pr2-temp-gs

November 2, 2024

[1]:
```
pip install pandas
```

```
Requirement already satisfied: pandas in /usr/local/lib/python3.10/dist-packages
(2.2.2)
Requirement already satisfied: numpy>=1.22.4 in /usr/local/lib/python3.10/dist-
packages (from pandas) (1.26.4)
Requirement already satisfied: python-dateutil>=2.8.2 in
/usr/local/lib/python3.10/dist-packages (from pandas) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-
packages (from pandas) (2024.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.10/dist-
packages (from pandas) (2024.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-
packages (from python-dateutil>=2.8.2->pandas) (1.16.0)
```

[2]:
```
import pandas as pd
import numpy as np
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score
import matplotlib.pyplot as plt
import seaborn as sns
```

[3]:
```
df = pd.read_csv("temperatures.csv")
```

[4]:
```
df
```

[4]:

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	\
0	1901	22.40	24.14	29.07	31.91	33.41	33.18	31.21	30.39	30.47	
1	1902	24.93	26.58	29.77	31.78	33.73	32.91	30.92	30.73	29.80	
2	1903	23.44	25.03	27.83	31.39	32.91	33.00	31.34	29.98	29.85	
3	1904	22.50	24.73	28.21	32.02	32.64	32.07	30.36	30.09	30.04	
4	1905	22.00	22.83	26.68	30.01	33.32	33.25	31.44	30.68	30.12	
..	…	…	…	…	…	…	…	…	…	…	
112	2013	24.56	26.59	30.62	32.66	34.46	32.44	31.07	30.76	31.04	
113	2014	23.83	25.97	28.95	32.74	33.77	34.15	31.85	31.32	30.68	
114	2015	24.58	26.89	29.07	31.87	34.09	32.48	31.88	31.52	31.55	
115	2016	26.94	29.72	32.62	35.38	35.72	34.03	31.64	31.79	31.66	
116	2017	26.45	29.46	31.60	34.95	35.84	33.82	31.88	31.72	32.22	

	OCT	NOV	DEC	ANNUAL	JAN-FEB	MAR-MAY	JUN-SEP	OCT-DEC
0	29.97	27.31	24.49	28.96	23.27	31.46	31.27	27.25
1	29.12	26.31	24.04	29.22	25.75	31.76	31.09	26.49
2	29.04	26.08	23.65	28.47	24.24	30.71	30.92	26.26
3	29.20	26.36	23.63	28.49	23.62	30.95	30.66	26.40
4	30.67	27.52	23.82	28.30	22.25	30.00	31.33	26.57
..	…	…	…	…	…	…	…	
112	30.27	27.83	25.37	29.81	25.58	32.58	31.33	27.83
113	30.29	28.05	25.08	29.72	24.90	31.82	32.00	27.81
114	31.04	28.10	25.67	29.90	25.74	31.68	31.87	28.27
115	31.98	30.11	28.01	31.63	28.33	34.57	32.28	30.03
116	32.29	29.60	27.18	31.42	27.95	34.13	32.41	29.69

[117 rows x 18 columns]

[5]:
```
df.describe()
```

[5]:

	YEAR	JAN	FEB	MAR	APR
count	117.000000	117.000000	117.000000	117.000000	117.000000
mean	1959.000000	23.687436	25.597863	29.085983	31.975812
std	33.919021	0.834588	1.150757	1.068451	0.889478
min	1901.000000	22.000000	22.830000	26.680000	30.010000
25%	1930.000000	23.100000	24.780000	28.370000	31.460000
50%	1959.000000	23.680000	25.480000	29.040000	31.950000
75%	1988.000000	24.180000	26.310000	29.610000	32.420000
max	2017.000000	26.940000	29.720000	32.620000	35.380000

	MAY	JUN	JUL	AUG	SEP	OCT
count	117.000000	117.000000	117.000000	117.000000	117.000000	117.000000
mean	33.565299	32.774274	31.035897	30.507692	30.486752	29.766581
std	0.724905	0.633132	0.468818	0.476312	0.544295	0.705492
min	31.930000	31.100000	29.760000	29.310000	29.070000	27.900000
25%	33.110000	32.340000	30.740000	30.180000	30.120000	29.380000
50%	33.510000	32.730000	31.000000	30.540000	30.520000	29.780000
75%	34.030000	33.180000	31.330000	30.760000	30.810000	30.170000
max	35.840000	34.480000	32.760000	31.840000	32.220000	32.290000

	NOV	DEC	ANNUAL	JAN-FEB	MAR-MAY	JUN-SEP
count	117.000000	117.000000	117.000000	117.000000	117.000000	117.000000
mean	27.285470	24.608291	29.181368	24.629573	31.517607	31.198205
std	0.714518	0.782644	0.555555	0.911239	0.740585	0.420508
min	25.700000	23.020000	28.110000	22.250000	29.920000	30.240000
25%	26.790000	24.040000	28.760000	24.110000	31.040000	30.920000
50%	27.300000	24.660000	29.090000	24.530000	31.470000	31.190000
75%	27.720000	25.110000	29.470000	25.150000	31.890000	31.400000
max	30.110000	28.010000	31.630000	28.330000	34.570000	32.410000

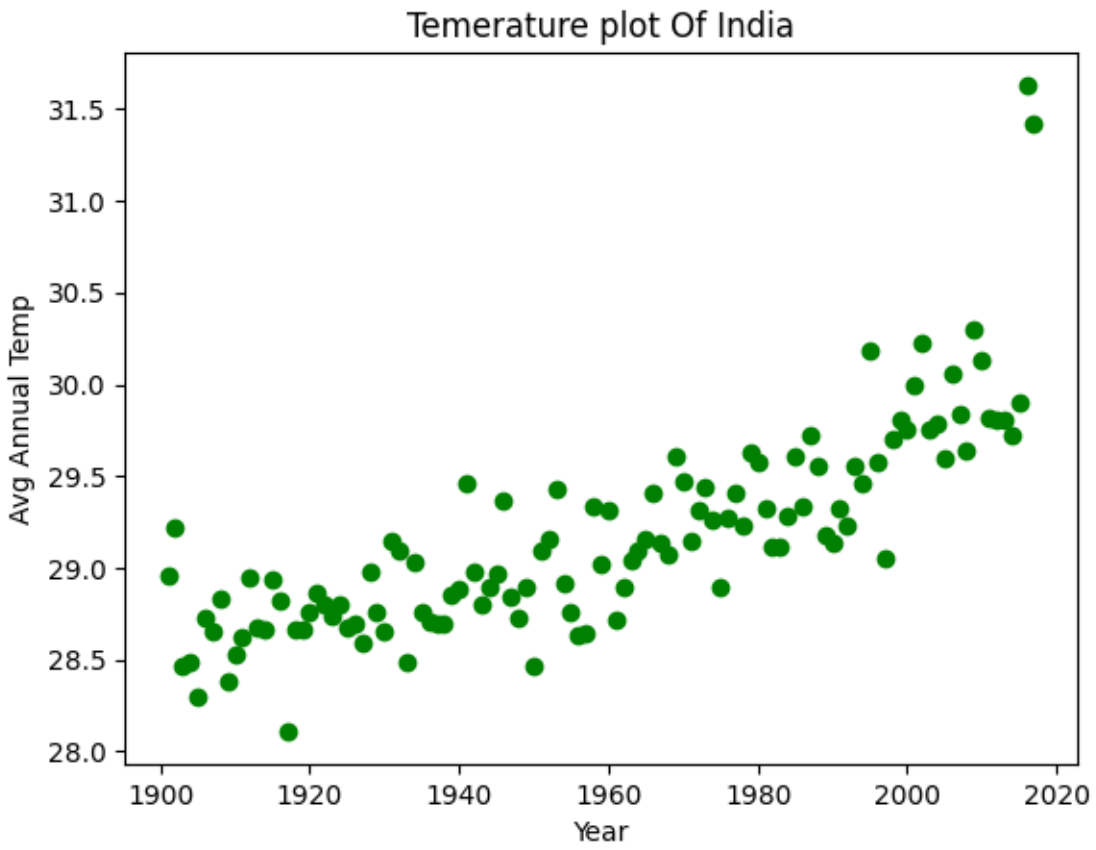
```
           OCT-DEC
count  117.000000
mean    27.208120
std      0.672003
min     25.740000
25%     26.700000
50%     27.210000
75%     27.610000
max     30.030000
```

[6]:
```
#input data
x = df['YEAR']

#output data
y = df['ANNUAL']
```

[7]:
```
plt.title("Temerature plot Of India")
plt.xlabel("Year")
plt.ylabel("Avg Annual Temp")
plt.scatter(x,y, color="green")
```

[7]:
```
<matplotlib.collections.PathCollection at 0x7bf62aa88ac0>
```



[8]:
```
x.shape
```

[8]:
```
(117,)
```

[9]:
```
x=x.values
```

[10]:
```
x
```

[10]:
```
array([1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911,
       1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922,
       1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933,
       1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944,
       1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955,
       1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966,
       1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977,
       1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988,
       1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999,
       2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010,
       2011, 2012, 2013, 2014, 2015, 2016, 2017])
```

[11]:
```
x=x.reshape(117,1)
```

[12]:
```
x.shape
```

[12]:
```
(117, 1)
```

[13]:
```
x
```

[13]:
```
array([[1901],
       [1902],
       [1903],
       [1904],
       [1905],
       [1906],
       [1907],
       [1908],
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       [1910],
       [1911],
       [1912],
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       [1914],
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       [1919],
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       [2013],
       [2014],
       [2015],
       [2016],
       [2017]])
```

[33]:
```
y.shape
```

[33]:
```
(117,)
```

[18]:
```
y=y.values
```

[31]:
```
y=y.reshape(117,)
```

[34]:
```
y
```

[34]:
```
array([28.96, 29.22, 28.47, 28.49, 28.3 , 28.73, 28.65, 28.83, 28.38,
       28.53, 28.62, 28.95, 28.67, 28.66, 28.94, 28.82, 28.11, 28.66,
       28.66, 28.76, 28.86, 28.8 , 28.74, 28.8 , 28.67, 28.7 , 28.59,
       28.98, 28.76, 28.65, 29.15, 29.09, 28.49, 29.03, 28.76, 28.71,
       28.7 , 28.7 , 28.85, 28.88, 29.46, 28.98, 28.8 , 28.89, 28.97,
```

```
       29.37, 28.84, 28.73, 28.89, 28.47, 29.09, 29.16, 29.43, 28.92,
       28.76, 28.63, 28.64, 29.34, 29.02, 29.31, 28.72, 28.89, 29.04,
       29.09, 29.16, 29.41, 29.14, 29.07, 29.61, 29.47, 29.15, 29.31,
       29.44, 29.26, 28.89, 29.27, 29.41, 29.23, 29.63, 29.58, 29.32,
       29.12, 29.11, 29.28, 29.61, 29.33, 29.72, 29.55, 29.18, 29.14,
       29.32, 29.23, 29.55, 29.46, 30.18, 29.58, 29.05, 29.7 , 29.81,
       29.75, 29.99, 30.23, 29.75, 29.79, 29.6 , 30.06, 29.84, 29.64,
       30.3 , 30.13, 29.82, 29.81, 29.81, 29.72, 29.9 , 31.63, 31.42])
```

[16]:
```
regressor = LinearRegression()
```

[35]:
```
regressor.fit(x,y)
```

[35]:
```
LinearRegression()
```

y = m.x + c

m = slope

c = y -intercep

where m is the gradient of the line (how steep the line is) and c is the y -intercept (the point in which the line crosses the y -axis)

[22]:
```
regressor.coef_ #m
```

[22]:
```
array([[0.01312158]])
```

[36]:
```
regressor.intercept_ #c
```

[36]:
```
3.4761897126187016
```

[25]:
```
regressor.predict([[2035]])
```

[25]:
```
array([[30.1786077]])
```

[37]:
```
predicted = regressor.predict(x)
```

[38]:
```
predicted
```

[38]:
```
array([28.4203158 , 28.43343739, 28.44655897, 28.45968055, 28.47280213,
       28.48592371, 28.49904529, 28.51216687, 28.52528846, 28.53841004,
       28.55153162, 28.5646532 , 28.57777478, 28.59089636, 28.60401794,
       28.61713952, 28.63026111, 28.64338269, 28.65650427, 28.66962585,
       28.68274743, 28.69586901, 28.70899059, 28.72211218, 28.73523376,
       28.74835534, 28.76147692, 28.7745985 , 28.78772008, 28.80084166,
       28.81396324, 28.82708483, 28.84020641, 28.85332799, 28.86644957,
       28.87957115, 28.89269273, 28.90581431, 28.91893589, 28.93205748,
       28.94517906, 28.95830064, 28.97142222, 28.9845438 , 28.99766538,
```

```
       29.01078696, 29.02390855, 29.03703013, 29.05015171, 29.06327329,
       29.07639487, 29.08951645, 29.10263803, 29.11575961, 29.1288812 ,
       29.14200278, 29.15512436, 29.16824594, 29.18136752, 29.1944891 ,
       29.20761068, 29.22073227, 29.23385385, 29.24697543, 29.26009701,
       29.27321859, 29.28634017, 29.29946175, 29.31258333, 29.32570492,
       29.3388265 , 29.35194808, 29.36506966, 29.37819124, 29.39131282,
       29.4044344 , 29.41755599, 29.43067757, 29.44379915, 29.45692073,
       29.47004231, 29.48316389, 29.49628547, 29.50940705, 29.52252864,
       29.53565022, 29.5487718 , 29.56189338, 29.57501496, 29.58813654,
       29.60125812, 29.6143797 , 29.62750129, 29.64062287, 29.65374445,
       29.66686603, 29.67998761, 29.69310919, 29.70623077, 29.71935236,
       29.73247394, 29.74559552, 29.7587171 , 29.77183868, 29.78496026,
       29.79808184, 29.81120342, 29.82432501, 29.83744659, 29.85056817,
       29.86368975, 29.87681133, 29.88993291, 29.90305449, 29.91617608,
       29.92929766, 29.94241924])
```

[39]:
```
y
```

[39]:
```
array([28.96, 29.22, 28.47, 28.49, 28.3 , 28.73, 28.65, 28.83, 28.38,
       28.53, 28.62, 28.95, 28.67, 28.66, 28.94, 28.82, 28.11, 28.66,
       28.66, 28.76, 28.86, 28.8 , 28.74, 28.8 , 28.67, 28.7 , 28.59,
       28.98, 28.76, 28.65, 29.15, 29.09, 28.49, 29.03, 28.76, 28.71,
       28.7 , 28.7 , 28.85, 28.88, 29.46, 28.98, 28.8 , 28.89, 28.97,
       29.37, 28.84, 28.73, 28.89, 28.47, 29.09, 29.16, 29.43, 28.92,
       28.76, 28.63, 28.64, 29.34, 29.02, 29.31, 28.72, 28.89, 29.04,
       29.09, 29.16, 29.41, 29.14, 29.07, 29.61, 29.47, 29.15, 29.31,
       29.44, 29.26, 28.89, 29.27, 29.41, 29.23, 29.63, 29.58, 29.32,
       29.12, 29.11, 29.28, 29.61, 29.33, 29.72, 29.55, 29.18, 29.14,
       29.32, 29.23, 29.55, 29.46, 30.18, 29.58, 29.05, 29.7 , 29.81,
       29.75, 29.99, 30.23, 29.75, 29.79, 29.6 , 30.06, 29.84, 29.64,
       30.3 , 30.13, 29.82, 29.81, 29.81, 29.72, 29.9 , 31.63, 31.42])
```

[41]:
```
#Mean absolute Error
abs(y-predicted)
```

[41]:
```
array([0.5396842 , 0.78656261, 0.02344103, 0.03031945, 0.17280213,
       0.24407629, 0.15095471, 0.31783313, 0.14528846, 0.00841004,
       0.06846838, 0.3853468 , 0.09222522, 0.06910364, 0.33598206,
       0.20286048, 0.52026111, 0.01661731, 0.00349573, 0.09037415,
       0.17725257, 0.10413099, 0.03100941, 0.07788782, 0.06523376,
       0.04835534, 0.17147692, 0.2054015 , 0.02772008, 0.15084166,
       0.33603676, 0.26291517, 0.35020641, 0.17667201, 0.10644957,
       0.16957115, 0.19269273, 0.20581431, 0.06893589, 0.05205748,
       0.51482094, 0.02169936, 0.17142222, 0.0945438 , 0.02766538,
       0.35921304, 0.18390855, 0.30703013, 0.16015171, 0.59327329,
       0.01360513, 0.07048355, 0.32736197, 0.19575961, 0.3688812 ,
       0.51200278, 0.51512436, 0.17175406, 0.16136752, 0.1155109 ,
```

```
0.48761068, 0.33073227, 0.19385385, 0.15697543, 0.10009701,
0.13678141, 0.14634017, 0.22946175, 0.29741667, 0.14429508,
0.1888265 , 0.04194808, 0.07493034, 0.11819124, 0.50131282,
0.1344344 , 0.00755599, 0.20067757, 0.18620085, 0.12307927,
0.15004231, 0.36316389, 0.38628547, 0.22940705, 0.08747136,
0.20565022, 0.1712282 , 0.01189338, 0.39501496, 0.44813654,
0.28125812, 0.3843797 , 0.07750129, 0.18062287, 0.52625555,
0.08686603, 0.62998761, 0.00689081, 0.10376923, 0.03064764,
0.25752606, 0.48440448, 0.0087171 , 0.01816132, 0.18496026,
0.26191816, 0.02879658, 0.18432501, 0.46255341, 0.27943183,
0.04368975, 0.06681133, 0.07993291, 0.18305449, 0.01617608,
1.70070234, 1.47758076])
```

[42]:
```
np.mean(abs(y-predicted))
```

[42]: 0.22535284978630413

[43]:
```
mean_absolute_error(y,predicted)
```

[43]: 0.22535284978630413

[45]:
```
np.mean((y-predicted)**2)
```

[45]: 0.10960795229110352

[46]:
```
mean_squared_error(y,predicted)
```

[46]: 0.10960795229110352

[47]:
```
r2_score(y,predicted)
```

[47]: 0.6418078912783682

[48]:
```
regressor.score(x,y)
```

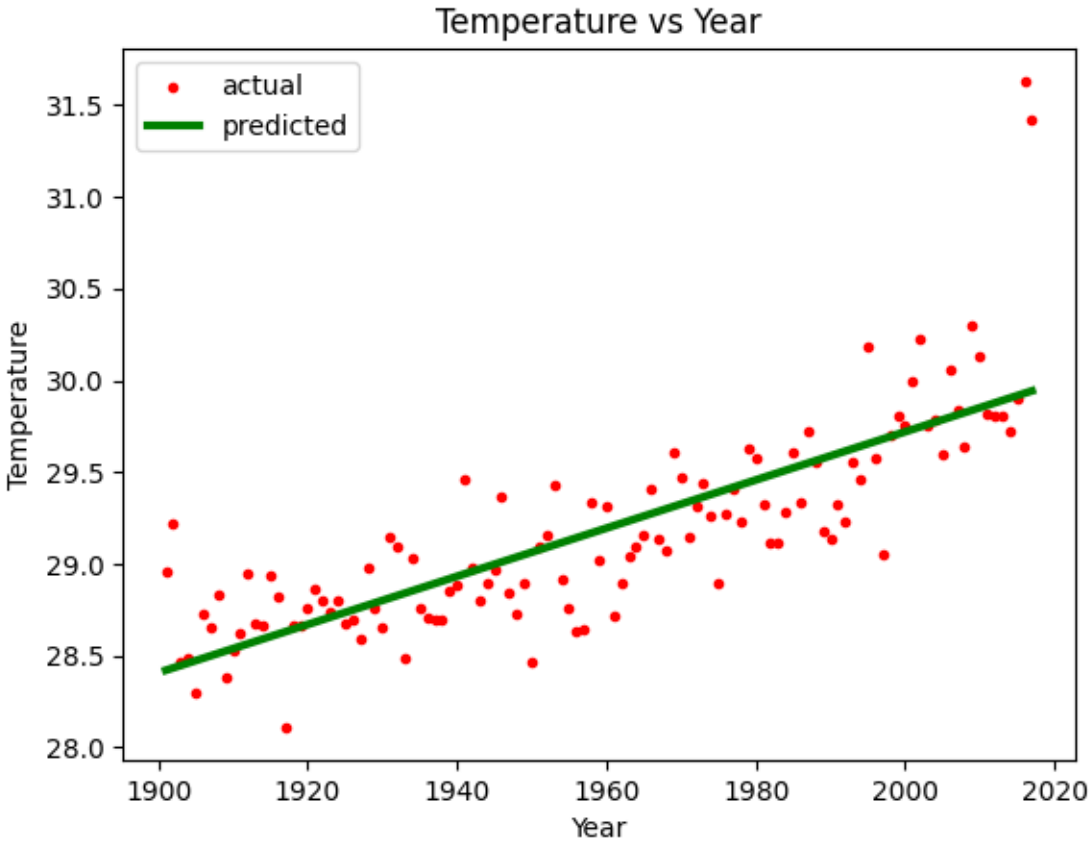
[48]: 0.6418078912783682

[50]:
```
print(f"MSE:  {mean_squared_error(y,predicted)}")
print(f"MAE:  {mean_absolute_error(y,predicted)}")
print(f"R-Sqaure :  {r2_score(y,predicted)}")
```

```
MSE:  0.10960795229110352
MAE:  0.22535284978630413
R-Sqaure :  0.6418078912783682
```

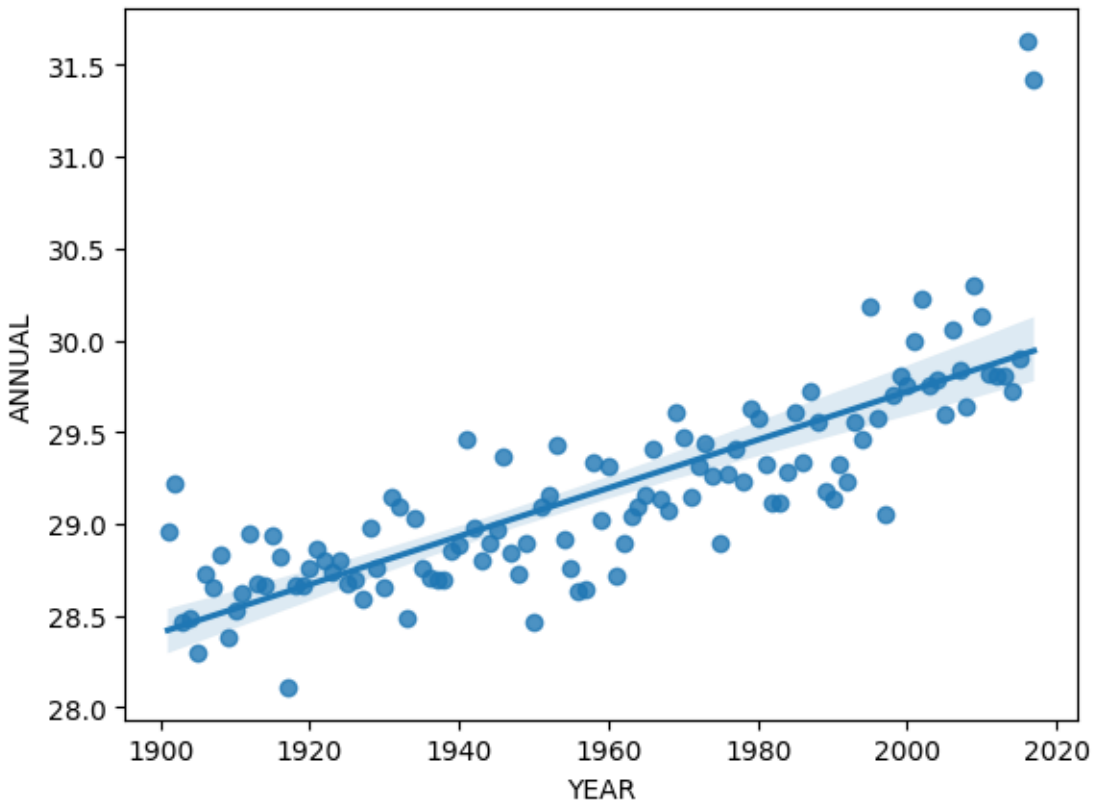
[55]:
```
plt.scatter(x, y, label='actual',color='red',marker='.')
plt.plot(x, predicted,label='predicted', color='green', linewidth=3)
```

```
plt.title("Temperature vs Year")
plt.xlabel("Year")
plt.ylabel("Temperature")
plt.legend()
plt.show()
```



[56]:
```
sns.regplot(x='YEAR',y='ANNUAL',data=df)
```

[56]: <Axes: xlabel='YEAR', ylabel='ANNUAL'>



==========After x shape and y shape==========

x_train, x_test, y_train, y_test = train_test_split(x, y,test_size=0.25)

print(f“x Training dataset: {x_train.shape}”) print(f“y Training dataset: {y_train.shape}”) print(f“x test dataset: {x_test.shape}”) print(f“y test dataset: {y_test.shape}”)

==========

model.fit(x_train,y_train)

==========

y_pred = model.predict(x_test)

==========

plt.scatter(x_train, y_train, color=‘blue’) plt.plot(x_test, y_pred, color=‘red’, linewidth=3) plt.title(“Temperature vs Year”) plt.xlabel(“Year”) plt.ylabel(“Temperature”) plt.show()

sns.regplot(data=df,x=x_train,y=y_train,)

[ ]:

[ ]: