```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

```
Elec = pd.read_csv('https://raw.githubusercontent.com/rusita-ai/pyData/master/Model_Validation.csv'
```

```
Elec.shape
```

```
(1000, 2)
```

Model_validation

1. 7 : 3 Array Split
    - random_state = 2045
2. 5차, 7차, 9차 모델
    - Test Error 비교
3. Split 및 Modeling 시각화

(1) DataFarm Split

```
from sklearn.model_selection import train_test_split
```

```
TR_Elec, TE_Elec = train_test_split(Elec, test_size = 0.3, random_state = 2045)
```

```
TR_Elec.shape, TE_Elec.shape
```

```
((700, 2), (300, 2))
```

```
TR_Elec.head()
```

	Inputs	Outputs
818	-2.671430	-0.849129
615	2.525234	1.042056
872	0.863997	0.374570
394	-0.955179	-0.540516
435	1.205815	0.729848

```
TE_Elec.head()
```

	Inputs	Outputs
665	-2.082845	-1.811198
200	0.852190	0.686995
439	-2.511907	0.108298
881	1.031356	0.040331
689	-1.877738	-1.187437

(2) Array Split

```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(Elec[['Inputs']], Elec['Outputs'],
                                                    test_size = 0.3, random_state = 2045)

X_train.shape, y_train.shape, X_test.shape, y_test.shape
```

```
((700, 1), (700,), (300, 1), (300,))
```

```
X_train.head()
```

	Inputs
818	-2.671430
615	2.525234
872	0.863997
394	-0.955179
435	1.205815

```
y_train.head()
```

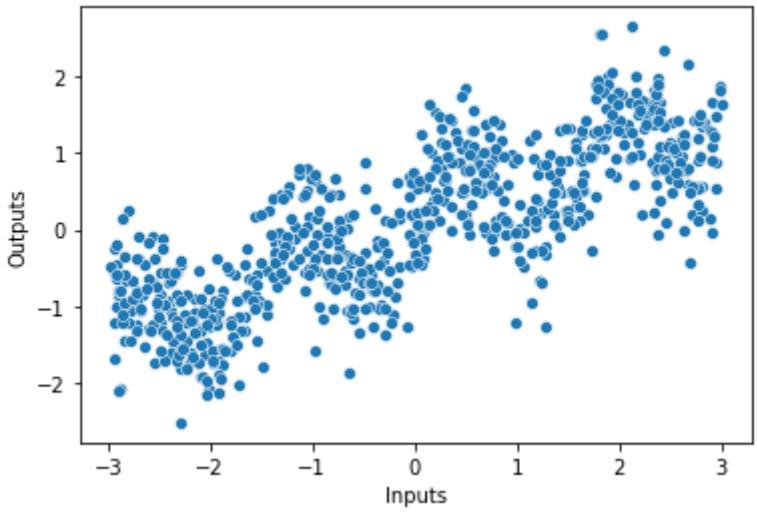
```
818   -0.849129
615    1.042056
872    0.374570
394   -0.540516
435    0.729848
Name: Outputs, dtype: float64
```

(3) Distribution Visualization

```
sns.scatterplot(TR_Elec['Inputs'], TR_Elec['Outputs'])
```

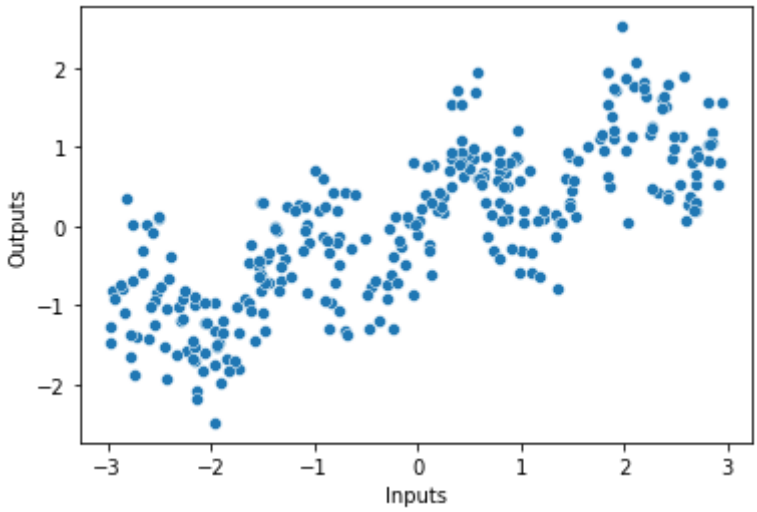
```
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the fol
  FutureWarning
```




```
sns.scatterplot(TE_Elec['Inputs'], TE_Elec['Outputs'])
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the fol
  FutureWarning
```



1) 5차 모델 Testing Error

```
from sklearn.preprocessing import PolynomialFeatures
```

```
poly = PolynomialFeatures(degree = 5, include_bias = False)
PX_5_TR = poly.fit_transform(X_train)
```

```
from sklearn.linear_model import LinearRegression
```

```
Model_5 = LinearRegression()
Model_5.fit(PX_5_TR, y_train)
```

```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
```

```
from sklearn.metrics import mean_squared_error
```

```
PX_5_TE = poly.fit_transform(X_test)
```

```
y_hat_5 = Model_5.predict(PX_5_TE)
```

```
from sklearn.metrics import mean_squared_error
```

```
TE_Err_5 = mean_squared_error(y_test, y_hat_5)
TE_Err_5
```

```
0.3602980472002336
```

2) 7차 모델 Testing Error

```
from sklearn.preprocessing import PolynomialFeatures
```

```
poly = PolynomialFeatures(degree = 7, include_bias = False)
PX_7_TR = poly.fit_transform(X_train)
```

```
from sklearn.linear_model import LinearRegression
```

```
Model_7 = LinearRegression()
Model_7.fit(PX_7_TR, y_train)
```

```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
```

```
PX_7_TE = poly.fit_transform(X_test)
```

```
y_hat_7 = Model_7.predict(PX_7_TE)
```

```
from sklearn.metrics import mean_squared_error
```

```
TE_Err_7 = mean_squared_error(y_test, y_hat_7)
TE_Err_7
```

```
0.35784993736519366
```

3) 9차 모델 Testing Error

```
from sklearn.preprocessing import PolynomialFeatures


poly = PolynomialFeatures(degree = 9, include_bias = False)
PX_9_TR = poly.fit_transform(X_train)


from sklearn.linear_model import LinearRegression


Model_9 = LinearRegression()
Model_9.fit(PX_9_TR, y_train)
```

```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
```

```
PX_9_TE = poly.fit_transform(X_test)

y_hat_9 = Model_9.predict(PX_9_TE)


from sklearn.metrics import mean_squared_error


TE_Err_9 = mean_squared_error(y_test, y_hat_9)
TE_Err_9
```

```
0.2893114750133329
```

4) 3개 모델 Testing Error 비교

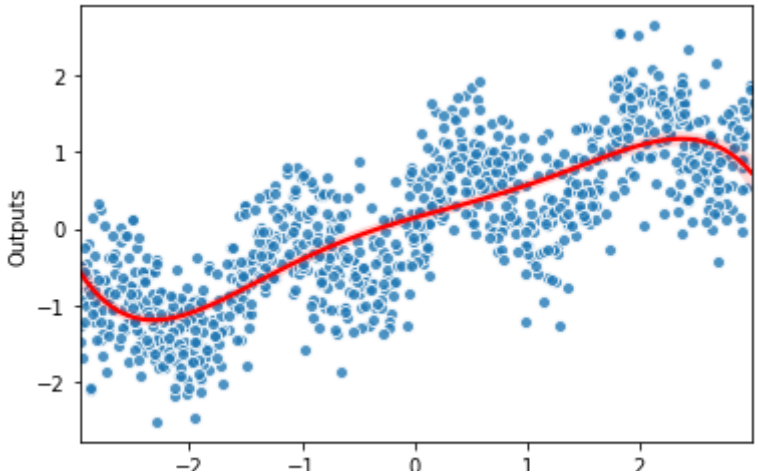
```
print('1차 모델 : ', TE_Err_1)
print('5차 모델 : ', TE_Err_5)
print('9차 모델 : ', TE_Err_9)
```

```
1차 모델 :  0.3933744691015871
5차 모델 :  0.3602980472002336
9차 모델 :  0.2893114750133329
```

Visualization

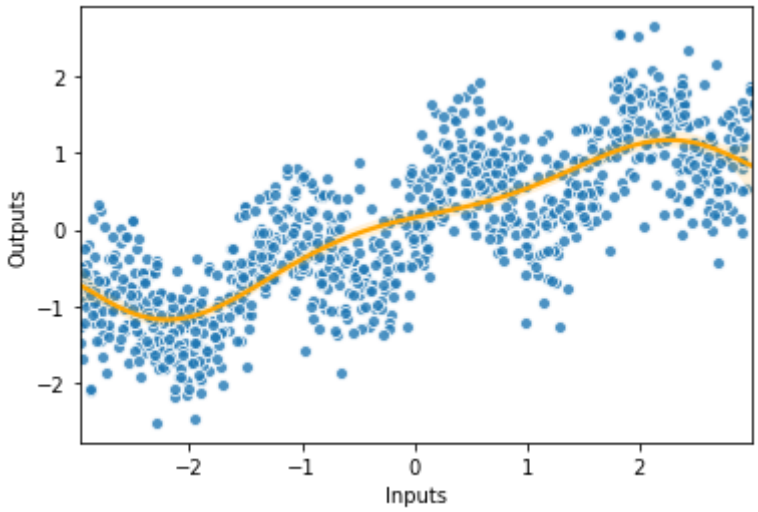
```
sns.regplot(x = 'Inputs', y = 'Outputs', data = Elec,
            line_kws = {'color' : 'red'},
            scatter_kws = {'edgecolor' : 'white'},
            order = 5)

plt.show()
```




```
sns.regplot(x = 'Inputs', y = 'Outputs', data = Elec,
            line_kws = {'color' : 'orange'},
            scatter_kws = {'edgecolor' : 'white'},
            order = 7)

plt.show()
```




```
sns.regplot(x = 'Inputs', y = 'Outputs', data = Elec,
            line_kws = {'color' : 'green'},
            scatter_kws = {'edgecolor' : 'white'},
            order = 9)

plt.show()
```

```
sns.regplot(x = 'Inputs', y = 'Outputs', data = Elec, line_kws = {'color' : 'red'}, order = 5)
sns.regplot(x = 'Inputs', y = 'Outputs', data = Elec, line_kws = {'color' : 'orange'}, order = 7)
sns.regplot(x = 'Inputs', y = 'Outputs', data = Elec, line_kws = {'color' : 'green'}, order = 9,
            scatter_kws = {'color' : 'gray', 'edgecolor' : 'white'})

# limit, ticks 설정 이해 필요

plt.show()
```