146e-06, 2.4401e-0…	900.0

[222]:
```
time_arr = np.linspace(int(Ntime[1]), int(Ntime[2]), int(Ntime[0]), endpoint =␣
 ↪True)

kBand = 2100 * 10
zBand = 910 * 10 #convert to angstrom
wv_ind = data.index[data.wavelength == zBand] # NOW YOU KNOW iobs, 11 as␣
 ↪expected
print(wv_ind)
plt.figure()
for i in range(len(wv_ind)):
    plt.plot(time_arr, data.data.iloc[wv_ind[i]])
plt.xlabel("Days")
plt.ylabel("Amplitude")
# plt.xlim(0, 1.5)
plt.show()
```

```
Int64Index([45, 545, 1045, 1545, 2045, 2545, 3045, 3545, 4045, 4545, 5045],
dtype='int64', name='iwave')
```


0.008
0.006
0.004
0.002
0.000
Amplitude
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Days