Analysis of Video Game Sales

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Abstract

We will explore the data set of video game sales to try to predict the global sales of video games.

Motivation

In this project we will make an analyze for video game sales data set with seaborn. We will make a data visualities at first with matplotlib and then we will use machine learning algorithms to predict the global sales according to the actual sales provided.

Dataset

-Data Source: Video Game Sales Dataset
-Location: https://www.kaggle.com/gregorut/videogamesales
-Filename: videogamesales.zip

Data Preparation and Cleaning

At a high-level, what did you need to do to prepare the data for analysis?

We need at first to clean up our data from null values so that we eliminate outliers and we can make a better analyze for our data.

Describe what problems, if any, did you encounter with the dataset?

If we don’t clean our data we will get weeker analyze results because we will consider outliers as part of our data.

Research Question(s)

Our research question in this project is:

According to the actual sales can we predict the global sales ?

Methods

We have used actual sales to predict global sales.

Findings

We have found that using actual sales we can predect glabal sales with a great accurency (99%)

Limitations

For our work, we have put a lot of time to understand what is the best feature to focus on it to predict the global sales of video games so we can not estimate that the acctuale sales can be used in every sales dataset to predict the global sales so every time we need to make a good analyse to find the best feature.

Conclusions

Using xgboost we have predect global sales of video games based on the actual sales.

Acknowledgements

I have collected data by my self from Kaggle, I haven’t got feedback because of limit time (this is the last day of the course)

References

https://xgboost.readthedocs.io/en/latest/

https://matplotlib.org/

https://seaborn.pydata.org/

Title: Analyzing video games sales ¶

Information about the data used:
-Data Source: Video Game Sales Dataset
-Location: https://www.kaggle.com/gregorut/videogamesales (https://www.kaggle.com/gregorut/videogamesales)
-Filename: videogamesales.zip

Initial the exploration of the Dataset

In [5]:
```
import numpy as np
import pandas as pd
```

Importing data

In [6]:
```
df = pd.read_csv('vgsales.csv')
```

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

Out[7]:

	Rank	Name	Platform	Year	Genre	Publisher	NA_Sales	EU_Sales	JP_Sales	Other
0	1	Wii Sports	Wii	2006.0	Sports	Nintendo	41.49	29.02	3.77	
1	2	Super Mario Bros.	NES	1985.0	Platform	Nintendo	29.08	3.58	6.81	
2	3	Mario Kart Wii	Wii	2008.0	Racing	Nintendo	15.85	12.88	3.79	
3	4	Wii Sports Resort	Wii	2009.0	Sports	Nintendo	15.75	11.01	3.28	
4	5	Pokemon Red/Pokemon Blue	GB	1996.0	Role-Playing	Nintendo	11.27	8.89	10.22	

In [9]:
```
df.shape
```

Out[9]:
```
(16598, 11)
```

In [10]:
```
df.columns
```

Out[10]:
```
Index(['Rank', 'Name', 'Platform', 'Year', 'Genre', 'Publisher', 'NA_Sales',
       'EU_Sales', 'JP_Sales', 'Other_Sales', 'Global_Sales'],
      dtype='object')
```

In [12]:
```
df.describe()
```

Out[12]:

	Rank	Year	NA_Sales	EU_Sales	JP_Sales	Other_Sales	Globa
count	16598.000000	16327.000000	16598.000000	16598.000000	16598.000000	16598.000000	16598
mean	8300.605254	2006.406443	0.264667	0.146652	0.077782	0.048063	0
std	4791.853933	5.828981	0.816683	0.505351	0.309291	0.188588	1
min	1.000000	1980.000000	0.000000	0.000000	0.000000	0.000000	0
25%	4151.250000	2003.000000	0.000000	0.000000	0.000000	0.000000	0
50%	8300.500000	2007.000000	0.080000	0.020000	0.000000	0.010000	0
75%	12449.750000	2010.000000	0.240000	0.110000	0.040000	0.040000	0
max	16600.000000	2020.000000	41.490000	29.020000	10.220000	10.570000	82

Know we will clean our data but let us first check if there is any null value

In [39]:
```
df.isnull().values.any()
```

Out[39]:
```
True
```

In [40]:
```
clean_df= df.dropna()
```

In [15]:
```
clean_df.isnull().values.any()
```

Out[15]:
```
False
```

Dimentions of new cleaned data

In [18]:
```
clean_df.shape
```

Out[18]:
```
(16291, 11)
```

In [19]:
```
clean_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 16291 entries, 0 to 16597
Data columns (total 11 columns):
Rank            16291 non-null int64
Name            16291 non-null object
Platform        16291 non-null object
Year            16291 non-null float64
Genre           16291 non-null object
Publisher       16291 non-null object
NA_Sales        16291 non-null float64
EU_Sales        16291 non-null float64
JP_Sales        16291 non-null float64
Other_Sales     16291 non-null float64
Global_Sales    16291 non-null float64
dtypes: float64(6), int64(1), object(4)
memory usage: 1.5+ MB
```

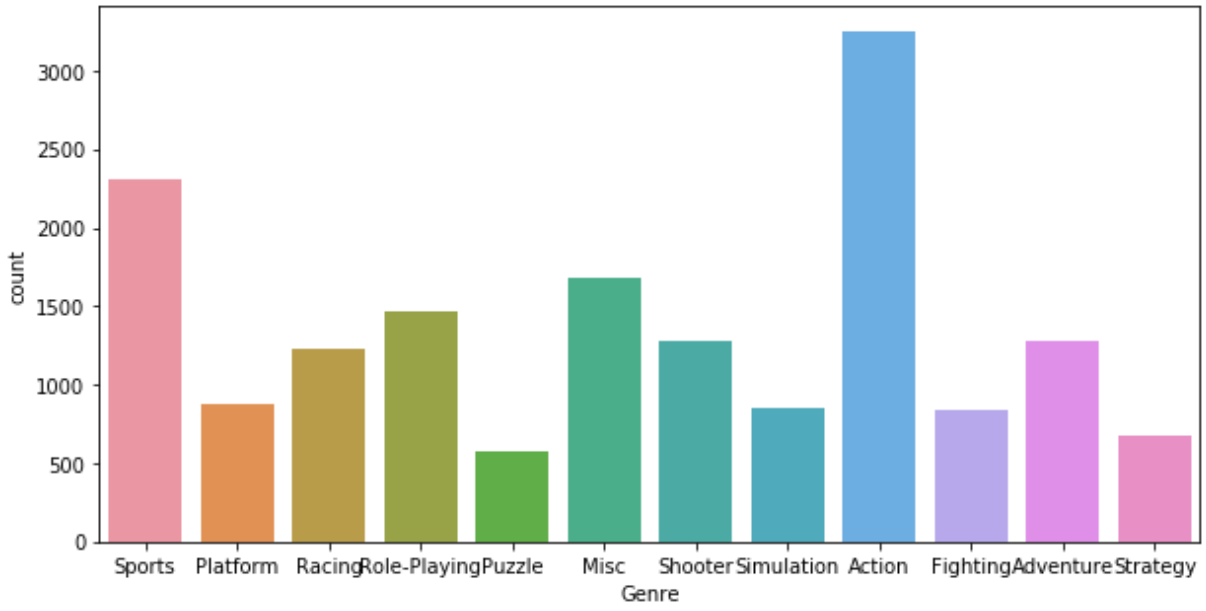
Importing seaborn and matplotlib

In [22]:
```
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

Data Visulation

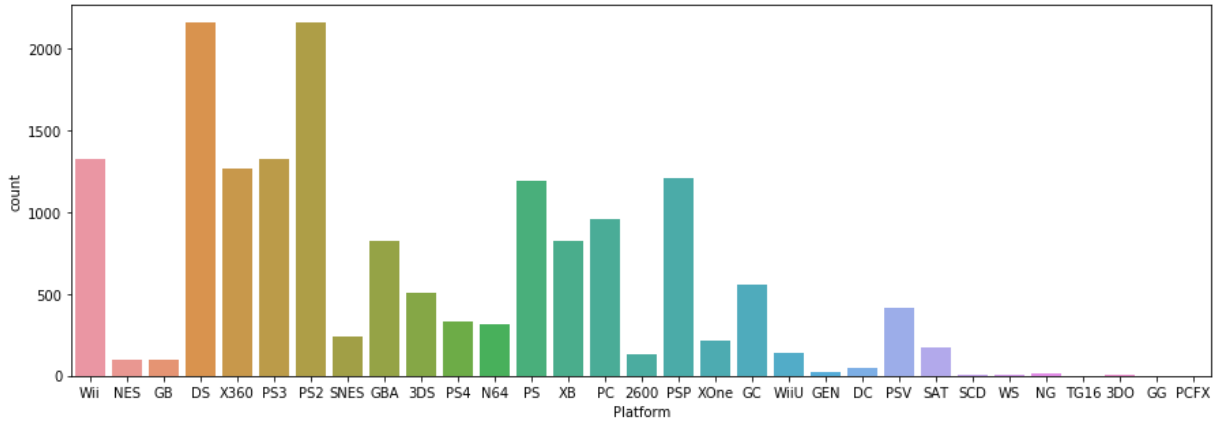
In [43]:
```
plt.figure(figsize=(10,5))
sns.countplot(clean_df['Genre'])
```

Out[43]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24b4a8ba5c0>
```



In [44]:
```
plt.figure(figsize=(15,5))
sns.countplot(df['Platform'])
```

Out[44]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24b49d09400>
```



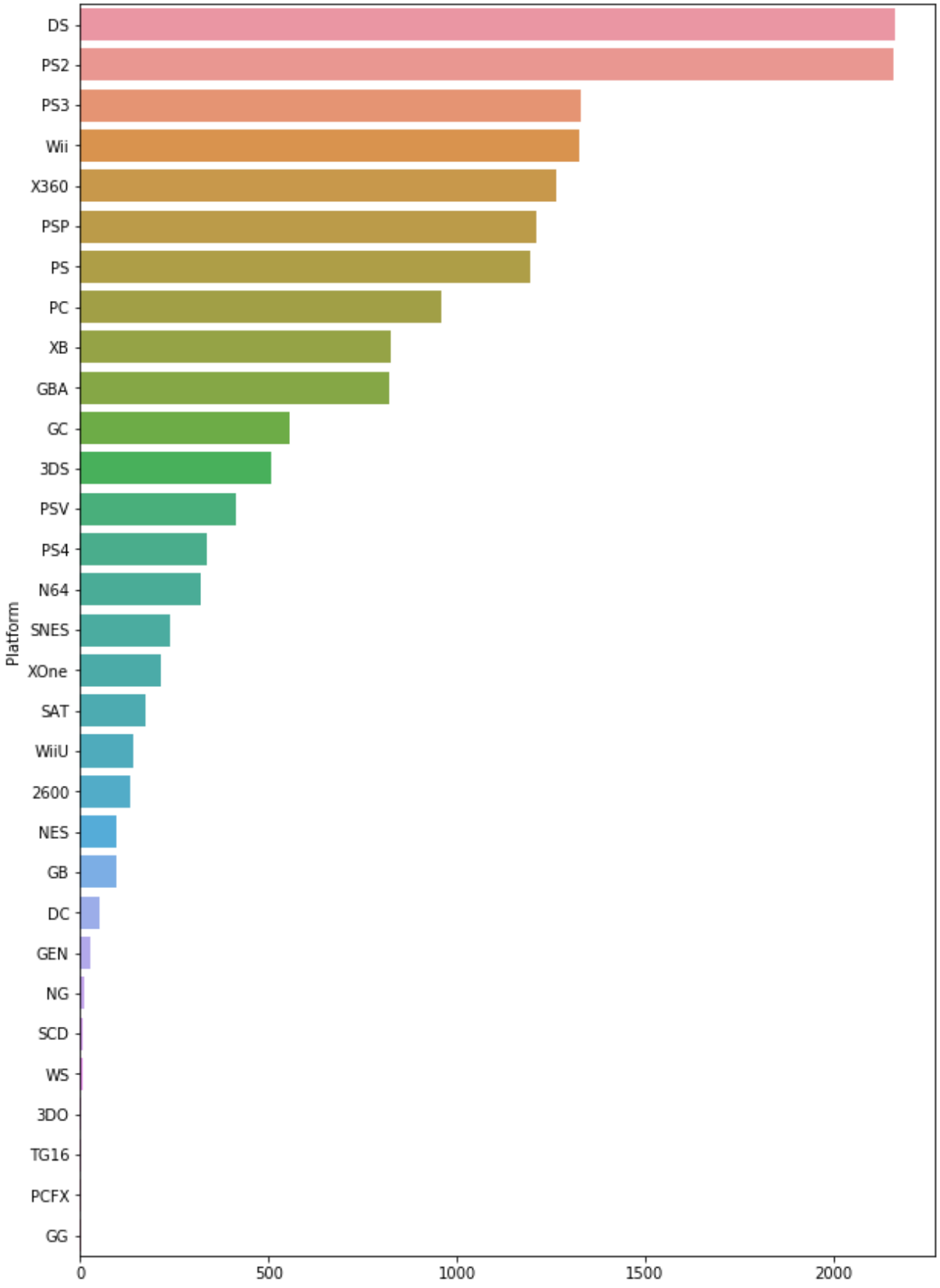
In [45]:
```
platGenre = pd.crosstab(df.Platform,df.Genre)
platGenre.head(5)
```

Out[45]:

Genre	Action	Adventure	Fighting	Misc	Platform	Puzzle	Racing	Role-Playing	Shooter	Simulatio
Platform										
2600	61	2	2	5	9	11	6	0	24	
3DO	0	1	0	0	0	1	0	0	0	
3DS	182	37	14	53	28	20	11	86	7	3
DC	3	11	12	0	2	0	6	4	3	
DS	343	240	36	393	92	238	67	200	42	28

In [46]:
```
platGenreTotal =platGenre.sum(axis=1).sort_values(ascending = False)
plt.figure(figsize=(10,15))
sns.barplot(x=platGenreTotal.values,y=platGenreTotal.index)
```

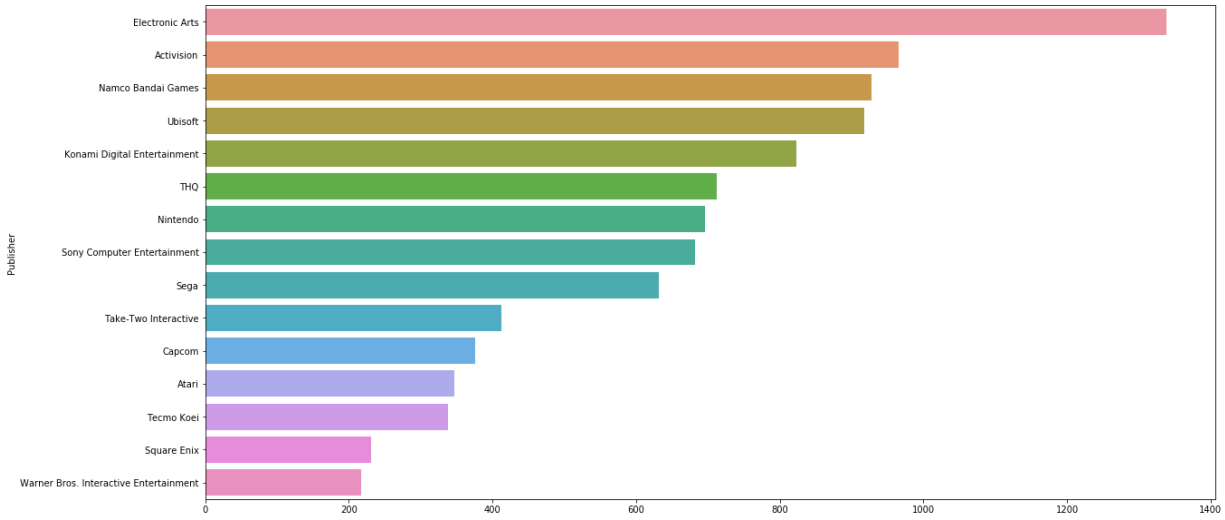
Out[46]: <matplotlib.axes._subplots.AxesSubplot at 0x24b49722cc0>



So You can see DS and PS2 have the most games in their platform and now, we can see the detail of genre of game in platform that have more than 1000 games. In the seaborn, it is easy to use heatrmap rather than the stacked bar, so we can use the heatmap to have a try.

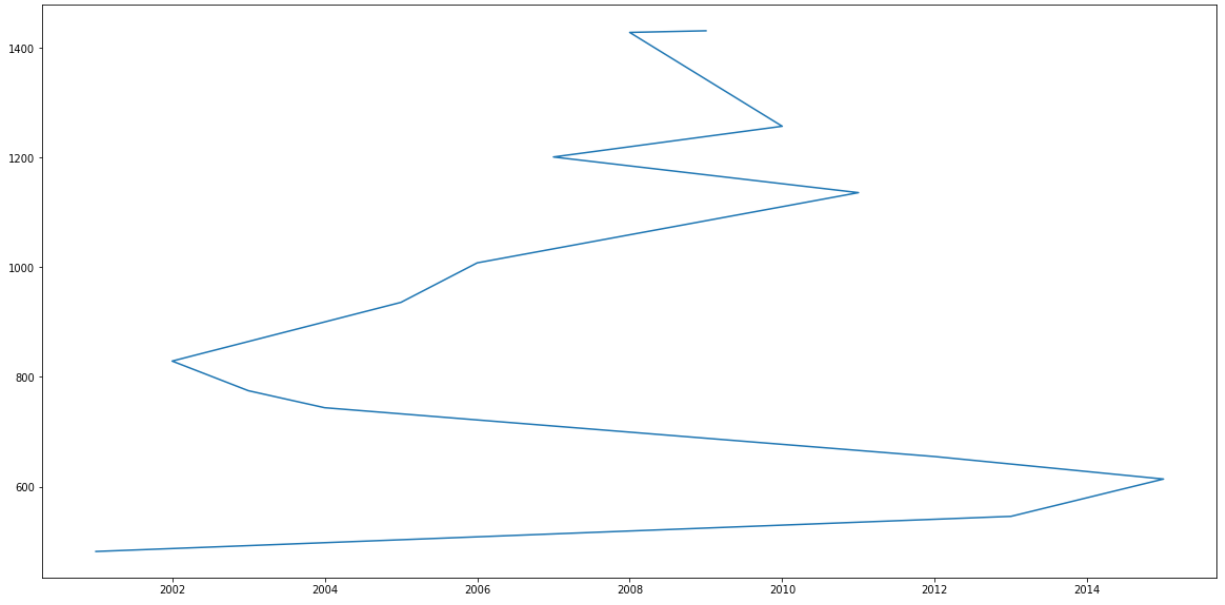
In [47]:
```
pub=clean_df.groupby('Publisher')['Publisher'].count().sort_values(ascending = Fa
sns.barplot(x=pub.values,y=pub.index)
```

Out[47]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24b461e8278>
```



In [49]:
```
yr=clean_df.groupby('Year')['Year'].count().sort_values(ascending = False).head(1
plt.plot(yr)
```

Out[49]:
```
[<matplotlib.lines.Line2D at 0x24b49c657b8>]
```



In [50]:
```
plt.figure(figsize=(10,5))
sns.pointplot(x=yr.index ,y=yr.values)
```

Out[50]: <matplotlib.axes._subplots.AxesSubplot at 0x24b49c43f60>

So it is showing most important year is 2009 based on others year

convert Categorical variable to numerical Variables

In [73]:
```
from sklearn import model_selection, preprocessing
for c in clean_df.columns:
    if clean_df[c].dtype == 'object':
        lbl = preprocessing.LabelEncoder()
        lbl.fit(list(clean_df[c].values))
        df[c] = lbl.transform(list(clean_df[c].values))
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-73-73b8d0b09c90> in <module>
      4         lbl = preprocessing.LabelEncoder()
      5         lbl.fit(list(clean_df[c].values))
----> 6         df[c] = lbl.transform(list(clean_df[c].values))
      7

~\Anaconda3\lib\site-packages\pandas\core\frame.py in __setitem__(self, key, va
lue)
   3117         else:
   3118             # set column
-> 3119             self._set_item(key, value)
   3120
   3121     def _setitem_slice(self, key, value):

~\Anaconda3\lib\site-packages\pandas\core\frame.py in _set_item(self, key, valu
e)
   3192
   3193         self._ensure_valid_index(value)
-> 3194         value = self._sanitize_column(key, value)
   3195         NDFrame._set_item(self, key, value)
   3196

~\Anaconda3\lib\site-packages\pandas\core\frame.py in _sanitize_column(self, ke
y, value, broadcast)
   3389
   3390             # turn me into an ndarray
-> 3391             value = _sanitize_index(value, self.index, copy=False)
   3392             if not isinstance(value, (np.ndarray, Index)):
   3393                 if isinstance(value, list) and len(value) > 0:

~\Anaconda3\lib\site-packages\pandas\core\series.py in _sanitize_index(data, in
dex, copy)
   3999
   4000     if len(data) != len(index):
-> 4001         raise ValueError('Length of values does not match length of '
'index')
   4002
   4003     if isinstance(data, ABCIndexClass) and not copy:

ValueError: Length of values does not match length of index
```

In [74]:
```
corr=clean_df.corr()
corr = (corr)
plt.figure(figsize=(14,14))
sns.heatmap(corr, cbar = True,  square = True, annot=True, fmt= '.2f',annot_kws=

{'size': 15},
            xticklabels=corr.columns.values,
            yticklabels=corr.columns.values)
sns.plt.title('Heatmap of Correlation Matrix')
```

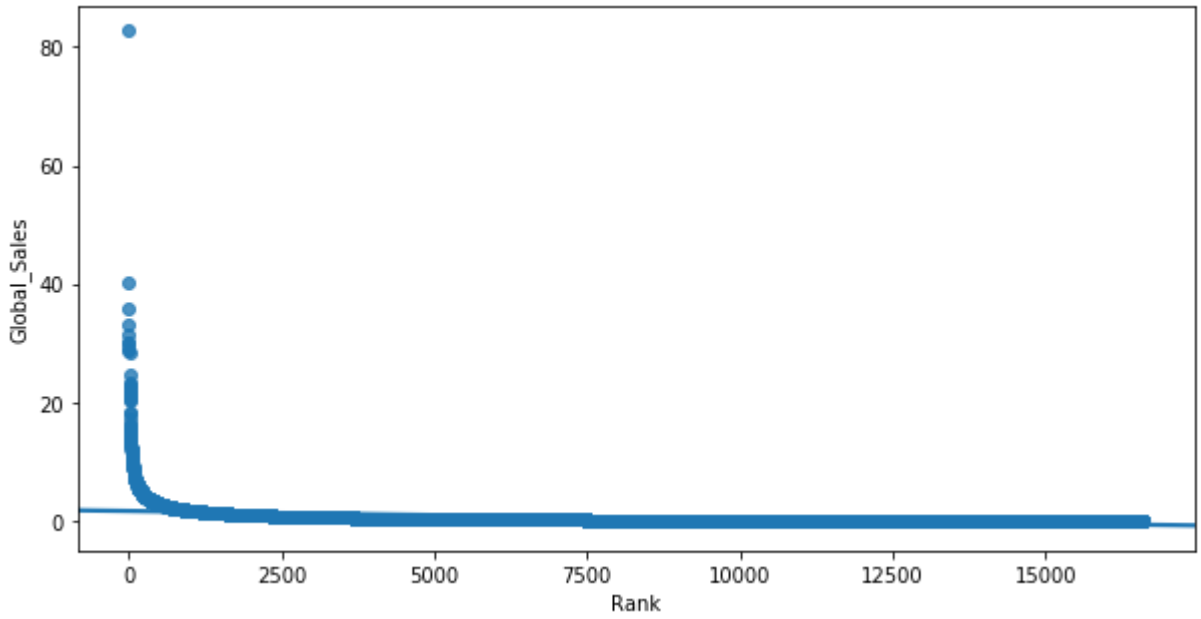
```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
<ipython-input-74-8c8a82c585d2> in <module>
      7             xticklabels=corr.columns.values,
      8             yticklabels=corr.columns.values)
----> 9 sns.plt.title('Heatmap of Correlation Matrix')

AttributeError: module 'seaborn' has no attribute 'plt'
```

so all sales are highly correlated with global sales which is very true..Rank is not showing highly correlated with global sales as this is shown in Matrix formation.

In [53]:
```
plt.figure(figsize=(10,5))
sns.regplot(x='Rank',y='Global_Sales',data=clean_df)
```

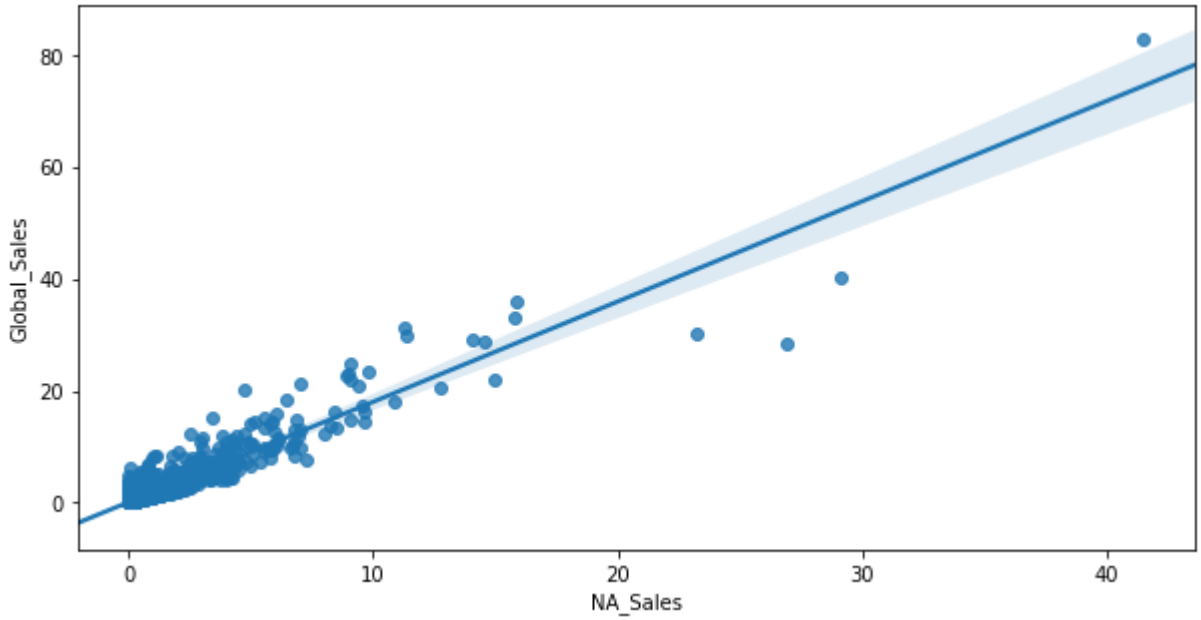
```
C:\Users\Aymen\Anaconda3\lib\site-packages\scipy\stats\stats.py:1713: FutureWar
ning: Using a non-tuple sequence for multidimensional indexing is deprecated; u
se `arr[tuple(seq)]` instead of `arr[seq]`. In the future this will be interpre
ted as an array index, `arr[np.array(seq)]`, which will result either in an err
or or a different result.
  return np.add.reduce(sorted[indexer] * weights, axis=axis) / sumval
```

Out[53]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24b4cc18978>
```



In [55]:
```
plt.figure(figsize=(10,5))
sns.regplot(x='NA_Sales',y='Global_Sales',data=clean_df)
```

Out[55]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24b4d507278>
```



In [56]:
```
clean_df.dtypes
```

Out[56]:
```
Rank             int64
Name            object
Platform        object
Year           float64
Genre           object
Publisher       object
NA_Sales       float64
EU_Sales       float64
JP_Sales       float64
Other_Sales    float64
Global_Sales   float64
dtype: object
```

In [57]:
```
#Train-Test split
from sklearn.model_selection import train_test_split
label = clean_df.pop('Global_Sales')
data_train, data_test, label_train, label_test = train_test_split(clean_df, label
```

In [58]:
```
data_train.shape,data_test.shape
```

Out[58]:
```
((13032, 10), (3259, 10))
```

Start with Extream gradient boosting

In [65]:
```
#!pip install xgboost
```

```
Collecting xgboost
  Downloading https://files.pythonhosted.org/packages/51/c1/198915b13e98b62a98f
48309c41012638464651da755d941f4abe384c012/xgboost-0.82-py2.py3-none-win_amd64.w
hl (https://files.pythonhosted.org/packages/51/c1/198915b13e98b62a98f48309c4101
2638464651da755d941f4abe384c012/xgboost-0.82-py2.py3-none-win_amd64.whl) (7.7M
B)
Requirement already satisfied: scipy in c:\users\aymen\anaconda3\lib\site-packa
ges (from xgboost) (1.1.0)
Requirement already satisfied: numpy in c:\users\aymen\anaconda3\lib\site-packa
ges (from xgboost) (1.15.4)
Installing collected packages: xgboost
Successfully installed xgboost-0.82
```

In [66]:
```
import xgboost as xgb

from sklearn.model_selection import KFold, train_test_split, GridSearchCV
```

In [67]:
```
xgb_params = {
    'eta': 0.05,
    'max_depth': 5,
    'subsample': 0.7,
    'colsample_bytree': 0.7,
    'objective': 'reg:linear',
    'eval_metric': 'rmse',
    'silent': 1
}
```

In [69]:
```
dtrain = xgb.DMatrix(data_train, label_train)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-69-f2c2fb056c93> in <module>
----> 1 dtrain = xgb.DMatrix(data_train, label_train)

~\Anaconda3\lib\site-packages\xgboost\core.py in __init__(self, data, label, mi
ssing, weight, silent, feature_names, feature_types, nthread)
    382         data, feature_names, feature_types = _maybe_pandas_data(data,
    383                                                                 feature
_names,
--> 384                                                                 feature
_types)
    385
    386         data, feature_names, feature_types = _maybe_dt_data(data,

~\Anaconda3\lib\site-packages\xgboost\core.py in _maybe_pandas_data(data, featu
re_names, feature_types)
    239         msg = """DataFrame.dtypes for data must be int, float or bool.
    240                 Did not expect the data types in fields """
--> 241         raise ValueError(msg + ', '.join(bad_fields))
    242
    243     if feature_names is None:

ValueError: DataFrame.dtypes for data must be int, float or bool.
                Did not expect the data types in fields Name, Platform, Genre,
 Publisher
```

In [70]:
```
lr_data_train=data_train[['NA_Sales','EU_Sales','JP_Sales','Other_Sales']]
lr_data_test=data_test[['NA_Sales','EU_Sales','JP_Sales','Other_Sales']]
lr_label_train=label_train
lr_label_test=label_test
```

In [71]:
```
#Linear Regression
from sklearn.linear_model import LinearRegression
lr = LinearRegression()
lr.fit(lr_data_train, lr_label_train)
lr_score_train = lr.score(lr_data_train, lr_label_train)
print("Training score: ",lr_score_train)
lr_score_test = lr.score(lr_data_test, lr_label_test)
print("Testing score: ",lr_score_test)
```

```
Training score:  0.9999889271662358
Testing score:  0.9999887509682348
```

The accuracy improved to 99%

In [75]:
```
y_pre = lr.predict(lr_data_test)
```

In [76]:
```
out_lr = pd.DataFrame({'Actual_Global_Sales': lr_label_test, 'Predict_Global_Sale
out_lr[['Actual_Global_Sales','Predict_Global_Sales','Diff']].head(5)
```

Out[76]:

	Actual_Global_Sales	Predict_Global_Sales	Diff
9317	0.14	0.130333	0.009667
14835	0.03	0.020339	0.009661
9752	0.12	0.120335	-0.000335
10251	0.11	0.110324	-0.000324
16565	0.01	0.010337	-0.000337

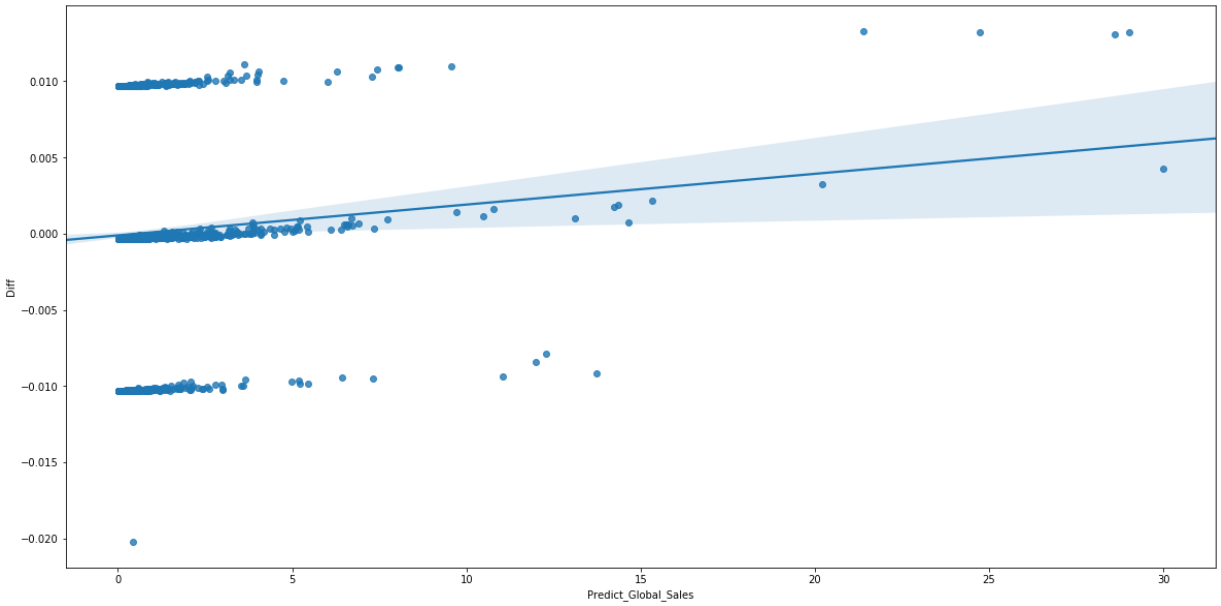
In [77]:
```
out_lr.shape
```

Out[77]:
```
(3259, 3)
```

In [78]:
```
sns.regplot(out_lr['Predict_Global_Sales'],out_lr['Diff'])
```

```
C:\Users\Aymen\Anaconda3\lib\site-packages\scipy\stats\stats.py:1713: FutureWar
ning: Using a non-tuple sequence for multidimensional indexing is deprecated; u
se `arr[tuple(seq)]` instead of `arr[seq]`. In the future this will be interpre
ted as an array index, `arr[np.array(seq)]`, which will result either in an err
or or a different result.
  return np.add.reduce(sorted[indexer] * weights, axis=axis) / sumval
```

Out[78]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x24b4cac4908>
```



In [79]:
```
#Ensemble XGBOOST & LINEAR REGRESSOR for train data
en_dtest=xgb.DMatrix(data_train)
y_xgb_pred = model.predict(en_dtest)

y_lr_pred = lr.predict(lr_data_train)

Ensemble=pd.DataFrame({'XGBOOST':y_xgb_pred ,'LINEAR_REG':y_lr_pred ,'GLOBAL_SALI
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-79-d8edccb37eeb> in <module>
      1 #Ensemble XGBOOST & LINEAR REGRESSOR for train data
----> 2 en_dtest=xgb.DMatrix(data_train)
      3 y_xgb_pred = model.predict(en_dtest)
      4
      5 y_lr_pred = lr.predict(lr_data_train)

~\Anaconda3\lib\site-packages\xgboost\core.py in __init__(self, data, label, mi
ssing, weight, silent, feature_names, feature_types, nthread)
    382             data, feature_names, feature_types = _maybe_pandas_data(data,
    383                                                                     feature
_names,
--> 384                                                                     feature
_types)
    385
    386             data, feature_names, feature_types = _maybe_dt_data(data,

~\Anaconda3\lib\site-packages\xgboost\core.py in _maybe_pandas_data(data, featu
re_names, feature_types)
    239             msg = """DataFrame.dtypes for data must be int, float or bool.
    240                     Did not expect the data types in fields """
--> 241             raise ValueError(msg + ', '.join(bad_fields))
    242
    243     if feature_names is None:

ValueError: DataFrame.dtypes for data must be int, float or bool.
                Did not expect the data types in fields Name, Platform, Genre,
 Publisher
```

In [80]:
```
corr=Ensemble.corr()
corr = (corr)
sns.heatmap(corr,
            xticklabels=corr.columns.values,
            yticklabels=corr.columns.values)
sns.plt.title('Heatmap of Correlation Matrix')
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-80-35c59d31881a> in <module>
----> 1 corr=Ensemble.corr()
      2 corr = (corr)
      3 sns.heatmap(corr,
      4             xticklabels=corr.columns.values,
      5             yticklabels=corr.columns.values)

NameError: name 'Ensemble' is not defined
```

In [ ]:

In [ ]:

In [ ]: