data-linear-regression

April 20, 2025

1 Linear Regression Model

1.1 Import Essential Libraries

[7]:

```
# Basic Libraries
import numpy as np
import pandas as pd
import seaborn as sb
import matplotlib.pyplot as plt # we only need pyplot
sb.set() # set the default Seaborn style for graphics
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import mean_squared_error, r2_score, mean_absolute_error
```

1.2 Import Data

[5]:

```
df = pd.read_csv('datasets/twitch-data-cleaned.csv')
df.head()
```

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```
    channel  watch_time_minutes  stream_time_minutes  peak_viewers  \
0     xQcOW          6196161750               215250        222720
1  summit1g          6091677300               211845        310998
2    Gaules          5644590915               515280        387315
3  ESL_CSGO          3970318140               517740        300575
4      Tfue          3671000070               123660        285644

   average_viewers  followers  followers_gained  views_gained  partnered  \
0            27716    3246298           1734810      93036735       True
1            25610    5310163           1370184      89705964       True
2            10976    1767635           1023779     102611607       True
3             7714    3944850            703986     106546942       True
4            29602    8938903           2068424      78998587       True

   mature    language  watch_time_hours  stream_time_hours  \
0   False     English      1.032694e+08            3587.50
1   False     English      1.015280e+08            3530.75
2    True  Portuguese      9.407652e+07            8588.00
```

```
3   False     English      6.617197e+07            8629.00
4   False     English      6.118333e+07            2061.00

   followers_per_hour  views_per_follower  engagement_rate
0          483.570732           53.629351         0.008538
1          388.071656           65.470013         0.004823
2          119.210410          100.228279         0.006209
3           81.583729          151.348098         0.001955
4         1003.602135           38.192647         0.003312
```

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```
# use all these features to predict watch_time_minutes
features = ['stream_time_minutes', 'average_viewers', 'peak_viewers',
            'followers', 'followers_gained', 'views_gained',
            'mature', 'views_per_follower', 'engagement_rate']

# language needs to be one-hot encoded as it is a categorical var
df_ml = pd.get_dummies(df, columns=['language'], drop_first=True)
df_ml.columns = [col.lower() if col.startswith('language_') else col for col in␣
 ↪df_ml.columns]

# filter for features and language columns
lang_columns = [col.lower() for col in df_ml.columns if col.
 ↪startswith('language_')]
X = df_ml[features + lang_columns].copy()
y = df_ml['watch_time_minutes']

# handle any missing vals
X = X.fillna(X.median())

# now we can perform a train/test split
# 80% for training and 20% for testing
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)

# scale the features so they each contribute equally
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)

linear_model = LinearRegression()
linear_model.fit(X_train_scaled, y_train)

# evalute linear regression model
y_pred_linear = linear_model.predict(X_test_scaled)
r2_linear = r2_score(y_test, y_pred_linear)
rmse_linear = np.sqrt(mean_squared_error(y_test, y_pred_linear))
mae_linear = mean_absolute_error(y_test, y_pred_linear)
```

```
print(f"Linear Regression Results:")
print(f"R² Score: {r2_linear:.4f}")
print(f"RMSE: {rmse_linear:.2f}")
print(f"MAE: {mae_linear:.2f}")
```

```
Linear Regression Results:
R² Score: 0.6536
RMSE: 332317064.43
MAE: 163213427.06
```

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```
def plot_actual_vs_predicted(model, X_test_scaled, y_test):
    y_pred = model.predict(X_test_scaled)

    plt.figure(figsize=(12, 8))
    plt.scatter(y_test, y_pred)
    plt.plot([y_test.min(), y_test.max()], [y_test.min(), y_test.max()], 'r--')
    plt.xlabel('Actual Watch Time (minutes)')
    plt.ylabel('Predicted Watch Time (minutes)')
    plt.title('Linear Regression: Actual vs Predicted Watch Time', fontsize=14)

    # Add performance metrics to plot
    r2 = r2_score(y_test, y_pred)
    rmse = np.sqrt(mean_squared_error(y_test, y_pred))
    plt.annotate(f'R² = {r2:.3f}\nRMSE = {rmse:.0f}',
                 xy=(0.05, 0.95), xycoords='axes fraction',
                 bbox=dict(boxstyle="round,pad=0.3", fc="white", ec="gray",␣
 ↪alpha=0.8))

    plt.show()
```

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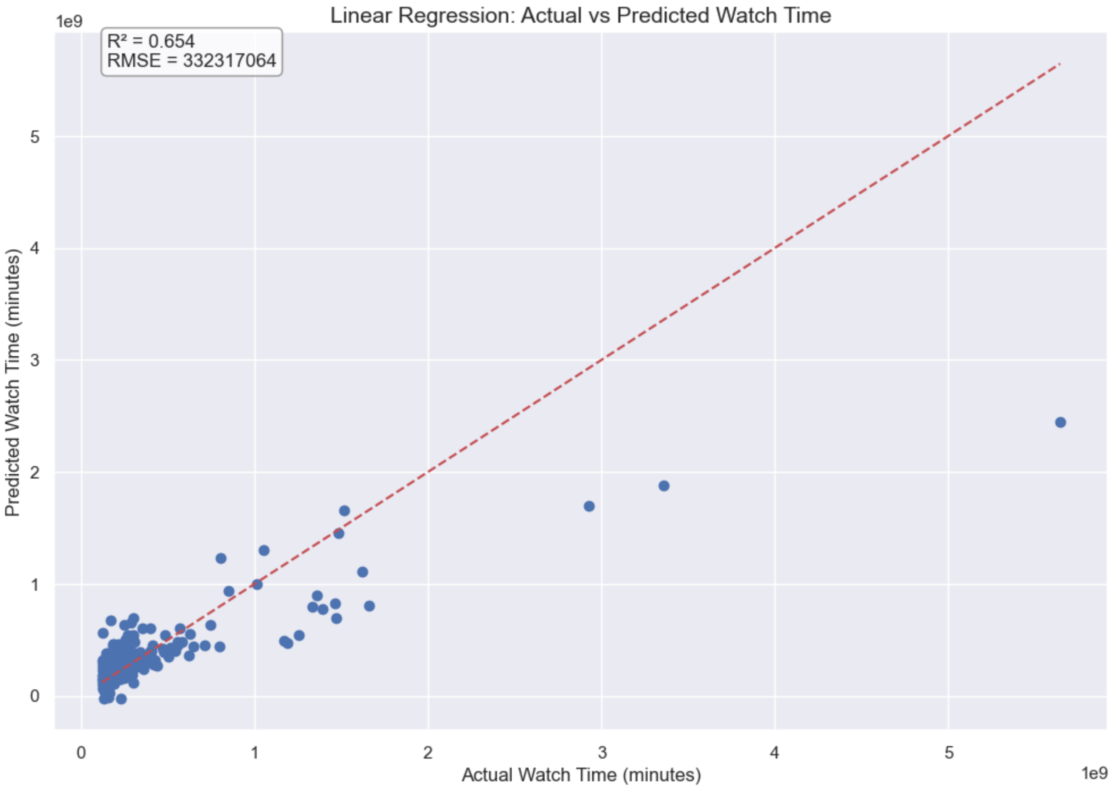
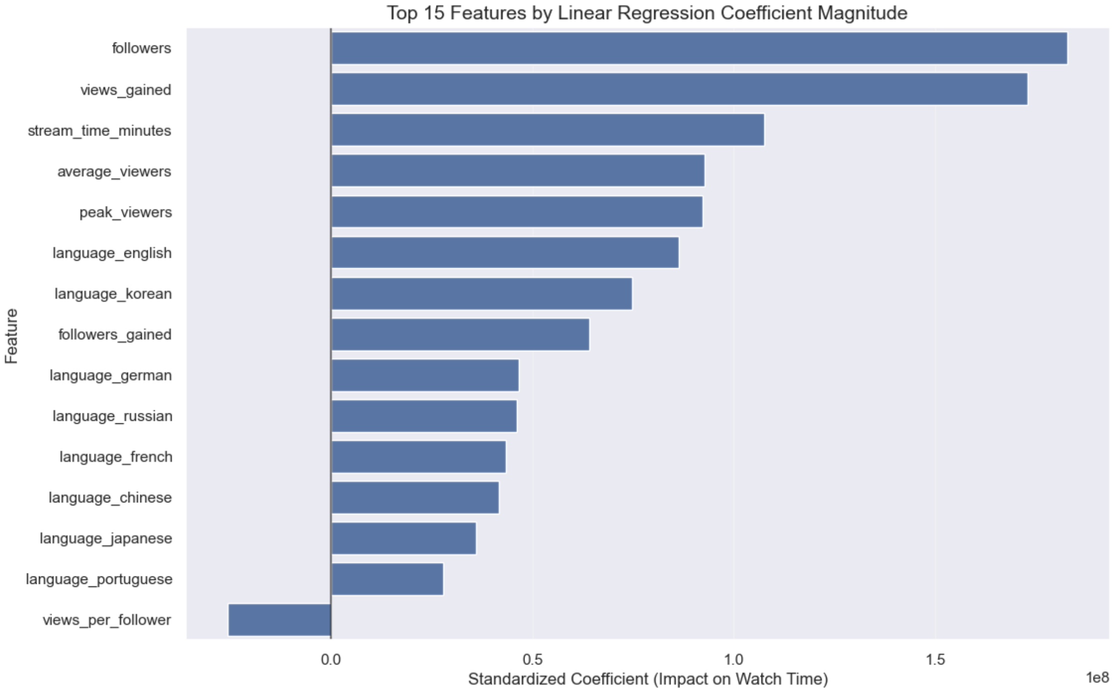
```
# Option 2: Coefficient Plot (Feature Importance)
def plot_linear_coefficients(model, feature_names):
    # Get coefficients
    coefficients = pd.DataFrame({
        'Feature': feature_names,
        'Coefficient': model.coef_
    })

    # Sort by absolute value
    coefficients['Abs_Coefficient'] = np.abs(coefficients['Coefficient'])
    coefficients = coefficients.sort_values('Abs_Coefficient', ascending=False)

    # Plot top 15 coefficients
    plt.figure(figsize=(12, 8))

    sb.barplot(x='Coefficient', y='Feature', data=coefficients.head(15))
```

```
  plt.title('Top 15 Features by Linear Regression Coefficient Magnitude',␣
↪fontsize=14)
  plt.xlabel('Standardized Coefficient (Impact on Watch Time)', fontsize=12)
  plt.axvline(x=0, color='black', linestyle='-', alpha=0.5)
  plt.grid(axis='x', alpha=0.3)
  plt.show()
```

[37]:
```
plot_actual_vs_predicted(linear_model, X_test_scaled, y_test)
```



[38]:
```
plot_linear_coefficients(linear_model, features + lang_columns)
```


Top 15 Features by Linear Regression Coefficient Magnitude
Feature
followers
views_gained
stream_time_minutes
average_viewers
peak_viewers
language_english
language_korean
followers_gained
language_german
language_russian
language_french
language_chinese
language_japanese
language_portuguese
views_per_follower
0.0
0.5
1.0
1.5
1e8
Standardized Coefficient (Impact on Watch Time)

```
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```