Analyze Child Mortality
Aim: To analyze child mortality rate to find out the cause of death for children under 5 years. This notebook describes the steps we followed to create and analyze the dataset. This notebook has analyzed the cause of death of children under 5years from many different countries.

Spark Use Case

Use children mortality data http://www.unicef.org/statistics/index_countrystats.html (Links to an external site.) to figure out what are the most important causes for under 5 year old kids die..

Initial Setup

Step 1: To create an instance on Bluemix.
1) Login in to IBM Bluemix, then click on dashboard which opens the catalog.
2) Select the data and analytics and then click on apache spark.
3) Add service is been displayed.
4) Wait for your service to set up by clicking on the create option.

Step 2 : create a notebook using iphython on apache spark
1) Select the new notebook option
2) Then choose the blank option available in the notebook.
3) Choose python and fill the name ( ).
4) Click on CREATE NOTEBOOK option present at the bottom.

Step3: upload the data to the notebook
1) From the site http://www.unicef.org/statistics/index_countrystats.html the data has been downloaded.
2) The data has been saved as .csv file i.e. child_mortality.csv
3) Then in the bluemix page select the Data Source option towards the right side.
4) Click the add source option present and upload the child_mortality.csv file to the notebook.

Load data

You can add the CSV file that you downloaded to this notebook by dragging the file to the **Data Source** pane in the notebook **Palette** in the notebook. The data file is listed on the **Data Source** pane and is saved in the Object Storage instance associated with your

Analytics for Apache Spark service. The progress bar below the file in the **Data Source** panel indicates the status of the load process. In the next step, you will learn how to access files in Object Storage.

Access data

One the option in python for structured data is pandas. Where series and DataFrame are primary data structure. In the following steps, you will load the child_mortality.csv file into a DataFrame in memory. Where child_mortality.csv file into the dataframe and to run this code, click on Run cell in the toolbar of the notebook.

Import packages to the notebook

Import the requests, base64, StringIO, pandas and re packages to use in the notebook. The pandas package is traditionally imported as pd:

In [524]:

```
import requests, StringIO, pandas as pd, json, re, numpy as np
```

Access Object Storage

Created an Object Storage, where uploaded the file using Data Sources menu in the Palette.

The child_mortality.csv needs to be accessed from the storage and should be loaded using the function get_file_content():

In [525]:

```
def get_file_content(credentials):
   """For given credentials, this functions returns a StringIO object containing the file
content."""

   url1 = ''.join([credentials['auth_url'], '/v3/auth/tokens'])
   data = {'auth': {'identity': {'methods': ['password'],
  'password': {'user': {'name': credentials['username'],'domain': {'id':
credentials['domain_id']}, 'password': credentials['password']}}}}}
   headers1 = {'Content-Type': 'application/json'}
   resp1 = requests.post(url=url1, data=json.dumps(data), headers=headers1
resp1_body = resp1.json()
 for e1 in resp1_body['token']['catalog']:
 if(e1['type']=='object-store'):
 for e2 in e1['endpoints']:
 if(e2['interface']=='public'and e2['region']==credentials['region']):url2 =
''.join([e2['url'],'/', credentials['container'], '/', credentials['filename']])
   s_subject_token = resp1.headers['x-subject-token']
   headers2 = {'X-Auth-Token': s_subject_token, 'accept': 'application/json'}
```

```
    resp2 = requests.get(url=url2, headers=headers2)
    return StringIO.StringIO(resp2.content)
```

Insert data source credentials

To insert source credentials to our file child_mortality.csv file. Selected the next code cell and clicked on the insert to code in the notebook present at the data source. Then the file child_mortality.csv is being added to the python dictionary. The file has been uploaded to the dataframe in pandas.

In [526]:

```
credentials_1 = {
  'auth_url':'https://identity.open.softlayer.com',
  'project':'object_storage_cafd18d7_24ad_4619_a6eb_3bf4b5eb4194',
  'project_id':'8734f08b21d54527afe65d5718b4e708',
  'region':'dallas',
  'user_id':'1d8b2d75b3ff4bc5b8dd25060f166602',
  'domain_id':'145b547e796e4e09ad6746cc09ba63ab',
  'domain_name':'1141629',
  'username':'admin_b5713dda62a90b597c9f5519992ce923e02f6d65',
  'password':"""lJ5.Zt]DhQ^pn5y3""",
  'filename':'child_mortality.csv',
  'container':'notebooks',
  'tenantId':'sc64-bd69cb70a56409-6cdf943bba59'
}
```

Load data into pandas DataFrame

Run the next cell to load the data into a pandas DataFrame:

In [527]:

```
content_string = get_file_content(credentials_1)
child_mortality_df = pd.read_csv(content_string)
child_mortality_df=child_mortality_df.replace(np.nan, '',regex=True)
```

4. Explore data

Now that your data is in memory, you can begin to explore and manipulate it. Show the first five and the last five rows of the data by using the head() and tail() methods. Run each code cell:

In [528]:

```
child_mortality_df.head()
```

Out[528]:

In [529]:

```
child_mortality_df.tail()
Out[529]:
```

```
In [531]:
child_mortality_df = child_mortality_df.set_index(child_mortality_df['Countries and areas'])
child_mortality_df.drop(['Countries and areas'], axis=1, inplace=True)
child_mortality_df.head()
Out[531]:
```

5. Plot the results

When you work in notebooks, you can decide how to present your anlysis results and derived information. So far, we have used normal print functions, which are informative. However, we can also show the results in a visual way by using the popular matplotlib package to create plots.

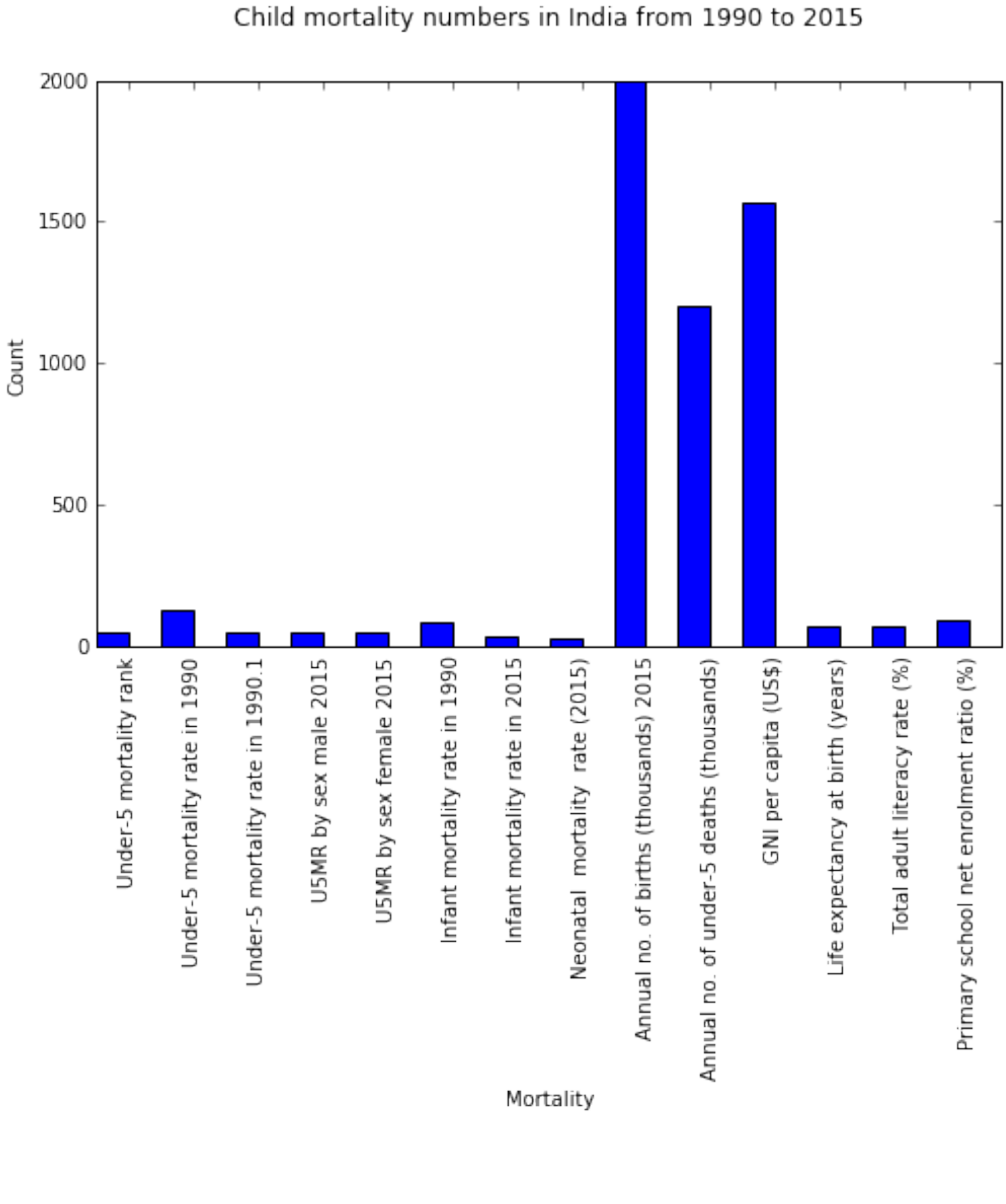
First, render your results as inline charts: Input: %matplotlib inline Now we used pandas wrappers around the matplotlib routines. Because we changed the index of the table rows, we can access the mortality rates of a country or area by name. For example, we ran the following cell to plot the annual mortality of India

```
In [532]:
%matplotlib inline
```

Now use pandas wrappers around the matplotlib routines. Because you changed the index of the table rows, you can access the mortality rates of a country or area by name. For example, run the following cell to plot the male child mortality of India

```
In [533]:
import matplotlib.pyplot as plt

india = child_mortality_df.ix['India'];
mortality = india.astype(np.float64).index
index = np.arange(len(mortality))
plt.figure(figsize=(8,5))
bar_width = 0.5
plt.bar(index, india, bar_width, color='b')
plt.xlabel("Mortality")
plt.ylabel("Count")
plt.title("Child mortality numbers in %s from 1990 to 2015" % india.name, y=1.08)
plt.xticks(index + bar_width, mortality, rotation=90)
plt.ylim( 1, 2000 )
plt.show()
```



Plot the countries or areas with the highest mortality rate

To get a list of the countries with the highest mortality rate , you have to compute the sum of all the mortality rates. You can do this by using the pandas sum() method. This method adds an additional column called SUM, which contains the sums of the mortality rates to the child_mortality_df DataFrame.

Next, sort the DataFrame by all the mortality rates depending on the gender and print :

In [534]:

```
child_mortality_sorted_df = child_mortality_df.sort_values(['U5MR by sex male 2015'],ascending=False);
top5_sums = pd.Series(child_mortality_sorted_df["U5MR by sex male 2015"].head(5))
top5_sums
```

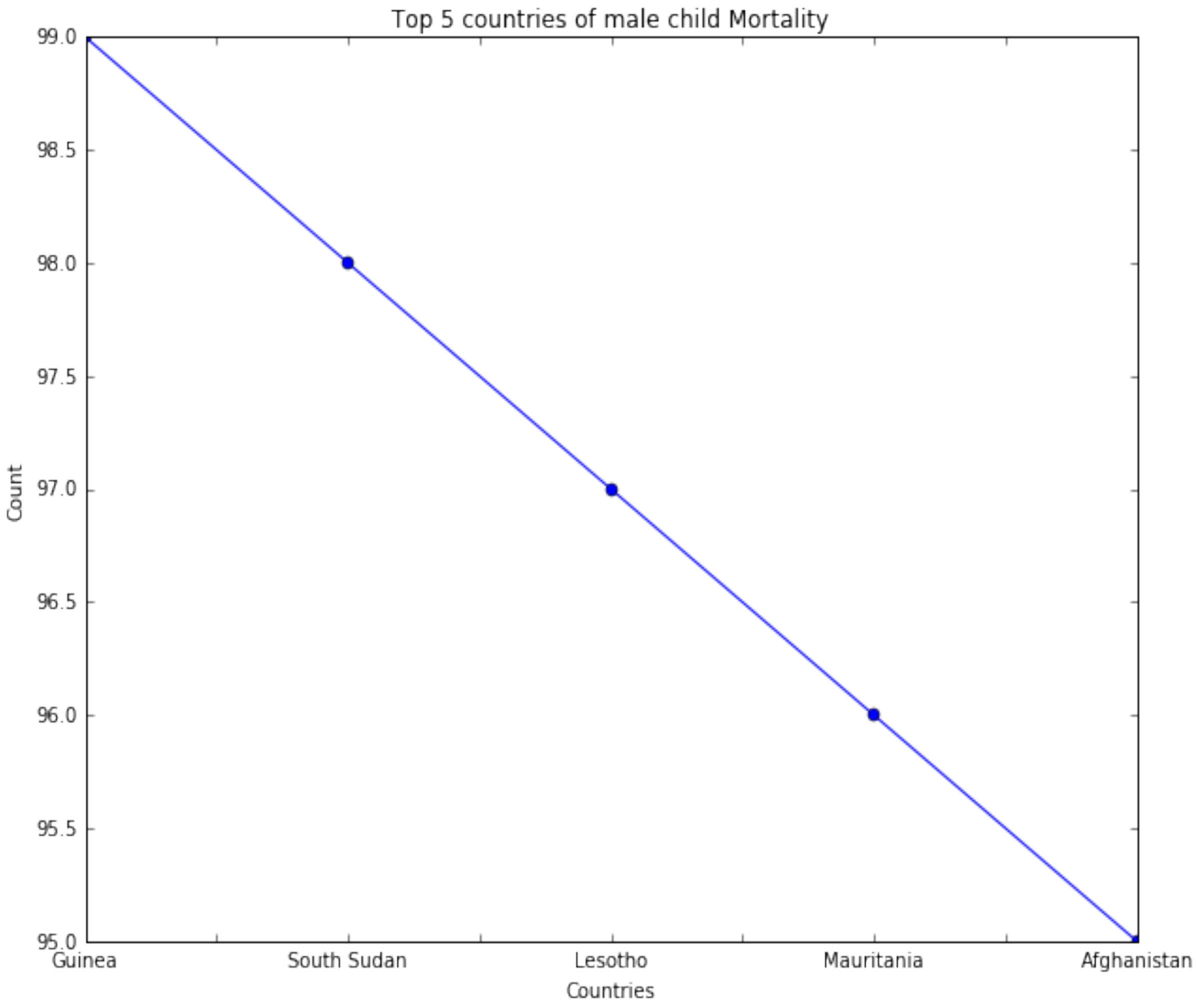
Out[534]:

```
Countries and areas
Guinea        99
South Sudan    98
Lesotho       97
Mauritania     96
Afghanistan    95
Name: U5MR by sex male 2015, dtype: object
```

Plotted the top five countries next to each another in a line graph for a better comparison of the recordings.

In [535]:

```
top5_bars = top5_sums.astype(np.float64)[0:5].transpose()
ax = top5_bars.plot(figsize=(10,8), marker='o', linestyle='-', title="Top 5 countries of male child Mortality")
ax.set_xlabel("Countries")
ax.set_ylabel("Count");
```



Finally, compared the male child mortality for the top five countries. Guinea has the highest death, followed by South Sudan. The line graph also shows that some values are missing, which makes comparing measurements difficult.

To show the total mortality for the top five countries in relation to the total mortality for all countries over the entire time period, we used a pie chart. Run the next code cell to create a pie chart by using the matplotlib library:

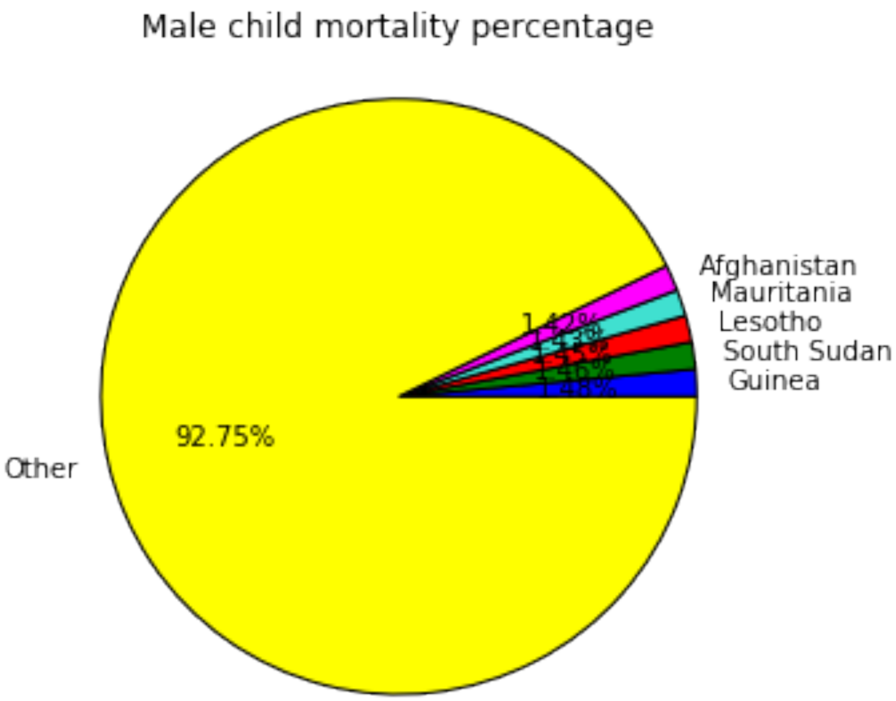
In [536]:

```
mortality_sums = top5_sums
d=child_mortality_sorted_df.applymap(lambda x: 0 if isinstance(x, basestring) and x.isspace() else x)
pd.to_numeric(d["U5MR by sex male 2015"]);


other_sums = d["U5MR by sex male 2015"].astype(np.float64)[5:].sum()

mortality_sums["Other"] = other_sums
```

```
plt.axis('equal')
plt.title("Male child mortality percentage",y=1.08)
plt.pie(
    mortality_sums,
    labels=mortality_sums.index,
    colors=['blue', 'green', 'red', 'turquoise', 'magenta','yellow'],
    autopct="%1.2f%%",
    radius=1.25);
```



A line of best fit is a straight line that is the best approximation of the given set of data. The polyfit() function fits a line through data points. Because the DataFrame you are using is two-dimentional, it returns two values, the slope and the intercept. To determine whether the trend is positive or negative, you need only the slope. And naturally, you have to exclude any data points that correpond to the value 0.0.

Run the next cells to determine and line plot the trend for Chile