Assignment 06

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3 Assignment 06

3.1 Linear Least Square Fitting

Github Link: https://github.com/farhan-93/assignment06.git

Import required libraries

```
In [1]: import numpy as np
        import matplotlib.pyplot as plt
```

Below function will generate the data.

```
In [2]: def make_data():

            num = 201
            std = 20
            a = 2
            b = 10
            #generate n random values
            n = np.random.rand (num)
            #Variance for sampling data
            nn = n - np.mean (n)
            #X points
            x = np.linspace (-100,100, num)
            #Points with Noise
            y1 = a * x + nn * std + b
            #Points without Noise
            y2 = a * x + b


            return x, y1, y2
```

Function calculates the best line that generate the best fit straight line for the data

```python
In [3]: def least_squares(x, y):

            n = len(x)
            A = np.c_[np.ones(n), x]


            ''''It is the Solution of least square problem. In this expression,
            its calculate the dot product of the Pseudo_inverse(A) and b'''
            # value of a and b for the linear equation
            b, a = np.linalg.inv(A.T.dot(A)).dot(A.T).dot(y)
            ''''It is the straight line fit equation.
            This equation fots the best straight line'''
            f = np.mean(y)+(np.std(y)/np.std(x))*(x-np.mean(x))

            return b, a,f

        x, y, y_org = make_data()

        b_ls, a_ls,f = least_squares(x, y)
        plt.figure(0)
        plt.title("Clean Data")
        plt.scatter(x, y_org, marker=".")


        plt.figure(1)
        plt.title("Noisy Data")
        plt.scatter(x, y, marker=".")

        plt.figure(2)
        plt.title("Straight line by Least square Solution(Psuedo Inverse method)")
        plt.scatter(x, y, marker=".")
        plt.plot(x, a_ls*x +b_ls , 'g', label="Psuedo Inverse method")
        plt.legend()

        plt.figure(3)
        plt.title("Straight line by Least Square Straight line fit method")
        plt.scatter(x, y, marker=".")
        plt.plot(x, f , 'r',label="Straight Line fitting Method")
        plt.legend()

        plt.figure(4)
        plt.title("Combined plots")
        plt.plot(x, y_org , 'k', label="Straight line with no noise data")
        plt.plot(x, f , 'r',label="Straight Line fitting Method")
        plt.plot(x, a_ls*x +b_ls , 'g', label="Psuedo Inverse method")
        plt.legend()

        plt.show()
```
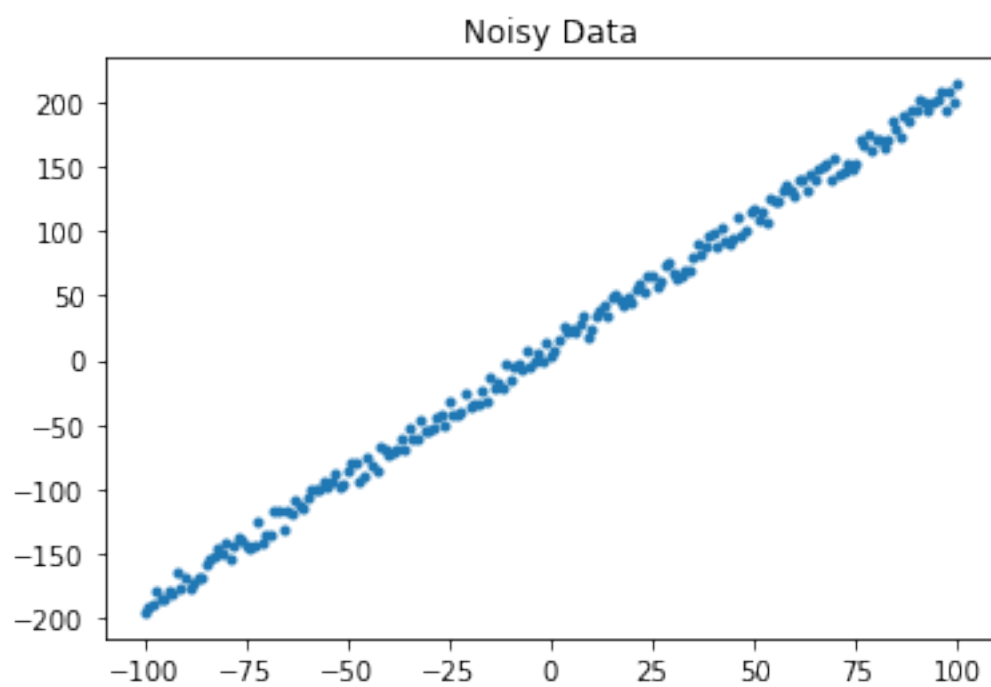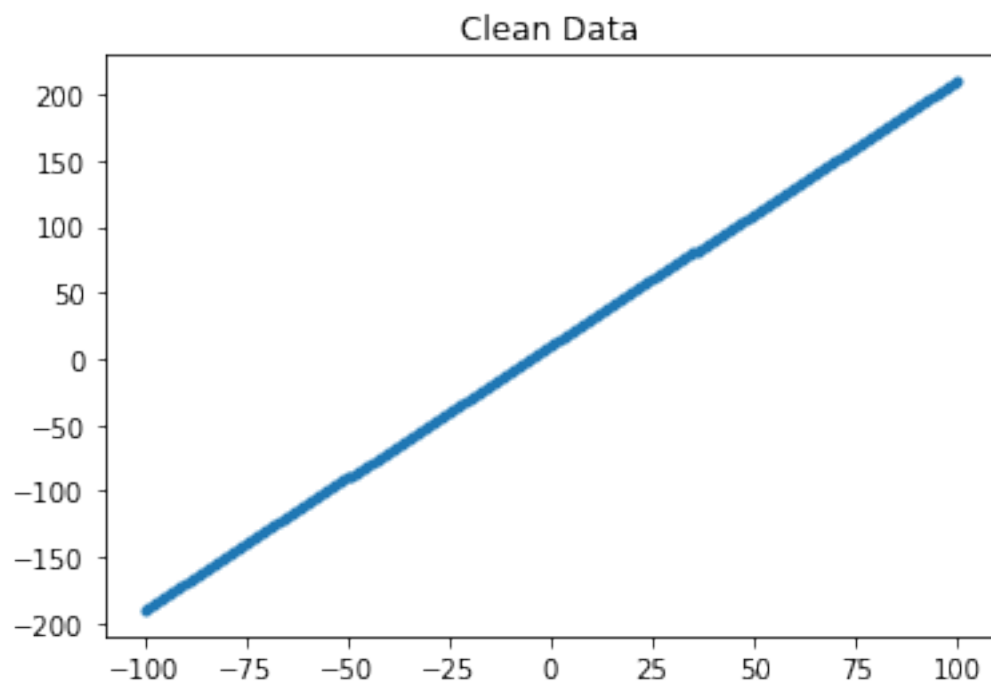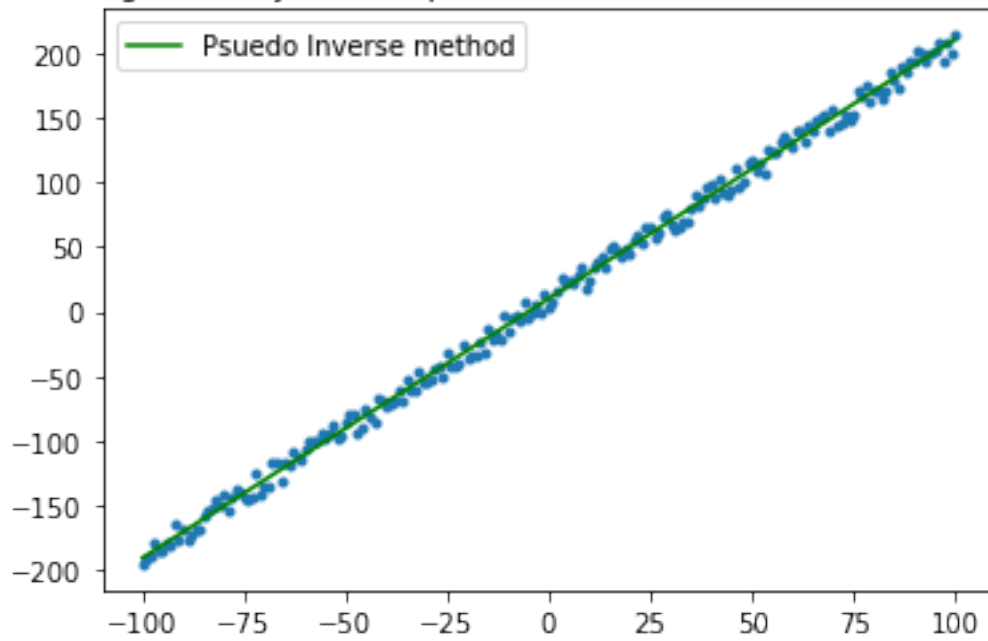
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Clean Data

Noisy Data

Straight line by Least square Solution(Psuedo Inverse method)

Straight line by Least Square Straight line fit method

Combined plots

Straight line with no noise data
Straight Line fitting Method
Psuedo Inverse method