```python
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()
```

```
    6
    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,
```
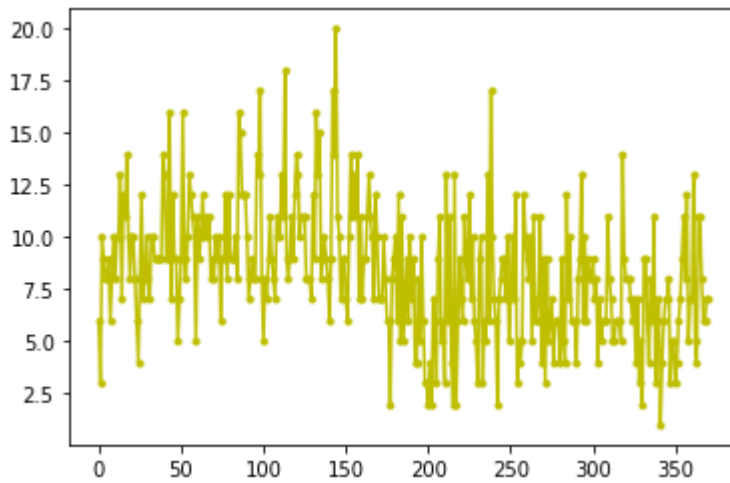
```python
########################################################################
# Plotting data
########################################################################
# plot pitch angle on y axis and row number on x axis with point marker (.)
# solid style line (-) and yellow colour (y)
plt.plot(row_number_list, 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()
```
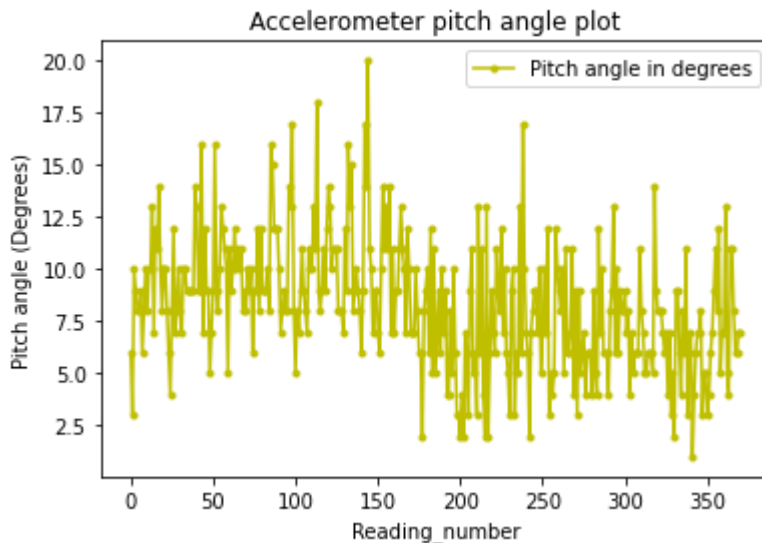


```
#######################
# Moving average filter function

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

def moving_average(window_length, data_list ):
```

```python
  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)
  print("Variance is", variance_data)

  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
Mean is: 8.336486486486486
Variance is 6.264479547114689
Standard deviation is 2.502894234104727
```
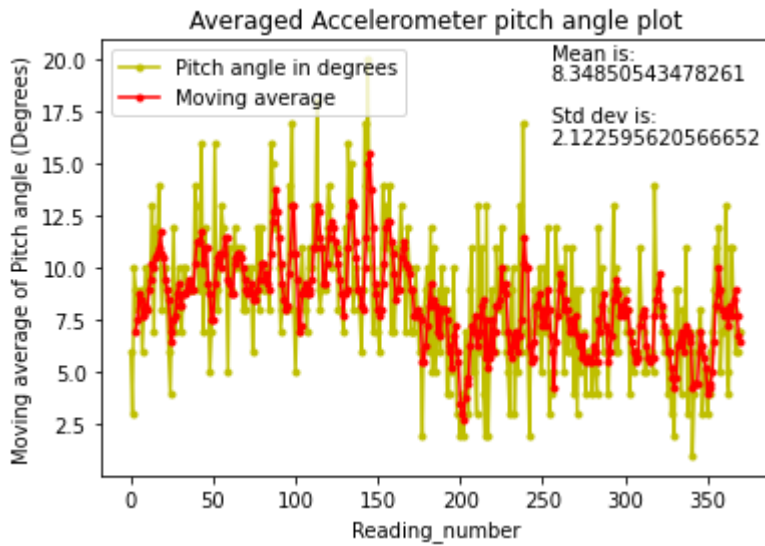
```
moving_average(4, pitch_angles_list)
```

```
Moving average window size is:  4
number_of_moving_averages is:  368
Mean is: 8.34850543478261
Variance is 4.50541216844873
Standard deviation is 2.122595620566652
```
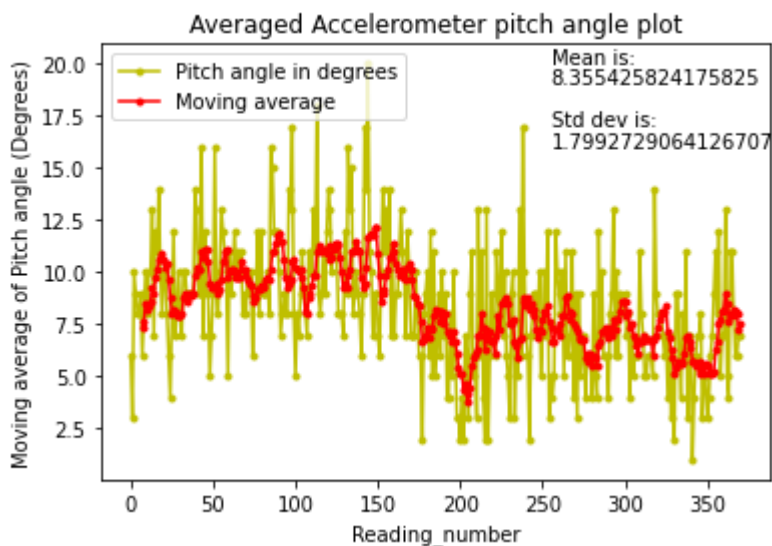


```
moving_average(8, pitch_angles_list)
```

```
Moving average window size is:  8
number_of_moving_averages is:  364
Mean is: 8.355425824175825
Variance is 3.2373829917506995
Standard deviation is 1.7992729064126707
```
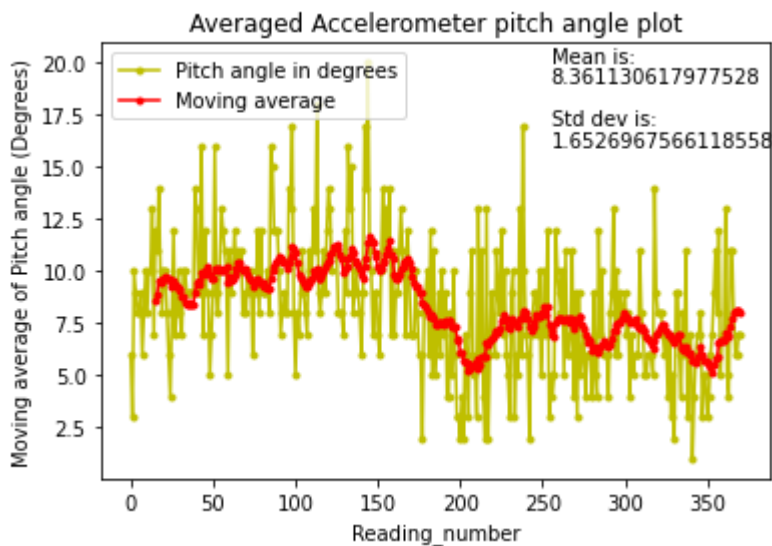

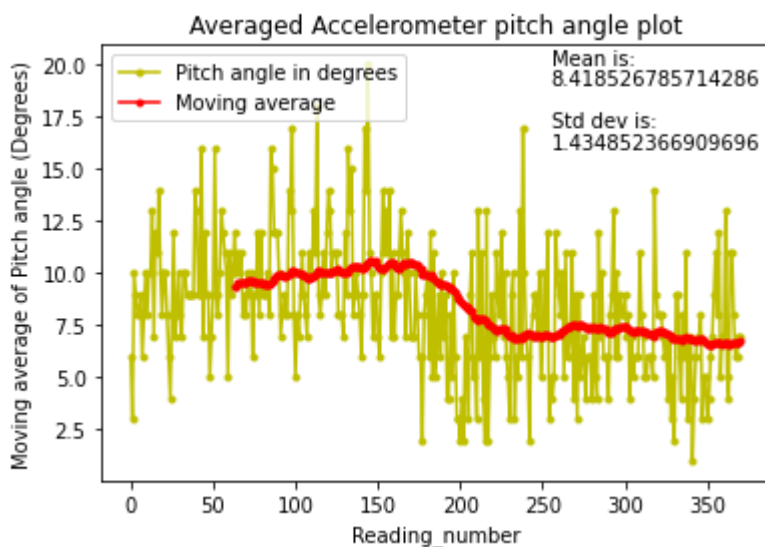```
moving_average(16, pitch_angles_list)
```

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

```
Moving average window size is:   16
number_of_moving_averages is:   356
Mean is: 8.36130617977528
Variance is 2.7314065693153475
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
Variance is 2.058801314826357
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
Variance is 1.452647577463635
Standard deviation is 1.2052583032128985
```


Averaged Accelerometer pitch angle plot