

# Weather Prediction Using Regression Models in Machine Learning

## Importing Libraries

```
In [328... import pandas as pd
import numpy as np
```

## Importing Dataset

```
In [329... weather= pd.read_csv("C:\\Users\\Garima Ranjan\\Downloads\\archive (5)\\Temperature")
```

```
In [330... weather
```

Out[330]:

	tavg	tmin	tmax	prcp
time				
01-01-1990	7.2	NaN	18.1	0.0
02-01-1990	10.5	NaN	17.2	0.0
03-01-1990	10.2	1.8	18.6	NaN
04-01-1990	9.1	NaN	19.3	0.0
05-01-1990	13.5	NaN	23.8	0.0
...	...	...	...	...
21-07-2022	27.4	25.1	33.1	27.3
22-07-2022	28.1	26.1	31.1	16.0
23-07-2022	30.3	26.2	34.7	11.9
24-07-2022	30.0	28.1	34.7	2.0
25-07-2022	27.1	24.1	34.3	0.5

11894 rows × 4 columns

## Data Cleaning

```
In [331... weather.apply(pd.isnull).sum()/weather.shape[0]
```

```
Out[331]: tavg    0.011602
tmin    0.295527
tmax    0.130570
prcp    0.517236
dtype: float64
```

```
In [332... weather[pd.isnull(weather["prcp"])]
```

Out[332]:

	tavg	tmin	tmax	prcp
time				
03-01-1990	10.2	1.8	18.6	NaN
19-01-1990	20.5	13.0	29.5	NaN
25-01-1990	18.9	NaN	26.2	NaN
03-02-1990	NaN	NaN	NaN	NaN
08-02-1990	20.7	12.9	26.1	NaN
...	...	...	...	...
18-05-2022	34.5	29.1	41.1	NaN
19-05-2022	35.3	29.1	41.8	NaN
20-05-2022	33.9	29.1	38.1	NaN
26-05-2022	31.5	25.1	37.1	NaN
27-05-2022	32.2	27.1	38.1	NaN

6152 rows × 4 columns

In [333...

```
weather.loc["01-01-1990":"04-02-1990",:]
```

Out[333]:

	tavg	tmin	tmax	prcp
time				
01-01-1990	7.2	NaN	18.1	0.0
02-01-1990	10.5	NaN	17.2	0.0
03-01-1990	10.2	1.8	18.6	NaN
04-01-1990	9.1	NaN	19.3	0.0
05-01-1990	13.5	NaN	23.8	0.0
06-01-1990	11.5	5.9	21.4	0.0
07-01-1990	14.2	5.4	23.6	0.0
08-01-1990	17.1	NaN	24.6	0.0
09-01-1990	11.1	NaN	24.6	0.0
10-01-1990	14.8	4.1	23.6	0.0
11-01-1990	12.9	5.1	23.6	0.0
12-01-1990	12.5	7.3	21.1	0.0
13-01-1990	15.3	NaN	NaN	0.0
14-01-1990	17.3	6.9	28.2	0.0
15-01-1990	16.5	9.0	24.9	0.0
16-01-1990	15.8	NaN	24.9	0.0
17-01-1990	17.6	NaN	26.9	0.0
18-01-1990	19.9	13.0	29.5	0.0
19-01-1990	20.5	13.0	29.5	NaN
20-01-1990	17.5	10.7	28.7	0.0
21-01-1990	18.6	NaN	26.4	0.0
22-01-1990	20.0	10.8	28.3	0.0
23-01-1990	18.8	13.2	28.9	0.0
24-01-1990	18.4	NaN	28.9	0.0
25-01-1990	18.9	NaN	26.2	NaN
26-01-1990	18.9	NaN	27.9	0.0
27-01-1990	18.9	9.8	29.9	0.0
28-01-1990	20.7	NaN	28.8	0.0
29-01-1990	21.4	NaN	28.8	0.0
30-01-1990	15.6	NaN	26.2	0.0
31-01-1990	17.1	10.0	26.2	0.0
01-02-1990	17.5	NaN	27.7	0.0
02-02-1990	15.2	NaN	27.7	0.0
03-02-1990	NaN	NaN	NaN	NaN
04-02-1990	17.4	NaN	24.6	0.0

```
In [334... weather["prcp"].value_counts()
```

```
Out[334]: 0.0      3897
0.5       173
1.0       159
2.0       130
3.0       108
...
64.3        1
35.8        1
25.4        1
42.7        1
27.3        1
Name: prcp, Length: 202, dtype: int64
```

```
In [335... weather["prcp"]=weather["prcp"].fillna(0)
```

```
In [336... weather[pd.isnull(weather["tmax"])]]
```

Out[336]:

	tavg	tmin	tmax	prcp
time				
13-01-1990	15.3	NaN	NaN	0.0
03-02-1990	NaN	NaN	NaN	0.0
05-02-1990	16.2	9.2	NaN	23.9
06-02-1990	15.2	NaN	NaN	0.0
20-02-1990	17.3	11.5	NaN	0.0
...	...	...	...	...
18-04-2020	30.7	23.9	NaN	0.0
28-04-2020	27.7	22.4	NaN	0.0
30-04-2020	29.8	23.5	NaN	0.0
02-05-2020	28.5	22.3	NaN	0.0
03-05-2020	30.0	24.0	NaN	0.0

1553 rows × 4 columns

```
In [337... weather= weather.fillna(method="ffill")
```

```
In [338... weather=weather.dropna()
```

```
In [339... weather.apply(pd.isnull).sum()/weather.shape[0]
```

```
Out[339]: tavg      0.0
tmin      0.0
tmax      0.0
prcp      0.0
dtype: float64
```

Data Preprocessing

```
In [340... weather.dtypes
```

```
Out[340]: tavg    float64  
          tmin    float64  
          tmax    float64  
          prcp    float64  
          dtype: object
```

```
In [341]: weather.index
```

```
Out[341]: Index(['03-01-1990', '04-01-1990', '05-01-1990', '06-01-1990', '07-01-1990',  
                '08-01-1990', '09-01-1990', '10-01-1990', '11-01-1990', '12-01-1990',  
                ...  
                '16-07-2022', '17-07-2022', '18-07-2022', '19-07-2022', '20-07-2022',  
                '21-07-2022', '22-07-2022', '23-07-2022', '24-07-2022', '25-07-2022'],  
              dtype='object', name='time', length=11892)
```

```
In [342]: weather.index = pd.to_datetime(weather.index)
```

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[illegible]

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[illegible]

[illegible]

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```
C:\Users\Garima Ranjan\AppData\Local\Temp\ipykernel_56104\143916205.py:1: UserWarning: Parsing '24-07-2022' in DD/MM/YYYY format. Provide format or specify infer_datetime_format=True for consistent parsing.
weather.index= pd.to_datetime(weather.index)
C:\Users\Garima Ranjan\AppData\Local\Temp\ipykernel_56104\143916205.py:1: UserWarning: Parsing '25-07-2022' in DD/MM/YYYY format. Provide format or specify infer_datetime_format=True for consistent parsing.
weather.index= pd.to_datetime(weather.index)
```

In [343...

`weather.index`

Out[343]:

```
DatetimeIndex(['1990-03-01', '1990-04-01', '1990-05-01', '1990-06-01',
               '1990-07-01', '1990-08-01', '1990-09-01', '1990-10-01',
               '1990-11-01', '1990-12-01',
               ...,
               '2022-07-16', '2022-07-17', '2022-07-18', '2022-07-19',
               '2022-07-20', '2022-07-21', '2022-07-22', '2022-07-23',
               '2022-07-24', '2022-07-25'],
              dtype='datetime64[ns]', name='time', length=11892, freq=None)
```

In [344...

`weather.index.month`

Out[344]:

```
Int64Index([ 3,  4,  5,  6,  7,  8,  9, 10, 11, 12,
             ...,
             7,  7,  7,  7,  7,  7,  7,  7,  7,  7],
           dtype='int64', name='time', length=11892)
```

In [345...

`weather.apply(lambda x: (x==9999).sum())`

Out[345]:

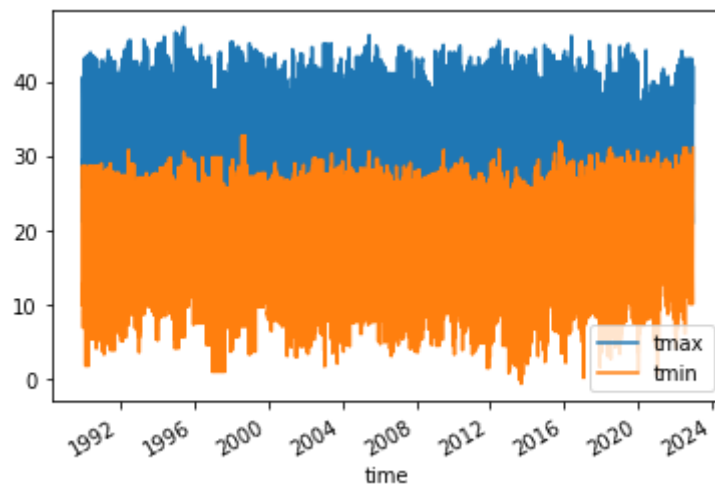
```
tavg    0
tmin    0
tmax    0
prcp    0
dtype: int64
```

In [346...

`weather[["tmax","tmin"]].plot()`

Out[346]:

&lt;AxesSubplot:xlabel='time'&gt;



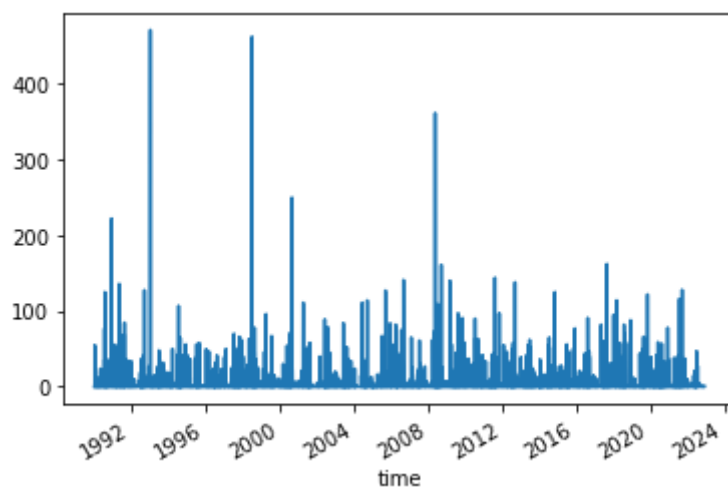
In [347...

`weather.index.year.value_counts().sort_index()`

```
Out[347]: 1990    363
          1991    365
          1992    366
          1993    365
          1994    365
          1995    365
          1996    366
          1997    365
          1998    365
          1999    365
          2000    366
          2001    365
          2002    365
          2003    365
          2004    366
          2005    365
          2006    365
          2007    365
          2008    366
          2009    365
          2010    365
          2011    365
          2012    366
          2013    365
          2014    365
          2015    365
          2016    366
          2017    365
          2018    365
          2019    365
          2020    366
          2021    365
          2022    206
          Name: time, dtype: int64
```

```
In [348... weather["prcp"].plot()
```

```
Out[348]: <AxesSubplot:xlabel='time'>
```



```
In [349... weather.groupby(weather.index.year).sum()["prcp"]
```



```
Out[349]:
```

time	
1990	917.5
1991	840.3
1992	555.3
1993	957.8
1994	778.7
1995	375.6
1996	476.4
1997	777.1
1998	1206.4
1999	591.3
2000	1105.2
2001	659.6
2002	571.0
2003	731.6
2004	667.0
2005	623.1
2006	709.2
2007	537.6
2008	1776.5
2009	905.1
2010	759.4
2011	856.5
2012	868.9
2013	813.7
2014	708.3
2015	577.0
2016	754.8
2017	804.5
2018	1164.6
2019	953.5
2020	923.9
2021	867.7
2022	228.6

Name: prcp, dtype: float64

```
In [350... weather["target"]=weather.shift(-1)["tmax"]
```

```
In [351... weather
```

Out[351]:

	tavg	tmin	tmax	prcp	target
time					
1990-03-01	10.2	1.8	18.6	0.0	19.3
1990-04-01	9.1	1.8	19.3	0.0	23.8
1990-05-01	13.5	1.8	23.8	0.0	21.4
1990-06-01	11.5	5.9	21.4	0.0	23.6
1990-07-01	14.2	5.4	23.6	0.0	24.6
...	...	...	...	...	...
2022-07-21	27.4	25.1	33.1	27.3	31.1
2022-07-22	28.1	26.1	31.1	16.0	34.7
2022-07-23	30.3	26.2	34.7	11.9	34.7
2022-07-24	30.0	28.1	34.7	2.0	34.3
2022-07-25	27.1	24.1	34.3	0.5	NaN

11892 rows × 5 columns

```
In [352... weather=weather.iloc[:-1,:].copy()  
or_weather=weather.copy()
```

```
In [353... weather
```

Out[353]:

	tavg	tmin	tmax	prcp	target
time					
1990-03-01	10.2	1.8	18.6	0.0	19.3
1990-04-01	9.1	1.8	19.3	0.0	23.8
1990-05-01	13.5	1.8	23.8	0.0	21.4
1990-06-01	11.5	5.9	21.4	0.0	23.6
1990-07-01	14.2	5.4	23.6	0.0	24.6
...	...	...	...	...	...
2022-07-20	28.6	25.1	33.1	17.7	33.1
2022-07-21	27.4	25.1	33.1	27.3	31.1
2022-07-22	28.1	26.1	31.1	16.0	34.7
2022-07-23	30.3	26.2	34.7	11.9	34.7
2022-07-24	30.0	28.1	34.7	2.0	34.3

11891 rows × 5 columns

## Ridge Model

```
In [354... predictors=["prcp","tmax","tmin"]  
train=weather.loc["2020-12-31"]  
test=weather.loc["2021-01-01"]
```

```
In [355... from sklearn.linear_model import Ridge
reg=Ridge(alpha=.1)
reg.fit(train[predictors], train["target"])
predictions=reg.predict(test[predictors])
```

```
In [356... from sklearn.metrics import mean_absolute_error
mean_absolute_error(test["target"], predictions)
```

Out[356]: 1.3789511889989914

```
In [357... combined= pd.concat([test["target"], pd.Series(predictions, index=test.index)], ax:
combined.columns=["actual", "pred"]
```

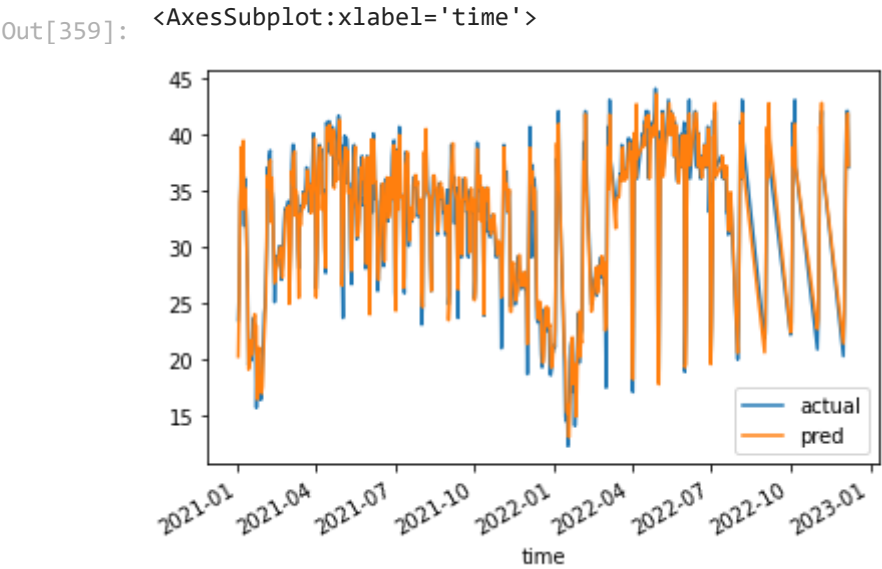
In [358... combined

Out[358]:

	actual	pred
time		
2021-01-01	23.5	20.260692
2021-02-01	24.7	23.666650
2021-03-01	25.2	24.960709
2021-04-01	26.3	25.535591
2021-05-01	28.1	26.579049
...	...	...
2022-07-20	33.1	33.275504
2022-07-21	31.1	33.263213
2022-07-22	34.7	31.442134
2022-07-23	34.7	34.819180
2022-07-24	34.3	34.899669

570 rows × 2 columns

```
In [359... combined.plot()
```



```
In [360... reg.coef_
Out[360]: array([-0.00128036,  0.93561876,  0.03569103])
```

The error in Ridge model is approx 1.379 and precipitation have negative effect while tmax have maximum affect

Trying to increase predictors in order to decrease error further

```
In [361... def create_predictions(predictors, weather, reg):
    train=weather.loc[:"2020-12-31"]
    test=weather.loc["2021-01-01":]
    reg.fit(train[predictors], train["target"])
    predictions=reg.predict(test[predictors])
    error=mean_absolute_error(test["target"], predictions)
    combined= pd.concat([test["target"], pd.Series(predictions, index=test.index)])
    combined.columns=["actual", "pred"]
    return error,combined
```

```
In [362... weather["month_max"]= weather["tmax"].rolling(30).mean()
```

```
In [363... weather
```

```
Out[363]:
```

	tavg	tmin	tmax	prcp	target	month_max
time						
1990-03-01	10.2	1.8	18.6	0.0	19.3	NaN
1990-04-01	9.1	1.8	19.3	0.0	23.8	NaN
1990-05-01	13.5	1.8	23.8	0.0	21.4	NaN
1990-06-01	11.5	5.9	21.4	0.0	23.6	NaN
1990-07-01	14.2	5.4	23.6	0.0	24.6	NaN
...	...	...	...	...	...	...
2022-07-20	28.6	25.1	33.1	17.7	33.1	37.110000
2022-07-21	27.4	25.1	33.1	27.3	31.1	37.010000
2022-07-22	28.1	26.1	31.1	16.0	34.7	36.776667
2022-07-23	30.3	26.2	34.7	11.9	34.7	36.696667
2022-07-24	30.0	28.1	34.7	2.0	34.3	36.550000

11891 rows × 6 columns

```
In [364... weather["month_day_max"]=weather["month_max"]/weather["tmax"]
```

```
In [365... weather["max_min"]=weather["tmax"]/weather["tmin"]
```

```
In [366... weather
```



Out[366]:

	tavg	tmin	tmax	prcp	target	month_max	month_day_max	max_min
time								
1990-03-01	10.2	1.8	18.6	0.0	19.3	NaN	NaN	10.333333
1990-04-01	9.1	1.8	19.3	0.0	23.8	NaN	NaN	10.722222
1990-05-01	13.5	1.8	23.8	0.0	21.4	NaN	NaN	13.222222
1990-06-01	11.5	5.9	21.4	0.0	23.6	NaN	NaN	3.627119
1990-07-01	14.2	5.4	23.6	0.0	24.6	NaN	NaN	4.370370
...	...	...	...	...	...	...	...	...
2022-07-20	28.6	25.1	33.1	17.7	33.1	37.110000	1.121148	1.318725
2022-07-21	27.4	25.1	33.1	27.3	31.1	37.010000	1.118127	1.318725
2022-07-22	28.1	26.1	31.1	16.0	34.7	36.776667	1.182529	1.191571
2022-07-23	30.3	26.2	34.7	11.9	34.7	36.696667	1.057541	1.324427
2022-07-24	30.0	28.1	34.7	2.0	34.3	36.550000	1.053314	1.234875

11891 rows × 8 columns

In [367...] weather=weather.dropna()

In [368...] predictors=["tavg","prcp","tmax","tmin","month\_max","month\_day\_max","max\_min"]

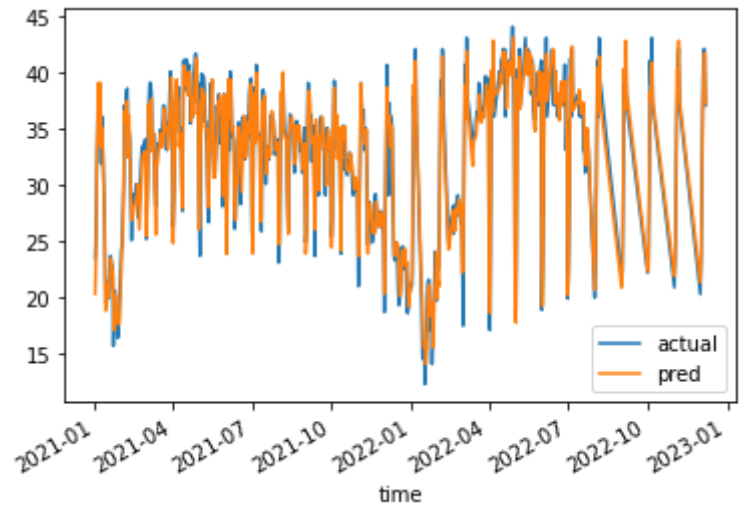
In [369...] error, combined= create\_predictions(predictors, weather, reg)

In [370...] error

Out[370]: 1.3174894801108292

In [371...] combined.plot()

Out[371]: <AxesSubplot:xlabel='time'>



# Trying Other Regression Models on the Preprocessed Dataset

In [458...

or\_weather

Out[458]:

	tavg	tmin	tmax	prcp	target
time					
1990-03-01	10.2	1.8	18.6	0.0	19.3
1990-04-01	9.1	1.8	19.3	0.0	23.8
1990-05-01	13.5	1.8	23.8	0.0	21.4
1990-06-01	11.5	5.9	21.4	0.0	23.6
1990-07-01	14.2	5.4	23.6	0.0	24.6
...	...	...	...	...	...
2022-07-20	28.6	25.1	33.1	17.7	33.1
2022-07-21	27.4	25.1	33.1	27.3	31.1
2022-07-22	28.1	26.1	31.1	16.0	34.7
2022-07-23	30.3	26.2	34.7	11.9	34.7
2022-07-24	30.0	28.1	34.7	2.0	34.3

11891 rows × 5 columns

In [459...

```
def diff_models(predictors, weather, reg, predictions):
    train=or_weather.loc[:"2020-12-31"]
    test=or_weather.loc["2021-01-01":]
    error=mean_absolute_error(test["target"], predictions)
    combined= pd.concat([test["target"], pd.Series(predictions, index=test.index)])
    combined.columns=["actual", "pred"]
    return error,combined
```

In [460...

```
train=or_weather.loc[:"2020-12-31"]
test=or_weather.loc["2021-01-01":]
```

In [461...

```
predictors=["prcp","tmax","tmin"]
```

## Linear Regression Model

In [462...

```
from sklearn.linear_model import LinearRegression
regl=LinearRegression()
regl.fit(train[predictors], train["target"])
predictionsl=regl.predict(test[predictors])
```

In [463...

```
errorl, combinedl= diff_models(predictors, or_weather, regl, predictionsl)
```

In [464...

```
regl.coef_
```

Out[464]:

```
array([-0.00128033,  0.93561943,  0.03569056])
```

In [465...

```
errorl
```

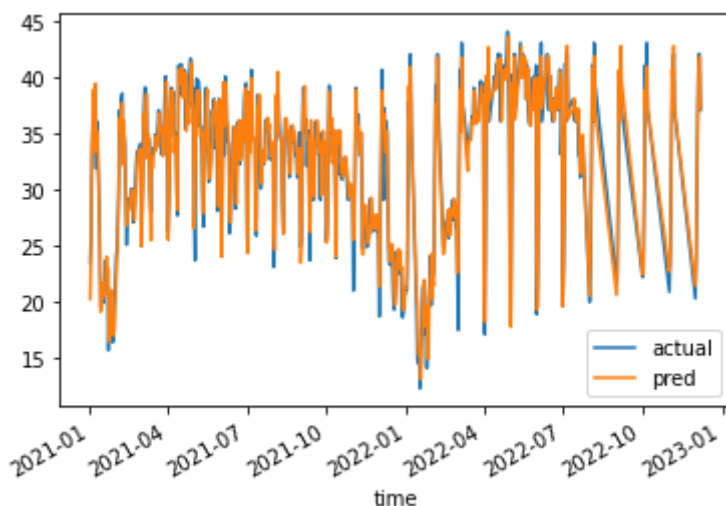
Out[465]:

```
1.3789512887593258
```

In [466...

```
combinedl.plot()
```

Out[466]: <AxesSubplot:xlabel='time'>



## Polynomial Regression Model

```
In [467... from sklearn.preprocessing import PolynomialFeatures
from sklearn.linear_model import LinearRegression
poly_reg= PolynomialFeatures(degree=4)
X_poly= poly_reg.fit_transform(train[predictors])

regp=LinearRegression()
regp.fit(X_poly, train["target"])
predictionsp=regp.predict(poly_reg.transform(test[predictors]))
```

```
In [468... errorp, combinedp= diff_models(predictors, or_weather, regp, predictionsp)
```

```
In [469... regp.coef_
```

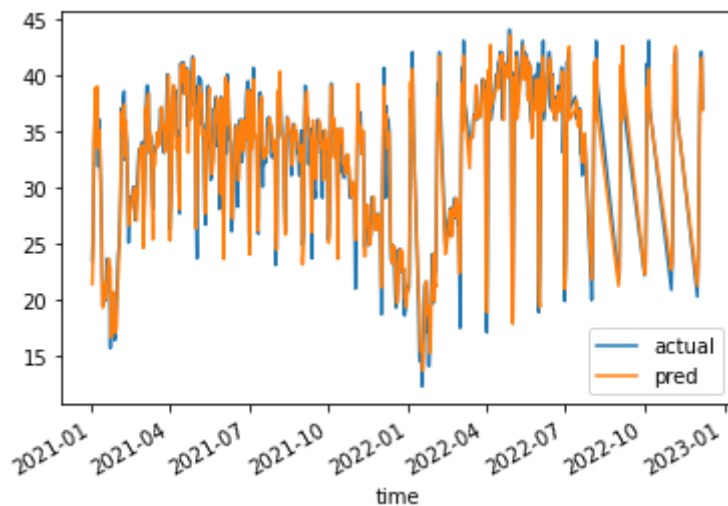
```
Out[469]: array([ 3.50100056e-09,  5.27106792e-01,  5.56000184e-01,  2.41484917e-01,
        -3.00638438e-03,  3.34629815e-02, -1.19230033e-01,  5.41350645e-02,
        -2.15437830e-01,  2.08627659e-01,  2.49237486e-06, -5.42856669e-05,
         2.34080196e-04, -5.07234916e-03,  1.16099983e-02, -2.54850343e-03,
        -2.93443633e-03,  1.48101073e-02, -1.84952685e-02,  4.61505832e-03,
         8.70223782e-10, -1.59711469e-07,  6.63228440e-08,  1.39244113e-05,
        -3.13283171e-05,  1.58215838e-05,  1.15193218e-04, -3.24614162e-04,
         2.54443623e-04, -1.07286529e-04,  4.53348563e-05, -2.51357996e-04,
         3.76265312e-04, -1.76474853e-04,  2.81092488e-05])
```

```
In [470... errorp
```

```
Out[470]: 1.3816696088226086
```

```
In [471... combinedp.plot()
```

Out[471]: <AxesSubplot:xlabel='time'>



## SVR Regression Model

In [472...

```
from sklearn.preprocessing import StandardScaler
sc_X= StandardScaler()
sc_Y=StandardScaler()

y = np.array(train["target"]).reshape(len(train["target"]),1)

X_train= sc_X.fit_transform(train[predictors])
Y_train= sc_Y.fit_transform(y)

from sklearn.svm import SVR
regs=SVR(kernel='rbf')
regs.fit(X_train, Y_train)
predictionss = sc_Y.inverse_transform(regs.predict(sc_X.transform(test[predictors])
```

C:\Users\Garima Ranjan\anaconda3\lib\site-packages\sklearn\utils\validation.py:993: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n\_samples, ), for example using ravel().

```
y = column_or_1d(y, warn=True)
```

In [473...

```
from sklearn.utils.validation import column_or_1d
predictionss=column_or_1d(predictionss, warn=True)
predictionss
```

C:\Users\Garima Ranjan\AppData\Local\Temp\ipykernel\_56104\356419259.py:2: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n\_samples, ), for example using ravel().

```
predictionss=column_or_1d(predictionss, warn=True)
```



```
Out[473]: array([21.16119827, 23.85810151, 24.94179086, 25.6139321 , 26.64231031,
28.11471806, 29.07509865, 26.12634199, 23.49612818, 25.4076116 ,
25.54333569, 21.46180875, 19.15897323, 19.99405716, 21.61355103,
21.88431344, 20.32592812, 21.1567145 , 23.45190944, 24.03351423,
23.19045473, 23.23588718, 16.53329019, 20.34080023, 21.03280403,
17.93038506, 18.13926775, 16.7671251 , 17.39411672, 20.39084192,
22.23062679, 24.38739878, 25.9234064 , 27.25114631, 28.58867386,
27.90266729, 24.01242584, 24.38220528, 24.74380568, 25.01802532,
25.9328466 , 27.12507198, 26.27711043, 27.12507198, 28.12576789,
28.24464404, 29.17163097, 29.05431346, 29.87799783, 30.05638127,
28.17479675, 27.25646058, 28.54794293, 30.48739657, 32.12443775,
33.35761748, 33.55301895, 33.34500718, 33.76612077, 34.17214912,
32.0284794 , 30.0815436 , 32.34598163, 32.95764667, 32.52407348,
33.17058139, 33.76108557, 33.8128679 , 34.37700317, 34.5839001 ,
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33.55222518, 35.00200209, 33.84364113, 34.78395364, 35.64144822,
37.33446835, 35.57302578, 35.75338055, 34.68792419, 33.1384531 ,
34.61109258, 35.86889173, 38.33434165, 40.30147011, 37.65311288,
35.90092394, 36.96478187, 37.3640948 , 37.58079655, 39.16648671,
40.10019213, 38.58074027, 38.79768169, 37.23128879, 39.36736196,
39.54901337, 39.2589456 , 40.84783923, 41.22027221, 39.56005193,
40.65724568, 41.14713071, 38.41514213, 39.54106711, 40.48086324,
40.6436845 , 34.61285773, 37.32635256, 37.72074023, 36.25280863,
39.94277048, 40.68720397, 41.74243523, 37.96571893, 37.24667347,
38.99421846, 35.14696384, 35.52106304, 39.29765447, 39.20516584,
35.67318771, 33.55029764, 36.08614127, 38.16979728, 35.32612394,
36.96590901, 36.16943947, 31.89259237, 35.17303012, 38.08534794,
38.99421846, 34.53951372, 33.68056812, 31.20705153, 31.77302464,
32.64904942, 35.49827283, 36.96590901, 36.00030994, 38.10280908,
36.5784431 , 34.00198059, 34.23471798, 29.72399712, 34.77774632,
37.96571893, 33.65377811, 36.80540513, 37.94994197, 39.06960328,
37.49730403, 39.44437272, 39.78499082, 40.4847514 , 38.58963967,
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32.64939424, 35.12397745, 36.00333217, 35.50215604, 33.14024104,
33.56594017, 36.00030994, 34.34771638, 35.29897547, 37.32333635,
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36.17205845, 35.50215604, 36.53175191, 36.19721585, 37.44397135,
38.20008729, 37.81815868, 33.15584616, 31.92260589, 33.50581974,
32.53198431, 33.6642878 , 32.81410699, 35.36281836, 35.34926089,
36.19542484, 35.40693087, 35.54590542, 32.80796906, 33.27870815,
33.65377811, 34.30768625, 33.60788832, 32.68712228, 33.19769817,
33.53518856, 34.76806872, 35.66635277, 34.54459253, 34.87478298,
34.81401632, 32.30873898, 33.1071088 , 33.53188238, 34.30062412,
34.72537723, 36.17601246, 35.99569169, 35.30633116, 35.13175158,
33.65377811, 32.14399316, 32.78548059, 35.13583168, 35.64216084,
34.31888733, 34.99851938, 34.72537723, 33.5426793 , 33.56594017,
32.29158042, 32.521579 , 33.85365554, 35.14088411, 35.99569169,
34.95062314, 33.98191793, 34.81941496, 35.66635277, 34.55120363,
34.58011893, 34.63743646, 34.78628866, 34.1070999 , 34.94750963,
35.99791013, 34.15737544, 31.11682059, 31.66968398, 31.50035782,
34.28308052, 34.35983492, 35.99569169, 35.14088411, 34.35983492,
33.56594017, 33.61903853, 30.29955663, 34.27556164, 35.14088411,
34.15331929, 33.56594017, 34.30768625, 33.47918856, 33.4283344 ,
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34.26708527, 34.24812306, 35.32612394, 35.13972495, 34.95591862,
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32.26754633, 32.58144373, 31.22438119, 32.01296083, 31.77021008,
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26.46557508, 28.98239334, 29.22977004, 29.54302761, 29.61159722,
29.16808683, 28.24989899, 28.43162258, 28.61423126, 27.25646058,
```

```

26.35160948, 25.27229934, 26.33815703, 26.77404181, 29.24829791,
29.26136604, 27.31103066, 27.52643662, 26.43923939, 26.96811932,
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24.92278995, 24.01894456, 23.64880186, 25.15176718, 24.76992481,
23.75991502, 20.98130108, 19.75158003, 20.39084192, 22.78211235,
24.74024032, 23.11803182, 24.74452447, 24.38018292, 22.88728825,
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31.16583714, 31.71162614, 34.17214912, 34.58271048, 34.58271048,
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40.50211749, 40.4903845 , 41.3936972 , 41.22542614, 39.08853346,
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40.79568778, 41.22027221, 42.0923116 , 41.124373 , 42.0233995 ,
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39.93716755, 41.04722638, 42.09851161, 43.75116047, 40.0293128 ,
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36.0909261 , 36.9654833 , 36.10228198, 36.93999678, 39.24448253,
36.8997474 , 36.93999678, 36.99617644, 37.01206024, 37.81815868,
36.82577445, 35.49975402, 36.92800317, 36.21303015, 36.92800317,
33.17508045, 32.95811386, 31.83656152, 34.52686824, 34.82983019]]

```

```

In [474... errors=mean_absolute_error(test["target"], predictionss)
combineds= pd.concat([test["target"], pd.Series(predictionss, index=test.index)],
combineds.columns=["actual", "pred"]

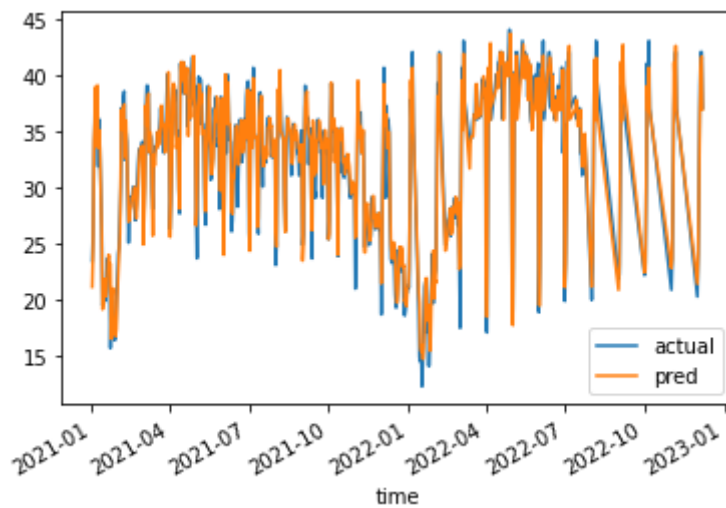
```

```
In [475... errors
```

```
Out[475]: 1.3560073089438582
```

```
In [476... combineds.plot()
```

```
Out[476]: <AxesSubplot:xlabel='time'>
```



## Decision Tree Regression Model

```
In [477... from sklearn.tree import DecisionTreeRegressor
regd=DecisionTreeRegressor(random_state=0)
regd.fit(train[predictors], train["target"])
predictionsd=regd.predict(test[predictors])
```

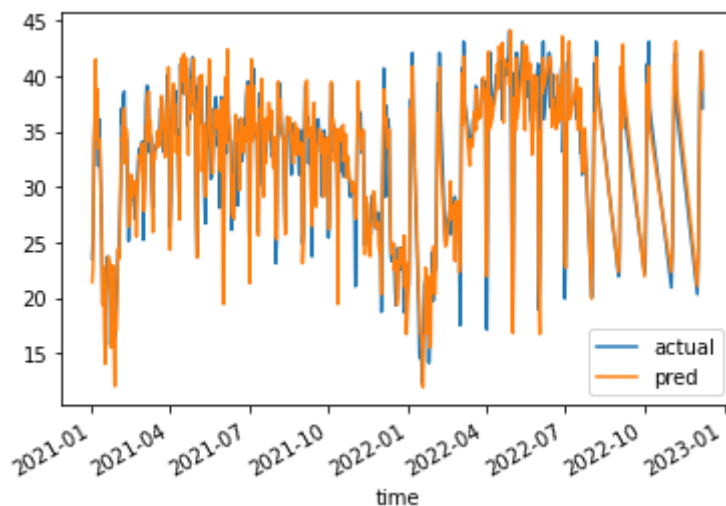
```
In [478... errorr, combinedd= diff_models(predictors, or_weather, regd,predictionsd)
```

```
In [479... errorr
```

```
Out[479]: 1.7581223893065998
```

```
In [480... combinedd.plot()
```

```
Out[480]: <AxesSubplot:xlabel='time'>
```



## Random Forest Regression Model

```
In [481... from sklearn.ensemble import RandomForestRegressor
regr=RandomForestRegressor(n_estimators=10, random_state=0)
regr.fit(train[predictors], train["target"])
predictionsr=regr.predict(test[predictors])
```

```
In [482... errorr, combinedr= diff_models(predictors, or_weather, regr, predictionsr)
```

In [483...

errorrr

Out[483]: 1.5390142614895714

In [484...

combinedr.plot()



We observe that SVR has the least error of all

In [485...

combineds

Out[485]:

	actual	pred
time		
2021-01-01	23.5	21.161198
2021-02-01	24.7	23.858102
2021-03-01	25.2	24.941791
2021-04-01	26.3	25.613932
2021-05-01	28.1	26.642310
...	...	...
2022-07-20	33.1	33.175080
2022-07-21	31.1	32.958114
2022-07-22	34.7	31.836562
2022-07-23	34.7	34.526868
2022-07-24	34.3	34.829830

570 rows × 2 columns

Trying to improve further on SVR by adding more predictors :  
Trying SVR on "weather"

In [486...

weather



Out[486]:

	tavg	tmin	tmax	prcp	target	month_max	month_day_max	max_min
time								
1990-01-02	17.5	10.0	27.7	0.0	27.7	25.736667	0.929122	2.770000
1990-02-02	15.2	10.0	27.7	0.0	27.7	26.040000	0.940072	2.770000
1990-03-02	15.2	10.0	27.7	0.0	24.6	26.320000	0.950181	2.770000
1990-04-02	17.4	10.0	24.6	0.0	24.6	26.346667	1.071003	2.460000
1990-05-02	16.2	9.2	24.6	23.9	24.6	26.453333	1.075339	2.673913
...	...	...	...	...	...	...	...	...
2022-07-20	28.6	25.1	33.1	17.7	33.1	37.110000	1.121148	1.318725
2022-07-21	27.4	25.1	33.1	27.3	31.1	37.010000	1.118127	1.318725
2022-07-22	28.1	26.1	31.1	16.0	34.7	36.776667	1.182529	1.191571
2022-07-23	30.3	26.2	34.7	11.9	34.7	36.696667	1.057541	1.324427
2022-07-24	30.0	28.1	34.7	2.0	34.3	36.550000	1.053314	1.234875

11862 rows × 8 columns

In [487...]

```
train=weather.loc[:"2020-12-31"]
test=weather.loc["2021-01-01":]
```

In [488...]

```
train
```

Out[488]:

	tavg	tmin	tmax	prcp	target	month_max	month_day_max	max_min
time								
1990-01-02	17.5	10.0	27.7	0.0	27.7	25.736667	0.929122	2.770000
1990-02-02	15.2	10.0	27.7	0.0	27.7	26.040000	0.940072	2.770000
1990-03-02	15.2	10.0	27.7	0.0	24.6	26.320000	0.950181	2.770000
1990-04-02	17.4	10.0	24.6	0.0	24.6	26.346667	1.071003	2.460000
1990-05-02	16.2	9.2	24.6	23.9	24.6	26.453333	1.075339	2.673913
...	...	...	...	...	...	...	...	...
2020-12-27	14.3	6.0	23.3	0.0	22.9	24.746667	1.062089	3.883333
2020-12-28	15.2	10.1	22.9	0.0	22.5	24.573333	1.073071	2.267327
2020-12-29	13.9	8.5	22.5	0.0	22.3	24.403333	1.084593	2.647059
2020-12-30	13.2	7.5	22.3	0.0	22.5	24.233333	1.086697	2.973333
2020-12-31	9.9	4.1	22.5	0.0	20.1	24.093333	1.070815	5.487805

11292 rows × 8 columns

In [489...]

```
predictors=["tavg", "prcp", "tmax", "tmin", "month_max", "month_day_max", "max_min"]
```

In [490...]

```
from sklearn.preprocessing import StandardScaler
sc_X= StandardScaler()
sc_Y=StandardScaler()
```

```
y = np.array(train["target"]).reshape(len(train["target"]),1)

X_train= sc_X.fit_transform(train[predictors])
Y_train= sc_Y.fit_transform(y)

from sklearn.svm import SVR
regs=SVR(kernel='rbf')
regs.fit(X_train, Y_train)
predictions = sc_Y.inverse_transform(regs.predict(sc_X.transform(test[predictors]))
```

```
C:\Users\Garima Ranjan\anaconda3\lib\site-packages\sklearn\utils\validation.py:99
3: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

In [491...

```
from sklearn.utils.validation import column_or_1d
prediction=column_or_1d(predictionss, warn=True)
prediction
```

```
Out[491]: array([21.16119827, 23.85810151, 24.94179086, 25.6139321 , 26.64231031,
28.11471806, 29.07509865, 26.12634199, 23.49612818, 25.4076116 ,
25.54333569, 21.46180875, 19.15897323, 19.99405716, 21.61355103,
21.88431344, 20.32592812, 21.1567145 , 23.45190944, 24.03351423,
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25.9328466 , 27.12507198, 26.27711043, 27.12507198, 28.12576789,
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```

```

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```

```

In [494... errors_new=mean_absolute_error(test["target"], prediction)
combineds_new= pd.concat([test["target"], pd.Series(prediction, index=test.index)])
combineds_new.columns=["actual", "pred"]

```

```
In [495... errors_new
```

```
Out[495]: 1.3560073089438582
```

```
In [496... combineds_new
```



Out[496]:

	actual	pred
time		
2021-01-01	23.5	21.161198
2021-02-01	24.7	23.858102
2021-03-01	25.2	24.941791
2021-04-01	26.3	25.613932
2021-05-01	28.1	26.642310
...	...	...
2022-07-20	33.1	33.175080
2022-07-21	31.1	32.958114
2022-07-22	34.7	31.836562
2022-07-23	34.7	34.526868
2022-07-24	34.3	34.829830

570 rows × 2 columns

# Ridge is the best Model