Train a model with bike rental data using XGBoost algorithm

Training log1p(count) dataset

Model is trained with XGBoost installed in notebook instance

In the later examples, we will train using SageMaker's XGBoost algorithm

In [1]:
```
# Install xgboost in notebook instance.
#### Command to install xgboost
!pip install xgboost
```

```
Looking in indexes: https://pypi.org/simple, https://pip.repos.neuron.amazonaws.com
Requirement already satisfied: xgboost in /home/ec2-user/anaconda3/envs/python3/lib/python3.10/site-packages (1.7.6)
Requirement already satisfied: numpy in /home/ec2-user/anaconda3/envs/python3/lib/python3.10/site-packages (from xgb
oost) (1.22.3)
Requirement already satisfied: scipy in /home/ec2-user/anaconda3/envs/python3/lib/python3.10/site-packages (from xgb
oost) (1.10.1)
```

In [2]:
```
import sys
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.metrics import mean_squared_error, mean_absolute_error

# XGBoost
import xgboost as xgb
```

In [3]:
```
column_list_file = 'bike_train_column_list.txt'
train_file = 'bike_train.csv'
validation_file = 'bike_validation.csv'
test_file = 'bike_test.csv'
```

In [4]:
```
columns = ''
with open(column_list_file,'r') as f:
    columns = f.read().split(',')
```

In [5]:
```
columns
```

Out[5]:
```
['count',
 'season',
 'holiday',
 'workingday',
 'weather',
 'temp',
 'atemp',
 'humidity',
 'windspeed',
 'year',
 'month',
 'day',
 'dayofweek',
 'hour']
```

In [6]:
```
# Specify the column names as the file does not have column header
df_train = pd.read_csv(train_file,names=columns)
df_validation = pd.read_csv(validation_file,names=columns)
```

In [7]:
```
df_train.head()
```

Out[7]:

	count	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	year	month	day	dayofweek	hour
0	4.477337	3	0	0	2	26.24	30.305	73	7.0015	2011	9	3	5	0
1	5.517453	3	0	1	1	32.80	34.850	33	7.0015	2012	8	13	0	14
2	5.814131	4	0	0	1	15.58	19.695	40	11.0014	2011	11	5	5	17
3	6.436150	3	0	1	1	32.80	37.880	55	12.9980	2012	8	9	3	19
4	4.262680	2	0	1	1	13.94	17.425	76	7.0015	2011	4	14	3	6

In [8]:
```
df_validation.head()
```

Out[8]:

	count	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	year	month	day	dayofweek	hour
0	6.095825	3	0	1	2	28.70	33.335	79	12.9980	2011	7	7	3	8
1	5.961005	2	0	0	1	32.80	37.880	55	12.9980	2011	6	11	5	13
2	1.098612	1	0	1	1	14.76	16.665	40	19.9995	2011	2	14	0	2
3	3.891820	1	0	1	1	9.02	9.090	47	36.9974	2011	2	8	1	10
4	4.025352	4	0	0	1	10.66	15.150	87	0.0000	2011	12	4	6	8

In [9]:
```
X_train = df_train.iloc[:,1:] # Features: 1st column onwards
y_train = df_train.iloc[:,0].ravel() # Target: 0th column

X_validation = df_validation.iloc[:,1:]
y_validation = df_validation.iloc[:,0].ravel()
```

In [10]:
```
# XGBoost Training Parameter Reference:
#   https://github.com/dmlc/xgboost/blob/master/doc/parameter.md
#regressor = xgb.XGBRegressor(max_depth=5,eta=0.1,subsample=0.7,num_round=150)
regressor = xgb.XGBRegressor(max_depth=5,n_estimators=150)
```

In [11]:
```
regressor
```

Out[11]:

XGBRegressor

```
XGBRegressor(base_score=None, booster=None, callbacks=None,
             colsample_bylevel=None, colsample_bynode=None,
             colsample_bytree=None, early_stopping_rounds=None,
             enable_categorical=False, eval_metric=None, feature_types=None,
             gamma=None, gpu_id=None, grow_policy=None, importance_type=None,
             interaction_constraints=None, learning_rate=None, max_bin=None,
             max_cat_threshold=None, max_cat_to_onehot=None,
             max_delta_step=None, max_depth=5, max_leaves=None,
             min_child_weight=None, missing=nan, monotone_constraints=None,
```

In [12]:
```
regressor.fit(X_train,y_train, eval_set = [(X_train, y_train), (X_validation, y_validation)])
```

```
[0]    validation_0-rmse:3.06460    validation_1-rmse:3.07128
[1]    validation_0-rmse:2.18561    validation_1-rmse:2.18977
[2]    validation_0-rmse:1.57973    validation_1-rmse:1.58729
[3]    validation_0-rmse:1.15916    validation_1-rmse:1.16584
[4]    validation_0-rmse:0.86291    validation_1-rmse:0.87348
[5]    validation_0-rmse:0.67593    validation_1-rmse:0.68940
[6]    validation_0-rmse:0.55710    validation_1-rmse:0.57295
[7]    validation_0-rmse:0.47210    validation_1-rmse:0.49133
[8]    validation_0-rmse:0.41153    validation_1-rmse:0.43610
[9]    validation_0-rmse:0.37590    validation_1-rmse:0.40111
[10]   validation_0-rmse:0.34717    validation_1-rmse:0.37443
[11]   validation_0-rmse:0.33554    validation_1-rmse:0.36382
[12]   validation_0-rmse:0.32311    validation_1-rmse:0.35253
[13]   validation_0-rmse:0.31561    validation_1-rmse:0.34656
[14]   validation_0-rmse:0.31065    validation_1-rmse:0.34307
[15]   validation_0-rmse:0.30379    validation_1-rmse:0.33729
[16]   validation_0-rmse:0.30120    validation_1-rmse:0.33574
[17]   validation_0-rmse:0.29738    validation_1-rmse:0.33265
[18]   validation_0-rmse:0.29363    validation_1-rmse:0.33012
[19]   validation_0-rmse:0.28230    validation_1-rmse:0.31960
[20]   validation_0-rmse:0.28065    validation_1-rmse:0.31865
[21]   validation_0-rmse:0.27929    validation_1-rmse:0.31837
[22]   validation_0-rmse:0.27543    validation_1-rmse:0.31537
[23]   validation_0-rmse:0.27240    validation_1-rmse:0.31359
[24]   validation_0-rmse:0.27125    validation_1-rmse:0.31330
[25]   validation_0-rmse:0.26807    validation_1-rmse:0.31087
[26]   validation_0-rmse:0.26695    validation_1-rmse:0.31061
[27]   validation_0-rmse:0.26557    validation_1-rmse:0.30983
[28]   validation_0-rmse:0.26483    validation_1-rmse:0.30959
[29]   validation_0-rmse:0.26218    validation_1-rmse:0.30775
[30]   validation_0-rmse:0.26009    validation_1-rmse:0.30638
[31]   validation_0-rmse:0.25702    validation_1-rmse:0.30447
[32]   validation_0-rmse:0.25219    validation_1-rmse:0.30066
[33]   validation_0-rmse:0.25082    validation_1-rmse:0.30016
[34]   validation_0-rmse:0.25006    validation_1-rmse:0.30001
[35]   validation_0-rmse:0.24881    validation_1-rmse:0.29997
[36]   validation_0-rmse:0.24700    validation_1-rmse:0.29957
[37]   validation_0-rmse:0.24604    validation_1-rmse:0.29944
[38]   validation_0-rmse:0.24537    validation_1-rmse:0.29931
[39]   validation_0-rmse:0.24505    validation_1-rmse:0.29909
[40]   validation_0-rmse:0.24388    validation_1-rmse:0.29895
[41]   validation_0-rmse:0.24261    validation_1-rmse:0.29857
```

```
[42]    validation_0-rmse:0.24127       validation_1-rmse:0.29878
[43]    validation_0-rmse:0.23997       validation_1-rmse:0.29840
[44]    validation_0-rmse:0.23906       validation_1-rmse:0.29831
[45]    validation_0-rmse:0.23720       validation_1-rmse:0.29806
[46]    validation_0-rmse:0.23589       validation_1-rmse:0.29711
[47]    validation_0-rmse:0.23477       validation_1-rmse:0.29711
[48]    validation_0-rmse:0.23410       validation_1-rmse:0.29720
[49]    validation_0-rmse:0.23378       validation_1-rmse:0.29726
[50]    validation_0-rmse:0.23307       validation_1-rmse:0.29714
[51]    validation_0-rmse:0.23290       validation_1-rmse:0.29719
[52]    validation_0-rmse:0.23238       validation_1-rmse:0.29728
[53]    validation_0-rmse:0.23174       validation_1-rmse:0.29745
[54]    validation_0-rmse:0.23019       validation_1-rmse:0.29654
[55]    validation_0-rmse:0.22935       validation_1-rmse:0.29631
[56]    validation_0-rmse:0.22672       validation_1-rmse:0.29506
[57]    validation_0-rmse:0.22604       validation_1-rmse:0.29503
[58]    validation_0-rmse:0.22533       validation_1-rmse:0.29528
[59]    validation_0-rmse:0.22463       validation_1-rmse:0.29480
[60]    validation_0-rmse:0.22409       validation_1-rmse:0.29477
[61]    validation_0-rmse:0.22325       validation_1-rmse:0.29470
[62]    validation_0-rmse:0.22239       validation_1-rmse:0.29470
[63]    validation_0-rmse:0.22142       validation_1-rmse:0.29461
[64]    validation_0-rmse:0.22079       validation_1-rmse:0.29465
[65]    validation_0-rmse:0.21931       validation_1-rmse:0.29375
[66]    validation_0-rmse:0.21840       validation_1-rmse:0.29406
[67]    validation_0-rmse:0.21726       validation_1-rmse:0.29411
[68]    validation_0-rmse:0.21638       validation_1-rmse:0.29398
[69]    validation_0-rmse:0.21593       validation_1-rmse:0.29391
[70]    validation_0-rmse:0.21451       validation_1-rmse:0.29330
[71]    validation_0-rmse:0.21333       validation_1-rmse:0.29310
[72]    validation_0-rmse:0.21286       validation_1-rmse:0.29275
[73]    validation_0-rmse:0.21211       validation_1-rmse:0.29260
[74]    validation_0-rmse:0.21102       validation_1-rmse:0.29255
[75]    validation_0-rmse:0.20990       validation_1-rmse:0.29237
[76]    validation_0-rmse:0.20917       validation_1-rmse:0.29246
[77]    validation_0-rmse:0.20814       validation_1-rmse:0.29266
[78]    validation_0-rmse:0.20762       validation_1-rmse:0.29285
[79]    validation_0-rmse:0.20734       validation_1-rmse:0.29269
[80]    validation_0-rmse:0.20727       validation_1-rmse:0.29276
[81]    validation_0-rmse:0.20645       validation_1-rmse:0.29244
[82]    validation_0-rmse:0.20502       validation_1-rmse:0.29156
[83]    validation_0-rmse:0.20409       validation_1-rmse:0.29175
```

```
[84]    validation_0-rmse:0.20323       validation_1-rmse:0.29154
[85]    validation_0-rmse:0.20222       validation_1-rmse:0.29140
[86]    validation_0-rmse:0.20213       validation_1-rmse:0.29135
[87]    validation_0-rmse:0.20202       validation_1-rmse:0.29122
[88]    validation_0-rmse:0.20184       validation_1-rmse:0.29115
[89]    validation_0-rmse:0.20122       validation_1-rmse:0.29113
[90]    validation_0-rmse:0.20085       validation_1-rmse:0.29121
[91]    validation_0-rmse:0.20008       validation_1-rmse:0.29090
[92]    validation_0-rmse:0.19988       validation_1-rmse:0.29101
[93]    validation_0-rmse:0.19970       validation_1-rmse:0.29110
[94]    validation_0-rmse:0.19913       validation_1-rmse:0.29120
[95]    validation_0-rmse:0.19850       validation_1-rmse:0.29104
[96]    validation_0-rmse:0.19787       validation_1-rmse:0.29102
[97]    validation_0-rmse:0.19706       validation_1-rmse:0.29103
[98]    validation_0-rmse:0.19631       validation_1-rmse:0.29085
[99]    validation_0-rmse:0.19620       validation_1-rmse:0.29079
[100]   validation_0-rmse:0.19551       validation_1-rmse:0.29071
[101]   validation_0-rmse:0.19493       validation_1-rmse:0.29062
[102]   validation_0-rmse:0.19440       validation_1-rmse:0.29044
[103]   validation_0-rmse:0.19425       validation_1-rmse:0.29045
[104]   validation_0-rmse:0.19393       validation_1-rmse:0.29034
[105]   validation_0-rmse:0.19326       validation_1-rmse:0.29036
[106]   validation_0-rmse:0.19307       validation_1-rmse:0.29041
[107]   validation_0-rmse:0.19251       validation_1-rmse:0.29033
[108]   validation_0-rmse:0.19186       validation_1-rmse:0.29065
[109]   validation_0-rmse:0.19124       validation_1-rmse:0.29053
[110]   validation_0-rmse:0.19090       validation_1-rmse:0.29066
[111]   validation_0-rmse:0.19012       validation_1-rmse:0.29036
[112]   validation_0-rmse:0.18899       validation_1-rmse:0.28999
[113]   validation_0-rmse:0.18818       validation_1-rmse:0.28995
[114]   validation_0-rmse:0.18750       validation_1-rmse:0.28975
[115]   validation_0-rmse:0.18727       validation_1-rmse:0.28975
[116]   validation_0-rmse:0.18677       validation_1-rmse:0.28989
[117]   validation_0-rmse:0.18672       validation_1-rmse:0.28990
[118]   validation_0-rmse:0.18605       validation_1-rmse:0.28986
[119]   validation_0-rmse:0.18557       validation_1-rmse:0.28999
[120]   validation_0-rmse:0.18498       validation_1-rmse:0.28981
[121]   validation_0-rmse:0.18473       validation_1-rmse:0.28989
[122]   validation_0-rmse:0.18469       validation_1-rmse:0.28996
[123]   validation_0-rmse:0.18452       validation_1-rmse:0.28997
[124]   validation_0-rmse:0.18382       validation_1-rmse:0.28962
[125]   validation_0-rmse:0.18352       validation_1-rmse:0.28963
```

```
[126]   validation_0-rmse:0.18330       validation_1-rmse:0.28963
[127]   validation_0-rmse:0.18261       validation_1-rmse:0.28935
[128]   validation_0-rmse:0.18253       validation_1-rmse:0.28934
[129]   validation_0-rmse:0.18190       validation_1-rmse:0.28933
[130]   validation_0-rmse:0.18108       validation_1-rmse:0.28946
[131]   validation_0-rmse:0.18010       validation_1-rmse:0.28909
[132]   validation_0-rmse:0.17941       validation_1-rmse:0.28895
[133]   validation_0-rmse:0.17879       validation_1-rmse:0.28896
[134]   validation_0-rmse:0.17859       validation_1-rmse:0.28877
[135]   validation_0-rmse:0.17844       validation_1-rmse:0.28871
[136]   validation_0-rmse:0.17802       validation_1-rmse:0.28904
[137]   validation_0-rmse:0.17735       validation_1-rmse:0.28903
[138]   validation_0-rmse:0.17673       validation_1-rmse:0.28922
[139]   validation_0-rmse:0.17636       validation_1-rmse:0.28915
[140]   validation_0-rmse:0.17586       validation_1-rmse:0.28900
[141]   validation_0-rmse:0.17579       validation_1-rmse:0.28905
[142]   validation_0-rmse:0.17521       validation_1-rmse:0.28906
[143]   validation_0-rmse:0.17483       validation_1-rmse:0.28913
[144]   validation_0-rmse:0.17444       validation_1-rmse:0.28919
[145]   validation_0-rmse:0.17414       validation_1-rmse:0.28917
[146]   validation_0-rmse:0.17365       validation_1-rmse:0.28909
[147]   validation_0-rmse:0.17327       validation_1-rmse:0.28922
[148]   validation_0-rmse:0.17273       validation_1-rmse:0.28917
[149]   validation_0-rmse:0.17217       validation_1-rmse:0.28913
```

Out[12]:

XGBRegressor

```
XGBRegressor(base_score=None, booster=None, callbacks=None,
             colsample_bylevel=None, colsample_bynode=None,
             colsample_bytree=None, early_stopping_rounds=None,
             enable_categorical=False, eval_metric=None, feature_types=None,
             gamma=None, gpu_id=None, grow_policy=None, importance_type=None,
             interaction_constraints=None, learning_rate=None, max_bin=None,
             max_cat_threshold=None, max_cat_to_onehot=None,
             max_delta_step=None, max_depth=5, max_leaves=None,
             min_child_weight=None, missing=nan, monotone_constraints=None,
```

In [13]:

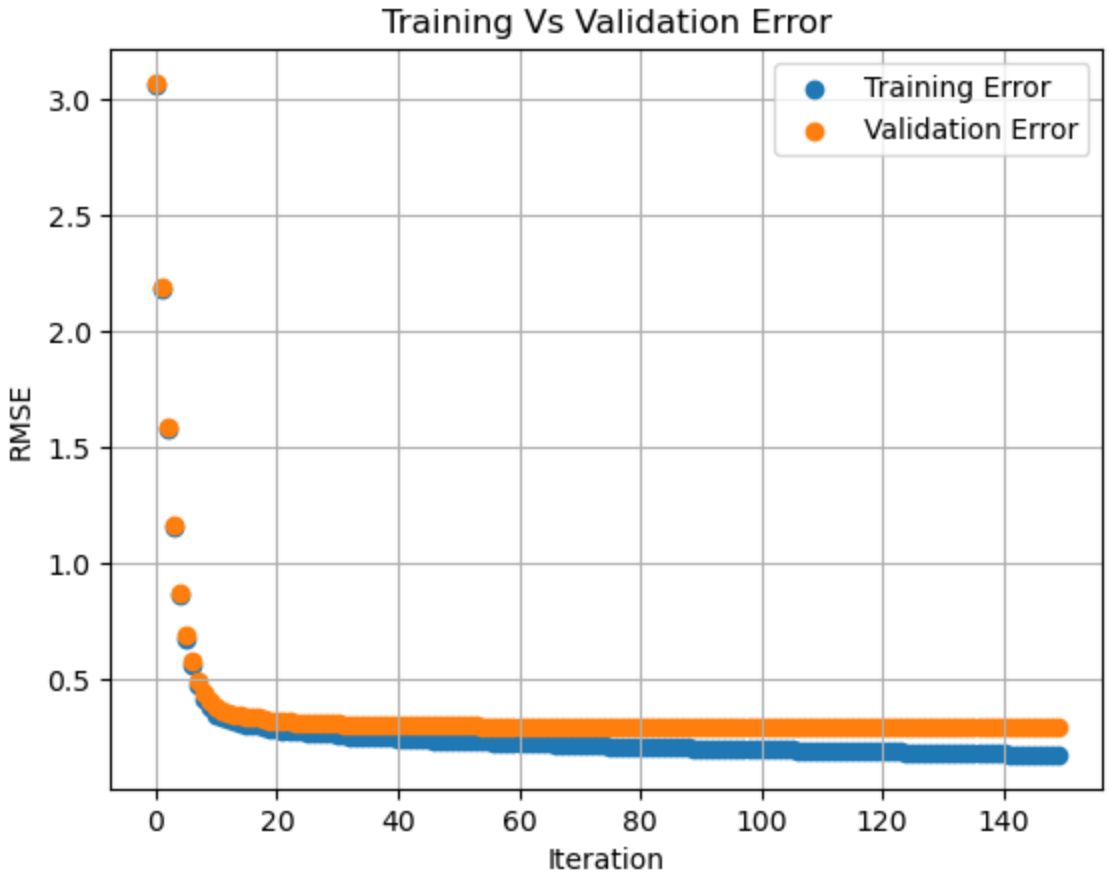
```
df_train['count'].describe()
```

Out[13]:
```
count    7620.000000
mean        4.583886
std         1.429959
min         0.693147
25%         3.737670
50%         4.976734
75%         5.652489
max         6.885510
Name: count, dtype: float64
```

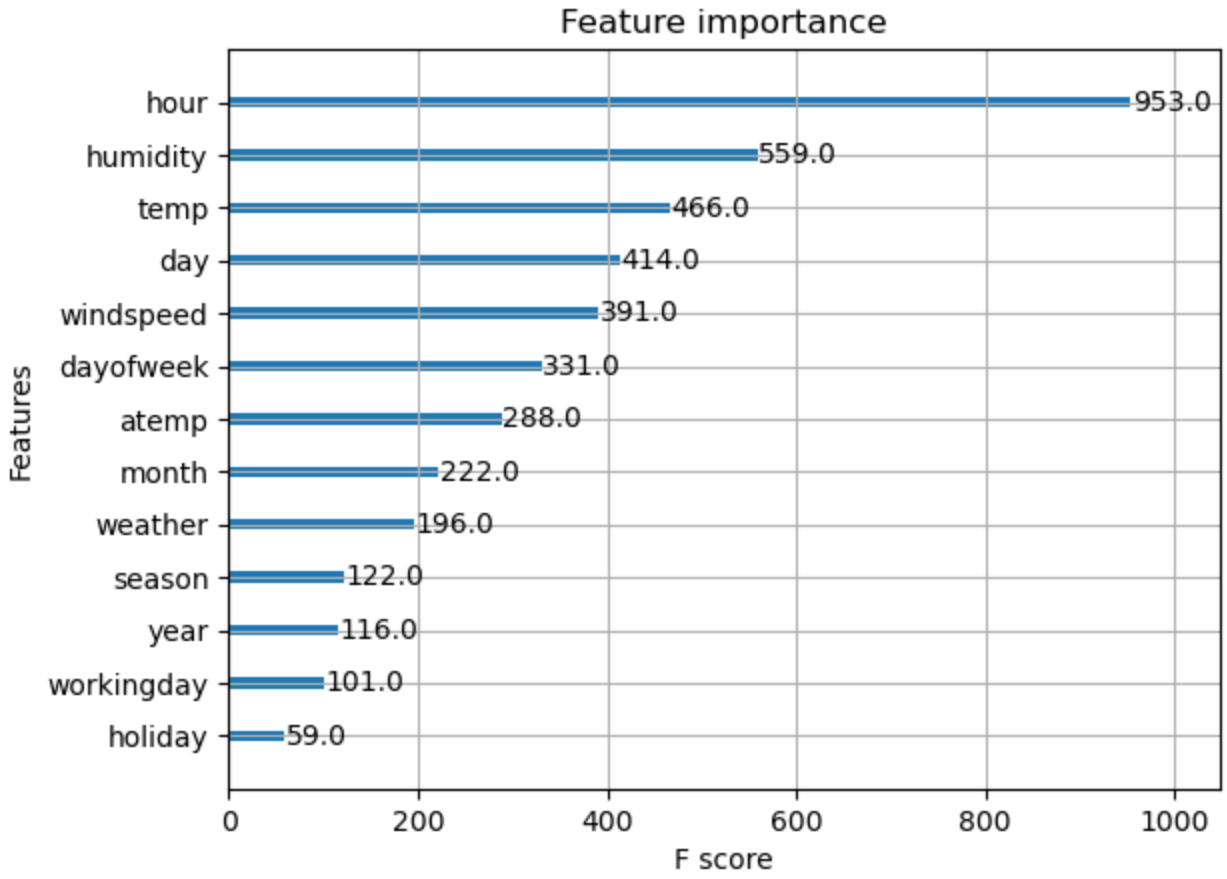
In [14]:
```
eval_result = regressor.evals_result()
```

In [15]:
```
training_rounds = range(len(eval_result['validation_0']['rmse']))
```

In [16]:
```
plt.scatter(x=training_rounds,y=eval_result['validation_0']['rmse'],label='Training Error')
plt.scatter(x=training_rounds,y=eval_result['validation_1']['rmse'],label='Validation Error')
plt.grid(True)
plt.xlabel('Iteration')
plt.ylabel('RMSE')
plt.title('Training Vs Validation Error')
plt.legend()
plt.show()
```



In [17]:
```
xgb.plot_importance(regressor)
plt.show()
```



In [18]:
```
# Updated - Changed to validation dataset
# Compare actual vs predicted performance with dataset not seen by the model before
df = pd.read_csv(validation_file,names=columns)
```

In [19]:
```
df.head()
```

Out[19]:

	count	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	year	month	day	dayofweek	hour
0	6.095825	3	0	1	2	28.70	33.335	79	12.9980	2011	7	7	3	8
1	5.961005	2	0	0	1	32.80	37.880	55	12.9980	2011	6	11	5	13
2	1.098612	1	0	1	1	14.76	16.665	40	19.9995	2011	2	14	0	2
3	3.891820	1	0	1	1	9.02	9.090	47	36.9974	2011	2	8	1	10
4	4.025352	4	0	0	1	10.66	15.150	87	0.0000	2011	12	4	6	8

In [20]:
```
X_test = df.iloc[:,1:]
print(X_test[:5])
```

```
   season  holiday  workingday  weather   temp   atemp  humidity  windspeed
0       3        0           1        2  28.70  33.335        79    12.9980  \
1       2        0           0        1  32.80  37.880        55    12.9980
2       1        0           1        1  14.76  16.665        40    19.9995
3       1        0           1        1   9.02   9.090        47    36.9974
4       4        0           0        1  10.66  15.150        87     0.0000

   year  month  day  dayofweek  hour
0  2011      7    7          3     8
1  2011      6   11          5    13
2  2011      2   14          0     2
3  2011      2    8          1    10
4  2011     12    4          6     8
```

In [21]:
```
result = regressor.predict(X_test)
```

In [22]:
```
result[:5]
```

Out[22]:
```
array([6.259567 , 5.966802 , 1.3931606, 3.9536645, 4.000689 ],
      dtype=float32)
```

In [23]:
```
df.head()
```

Out[23]:

	count	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	year	month	day	dayofweek	hour
0	6.095825	3	0	1	2	28.70	33.335	79	12.9980	2011	7	7	3	8
1	5.961005	2	0	0	1	32.80	37.880	55	12.9980	2011	6	11	5	13
2	1.098612	1	0	1	1	14.76	16.665	40	19.9995	2011	2	14	0	2
3	3.891820	1	0	1	1	9.02	9.090	47	36.9974	2011	2	8	1	10
4	4.025352	4	0	0	1	10.66	15.150	87	0.0000	2011	12	4	6	8

In [24]:
```
df['count_predicted'] = result
```

In [25]:
```
df.head()
```

Out[25]:

	count	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	year	month	day	dayofweek	hour	count_pre
0	6.095825	3	0	1	2	28.70	33.335	79	12.9980	2011	7	7	3	8	6.2
1	5.961005	2	0	0	1	32.80	37.880	55	12.9980	2011	6	11	5	13	5.9
2	1.098612	1	0	1	1	14.76	16.665	40	19.9995	2011	2	14	0	2	1.3
3	3.891820	1	0	1	1	9.02	9.090	47	36.9974	2011	2	8	1	10	3.9
4	4.025352	4	0	0	1	10.66	15.150	87	0.0000	2011	12	4	6	8	4.0

In [26]:
```
# Negative Values are #DWB# NOT!! #DWB# predicted
df['count_predicted'].describe()
```

Out[26]:
```
count    3266.000000
mean        4.592924
std         1.380849
min         0.626428
25%         3.790787
50%         4.991671
75%         5.625294
max         6.830800
Name: count_predicted, dtype: float64
```

In [27]:
```
df[df['count_predicted'] < 0]
```

Out[27]:

count	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	year	month	day	dayofweek	hour	count_predicte

In [28]:
```
def adjust_count(x):
    if x < 0:
        return 0
    else:
        return x
```

In [29]:
```
df['count_predicted'] = df['count_predicted'].map(adjust_count)
```

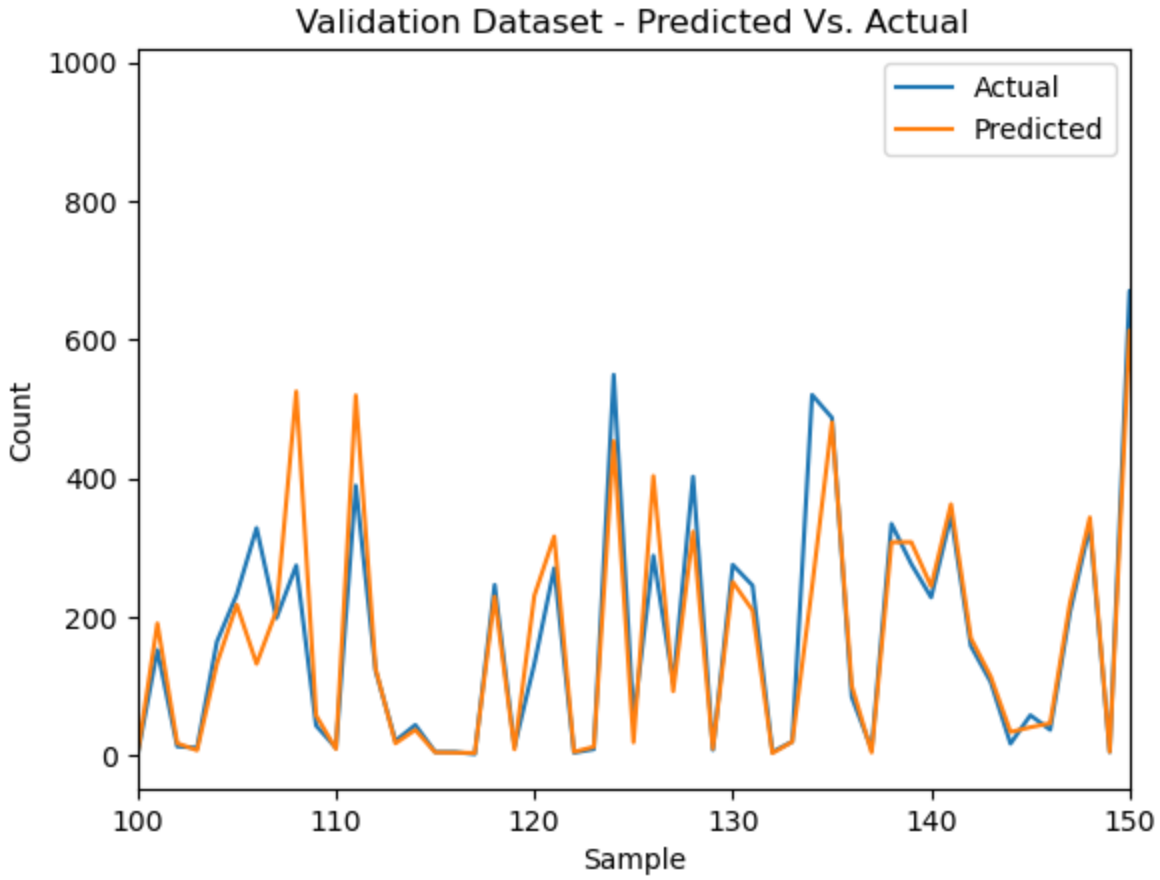
In [30]:
```
df[df['count_predicted'] < 0]
```

Out[30]:

count	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	year	month	day	dayofweek	hour	count_predicte

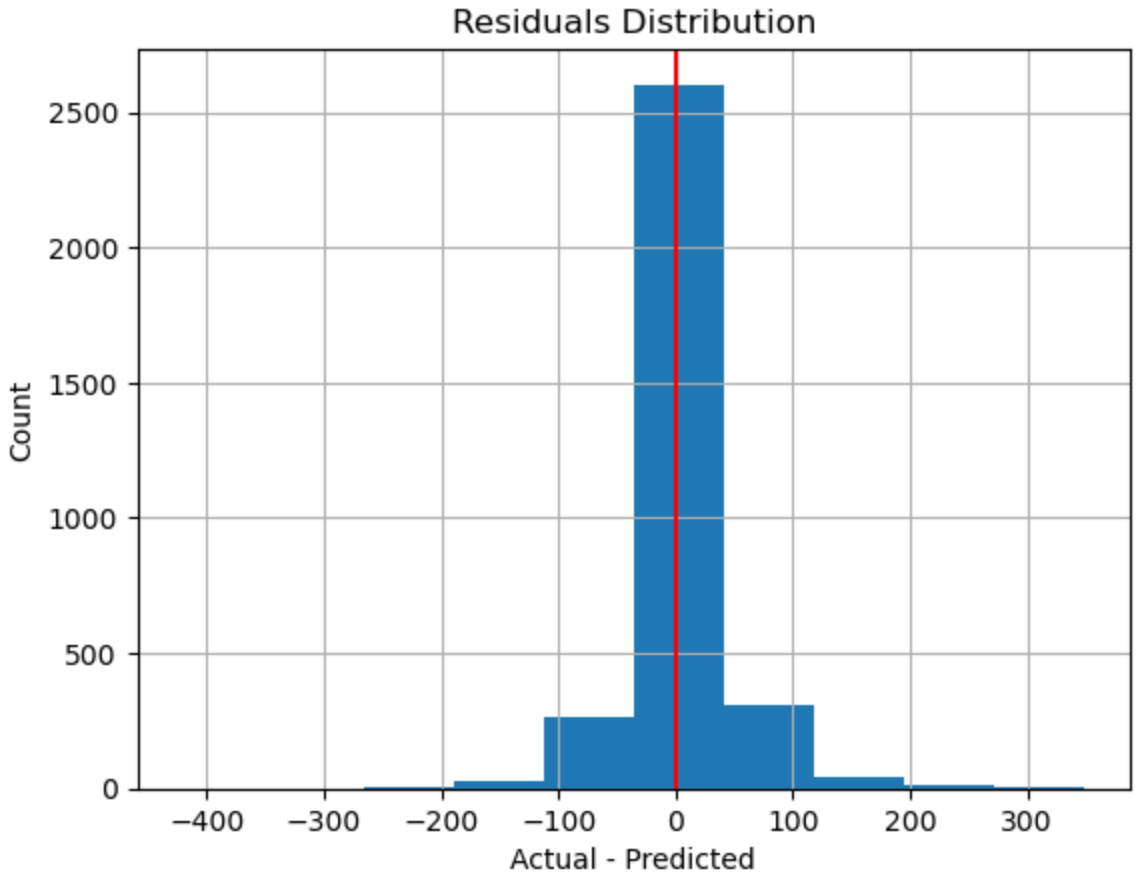
In [31]:
```
df['count'] = df['count'].map(np.expm1)
df['count_predicted'] = df['count_predicted'].map(np.expm1)
```

In [32]:
```
# Actual Vs Predicted
plt.plot(df['count'], label='Actual')
plt.plot(df['count_predicted'],label='Predicted')
plt.xlabel('Sample')
plt.ylabel('Count')
plt.xlim([100,150])
plt.title('Validation Dataset - Predicted Vs. Actual')
plt.legend()
plt.show()
```



In [33]:
```
# Over prediction and Under Prediction needs to be balanced
# Training Data Residuals
residuals = (df['count'] - df['count_predicted'])

plt.hist(residuals)
plt.grid(True)
plt.xlabel('Actual - Predicted')
plt.ylabel('Count')
plt.title('Residuals Distribution')
plt.axvline(color='r')
plt.show()
```



In [34]:
```
value_counts = (residuals > 0).value_counts(sort=False)
print(' Under Estimation: {0:.2f}'.format(value_counts[True]/len(residuals)))
print(' Over  Estimation: {0:.2f}'.format(value_counts[False]/len(residuals)))
```

```
 Under Estimation: 0.53
 Over  Estimation: 0.47
```

In [35]:
```
import sklearn.metrics as metrics
print("RMSE: {0:.2f}".format(metrics.mean_squared_error(df['count'],
                                                        df['count_predicted'])**.5))
```

```
RMSE: 42.41
```

In [36]:
```
# Metric Use By Kaggle
def compute_rmsle(y_true, y_pred):
```

```
    if type(y_true) != np.ndarray:
        y_true = np.array(y_true)

    if type(y_pred) != np.ndarray:
        y_pred = np.array(y_pred)

    return(np.average((np.log1p(y_pred) - np.log1p(y_true))**2)**.5)
```

In [37]:
```
print("RMSLE: {0:.2f}".format(compute_rmsle(df['count'],df['count_predicted'])))
```

```
RMSLE: 0.29
```

In [38]:
```
# Prepare Data for Submission to Kaggle
df_test = pd.read_csv(test_file,parse_dates=['datetime'])
```

In [39]:
```
df_test.head()
```

Out[39]:

	datetime	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	year	month	day	dayofweek	hour
0	2011-01-20 00:00:00	1	0	1	1	10.66	11.365	56	26.0027	2011	1	20	3	0
1	2011-01-20 01:00:00	1	0	1	1	10.66	13.635	56	0.0000	2011	1	20	3	1
2	2011-01-20 02:00:00	1	0	1	1	10.66	13.635	56	0.0000	2011	1	20	3	2
3	2011-01-20 03:00:00	1	0	1	1	10.66	12.880	56	11.0014	2011	1	20	3	3
4	2011-01-20 04:00:00	1	0	1	1	10.66	12.880	56	11.0014	2011	1	20	3	4

In [40]:
```
X_test =  df_test.iloc[:,1:] # Exclude datetime for prediction
```

In [41]:
```
X_test.head()
```

Out[41]:

	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	year	month	day	dayofweek	hour
0	1	0	1	1	10.66	11.365	56	26.0027	2011	1	20	3	0
1	1	0	1	1	10.66	13.635	56	0.0000	2011	1	20	3	1
2	1	0	1	1	10.66	13.635	56	0.0000	2011	1	20	3	2
3	1	0	1	1	10.66	12.880	56	11.0014	2011	1	20	3	3
4	1	0	1	1	10.66	12.880	56	11.0014	2011	1	20	3	4

In [42]:
```
result = regressor.predict(X_test)
```

In [43]:
```
result[:5]
```

Out[43]:
```
array([2.0552852, 1.5469345, 1.3397862, 1.1393155, 1.051079 ],
      dtype=float32)
```

In [44]:
```
np.expm1(result)
```

Out[44]:
```
array([  6.809065 ,   3.6970491,   2.818227 , ..., 125.76962  ,
        86.26166  ,  44.861454 ], dtype=float32)
```

In [45]:
```
# Convert result to actual count
df_test["count"] = np.expm1(result)
```

In [46]:
```
df_test.head()
```

Out[46]:

	datetime	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	year	month	day	dayofweek	hour	count
0	2011-01-20 00:00:00	1	0	1	1	10.66	11.365	56	26.0027	2011	1	20	3	0	6.809065
1	2011-01-20 01:00:00	1	0	1	1	10.66	13.635	56	0.0000	2011	1	20	3	1	3.697049
2	2011-01-20 02:00:00	1	0	1	1	10.66	13.635	56	0.0000	2011	1	20	3	2	2.818227
3	2011-01-20 03:00:00	1	0	1	1	10.66	12.880	56	11.0014	2011	1	20	3	3	2.124629
4	2011-01-20 04:00:00	1	0	1	1	10.66	12.880	56	11.0014	2011	1	20	3	4	1.860736

In [47]:
```
df_test[df_test["count"] < 0]
```

Out[47]:

datetime	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	year	month	day	dayofweek	hour	count

In [48]:
```
df_test[['datetime','count']].to_csv('predicted_count.csv',index=False)
```

In [49]:
```
# RMSLE (Kaggle) Score
# Test 1: 0.62 # Chandra
#DWB# Test 1: 0.71796
# Test 2(log of count): 0.40 # Chandra
#DWB# Test2 (log of count): 0.42225
```

In [ ]:
```

```