1. Business Problem

1.1 Description

Description

Walmart is an American multinational retail corporation that operates a chain of hypermarkets, discount department stores, and grocery stores, headquartered in Bentonville, Arkansas. The company was founded by Sam Walton in 1962 and incorporated on October 31, 1969.

In this recruiting competition, job-seekers are provided with historical sales data for 45 Walmart stores located in different regions. Each store contains many departments, and participants must project the sales for each department in each store. To add to the challenge, selected holiday markdown events are included in the dataset. These markdowns are known to affect sales, but it is challenging to predict which departments are affected and the extent of the impact.

Problem Statemtent

We are provided with historical sales data for 45 Walmart stores located in different regions. Each store contains a number of departments, and we are tasked with predicting the department-wide sales for each store.

1.2 Source

Data Source : https://www.kaggle.com/c/walmart-recruiting-store-sales-forecasting/data (https://www.kaggle.com/c/walmart-recruiting-store-sales-forecasting/data)

1.3 Real World / Business Objectives and Constraints

1. Predict the department-wide sales for each store.
2. No strict latency constraints.

2. Data

2.1 Data

2.1.1 Data Overview

Data Field Explaination

Data contains total 4 datasets

stores.csv

This file has 45 rows.

This is the historical training data, which covers to 2010-02-05 to 2012-11-01. Within this file you will find the following fields:

train.csv

- Store - the store number
- Dept - the department number
- Date - the week
- Weekly_Sales - sales for the given department in the given store
- IsHoliday - whether the week is a special holiday week This file contains anonymized information about the 45 stores, indicating the type and size of store.

test.csv This file is identical to train.csv, except we have withheld the weekly sales. You must predict the sales for each triplet of store, department, and date in this file.

features.csv

This file contains additional data related to the store, department, and regional activity for the given dates. It contains the following fields:

- Store - the store number
- Date - the week
- Temperature - average temperature in the region

- Fuel_Price - cost of fuel in the region
- MarkDown1-5 - anonymized data related to promotional markdowns that Walmart is running. MarkDown data is only available after Nov 2011, and is not available for all stores all the time. Any missing value is marked with an NA.
- CPI - the consumer price index Unemployment - the unemployment rate
- IsHoliday - whether the week is a special holiday week

In [0]:

Using Kaggle Datasets in Google Colab

Reference: https://stackoverflow.com/questions/49310470/using-kaggle-datasets-in-google-colab (https://stackoverflow.com/questions/49310470/using-kaggle-datasets-in-google-colab)

https://www.kaggle.com/general/51898 (https://www.kaggle.com/general/51898)

In [0]:
```
# Run this cell and select the kaggle.json file downloaded
# from the Kaggle account settings page.
from google.colab import files
files.upload()
```

Choose Files No file chosen

Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.

```
Saving kaggle.json to kaggle (1).json
```

Out[137]:
```
{'kaggle.json': b'{"username":"ishritam","key":"890acd089a8a7da97393fc2e21cb0a9
1"}'}
```

In [0]:
```
# Let's make sure the kaggle.json file is present.
!ls -lha kaggle.json
```

```
-rw-r--r-- 1 root root 64 Nov 25 07:18 kaggle.json
```

In [0]:
```
# Next, install the Kaggle API client.
!pip install -q kaggle
```

In [0]:
```
# The Kaggle API client expects this file to be in ~/.kaggle,
# so move it there.
!mkdir -p ~/.kaggle
!cp kaggle.json ~/.kaggle/

# This permissions change avoids a warning on Kaggle tool startup.
!chmod 600 ~/.kaggle/kaggle.json
```

In [0]:
```
# List available datasets. ---->   !kaggle datasets list
#-------------------------------> !kaggle competitions list
```

In [0]:
```
#lets search for our problem
!kaggle competitions list -s walmart-recruiting-store-sales-forecasting
```

```
Warning: Looks like you're using an outdated API Version, please consider updat
ing (server 1.5.6 / client 1.5.4)
ref                                             deadline             category
reward  teamCount  userHasEntered
----------------------------------------------  -------------------  -----------
------  ---------  --------------
walmart-recruiting-store-sales-forecasting      2014-05-05 23:59:00  Recruitment
Jobs        690            True
FacebookRecruiting                              2012-07-10 23:59:59  Recruitment
Jobs        418           False
yelp-recruiting                                 2013-06-30 23:59:00  Recruitment
Jobs        350           False
walmart-recruiting-trip-type-classification     2015-12-27 23:59:00  Recruitment
Jobs       1046           False
facebook-recruiting-iv-human-or-bot             2015-06-08 23:59:00  Recruitment
Jobs        985           False
facebook-recruiting-iii-keyword-extraction      2013-12-20 23:59:00  Recruitment
Jobs        367            True
walmart-recruiting-sales-in-stormy-weather      2015-05-25 23:59:00  Recruitment
Jobs        485           False
facebook-ii                                     2012-11-21 23:59:00  Recruitment
Jobs        111           False
```

In [0]:
```
!kaggle competitions download -c walmart-recruiting-store-sales-forecasting
```

```
Warning: Looks like you're using an outdated API Version, please consider updat
ing (server 1.5.6 / client 1.5.4)
Downloading features.csv.zip to /content
  0% 0.00/158k [00:00<?, ?B/s]
100% 158k/158k [00:00<00:00, 61.2MB/s]
Downloading sampleSubmission.csv.zip to /content
  0% 0.00/220k [00:00<?, ?B/s]
100% 220k/220k [00:00<00:00, 72.4MB/s]
Downloading stores.csv to /content
  0% 0.00/532 [00:00<?, ?B/s]
100% 532/532 [00:00<00:00, 517kB/s]
Downloading test.csv.zip to /content
  0% 0.00/235k [00:00<?, ?B/s]
100% 235k/235k [00:00<00:00, 69.3MB/s]
Downloading train.csv.zip to /content
  0% 0.00/2.47M [00:00<?, ?B/s]
100% 2.47M/2.47M [00:00<00:00, 81.4MB/s]
```

In [0]:
```
#OR for permanent store,moved all file to drive folder and unizip all in a single
import zipfile
zip_ref = zipfile.ZipFile("/content/drive/My Drive/ML self/walmart-recruiting-sto
zip_ref.extractall("/content/drive/My Drive/ML self")
zip_ref.close()
```

In [0]:
```
import os
os.listdir("/content/drive/My Drive/ML self")
```

Out[143]:
```
['walmart-recruiting-store-sales-forecasting.zip',
 'train.csv',
 'sampleSubmission.csv',
 'test.csv',
 'features.csv',
 'stores.csv',
 'train_with_feature',
 'test_with_feature']
```

Mounting Google Drive locally

In [0]:
```
from google.colab import drive
drive.mount('/content/drive')
```

```
Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?client_i
d=947318989803-6bn6qk8qdgf4n4g3pfee6491hc0brc4i.apps.googleusercontent.com&redi
rect_uri=urn%3aietf%3awg%3aoauth%3a2.0%3aoob&response_type=code&scope=email%20h
ttps%3a%2f%2fwww.googleapis.com%2fauth%2fdocs.test%20https%3a%2f%2fwww.googleap
is.com%2fauth%2fdrive%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdrive.photos.
readonly%20https%3a%2f%2fwww.googleapis.com%2fauth%2fpeopleapi.readonly (http
s://accounts.google.com/o/oauth2/auth?client_id=947318989803-6bn6qk8qdgf4n4g3pf
ee6491hc0brc4i.apps.googleusercontent.com&redirect_uri=urn%3aietf%3awg%3aoauth%
3a2.0%3aoob&response_type=code&scope=email%20https%3a%2f%2fwww.googleapis.com%2
fauth%2fdocs.test%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdrive%20https%3a%
2f%2fwww.googleapis.com%2fauth%2fdrive.photos.readonly%20https%3a%2f%2fwww.goog
leapis.com%2fauth%2fpeopleapi.readonly)

Enter your authorization code:
··********
Mounted at /content/drive
```

3. Exploratory Data Analysis

3.1 Data Loading and Cleaning

In [0]:
```
import warnings
warnings.filterwarnings("ignore")
import pandas as pd

import csv
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np

import re
import os

from datetime import datetime
from sklearn.ensemble import RandomForestRegressor
```

stores.csv

In [0]:
```
stores = pd.read_csv("/content/drive/My Drive/ML self/stores.csv")
print(f"Shape of stores.csv: {stores.shape}")
stores.head()
```

```
Shape of stores.csv: (45, 3)
```

Out[144]:

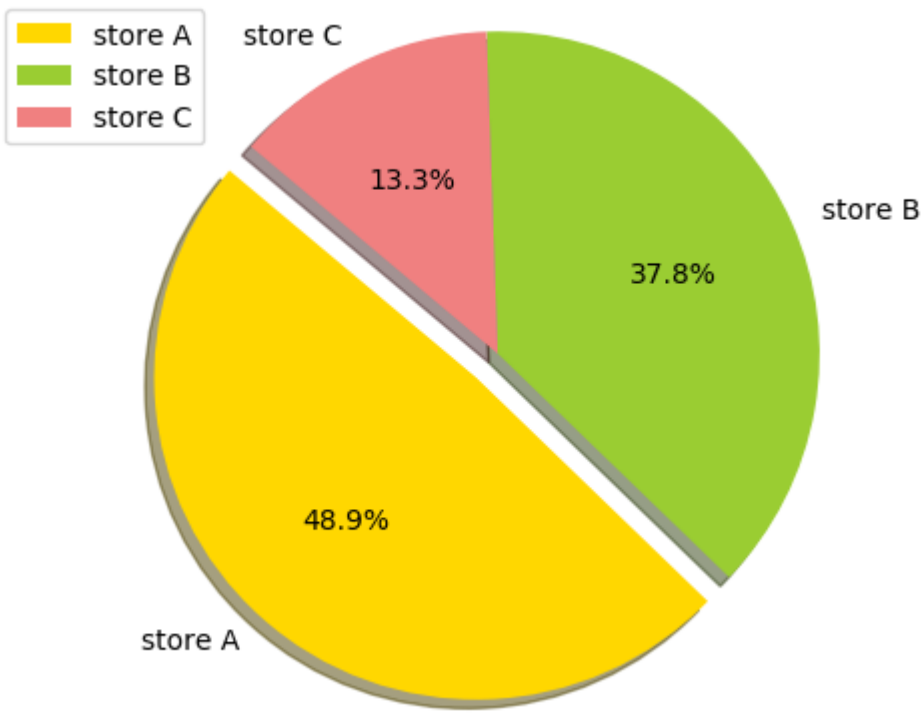
	Store	Type	Size
0	1	A	151315
1	2	A	202307
2	3	B	37392
3	4	A	205863
4	5	B	34875

In [0]:
```
print("Types of stores:")
stores['Type'].value_counts()
```

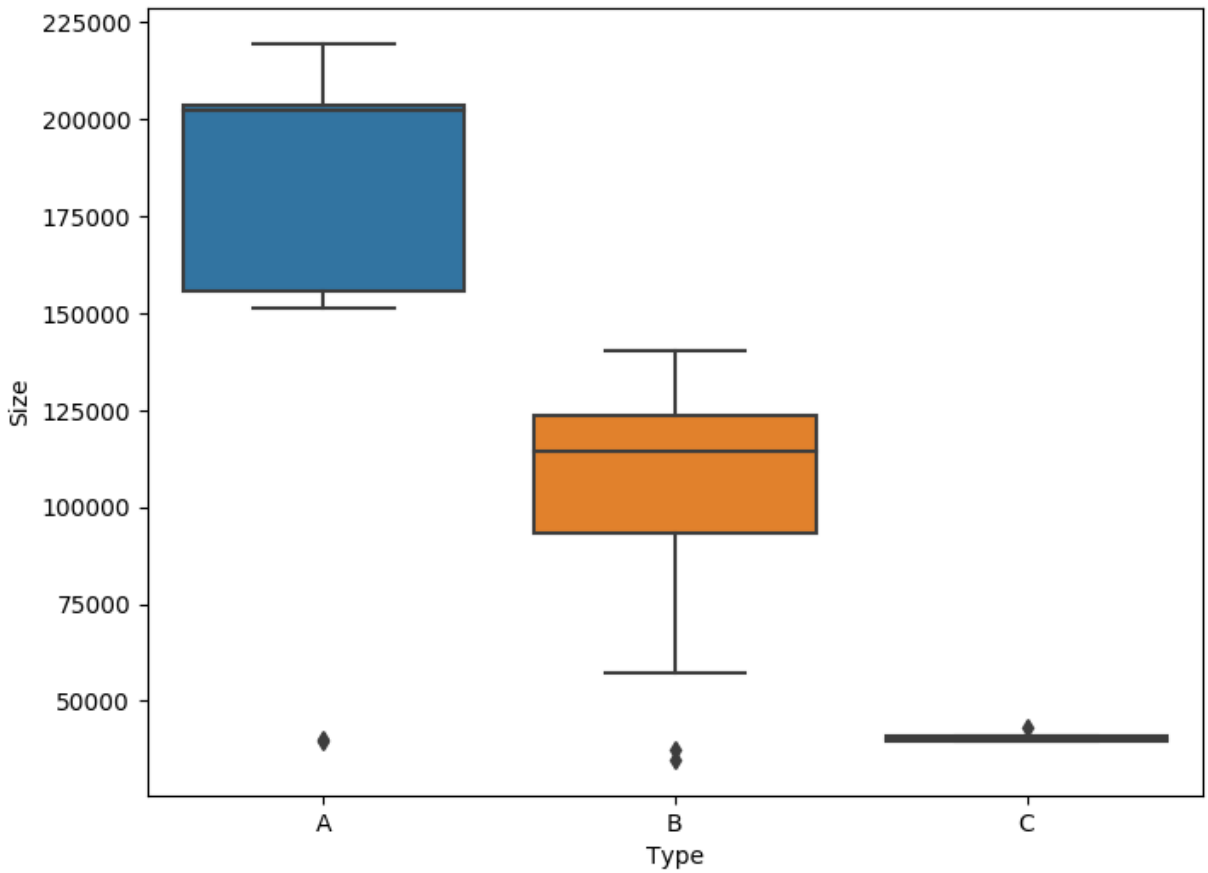
```
Types of stores:
```

Out[146]:
```
A    22
B    17
C     6
Name: Type, dtype: int64
```

In [0]:
```
#pie-chart for the visual representation of store types
#https://pythonspot.com/matplotlib-pie-chart/
# Data to plot
labels = 'store A','store B','store C'
sizes = [(22/(45))*100,(17/(45))*100,(6/(45))*100]
colors = ['gold', 'yellowgreen', 'lightcoral']
explode = (0.1, 0, 0)  # explode 1st slice

# Plot
plt.pie(sizes, explode=explode, labels=labels, colors=colors,
autopct='%1.1f%%', shadow=True, startangle=140)
plt.legend(labels, loc="best")
plt.axis('equal')
plt.show()
```

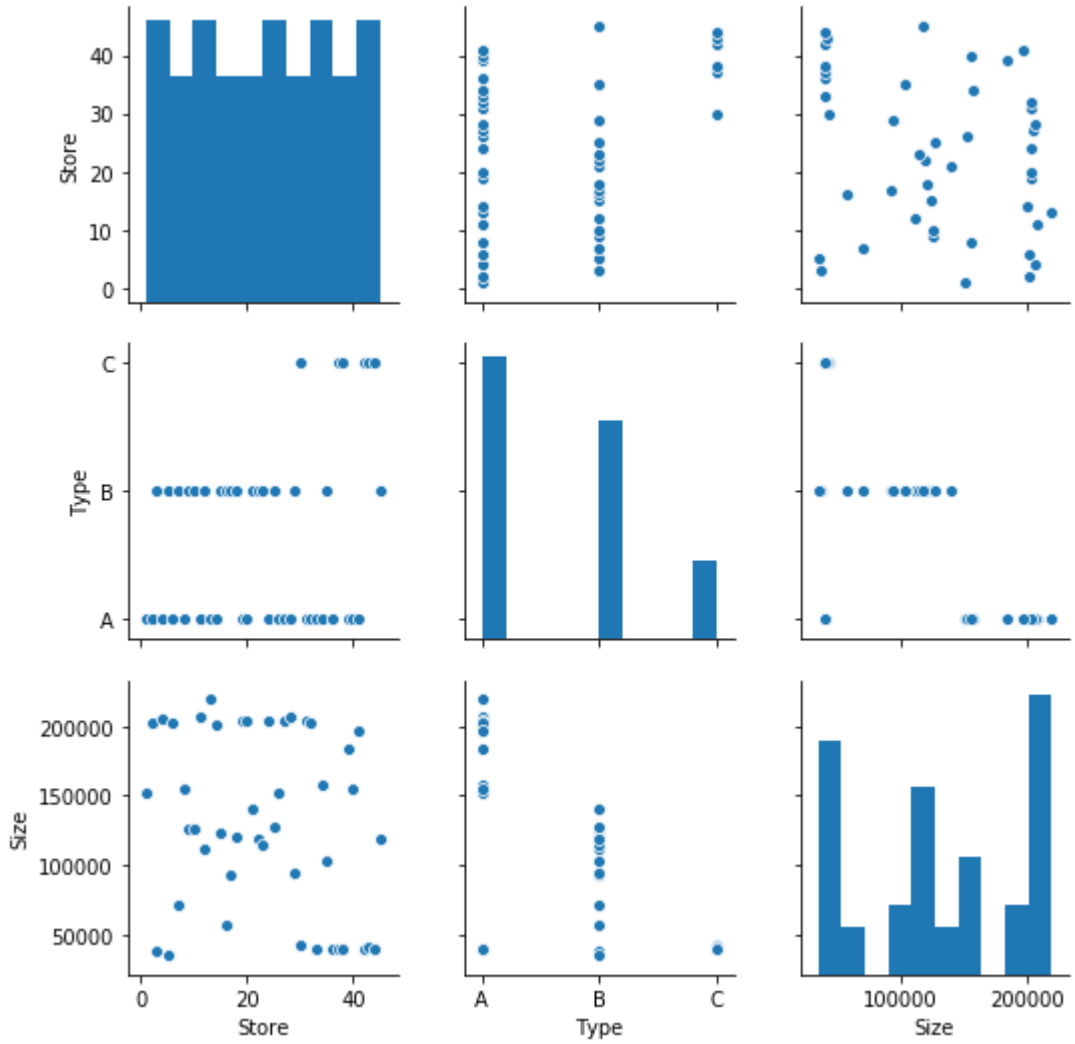


In [0]:
```
# boxplot for sizes of types of stores
store_type = pd.concat([stores['Type'], stores['Size']], axis=1)
f, ax = plt.subplots(figsize=(8, 6))
fig = sns.boxplot(x='Type', y='Size', data=store_type)
```



In [0]:
```
#pairplot
sns.pairplot(stores, vars=['Store','Type','Size'])
```

Out[98]: <seaborn.axisgrid.PairGrid at 0x7f816ae12588>



Observation:

- There are 45 stores in total.
- There are a total of 3 types of stores: Type A, B and C.
- By boxplot and piechart, we can say that type A store is the largest store and C is the smallest
- There is no overlapped area in size among A, B, and C.

In [0]:

Train.csv

This is the historical testing data, which covers to 2010-02-05 to 2012-11-01. Within this file you will find the following fields:

- Store - the store number
- Dept - the department number
- Date - the week
- Weekly_Sales - sales for the given department in the given store
- IsHoliday - whether the week is a special holiday week

In [0]:

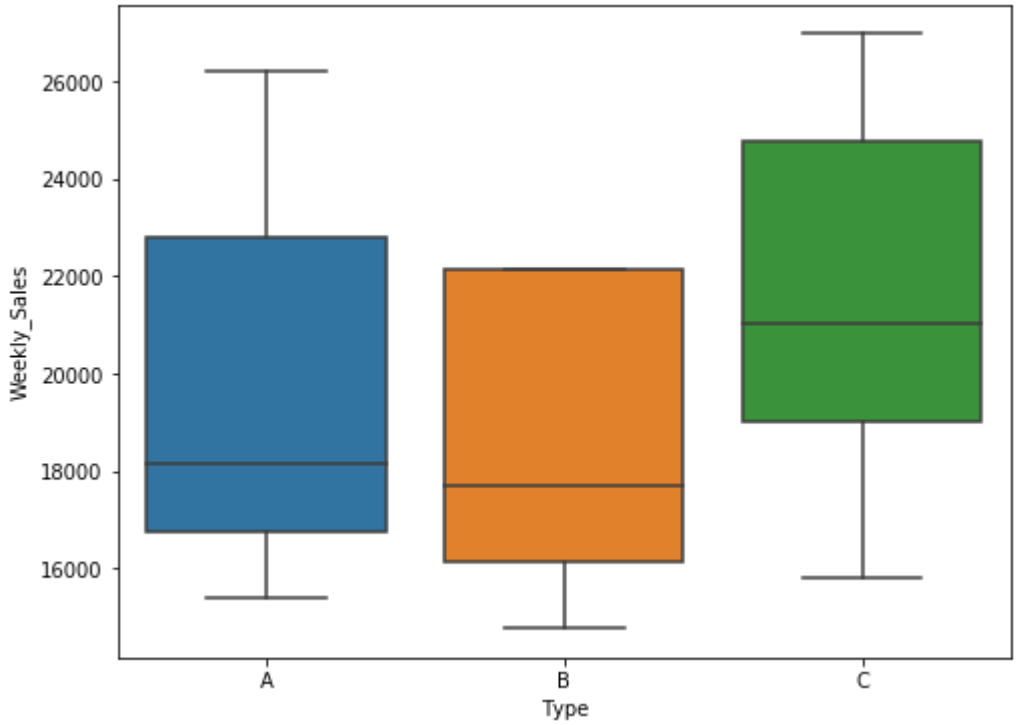
```
import pandas as pd
train = pd.read_csv("/content/drive/My Drive/ML self/train.csv")
print(f"Shape of train.csv: {train.shape}")
train.head()
```

```
Shape of train.csv: (421570, 5)
```

Out[171]:

	Store	Dept	Date	Weekly_Sales	IsHoliday
0	1	1	2010-02-05	24924.50	False
1	1	1	2010-02-12	46039.49	True
2	1	1	2010-02-19	41595.55	False
3	1	1	2010-02-26	19403.54	False
4	1	1	2010-03-05	21827.90	False

In [0]:
```
#boxplot for weekly sales for different types of stores :
store_sale = pd.concat([stores['Type'], train['Weekly_Sales']], axis=1)
f, ax = plt.subplots(figsize=(8, 6))
fig = sns.boxplot(x='Type', y='Weekly_Sales', data=store_sale, showfliers=False)
```



In [0]:
```
train['IsHoliday'].value_counts()
```

Out[103]:
```
False    391909
True      29661
Name: IsHoliday, dtype: int64
```

In [0]:
```
objects = ('Non holidays','Holidays')
y_pos = np.arange(len(objects))
```

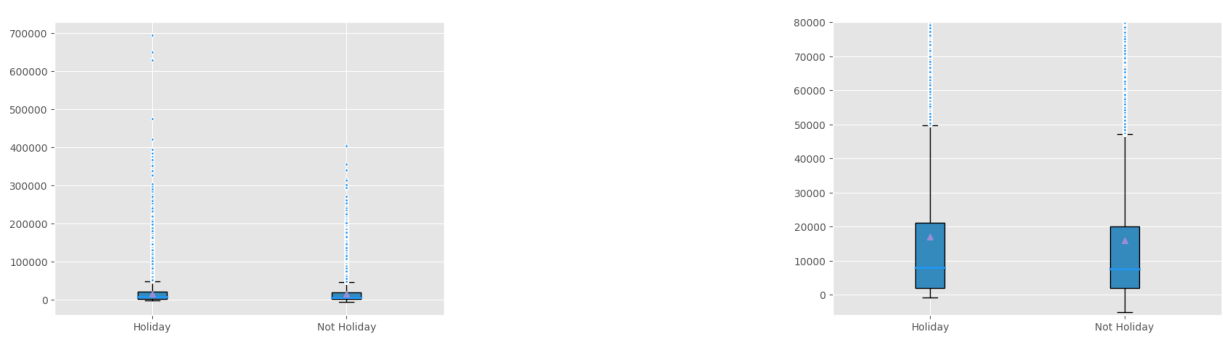
In [0]:
```
y_pos
```

Out[106]:
```
array([0, 1])
```

In [0]:
```
# total count of sales on holidays and non holidays
print('sales on non-holiday : ',train[train['IsHoliday']==False]['Weekly_Sales']
print('sales on holiday : ',train[train['IsHoliday']==True]['Weekly_Sales'].coun
```

```
sales on non-holiday :  391909
sales on holiday :  29661
```

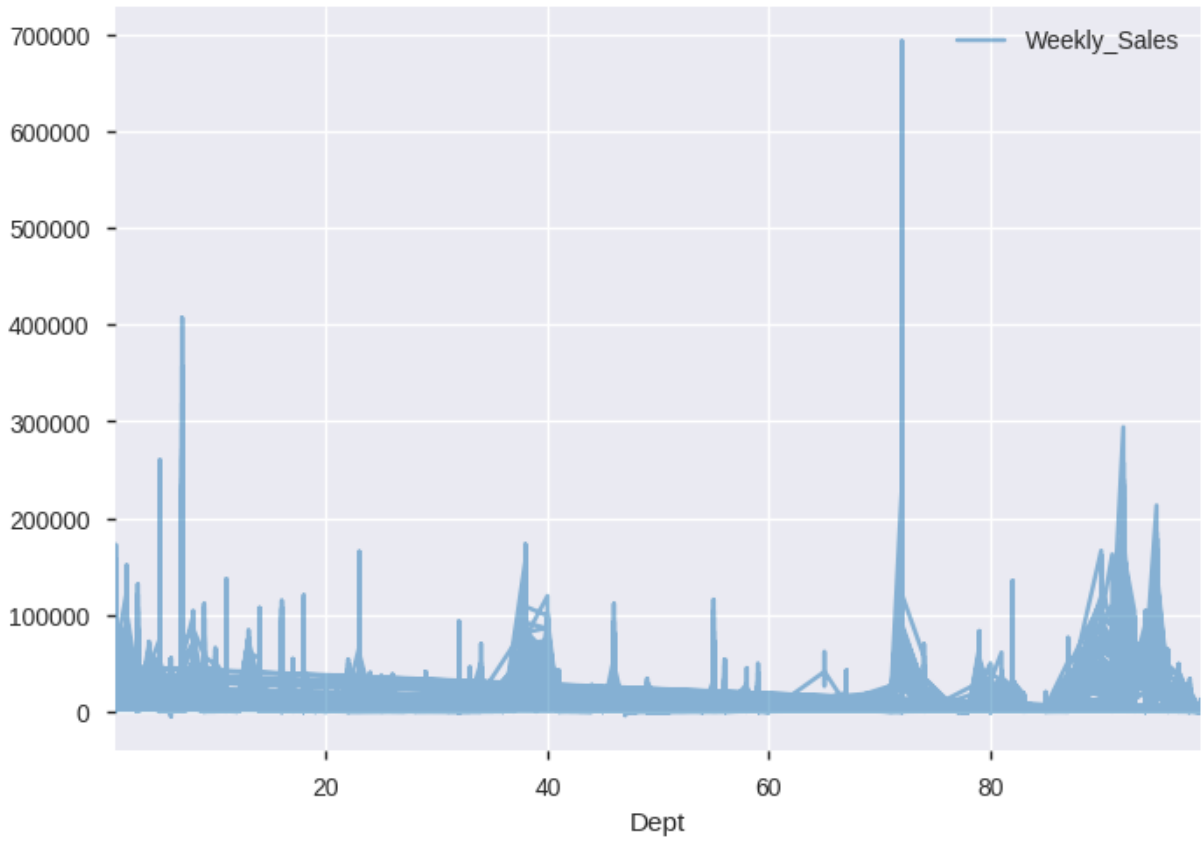
In [0]:
```
#https://www.kaggle.com/yepp2411/walmart-prediction-1-eda-with-time-and-space
plt.style.use('ggplot')
fig, axes = plt.subplots(1,2, figsize = (20,5))
fig.subplots_adjust(wspace=1, hspace=1)
fig.subplots_adjust(left=0.1, right=0.9, bottom=0.1, top=0.9)

sales_holiday=train[['IsHoliday','Weekly_Sales']]
target=[sales_holiday['Weekly_Sales'].loc[sales_holiday['IsHoliday']==True],sale
labels=['Holiday','Not Holiday']

#median
medianprop={'color':'#2196F3',
            'linewidth': 2,
            'linestyle':'-'}
# outliers

flierprop={'color' : '#EC407A',
          'marker' : 'o',
          'markerfacecolor': '#2196F3',
          'markeredgecolor':'white',
          'markersize' : 3,
          'linestyle' : 'None',
          'linewidth' : 0.1}



axes[0].boxplot(target,labels=labels, patch_artist = 'Patch',
                  showmeans=True,
                  flierprops=flierprop,
                  medianprops=medianprop)


axes[1].boxplot(target,labels=labels, patch_artist = 'Patch',
                  showmeans=True,
                  flierprops=flierprop,
                  medianprops=medianprop)

axes[1].set_ylim(-6000,80000)

plt.show()
```



In [0]:

In [0]:
```
train.plot(kind='line', x='Dept', y='Weekly_Sales', alpha=1.5,fig=(4,5))
```

Out[141]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f1e15f8bc50>
```



Observation:

- Sales in holiday is a little bit more than sales in not-holiday
- From this plot, we notice Deptartment with the highest sales lies between Dept 60 and 80

In [0]:
```

```

test.csv

This file is identical to train.csv, except we have withheld the weekly sales. You must predict the sales for each triplet of store, department, and date in this file.

In [0]:
```
import pandas as pd
test = pd.read_csv("/content/drive/My Drive/ML self/test.csv")
print(f"Shape of test.csv: {test.shape}")
test.head()
```

```
Shape of test.csv: (115064, 4)
```

Out[153]:

	Store	Dept	Date	IsHoliday
0	1	1	2012-11-02	False
1	1	1	2012-11-09	False
2	1	1	2012-11-16	False
3	1	1	2012-11-23	True
4	1	1	2012-11-30	False

Total we have **421570 values** for **training** and **115064** for **testing** as part of the competition. But we will **work only on 421570 data** as we have labels to test the performance and accuracy of models.

features.csv

This file contains additional data related to the store, department, and regional activity for the given dates. It contains the following fields:

- Store - the store number
- Date - the week
- Temperature - average temperature in the region
- Fuel_Price - cost of fuel in the region
- MarkDown1-5 - anonymized data related to promotional markdowns that Walmart is
- running. MarkDown data is only available after Nov 2011, and is not available * for all stores all the time. Any missing value is marked with an NA.
- CPI - the consumer price index
- Unemployment - the unemployment rate
- IsHoliday - whether the week is a special holiday week

In [0]:
```
import pandas as pd
features = pd.read_csv("/content/drive/My Drive/ML self/features.csv")
print(f"Shape of features.csv: {features.shape}")
features.head()
```

```
Shape of features.csv: (8190, 12)
```

Out[154]:

	Store	Date	Temperature	Fuel_Price	MarkDown1	MarkDown2	MarkDown3	MarkDown4	MarkD
0	1	2010-02-05	42.31	2.572	NaN	NaN	NaN	NaN	
1	1	2010-02-12	38.51	2.548	NaN	NaN	NaN	NaN	
2	1	2010-02-19	39.93	2.514	NaN	NaN	NaN	NaN	
3	1	2010-02-26	46.63	2.561	NaN	NaN	NaN	NaN	
4	1	2010-03-05	46.50	2.625	NaN	NaN	NaN	NaN	

In [0]:

Advance Feature

In [0]:
```
#https://stackoverflow.com/questions/33365055/attributeerror-can-only-use-dt-acce
#https://pandas.pydata.org/pandas-docs/stable/reference/series.html#datetime-prop
train['Date'] = pd.to_datetime(train['Date'])
test['Date'] = pd.to_datetime(test['Date'])

#week feature
train['Week'] = train['Date'].dt.week
test['Week'] = test['Date'].dt.week
```

In [0]:
```
train['Day_of_week'] =train['Date'].dt.dayofweek
test['Day_of_week'] =test['Date'].dt.dayofweek

train['Month'] =train['Date'].dt.month
test['Month'] =test['Date'].dt.month

train['Year'] =train['Date'].dt.year
test['Year'] =test['Date'].dt.year

train['Day'] =train['Date'].dt.day
test['Day'] =test['Date'].dt.day
```

In [0]:

In [0]:
```
#train data
#let's take mean of Temp and Unemployment
train_with_feature['Temp_mean'] = train_with_feature['Temperature'].mean()
train_with_feature['Unemployment_mean'] = train_with_feature['Unemployment'].mea

#test data
test_with_feature['Temp_mean'] = test_with_feature['Temperature'].mean()
test_with_feature['Unemployment_mean'] = test_with_feature['Unemployment'].mean(
```

Merge all the features

In [0]:
```
features['Date'] = pd.to_datetime(features['Date'])

#merge all the features
train_with_feature = pd.merge_asof(train, features, on='Store',by='Date')
test_with_feature = pd.merge_asof(test, features, on='Store',by='Date')
```

In [0]:
```
train_with_feature.head()
```

Out[178]:

	Store	Dept	Date	Weekly_Sales	IsHoliday_x	Week	Day_of_week	Month	Year	Day	Temper
0	1	1	2010-02-05	24924.50	False	5	4	2	2010	5	
1	1	1	2010-02-12	46039.49	True	6	4	2	2010	12	
2	1	1	2010-02-19	41595.55	False	7	4	2	2010	19	
3	1	1	2010-02-26	19403.54	False	8	4	2	2010	26	
4	1	1	2010-03-05	21827.90	False	9	4	3	2010	5	

In [0]:
```
#merge all the features
train_with_feature_new = pd.merge(train_with_feature,stores)
test_with_feature_new = pd.merge(test_with_feature,stores)
```

In [0]:
```
train_with_feature_new.shape
```

Out[180]: (421570, 22)

In [0]:
```
train_with_feature_new.head(1)
```

Out[181]:

	Store	Dept	Date	Weekly_Sales	IsHoliday_x	Week	Day_of_week	Month	Year	Day	Temper
0	1	1	2010-02-05	24924.5	False	5	4	2	2010	5	

In [0]:
```
#drop the dublicate of IsHoliday column
train_with_feature = train_with_feature_new.drop(columns=['IsHoliday_x'])
test_with_feature = test_with_feature_new.drop(columns=['IsHoliday_x'])

#let's rename the IsHoliday_y column to IsHoliday
train_with_feature = train_with_feature.rename(columns={"IsHoliday_y": "IsHolida
test_with_feature = test_with_feature.rename(columns={"IsHoliday_y": "IsHoliday"
```

In [0]:
```
print(train_with_feature.shape)
train_with_feature.head()
```

```
(421570, 21)
```

Out[183]:

	Store	Dept	Date	Weekly_Sales	Week	Day_of_week	Month	Year	Day	Temperature	Fuel_P
0	1	1	2010-02-05	24924.50	5	4	2	2010	5	42.31	2
1	1	1	2010-02-12	46039.49	6	4	2	2010	12	38.51	2
2	1	1	2010-02-19	41595.55	7	4	2	2010	19	39.93	2
3	1	1	2010-02-26	19403.54	8	4	2	2010	26	46.63	2
4	1	1	2010-03-05	21827.90	9	4	3	2010	5	46.50	2

In [0]:

changing IsHoliday column with Flase to be 0 and True to be 1

In [0]:
```
def paron(x):
    if x == False:
        return 0
    return 1
#Train.csv
actualScore = train_with_feature['IsHoliday']
posiveNegave = actualScore.map(paron)
train_with_feature['IsHoliday'] = posiveNegave
print("Shape of train_with_feature: ", train_with_feature.shape)
train_with_feature.head(3)
```

```
Shape of train_with_feature:  (421570, 21)
```

Out[184]:

	Store	Dept	Date	Weekly_Sales	Week	Day_of_week	Month	Year	Day	Temperature	Fuel_P
0	1	1	2010-02-05	24924.50	5	4	2	2010	5	42.31	2
1	1	1	2010-02-12	46039.49	6	4	2	2010	12	38.51	2
2	1	1	2010-02-19	41595.55	7	4	2	2010	19	39.93	2

In [0]:
```
#Test.csv

actualScore_test = test_with_feature['IsHoliday']
posiveNegave = actualScore.map(paron)
test_with_feature['IsHoliday'] = posiveNegave
print("Shape of test_with_feature: ", test_with_feature.shape)
test_with_feature.head(3)
```

```
Shape of test_with_feature:  (115064, 20)
```

Out[185]:

	Store	Dept	Date	Week	Day_of_week	Month	Year	Day	Temperature	Fuel_Price	MarkDowr
0	1	1	2012-11-02	44	4	11	2012	2	55.32	3.386	6766.4
1	1	1	2012-11-09	45	4	11	2012	9	61.24	3.314	11421.3
2	1	1	2012-11-16	46	4	11	2012	16	52.92	3.252	9696.2

In [0]:

In [0]:
```
def type_count(x):
    ''' This function will chang
    IsHoliday column with Flase to be 0
    and True to be 1'''

    if x == 'A':
        return 1
    elif x == 'B':
        return 2
    return 3

#Train.csv
actualScore = train_with_feature['Type']
type_coun = actualScore.map(type_count)
train_with_feature['Types'] = type_coun
```

In [0]:
```
#Test.csv
actualScore = test_with_feature['Type']
type_coun = actualScore.map(type_count)
test_with_feature['Types'] = type_coun
```

In [0]:
```
train_with_feature.describe()
```

In [0]:
```
#train data
#let's take mean of Temp and Unemployment
train_with_feature['Temp_mean'] = train_with_feature['Temperature'].mean()
train_with_feature['Unemployment_mean'] = train_with_feature['Unemployment'].mea

#test data
test_with_feature['Temp_mean'] = test_with_feature['Temperature'].mean()
test_with_feature['Unemployment_mean'] = test_with_feature['Unemployment'].mean(
```

In [0]:
```
train_with_feature=train_with_feature.drop(['Type'], axis=1)
test_with_feature=test_with_feature.drop(['Type'], axis=1)
```

In [0]:
```
train_with_feature.head(2)
```

Out[191]:

	Store	Dept	Date	Weekly_Sales	Week	Day_of_week	Month	Year	Day	Temperature	Fuel_P
0	1	1	2010-02-05	24924.50	5	4	2	2010	5	42.31	2
1	1	1	2010-02-12	46039.49	6	4	2	2010	12	38.51	2

Train and Test dataset Correlations

In [0]:
```
#train
print(train_with_feature.shape)
train_with_feature.head()
```

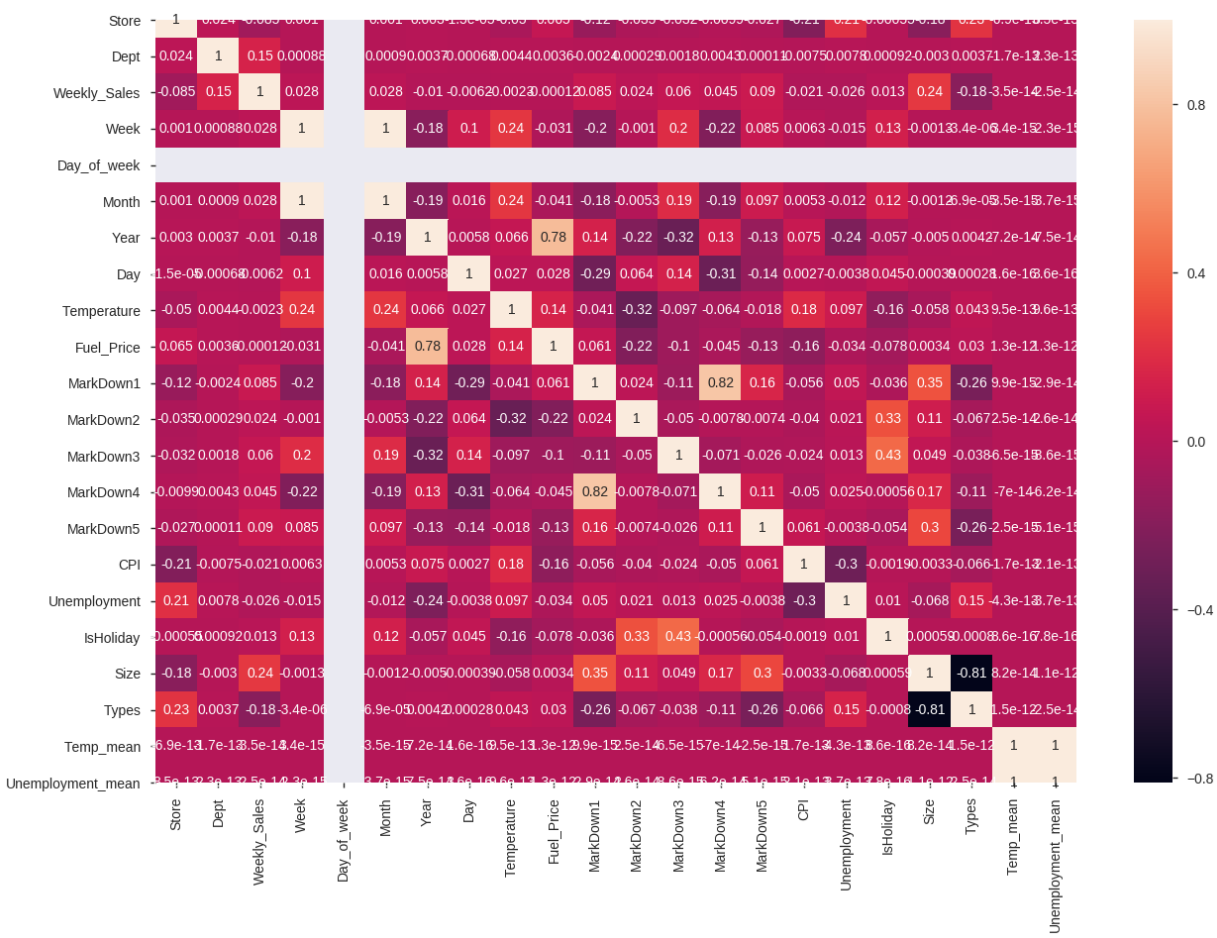
```
(421570, 23)
```

Out[193]:

	Store	Dept	Date	Weekly_Sales	Week	Day_of_week	Month	Year	Day	Temperature	Fuel_P
0	1	1	2010-02-05	24924.50	5	4	2	2010	5	42.31	2
1	1	1	2010-02-12	46039.49	6	4	2	2010	12	38.51	2
2	1	1	2010-02-19	41595.55	7	4	2	2010	19	39.93	2
3	1	1	2010-02-26	19403.54	8	4	2	2010	26	46.63	2
4	1	1	2010-03-05	21827.90	9	4	3	2010	5	46.50	2

In [0]:
```
corr = train_with_feature.corr()
plt.figure(figsize=(15, 10))
sns.heatmap(corr, annot=True)
plt.plot()
```

Out[194]:
```
[]
```



In [0]:
```
#test
print(test_with_feature.shape)
test_with_feature.head()
```

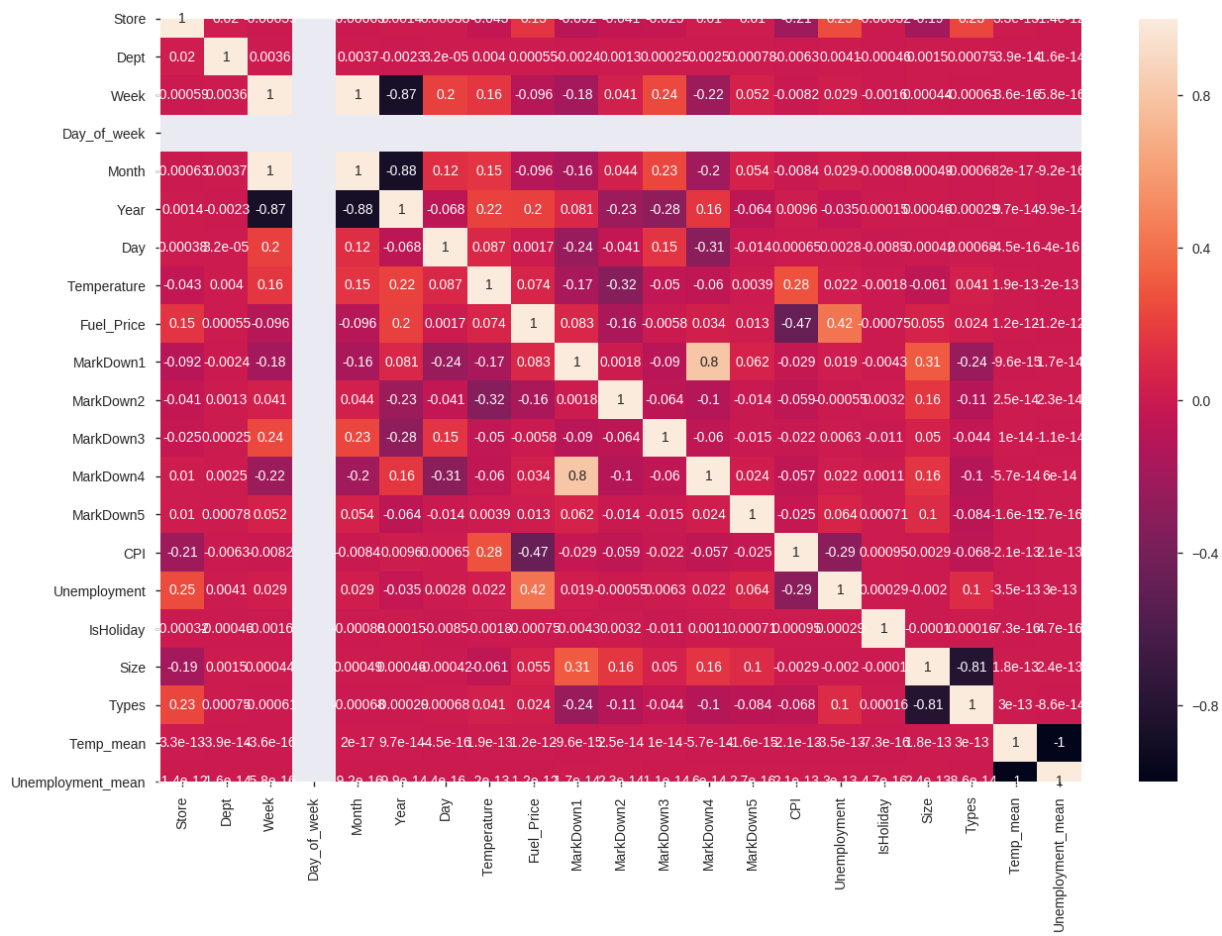
```
(115064, 22)
```

Out[195]:

	Store	Dept	Date	Week	Day_of_week	Month	Year	Day	Temperature	Fuel_Price	MarkDown
0	1	1	2012-11-02	44	4	11	2012	2	55.32	3.386	6766.4
1	1	1	2012-11-09	45	4	11	2012	9	61.24	3.314	11421.3
2	1	1	2012-11-16	46	4	11	2012	16	52.92	3.252	9696.2
3	1	1	2012-11-23	47	4	11	2012	23	56.23	3.211	883.5
4	1	1	2012-11-30	48	4	11	2012	30	52.34	3.207	2460.0

In [0]:
```
corr = test_with_feature.corr()
plt.figure(figsize=(15, 10))
sns.heatmap(corr, annot=True)
plt.plot()
```

Out[196]:
```
[]
```



In [0]:

```

```

Finding Missing Values

In [0]:
```
print(train_with_feature.isnull().sum())
print("*"*30)
print(test_with_feature.isnull().sum())
```

```
Store                     0
Dept                      0
Date                      0
Weekly_Sales              0
Week                      0
Day_of_week               0
Month                     0
Year                      0
Day                       0
Temperature               0
Fuel_Price                0
MarkDown1            270889
MarkDown2            310322
MarkDown3            284479
MarkDown4            286603
MarkDown5            270138
CPI                       0
Unemployment              0
IsHoliday                 0
Size                      0
Types                     0
Temp_mean                 0
Unemployment_mean         0
dtype: int64
******************************
Store                     0
Dept                      0
Date                      0
Week                      0
Day_of_week               0
Month                     0
Year                      0
Day                       0
Temperature               0
Fuel_Price                0
MarkDown1               149
MarkDown2             28627
MarkDown3              9829
MarkDown4             12888
MarkDown5                 0
CPI                   38162
Unemployment          38162
IsHoliday                 0
Size                      0
Types                     0
Temp_mean                 0
Unemployment_mean         0
dtype: int64
```

Other Missing Value Treatment like Markdown, Imputing it with Zero(No Markdown)

We can probably safely fill all missing values with zero.

For the markdowns this means that there was no markdown.

In [0]:
```
train_with_feature=train_with_feature.fillna(0)
test_with_feature=test_with_feature.fillna(0)
```

In [0]:
```
train_with_feature.head(5)
```

Out[199]:

	Store	Dept	Date	Weekly_Sales	Week	Day_of_week	Month	Year	Day	Temperature	Fuel_P
0	1	1	2010-02-05	24924.50	5	4	2	2010	5	42.31	2
1	1	1	2010-02-12	46039.49	6	4	2	2010	12	38.51	2
2	1	1	2010-02-19	41595.55	7	4	2	2010	19	39.93	2
3	1	1	2010-02-26	19403.54	8	4	2	2010	26	46.63	2
4	1	1	2010-03-05	21827.90	9	4	3	2010	5	46.50	2

In [0]:
```
#check NULL
print(train_with_feature.isnull().sum())
print("*"*50)
print(test_with_feature.isnull().sum())
```

```
Store                0
Dept                 0
Date                 0
Weekly_Sales         0
Week                 0
Day_of_week          0
Month                0
Year                 0
Day                  0
Temperature          0
Fuel_Price           0
MarkDown1            0
MarkDown2            0
MarkDown3            0
MarkDown4            0
MarkDown5            0
CPI                  0
Unemployment         0
IsHoliday            0
Size                 0
Types                0
Temp_mean            0
Unemployment_mean    0
dtype: int64
**************************************************
Store                0
Dept                 0
Date                 0
Week                 0
Day_of_week          0
Month                0
Year                 0
Day                  0
Temperature          0
Fuel_Price           0
MarkDown1            0
MarkDown2            0
MarkDown3            0
MarkDown4            0
MarkDown5            0
CPI                  0
Unemployment         0
IsHoliday            0
Size                 0
Types                0
Temp_mean            0
Unemployment_mean    0
dtype: int64
```

In [0]:

Let's pickle our final train test dataset with all features

In [0]:
```
import pickle

# open a file, where you want to store the data
file111 = open('/content/drive/My Drive/ML self/train_with_feature_final', 'wb')
file222 = open('/content/drive/My Drive/ML self/test_with_feature_final', 'wb')


# dump information to that file
pickle.dump(train_with_feature, file111)
pickle.dump(test_with_feature, file222)


# close the file
file111.close()
file222.close()
```

In [0]:
```
#load the data
import pickle

# open a file, where you want to store the data
file1 = open('/content/drive/My Drive/ML self/train_with_feature_final', 'rb')
file2 = open('/content/drive/My Drive/ML self/test_with_feature_final', 'rb')


# load files
train_with_feature = pickle.load(file1)
test_with_feature = pickle.load(file2)

# close the files
file1.close()
file2.close()
```

In [0]:

In [0]:
```
# After some submition testing, I got to know that mean of feature is improving t
# so, let's add mean of Fuel and mean of CPI feature
#train data
train_with_feature['Fuel_Price_mean'] = train_with_feature['Fuel_Price'].mean()
train_with_feature['CPI_mean'] = train_with_feature['CPI'].mean()

#test data
test_with_feature['CPI_mean'] = test_with_feature['CPI'].mean()
test_with_feature['Fuel_Price_mean'] = test_with_feature['Fuel_Price'].mean()
```

Define training and testing set

In [0]:
```
#/content/submission predicted_rf_25Nov.csv
#features_drop=['Unemployment','CPI','Day_of_week', 'Type'] #by droping all marke
#train_final=train_with_feature_new.drop(features_drop, axis=1)
#test_final=test_with_feature_new.drop(features_drop, axis=1)
```

In [0]:
```
features_drop=['CPI','Unemployment','Fuel_Price','Day_of_week','MarkDown1','MarkD
train_final=train_with_feature.drop(features_drop, axis=1)
test_final=test_with_feature.drop(features_drop, axis=1)
```

Final Train_Test Data

In [0]:
```
#### train X= Exery thing except Weekly_Sales
train_X=train_final.drop(['Weekly_Sales','Date'], axis=1)


#### train Y= Only Weekly_Sales
train_y=train_final['Weekly_Sales']
test_X=test_final.drop('Date',axis=1).copy()

train_X.shape, train_y.shape, test_X.shape
```

Out[58]:
```
((421570, 14), (421570,), (115064, 14))
```

In [0]:
```
train_X.head(2)
```

Out[59]:

	Store	Dept	Week	Month	Year	Day	Temperature	IsHoliday	Size	Types	Temp_mean	Un
0	1	1	5	2	2010	5	42.31	0	151315	1	60.090059	
1	1	1	6	2	2010	12	38.51	1	151315	1	60.090059	

In [0]:
```
test_X.head(2)
```

Out[60]:

	Store	Dept	Week	Month	Year	Day	Temperature	IsHoliday	Size	Types	Temp_mean	Un
0	1	1	44	11	2012	2	55.32	0	151315	1	53.941804	
1	1	1	45	11	2012	9	61.24	1	151315	1	53.941804	

4. Machine Learning Models

Model to Predict the Next Year's Sales

Dimention of the final dataset is not too large, bagged decision trees like Random Forest and Extra Trees can be used to estimate the importance of features.

In [0]:
```
clf = RandomForestRegressor(n_estimators=100)
clf.fit(train_X, train_y)
y_pred_rf=clf.predict(test_X)
acc_rf= round(clf.score(train_X, train_y) * 100,3)
print ("Accuracy: {acc_rf} %")
```

```
Accuracy: 99 %
```

Prediction

Prediction using our Random Forest model

In [0]:
```

#https://stackoverflow.com/questions/52411992/how-to-produce-a-kaggle-submission
import pandas as pd
submission = pd.DataFrame({
        "Id": test.Store.astype(str)+'_'+test.Dept.astype(str)+'_'+test.Date.asty
        "Weekly_Sales": y_pred_rf
    })

submission.to_csv('submission predicted_RF_Final_3.csv', index=False)
```

In [0]:
```
submission.head()
```

Out[63]:

	Id	Weekly_Sales
0	1_1_2012-11-02	35240.2785
1	1_1_2012-11-09	21429.0745
2	1_1_2012-11-16	19465.2433
3	1_1_2012-11-23	20105.2957
4	1_1_2012-11-30	26118.5569

Let's upload our predicted CSV

In [0]:
```
!pip install -q kaggle
```

In [0]:
```
!mkdir -p ~/.kaggle
!cp kaggle.json ~/.kaggle/
```

In [0]:
```
!kaggle datasets list
```

```
Warning: Your Kaggle API key is readable by other users on this system! To fix
this, you can run 'chmod 600 /root/.kaggle/kaggle.json'
Warning: Looks like you're using an outdated API Version, please consider updat
ing (server 1.5.6 / client 1.5.4)
ref                                                             title
size  lastUpdated          downloadCount
--------------------------------------------------------------  ----------------------
---------------------------  -----  -------------------  ------------
chirin/africa-economic-banking-and-systemic-crisis-data  Africa Economic, Banki
ng and Systemic Crisis Data   14KB  2019-07-21 02:00:17           5499
tristan581/17k-apple-app-store-strategy-games            17K Mobile Strategy Ga
mes                            8MB  2019-08-26 08:22:16          12743
gustavomodelli/forest-fires-in-brazil                    Forest Fires in Brazil
31KB  2019-08-24 16:09:16          15062
akhilv11/border-crossing-entry-data                      Border Crossing Entry
Data                           4MB  2019-08-21 14:51:34           6267
ruslankl/european-union-lgbt-survey-2012                 EU LGBT Survey
610KB  2019-07-19 11:15:25           2201
kapilverma/hindi-bible                                   Hindi Bible
5MB  2019-09-07 18:04:35            454
shuyangli94/food-com-recipes-and-user-interactions       Food.com Recipes and I
nteractions                  267MB  2019-11-08 01:18:21           4519
rajeevw/ufcdata                                          UFC-Fight historical d
ata from 1993 to 2019          3MB  2019-07-05 09:58:02           9636
pascalbliem/european-social-survey-ess-8-ed21-201617     European Social Survey
(ESS) 8 ed2.1 (2016/17)      10MB  2019-09-29 07:30:37           1041
grikomsn/amazon-cell-phones-reviews                      Amazon Cell Phones Rev
iews                          10MB  2019-09-29 02:26:48           3827
hmavrodiev/sofia-air-quality-dataset                     Sofia air quality data
set                            3GB  2019-09-14 05:48:09           1908
brkurzawa/us-breweries                                   US Breweries
76KB  2019-10-02 03:15:27            2931
jojoker/singapore-airbnb                                 Singapore Airbnb
350KB  2019-09-25 22:05:44           3278
srikantsahu/co2-and-ghg-emission-data                    CO2 and GHG emission d
ata                           91KB  2019-09-26 20:10:59           2556
mabusalah/brent-oil-prices                               Brent Oil Prices
38KB  2019-10-14 12:31:05            2401
irinachuchueva/russian-wholesale-electricity-market      Russian Wholesale Elec
tricity Market                 1MB  2019-10-09 08:20:57           1028
smid80/canadian-federal-election-results-timeseries      Canadian Federal Elect
ion Results (Timeseries)      18MB  2019-10-09 11:08:29            982
nitinsss/military-expenditure-of-countries-19602019       Military Spending of C
ountries (1960-2019)          55KB  2019-10-10 12:17:37           4208
valentynsichkar/traffic-signs-preprocessed               Traffic Signs Preproce
ssed                           4GB  2019-08-31 18:22:11           1846
hmavrodiev/london-bike-sharing-dataset                   London bike sharing da
taset                        165KB  2019-10-10 12:49:37           4912
```

In [0]:

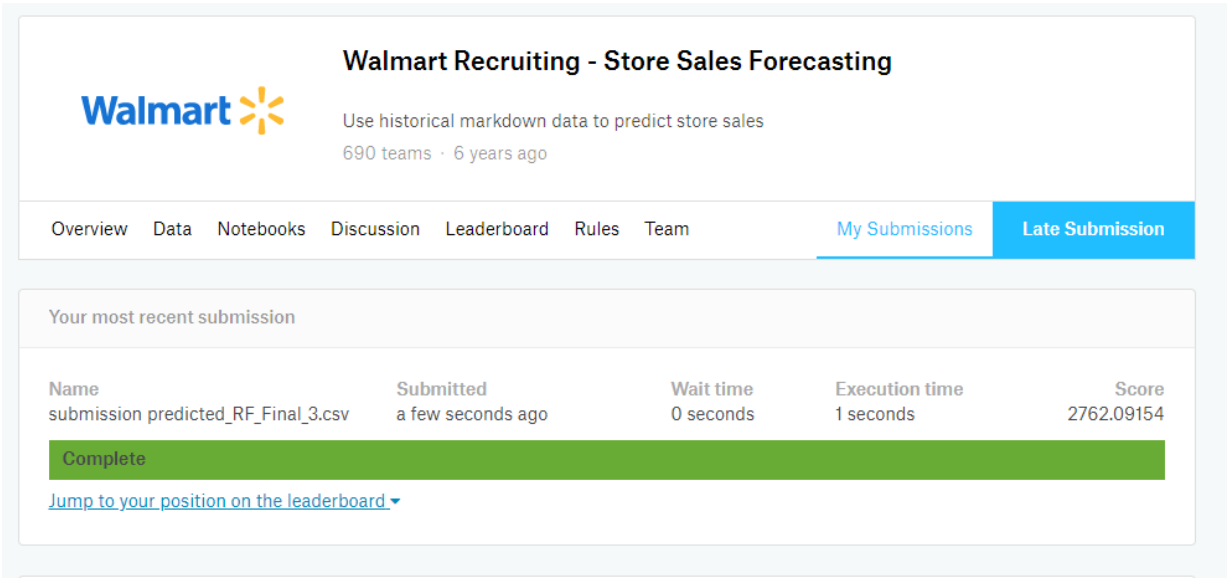
In [0]:
```
!kaggle competitions submit -c walmart-recruiting-store-sales-forecasting -f "/c
```

```
Warning: Your Kaggle API key is readable by other users on this system! To fix
this, you can run 'chmod 600 /root/.kaggle/kaggle.json'
Warning: Looks like you're using an outdated API Version, please consider updat
ing (server 1.5.6 / client 1.5.4)
100% 3.74M/3.74M [00:00<00:00, 9.44MB/s]
Successfully submitted to Walmart Recruiting - Store Sales Forecasting
```

In [0]:
```
```

Final Score Rank

2762.09154



Conclusion:

Our aim was to accurately forecast sales of Walmart as it is key for its ability to function. The data set for analysis was obtained from Kaggle and it contains weekly sales of various departments within different stores over different period of time.

Features

Final Features to train model:

```
['Store', 'Dept', 'Week', 'Month', 'Year', 'Day', 'Temperature', 'IsHoliday', 'Size',
'Types', 'Temp_mean', 'Unemployment_mean', 'Fuel_Price_mean', 'CPI_mean']
```

- Store - the store number
- Dept - the department number
- Week: The week ordinal of the year.
- Month: The month as January=1, December=12.
- Year: The year of the datetime.
- Day: The days of the datetime.
- Temperature - average temperature in the region
- IsHoliday: If Holiday = True == 1, else 0
- Size: size of store
- Types: Types of store, A = 1, B = 2, C = 3
- Temp_mean: Mean value Temprature
- Unemployment_mean: Mean value of Unemployment
- Fuel_Price_mean: Mean value of cost of fuel in the region
- CPI_mean: Mean value of CPI_mean

Feature we should not use for this problem:

- I tried adding and Dropping of Markdown feature and got to know that, it's not helping to improve the score. Skewness is the reason, why we should not take it as our final features.

In [0]:

How can we improve further:

We can furture use this information to make some more feature to improve the Score:

For convenience, the four holidays fall within the following weeks in the dataset (not all holidays are in the data):

- Super Bowl: 12-Feb-10, 11-Feb-11, 10-Feb-12, 8-Feb-13
- Labor Day: 10-Sep-10, 9-Sep-11, 7-Sep-12, 6-Sep-13
- Thanksgiving: 26-Nov-10, 25-Nov-11, 23-Nov-12, 29-Nov-13
- Christmas: 31-Dec-10, 30-Dec-11, 28-Dec-12, 27-Dec-13

Reference

EDA:

https://www.kaggle.com/yepp2411/walmart-prediction-1-eda-with-time-and-space (https://www.kaggle.com/yepp2411/walmart-prediction-1-eda-with-time-and-space)
https://www.kaggle.com/bnorbert/eda-walmart (https://www.kaggle.com/bnorbert/eda-walmart)

Date time features:

https://pandas.pydata.org/pandas-docs/stable/reference/series.html#datetime-properties (https://pandas.pydata.org/pandas-docs/stable/reference/series.html#datetime-properties)

https://stackoverflow.com/questions/33365055/attributeerror-can-only-use-dt-accessor-with-datetimelike-values (https://stackoverflow.com/questions/33365055/attributeerror-can-only-use-dt-accessor-with-datetimelike-values)

https://stackoverflow.com/questions/25146121/extracting-just-month-and-year-separately-from-pandas-datetime-column (https://stackoverflow.com/questions/25146121/extracting-just-month-and-year-separately-from-pandas-datetime-column)

Feature Selection:

https://www.kaggle.com/c/walmart-recruiting-store-sales-forecasting/discussion/8032#latest-44077 (https://www.kaggle.com/c/walmart-recruiting-store-sales-forecasting/discussion/8032#latest-44077)

https://www.kaggle.com/c/walmart-recruiting-store-sales-forecasting/discussion/8033#latest-181583 (https://www.kaggle.com/c/walmart-recruiting-store-sales-forecasting/discussion/8033#latest-181583)

In [0]:

```
```