ecommerce_data_peerreview

December 14, 2023

0.1 Importing Libraries

[1]:
```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error
from sklearn.metrics import mean_absolute_error
from sklearn.metrics import r2_score
from catboost import CatBoostRegressor
```

0.2 Converting Data to Pandas DataFrame

[2]:
```python
df = pd.read_csv('Ecommerce Customers.csv')
```

0.3 Reading the first 5 rows

[3]:
```python
df.head()
```

[3]:
```
                           Email  \
0      mstephenson@fernandez.com
1              hduke@hotmail.com
2               pallen@yahoo.com
3        riverarebecca@gmail.com
4  mstephens@davidson-herman.com

                                             Address            Avatar  \
0      835 Frank Tunnel\nWrightmouth, MI 82180-9605            Violet
1    4547 Archer Common\nDiazchester, CA 06566-8576         DarkGreen
2  24645 Valerie Unions Suite 582\nCobbborough, D…            Bisque
3   1414 David Throughway\nPort Jason, OH 22070-1220       SaddleBrown
4  14023 Rodriguez Passage\nPort Jacobville, PR 3…  MediumAquaMarine

   Avg. Session Length  Time on App  Time on Website  Length of Membership  \
0           34.497268   12.655651        39.577668                4.082621
1           31.926272   11.109461        37.268959                2.664034
2           33.000915   11.330278        37.110597                4.104543
3           34.305557   13.717514        36.721283                3.120179
4           33.330673   12.795189        37.536653                4.446308

   Yearly Amount Spent
0           587.951054
1           392.204933
2           487.547505
3           581.852344
4           599.406092
```

0.4 Getting data information using describe and info

[4]:
```
df.describe()
```

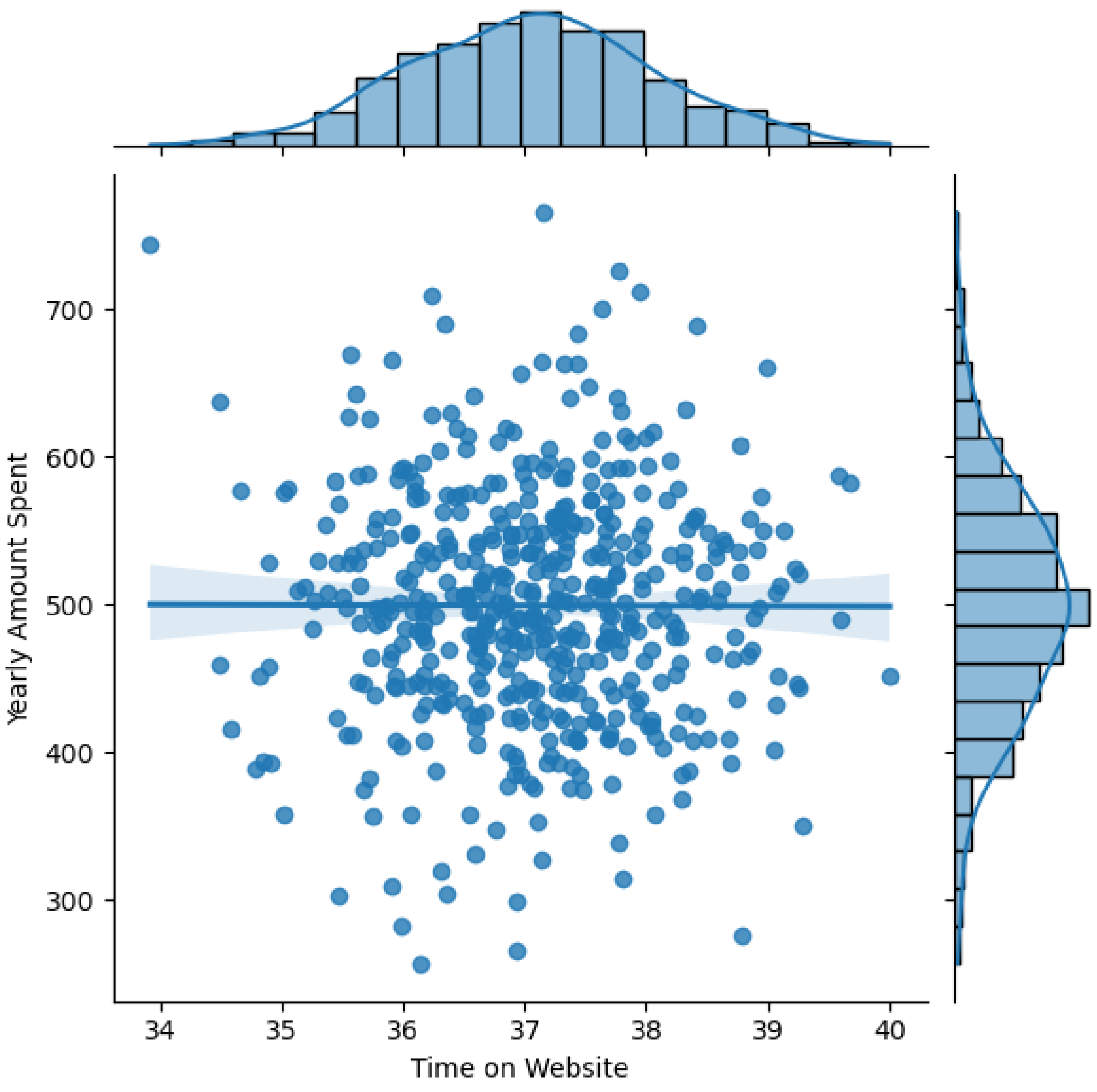
[4]:
```
       Avg. Session Length  Time on App  Time on Website  \
count           500.000000   500.000000       500.000000
mean             33.053194    12.052488        37.060445
std               0.992563     0.994216         1.010489
min              29.532429     8.508152        33.913847
25%              32.341822    11.388153        36.349257
50%              33.082008    11.983231        37.069367
75%              33.711985    12.753850        37.716432
max              36.139662    15.126994        40.005182

       Length of Membership  Yearly Amount Spent
count            500.000000           500.000000
mean               3.533462           499.314038
std                0.999278            79.314782
min                0.269901           256.670582
25%                2.930450           445.038277
50%                3.533975           498.887875
75%                4.126502           549.313828
max                6.922689           765.518462
```

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

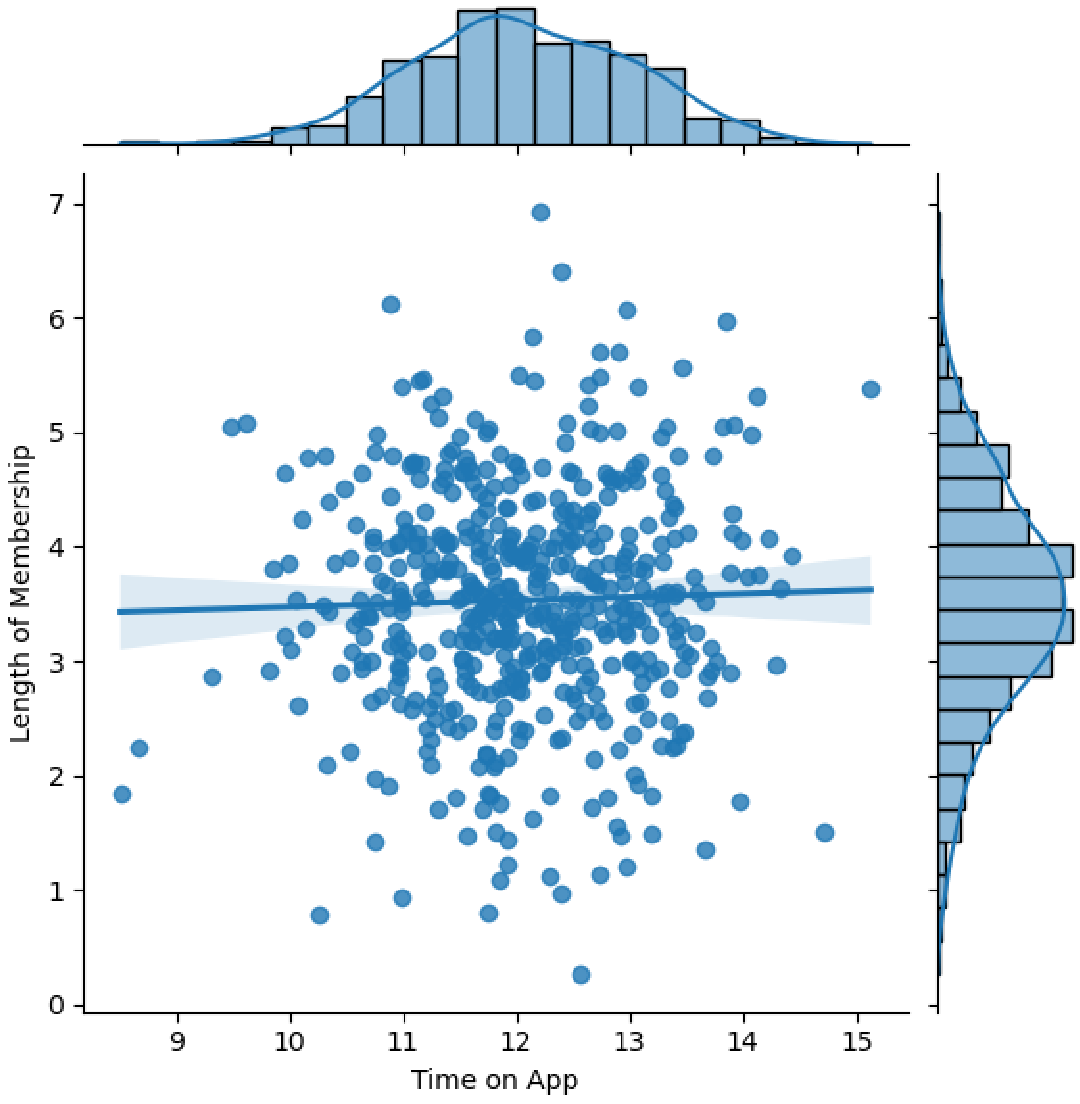
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 500 entries, 0 to 499
Data columns (total 8 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   Email                 500 non-null    object
 1   Address               500 non-null    object
 2   Avatar                500 non-null    object
 3   Avg. Session Length   500 non-null    float64
 4   Time on App           500 non-null    float64
 5   Time on Website       500 non-null    float64
 6   Length of Membership  500 non-null    float64
 7   Yearly Amount Spent   500 non-null    float64
dtypes: float64(5), object(3)
memory usage: 31.4+ KB
```

0.5 Plotting the data

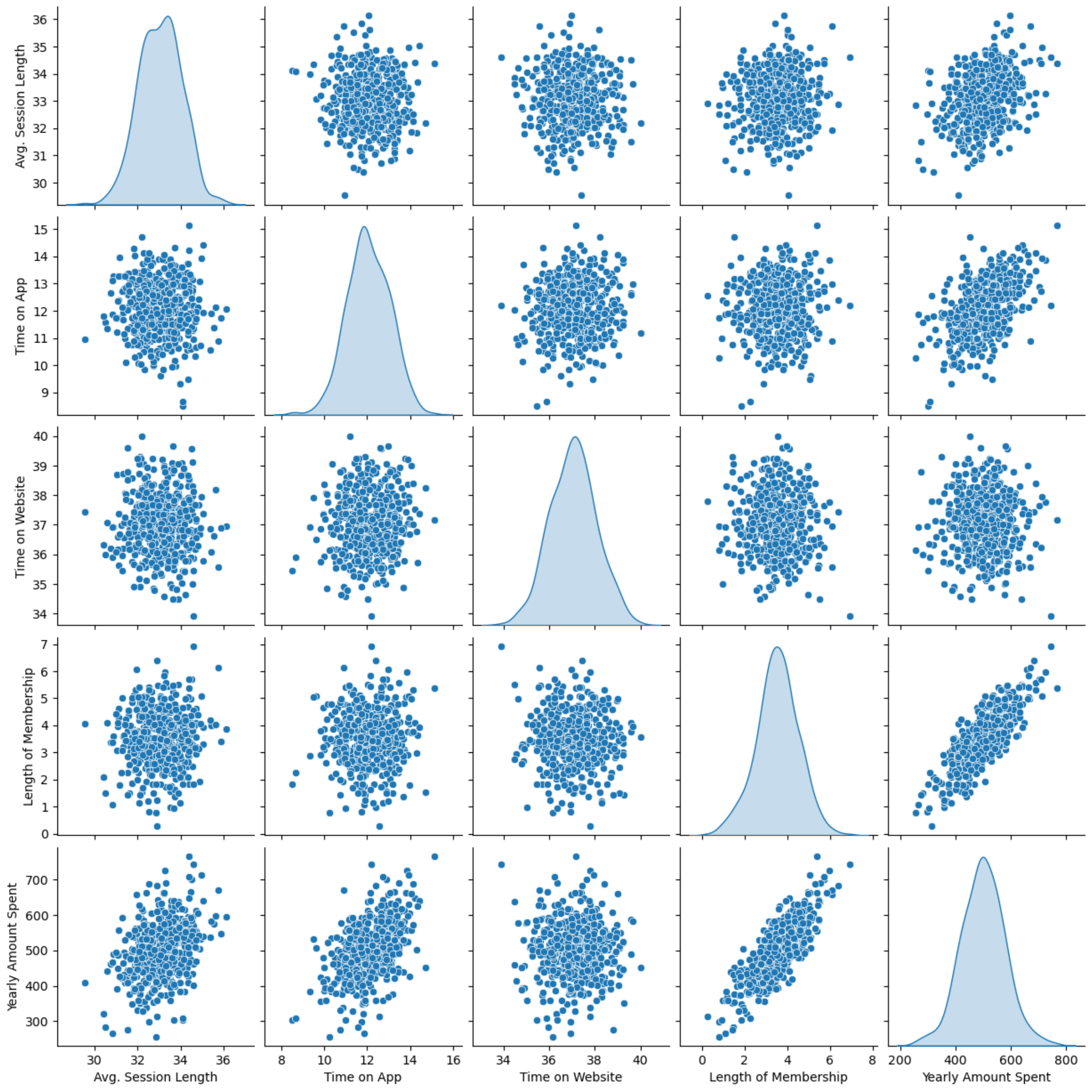
[6]:
```
sns.jointplot(data=df, x="Time on Website", y="Yearly Amount Spent", kind="reg")
plt.show()
```



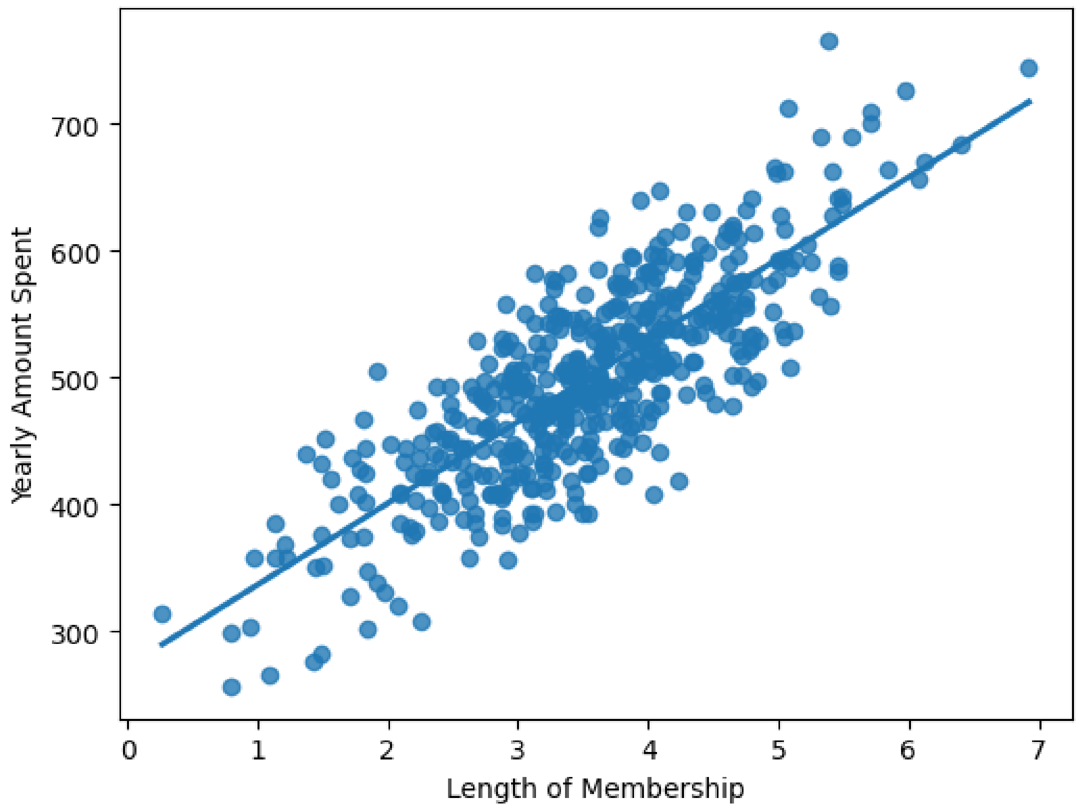
[7]:
```
sns.jointplot(data=df, x="Time on App", y="Length of Membership", kind="reg")
plt.show()
```



[8]:
```
sns.pairplot(data=df, diag_kind = 'kde')
plt.show()
```



[9]:
```
sns.regplot(data=df, x="Length of Membership", y="Yearly Amount Spent", ci=None)
plt.show()
```



0.6 Training the dataset

```
[10]: X = df.drop(['Yearly Amount Spent', 'Email', 'Address', 'Avatar'], axis=1)
      y = df['Yearly Amount Spent']
      X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)
```

0.7 Finding prediction, coefficients and score using LinearRegression()

```
[11]: lr = LinearRegression().fit(X_train,y_train)
```

```
[12]: pd.DataFrame(zip(X.columns, lr.coef_))
```

```
[12]:                       0          1
      0   Avg. Session Length  25.540333
      1           Time on App  38.756677
      2       Time on Website   0.095358
      3  Length of Membership  61.395478
```

0.7.1 Clearly the time on app has a much higher coefficient than the time on the website, meaning it influences a lot more our target. A focus on the app can help increase the values.

[13]:
```
lr.intercept_
```

[13]:
```
-1032.4048272666016
```

[14]:
```
y_pred = lr.predict(X_test)
lr.score(X_test, y_test)
```

[14]:
```
0.9862104585031302
```

[15]:
```
print('MSE: ', mean_squared_error(y_test,y_pred))
print('MAE: ', mean_absolute_error(y_test,y_pred))
print('RMSE: ', (np.sqrt(mean_squared_error(y_test,y_pred))))
print('R2 Score:' , str(round(r2_score(y_test, y_pred) * 100)) + '%')
```

```
MSE:  84.17911922645058
MAE:  7.450059825799415
RMSE:  9.174917941128987
R2 Score: 99%
```

0.8 Finding scores using CatBoostRegressor

[21]:
```
model = CatBoostRegressor(iterations = 6542, learning_rate = 0.02,␣
↪loss_function = 'RMSE')
```

[33]:
```
# model.fit(X_train,y_train,eval_set= (X_test,y_test),) hiding results (too␣
↪long)
```

[29]:
```
pred = model.predict(X_test)
rmse = (np.sqrt(mean_squared_error(y_test,pred)))
r2 = r2_score(y_test,pred)
```

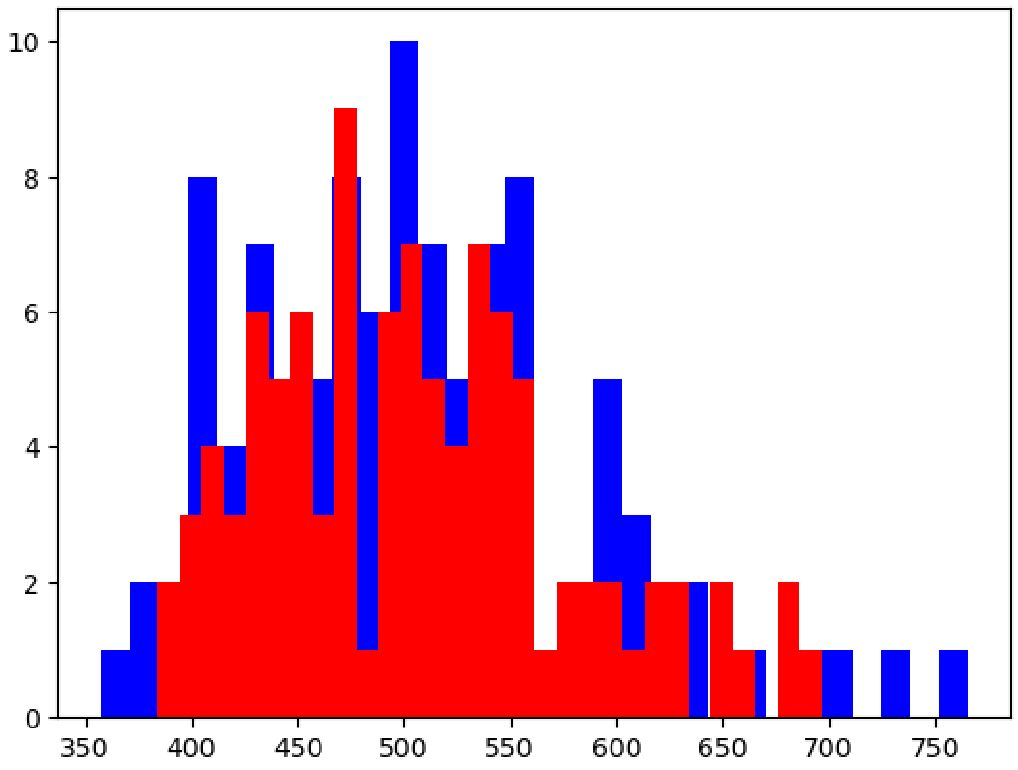
[30]:
```
print('MSE: ', mean_squared_error(y_test,pred))
print('MAE: ', mean_absolute_error(y_test,pred))
print('RMSE: ', rmse)
print('R2 Score:' , str(round(r2_score(y_test, pred) * 100)) + '%')
```

```
MSE:  219.41178083745407
MAE:  10.725174838054881
RMSE:  14.812554838293565
R2 Score: 96%
```

0.9 Plotting the scores

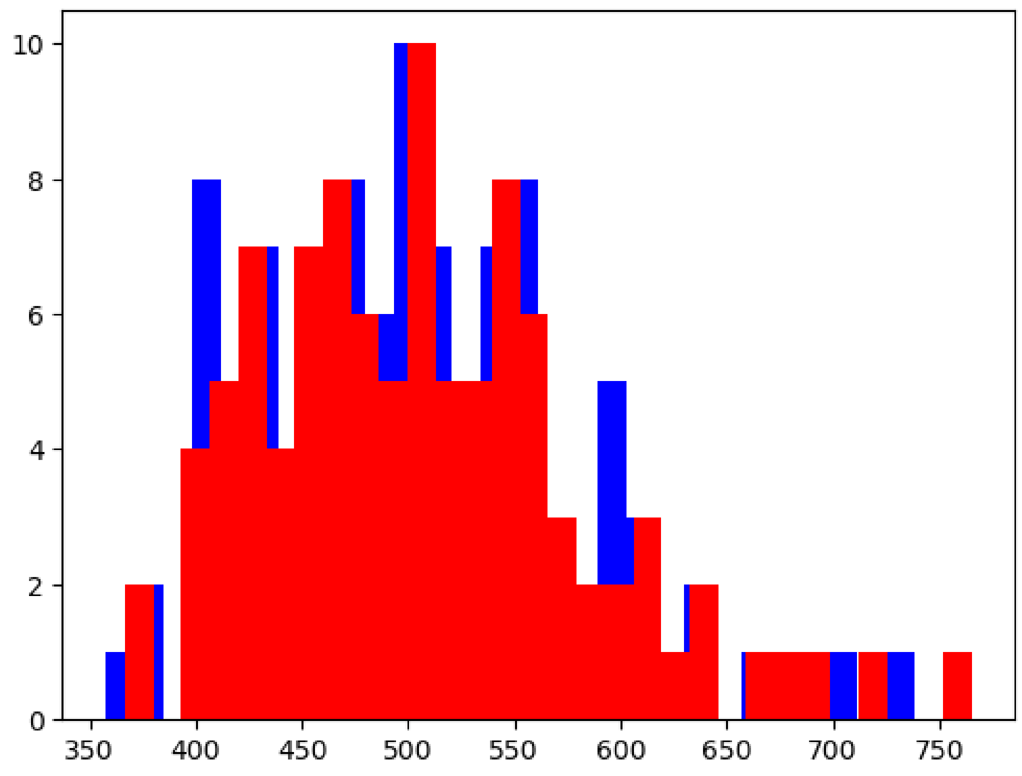
```
[31]: plt.hist(y_test, bins=30,color= 'b')
      plt.hist(pred, bins=30, color= 'r')
```

```
[31]: (array([2., 3., 4., 3., 6., 5., 6., 3., 9., 1., 6., 7., 5., 4., 7., 6., 5.,
              1., 2., 2., 2., 1., 2., 2., 0., 2., 1., 0., 2., 1.]),
       array([384.02256739, 394.44480081, 404.86703422, 415.28926764,
              425.71150105, 436.13373447, 446.55596788, 456.9782013 ,
              467.40043471, 477.82266813, 488.24490154, 498.66713496,
              509.08936837, 519.51160179, 529.9338352 , 540.35606862,
              550.77830203, 561.20053545, 571.62276886, 582.04500228,
              592.46723569, 602.8894691 , 613.31170252, 623.73393593,
              634.15616935, 644.57840276, 655.00063618, 665.42286959,
              675.84510301, 686.26733642, 696.68956984]),
       <BarContainer object of 30 artists>)
```



```
[32]: plt.hist(y_test, bins=30, color='b')
      plt.hist(y_pred, bins=30, color= 'r')
```

```
[32]: (array([ 2.,  0.,  4.,  5.,  7.,  4.,  7.,  8.,  6.,  5., 10.,  5.,  5.,
               8.,  6.,  3.,  2.,  2.,  3.,  1.,  2.,  0.,  1.,  1.,  1.,  0.,
         1.,  0.,  0.,  1.]),
 array([366.65965982, 379.95435107, 393.24904231, 406.54373356,
        419.83842481, 433.13311606, 446.42780731, 459.72249856,
        473.0171898 , 486.31188105, 499.6065723 , 512.90126355,
        526.1959548 , 539.49064605, 552.78533729, 566.08002854,
        579.37471979, 592.66941104, 605.96410229, 619.25879354,
        632.55348478, 645.84817603, 659.14286728, 672.43755853,
        685.73224978, 699.02694102, 712.32163227, 725.61632352,
        738.91101477, 752.20570602, 765.50039727]),
 <BarContainer object of 30 artists>)
```



```
[ ]:
```