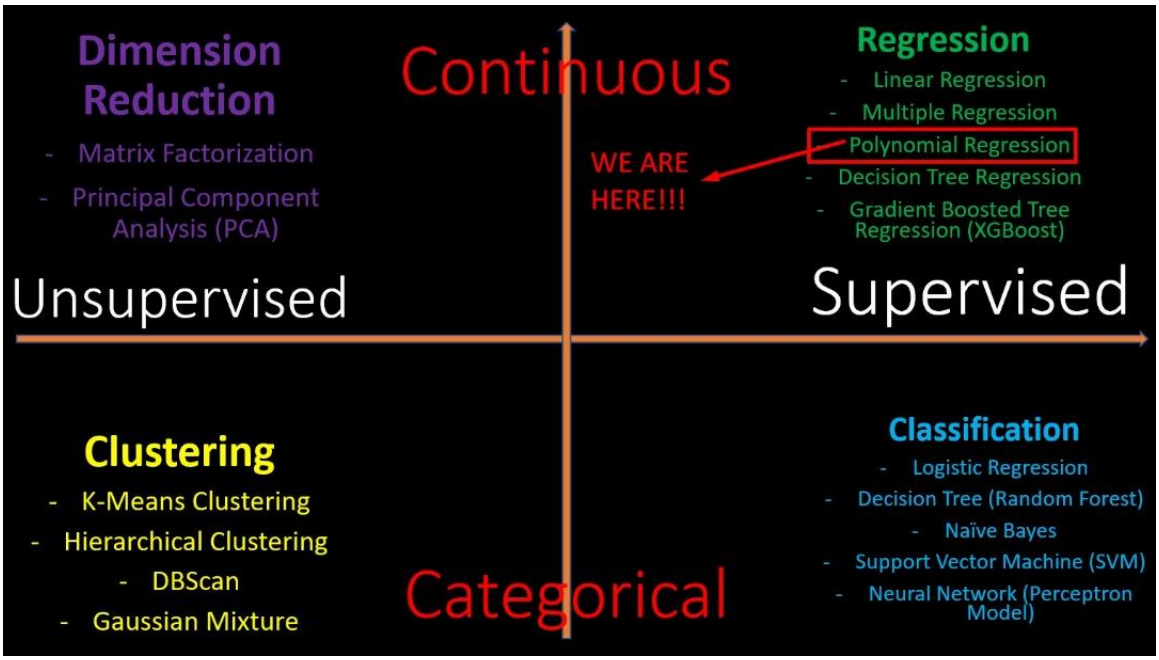
POLYNOMIAL REGRESSION WITH PYTHON

DR. ALVIN ANG

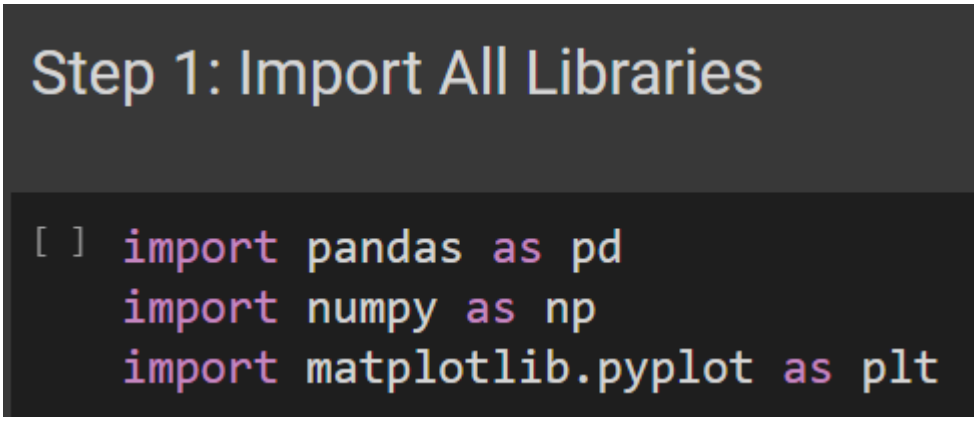
CONTENTS



STEP 1: IMPORT ALL LIBRARIES

https://www.alvinang.sg/s/Polynomial_Regression_with_Python_by_Dr_Alvin_Ang.ipynb

https://www.alvinang.sg/s/automobileEDA.csv



STEP 2: IMPORT THE DATA

Step 2: Import the Data

```
[ ] path = 'https://www.alvinang.sg/s/automobileEDA.csv'
    df = pd.read_csv(path)
    df.sample()
```

	symboling	normalized-losses	make	aspiration	num-of-doors	body-style	drive-wheels	engine-location	wheel-base	length	...	compression-ratio	horsepower	peak-rpm	city-mpg	highway-mpg
151	0	91	toyota	std	four	wagon	4wd	front	95.7	0.815473	...	9.0	62.0	4800.0	27	32

1 rows × 29 columns

Step 3: Polynomial Fit - 3rd Order - X3

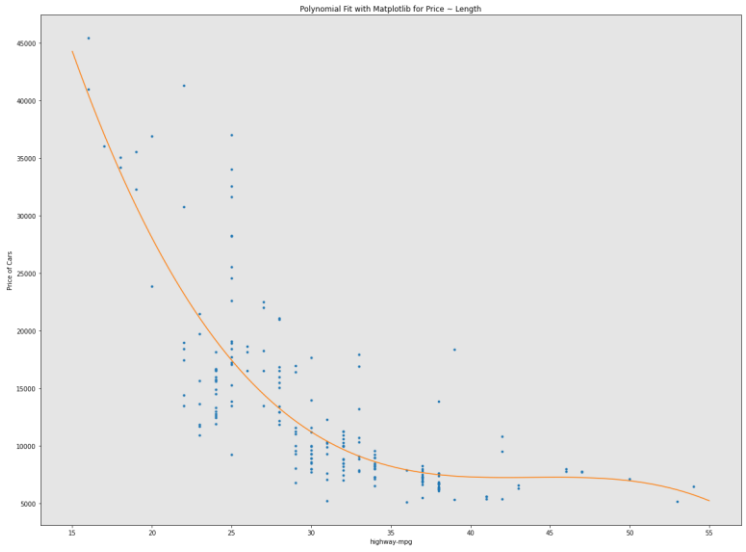
```
[ ] x = df['highway-mpg']
    y = df['price']

    f = np.polyfit(x, y, 3)
    p = np.poly1d(f)
    print(p)

    #we use a polynomial of 3rd order (cubic)

    # Y = (-1.557*x3) + (204.8*x2) - (8965*x) + 1.379e+05
```

```
        3         2
-1.557 x + 204.8 x - 8965 x + 1.379e+05
```

Step 4: Define a Plotpolly Function to Set Plotting Parameters

```
def PlotPolly(model, independent_variable, dependent_variable, Name):

    x_new = np.linspace(15, 55, 100)
    y_new = model(x_new)

    plt.figure(figsize=(20, 15))
    plt.plot(independent_variable, dependent_variable, '.', x_new, y_new, '-')
    plt.title('Polynomial Fit with Matplotlib for Price ~ Length')

    ax = plt.gca()
    ax.set_facecolor((0.898, 0.898, 0.898))
    fig = plt.gcf()


    plt.xlabel(Name)
    plt.ylabel('Price of Cars')
    plt.show()
    plt.close()
```

```
[ ] PlotPolly(p, x, y, 'highway-mpg')
```



Step 6: Another Way to Obtain the Polynomial Equation

```
[ ] np.polyfit(x, y, 3)
    # Y = (-1.557*x3) + (204.8*x2) - (8965*x) + 1.379e+05
```

```
array([-1.55663829e+00,  2.04754306e+02, -8.96543312e+03,  1.37923594e+05])
```

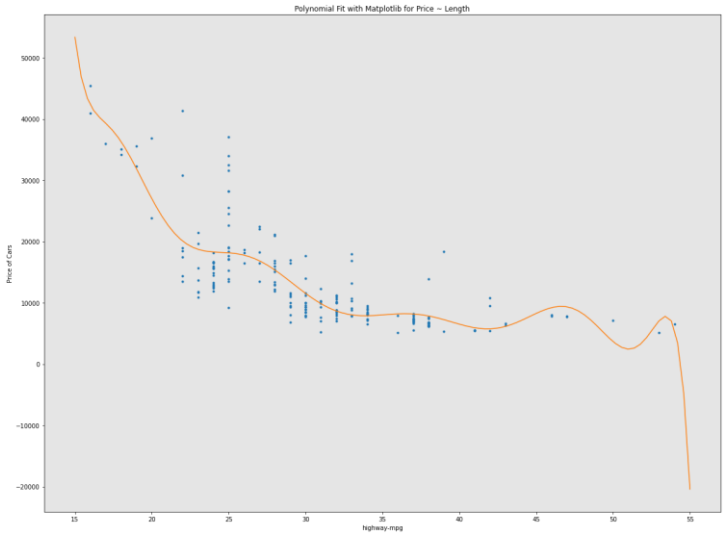
Step 7: Polynomial Fit - Explore X with 11 Degrees

```
[ ] x = df['highway-mpg']
    y = df['price']
```

```
[ ] f1 = np.polyfit(x, y, 11)
    p1 = np.poly1d(f1)
    print(p1)

    #we use a polynomial of 11th order

    # Y = (-1.2e-08*X11) + (4.7e-06*X10) - (0.0008028*X9) + (0.08056*X8)
    # - (5.297*X7) + (239.5*X6) - (7588*X5) + (1.684e+05*X4) - (2.565e+06*X3)
    # + (2.5e+07*X2) - (1.4e+08*X) + 3.879e+08
```

```
            11            10             9           8         7
-1.243e-08 x  + 4.722e-06 x  - 0.0008028 x + 0.08056 x - 5.297 x
          6         5          4          3          2
 + 239.5 x - 7588 x + 1.684e+05 x - 2.565e+06 x + 2.551e+07 x - 1.491e+08 x + 3.879e+08
```

```
[ ] PlotPolly(p1, x, y, 'highway-mpg')
```



Step 8: Compute and Compare R2 Scores

```
[ ] from sklearn.metrics import r2_score
```

```
[ ] r_squared = r2_score(y, p(x))
    print("The R2 is", r_squared)

    #The X3 model fits the data 67%
```

```
The R2 is 0.674194666390652
```

```
[ ] r_squared_2 = r2_score(y, p1(x))
    print("The R2 is", r_squared_2)

    #The X11 model fits the data 70%
```

```
The R2 is 0.7023769093756598
```

Step 9: Compuate and Compare MSE Scores

```
[ ] from sklearn.metrics import mean_squared_error
```

```
[ ] mean_squared_error(df['price'], p(x))

    #the MSE for X3 is 20,474,146
```

```
20474146.426361218
```

```
[ ] mean_squared_error(df['price'], p1(x))

    #the MSE for X11 is 18,703,127
```

```
18703127.63085496
```

```
[1] #Conclusion: X11 seems to be a better model fit.

    #However, comparing their plots, it appears that X11 is overfitting towards the
    #end of the curve
```

THE END

ABOUT DR. ALVIN ANG

Dr. Alvin Ang earned his Ph.D., Masters and Bachelor degrees from NTU, Singapore. He is a scientist, entrepreneur, as well as a personal/business advisor. More about him at www.AlvinAng.sg.