

```
import numpy as np
import matplotlib
import matplotlib.pyplot as plt

#####
# Load 5th entry of each row data into numpy array
# 5th entry = Pitch angle in degrees
#####

readings = open('imudata.txt','r')
lines = readings.readlines()
# print(lines)

pitch_angles_list = []
row_number_list = []

line_number = 0
for line in lines:
    # print(line)

    # remove spaces at start and end of line
    line.strip()

    # get 5th reading
    pitch_angle = int(line.split(' ')[4])
    print(pitch_angle)

    pitch_angles_list.append(pitch_angle)
    row_number_list.append(line_number)

    line_number += 1

print(pitch_angles_list)
print(row_number_list)

readings.close()

0
6
5
14
9
8
8
8
7
6
7
4
```

```

.
7
3
5
2
9
9
6
4
8
6
11
3
6
7
1
4
6
7
7
8
3
5
5
3
4
6

7
9
11
8
12
5
7
7
13
5
4
11
11
8
6
6
7
7
[6, 3, 10, 9, 8, 8, 9, 6, 8, 10, 8, 10, 10, 13, 7, 12, 11, 14, 10, 8, 10, 10,
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21,

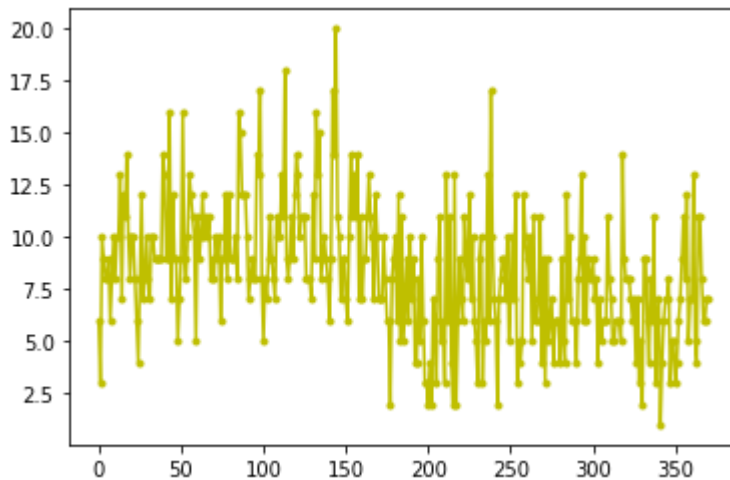
```

```

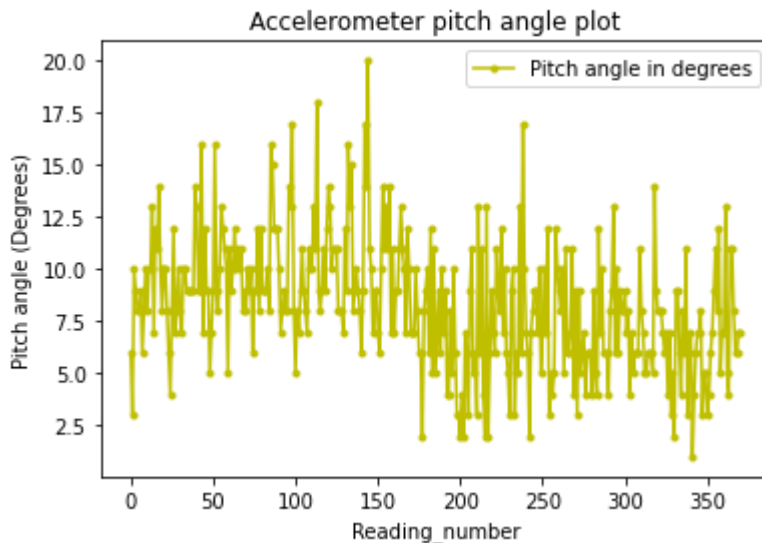
#####
# Plotting data
#####
# plot pitch angle on y axis and row number on x axis with point marker (.)
# solid style line (-) and yellow colour (y)
plt.plot(row_number_list, pitch_angles_list, '-.y')

```

```
plt.show()
```



```
#####
# Label axes, add title, legend
#####
# plot pitch angle on y axis and row number on x axis with point marker (.)
# solid style line (-) and yellow colour (y)
plt.plot(row_number_list, pitch_angles_list, '-y', label = 'Pitch angle in degrees')
plt.xlabel('Reading_number')
plt.ylabel('Pitch angle (Degrees)')
plt.title('Accelerometer pitch angle plot')
plt.legend(loc = "upper right")
plt.show()
```



```
#####
# Moving average filter function

data_list = [1,2,3,4,5]

def moving_average(window_length, data_list ):
```

```
print("Moving average window size is: ", window_length)
reading_index = 0
moving_average_list = []

number_of_moving_averages = len(data_list) - window_length + 1
print("number_of_moving_averages is: " , number_of_moving_averages)

while reading_index < number_of_moving_averages:

    current_window = data_list[reading_index:reading_index+window_length]

    window_sum_total = 0
    for i in current_window:
        window_sum_total = window_sum_total + i

    current_window_average = window_sum_total/ window_length

    # print(current_window_average)
    moving_average_list.append(current_window_average)

    reading_index = reading_index + 1

#### mean

sum_averaged_data = 0
for j in moving_average_list:
    sum_averaged_data = sum_averaged_data + j

mean_of_averaged_data = sum_averaged_data/ len(moving_average_list)
print("Mean is:" , mean_of_averaged_data)

#### std deviation
sum_std = 0
for x in moving_average_list:
    square_term = (x - mean_of_averaged_data) ** 2
    sum_std = sum_std + square_term

variance_data = sum_std/len(moving_average_list)

std_dev_averaged_data = variance_data**0.5

print("Standard deviation is",std_dev_averaged_data )

#### plot

plt.plot(row_number_list, pitch_angles_list,'.-y', label = 'Pitch angle in degrees')
```

```
# plt.xlabel('Reading_number')
# plt.ylabel('Pitch angle (Degrees)')
# plt.title('Accelerometer pitch angle plot')
# plt.legend(loc = "upper right")

size = len(row_number_list) - window_length + 1
# print(size)
# print(moving_average_list)
# print("len",len(moving_average_list))
start = len(row_number_list) - size
plt.plot(row_number_list[start:], moving_average_list,'.-r', label = 'Moving averag
# plt.plot(row_number_list, moving_average_list,'.-r', label = 'Moving average')
plt.xlabel('Reading_number')
plt.ylabel('Moving average of Pitch angle (Degrees)')
plt.title('Averaged Accelerometer pitch angle plot')
plt.legend(loc = "upper left")
plt.text(255,20,"Mean is: ")
plt.text(255,19,mean_of_averaged_data)
plt.text(255,17,"Std dev is: ")
plt.text(255,16,std_dev_averaged_data)
plt.show()

# return moving_average_list, mean_of_averaged_data, std_dev_averaged_data
```

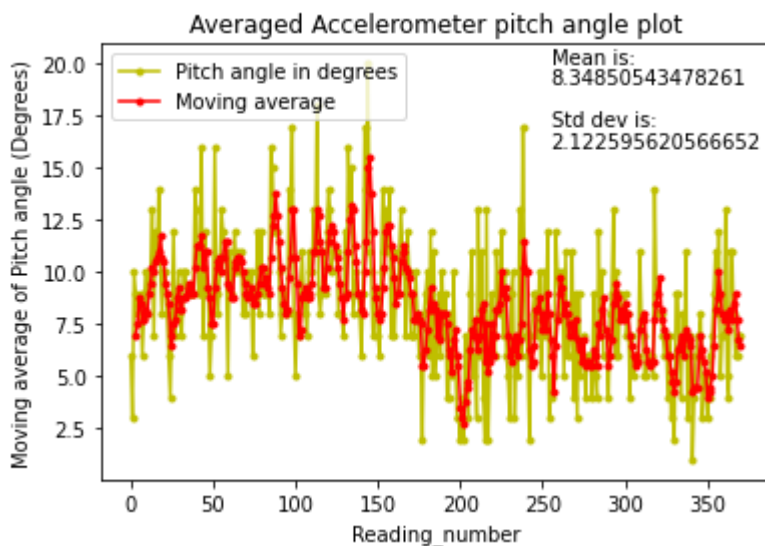
Double-click (or enter) to edit

```
moving_average(2, pitch_angles_list)
```

```
Moving average window size is: 2
number_of_moving_averages is: 370
.. ~~~~~
```

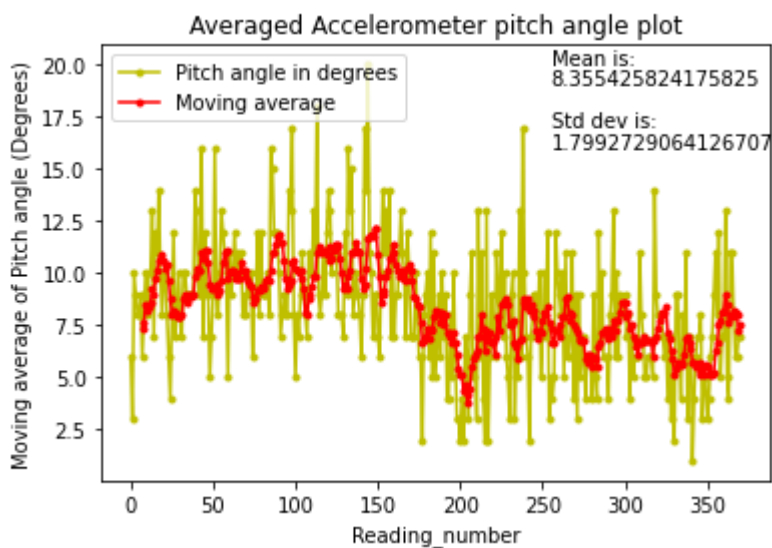
```
moving_average(4, pitch_angles_list)
```

```
Moving average window size is: 4
number_of_moving_averages is: 368
Mean is: 8.34850543478261
Standard deviation is 2.122595620566652
```



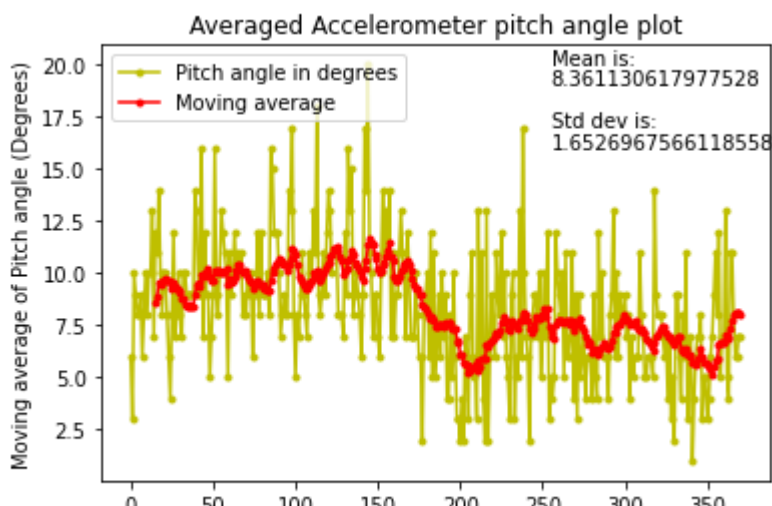
```
moving_average(8, pitch_angles_list)
```

```
Moving average window size is: 8
number_of_moving_averages is: 364
Mean is: 8.355425824175825
Standard deviation is 1.7992729064126707
```



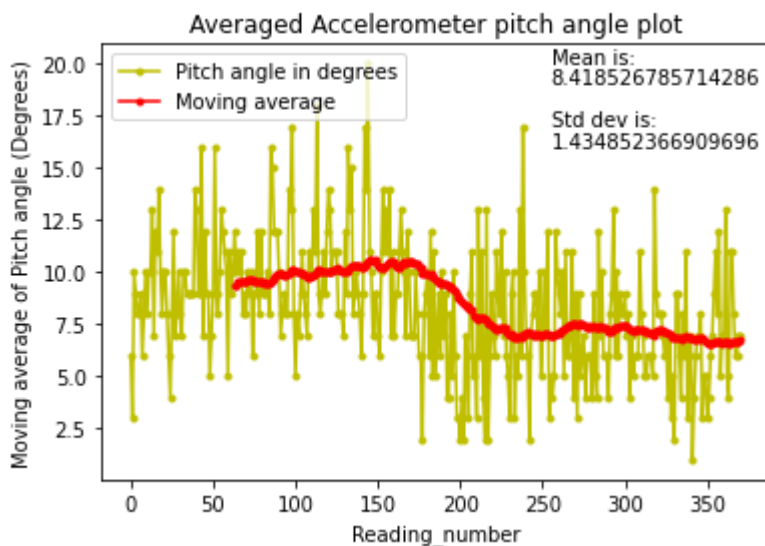
```
moving_average(16, pitch_angles_list)
```

Moving average window size is: 16  
 number\_of\_moving\_averages is: 356  
 Mean is: 8.361130617977528  
 Standard deviation is 1.6526967566118558



```
moving_average(64, pitch_angles_list)
```

→ Moving average window size is: 64  
 number\_of\_moving\_averages is: 308  
 Mean is: 8.418526785714286  
 Standard deviation is 1.434852366909696



```
moving_average(128, pitch_angles_list)
```

Moving average window size is: 128  
number\_of\_moving\_averages is: 244  
Mean is: 8.437115778688524  
Standard deviation is 1.2052583032128985

