Polynomial Regression

```
# from google.colab import files
# up = files.upload()
```

import dataset

```
import pandas as pd
df = pd.read_csv('dataset.csv')
df.head(3)
```

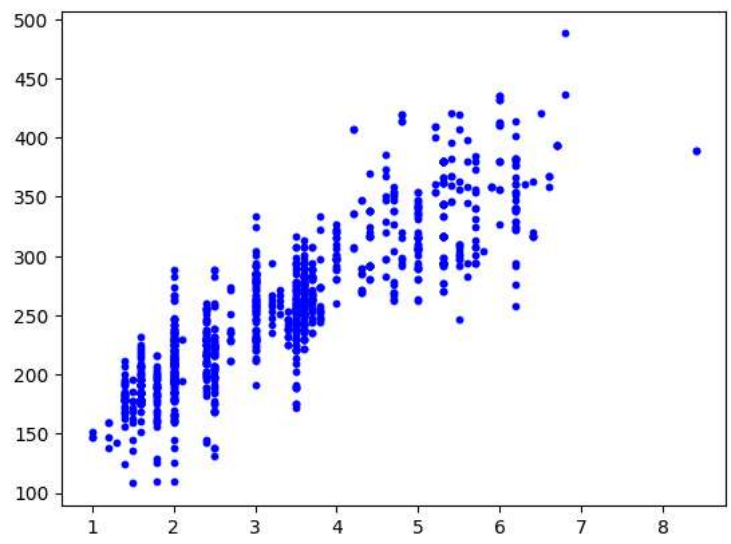
	A	B	C	T
0	2.0	4	8.5	196
1	2.4	4	9.6	221
2	1.5	4	5.9	136

```
df = df[['A', 'T']]
df.head(3)
```

	A	T
0	2.0	196
1	2.4	221
2	1.5	136

```
# df.info()
```

```
import matplotlib.pyplot as plt
plt.scatter(df['A'], df['T'], s=10, c='b')
plt.show()
```



cleaning

```
# clean the data
```

encoding

```
# encode the data
```

define x , y

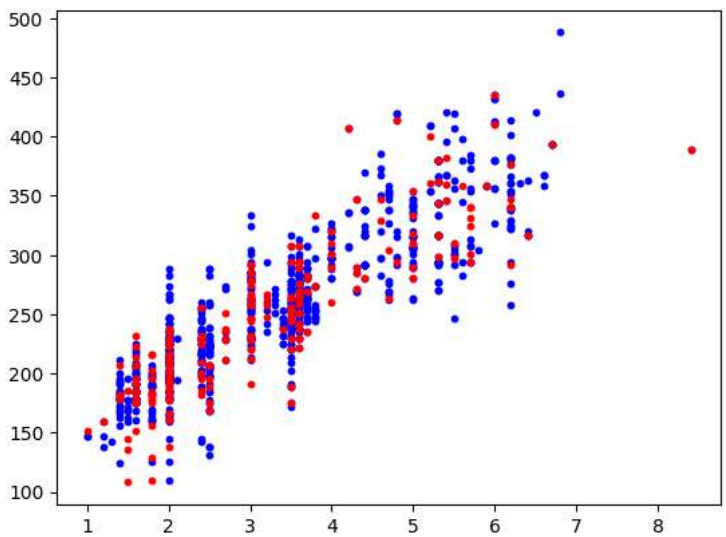
```
import numpy as np
x = np.array(df[['A']])
y = np.array(df['T'])
```

```
y[:5]
```

```
array([196, 221, 136, 255, 244])
```

spliting

```
### finding best random state

# from sklearn.model_selection import train_test_split
# from sklearn.preprocessing import PolynomialFeatures
# from sklearn.linear_model import LinearRegression
# from sklearn.metrics import r2_score
# from sklearn.preprocessing import PolynomialFeatures

# import time
# t1 = time.time()
# lst = []
# for i in range(1,10):
#     x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.25, random_state=i)
#     pnf = PolynomialFeatures(degree=2).fit(x_train)
#     x_train_pnf = pnf.transform(x_train)
#     x_test_pnf = pnf.transform(x_test)
#     pr = LinearRegression()
#     pr.fit(x_train_pnf, y_train)
#     yhat_test = pr.predict(x_test_pnf)
#     r2 = r2_score(y_test, yhat_test)
#     lst.append(r2)
# t2 = time.time()
# print(f"run time: {round((t2 - t1)/60, 2)} min")
# print(f"r2_score: {round(max(lst), 2)}")
# rs = np.argmax(lst) + 1
# print(f"random_state: {rs}")

from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2, random_state=42)

plt.scatter(x_train, y_train, s=10, c='b')
plt.scatter(x_test, y_test, s=10, c='r')
plt.show()
```



preprocessing on x data

```
from sklearn.preprocessing import PolynomialFeatures
pnf = PolynomialFeatures(degree=2).fit(x_train)

x_train_pnf = pnf.transform(x_train)
x_test_pnf = pnf.transform(x_test)

x_train_pnf[:3]
```

```
array([[ 1.  ,  1.4 ,  1.96],
       [ 1.  ,  4.4 , 19.36],
       [ 1.  ,  3.  ,  9.  ]])
```

scaling

```
# do not need for scaling in polynomial regression
```

fit train data

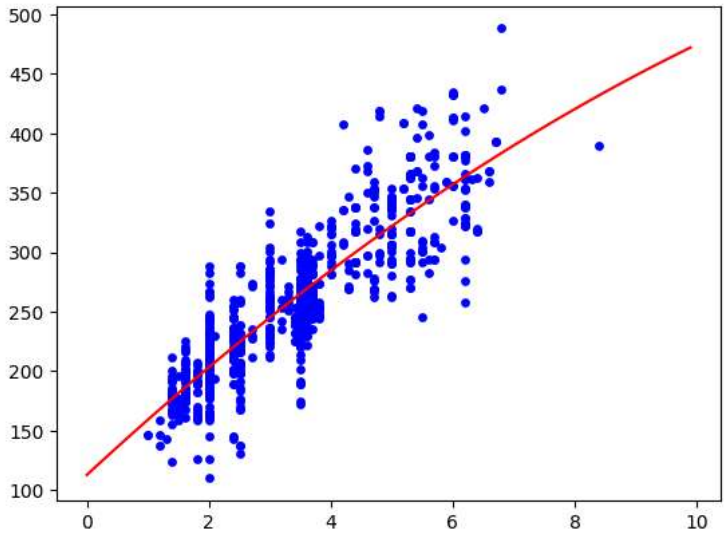
```
### K-fold cross validation

# from sklearn.linear_model import LinearRegression
# from sklearn.model_selection import GridSearchCV

# parameters = {
#     'fit_intercept': [True, False],
#     'copy_X': [True, False],
#     'n_jobs': [None],
#     'positive': [True, False]
# }

# pr = LinearRegression()
# gs = GridSearchCV(estimator=pr, param_grid=parameters, cv=5)

# gs.fit(x_train, y_train)

# best_params = gs.best_params_
# print(best_params)

# def param
# fit_intercept=True, copy_X=True, n_jobs=None, positive=False

from sklearn.linear_model import LinearRegression
pr = LinearRegression()
pr.fit(x_train_pnf, y_train)
```

```
LinearRegression()
```

```
print(pr.intercept_)
print(pr.coef_)
```

```
112.92021963451731
[ 0.         47.42976379 -1.12705382]
```

```
xx = np.arange(0,10,0.1)
plt.scatter(x_train, y_train, s=15, c='b')
plt.plot(xx, pr.intercept_ + pr.coef_[1] * xx + pr.coef_[2] * np.power(xx, 2) , c='r')
plt.show()
```



predict test data

```
yhat_test = pr.predict(x_test_pnf)
```

evaluate the model

```
from sklearn.metrics import r2_score
print("r2-score (train data): %0.4f" % r2_score(y_train, pr.predict(x_train_pnf)))
print("r2-score (test data): %0.4f" % r2_score(y_test, yhat_test))
```

```
r2-score (train data): 0.7658
r2-score (test data): 0.7676
```

```
from sklearn.metrics import mean_squared_error
from sklearn.metrics import mean_absolute_error
print(f"MSE (train data): {mean_squared_error(y_train, pr.predict(x_train_pnf))}")
print(f"MAE (train data): {mean_absolute_error(y_train, pr.predict(x_train_pnf))}")
print(f"MSE (test data): {mean_squared_error(y_test, yhat_test)}")
print(f"MAE (test data): {mean_absolute_error(y_test, yhat_test)}")
```

```
MSE (train data): 931.2807597015276
MAE (train data): 23.184491692811502
MSE (test data): 960.8705832028331
MAE (test data): 23.915883545298716
```

predict new data

```
pr.predict(pnf.transform([[2]]))
```

```
array([203.27153193])
```

save the model

```
# import joblib
# joblib.dump(pr, 'pr_model.pkl')
```

load the model

```
# import joblib
# pr = joblib.load('pr_model.pkl')
```