PySpark Clustering update

November 18, 2015

0.1 For nicer formatting view, please go to:

0.1.1 http://bit.ly/1HYPLjf

0.2 IS622: Week 10 Mini-Project (update)

0.2.1 Clustering with PySpark

0.2.2 Brian Chu | Nov. 18, 2015

This is the PySpark implementation of k-means clustering for Meetup.com RSVP location data

The dataset is the same streaming file used in Weeks 8 and 9.
It is unique RSVP information for Meetup.com based on GPS coordinates, city, and country of responder, and Meetup group name.
http://meetup.github.io/stream/rsvpTicker/

```
In [1]: import os
        import sys

        # Path for Spark source folder
        os.environ['SPARK_HOME']="/home/brian/workspace/cuny_msda_is622/spark-1.5.1-bin-hadoop2.6"

        # Append pyspark to Python Path
        sys.path.append("/home/brian/workspace/cuny_msda_is622/spark-1.5.1-bin-hadoop2.6/python/")

        # Append py4j to Python Path
        sys.path.append("/home/brian/workspace/cuny_msda_is622/spark-1.5.1-bin-hadoop2.6/python/lib/py4
```

```
In [2]: # Launch Spark
        execfile("/home/brian/workspace/cuny_msda_is622/spark-1.5.1-bin-hadoop2.6/python/pyspark/shell.
```

```
Welcome to
      ____              __
     / __/__  ___ _____/ /__
    _\ \/ _ \/ _ `/ __/  '_/
   /__ / .__/\_,_/_/ /_/\_\   version 1.5.1
      /_/

Using Python version 2.7.10 (default, Oct 14 2015 16:09:02)
SparkContext available as sc, HiveContext available as sqlContext.
```

```
In [3]: # Load required packages
        from pyspark.sql import SQLContext
        import numpy as np
        import csv
        import dateutils
        import pyspark_csv as pycsv #https://github.com/seahboonsiew/pyspark-csv
        import warnings
        warnings.filterwarnings('ignore')
```

```
In [4]: # Import data
        raw = sc.textFile("meetup.csv")
        type(raw)

        # Convert raw csv data to Spark dataframe
        sqlc = SQLContext(sc)
        meetup = pycsv.csvToDataFrame(sqlc, raw)
        meetup.show(5)
```

```
+----------+----------+-----------+-------+--------------------+
|       lat|      long|       city|country|               group|
+----------+----------+-----------+-------+--------------------+
| 42.346603| -71.10743|     Boston|     us|Greater Boston Pe...|
| 51.494598|  -0.10047|     London|     gb|London Digital An...|
|-33.761341|150.666107|     Sydney|     au|Sydney Kayaking M...|
| 49.232578| -123.1166|  Vancouver|     ca|The Vancouver Man...|
| 44.856516|-93.434491|Minneapolis|     us|Twin Cities Profe...|
+----------+----------+-----------+-------+--------------------+
only showing top 5 rows
```

```
In [5]: # Subset US and scale data in Pandas
        import pandas as pd
        from sklearn.preprocessing import scale

        pdf = meetup.toPandas()
        pdfUS = pdf[(pdf.country=="us") & (pdf.long < -50)]
        dfplot = sqlc.createDataFrame(pdfUS)

        pdfUS_norm = pdfUS
        pdfUS_norm.lat = scale(pdfUS_norm.iloc[:,0])
        pdfUS_norm.long = scale(pdfUS_norm.iloc[:,1])

        # Convert back to PySpark DF and subset GPS columns
        df_norm = sqlc.createDataFrame(pdfUS_norm)
        df_norm = df_norm["long", "lat"]
        df_norm.show(3)
```

```
+-------------------+------------------+
|               long|               lat|
+-------------------+------------------+
|  1.306523253301959|0.9473386444772237|
|0.15292857847310476|1.4593321656122435|
|-1.2013698374901778|-0.112316408258129|
+-------------------+------------------+
only showing top 3 rows
```

0.2.3 PySpark MLlib package for k-means clustering

Modified source code from:
http://spark.apache.org/docs/latest/mllib-clustering.html

```
In [6]: # Use PySpark MLlib package for k-means clustering

        from pyspark.mllib.clustering import KMeans, KMeansModel
        from numpy import array

        k = 5 # number of clusters (consistent with prior weeks)
        dfk = df_norm.map(lambda row: array([float(x) for x in row]))
        clusters = KMeans.train(dfk, k, maxIterations=10, seed=50)
```

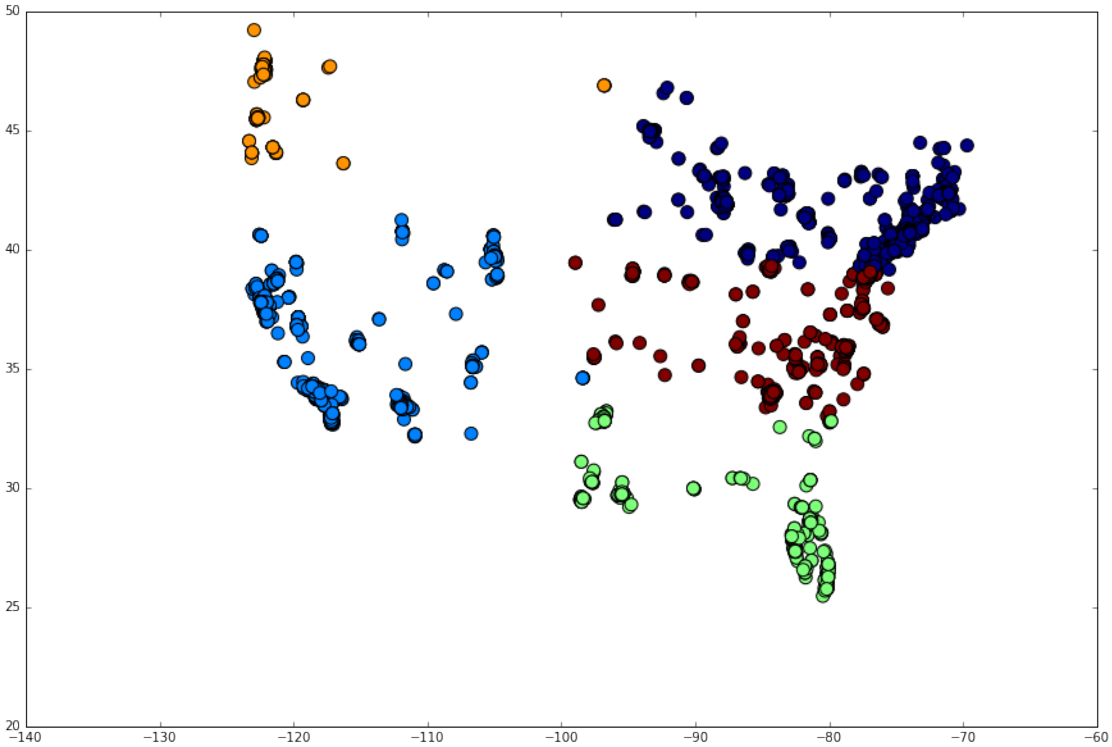
The MLlib k-means function seems to assume labeled data in train/test format. Since we just want to do unsupervised learning on our dataset, we 'predict' over the entire data.

```
In [7]: # Sample first 20 rows
        clust = clusters.predict(dfk).take(dfk.count())
```

```
In [8]: # Plot clusters
        import matplotlib.pyplot as plt
        %matplotlib inline

        sqlCtx.registerDataFrameAsTable(dfplot, "gps")
        dfk2 = sqlCtx.sql("SELECT long, lat from gps")
        plt.figure(figsize=(15,10))
        r = [(x,y) for x,y in dfk2.take(dfk2.count())]
        x1 = [x for (x,y) in r]
        y1 = [y for (x,y) in r]
        plt.xlim([-140,-60])
        plt.ylim([20,50])
        plt.scatter(x1,y1, c=clust, s=100)
```

```
Out[8]: <matplotlib.collections.PathCollection at 0x7f1211f2b7d0>
```



0.2.4 Examine center points

```
In [9]: # Convert back to original scale
        from sklearn.preprocessing import StandardScaler
        import warnings
        warnings.filterwarnings('ignore')

        pdfplot = pdf[(pdf.country=="us") & (pdf.long < -50)]
        [x for x in pdfplot[["long", "lat"]]]
        sslat = StandardScaler().fit(pdfplot["lat"])
        sslong = StandardScaler().fit(pdfplot["long"])

        # Put into Pandas DF
        cc = pd.DataFrame(clusters.centers)
        cc.columns = ["long", "lat"]
        cc.long = sslong.inverse_transform(cc.iloc[:,0])
        cc.lat = sslat.inverse_transform(cc.iloc[:,1])
```

```
In [10]: cc.sort("long", ascending=False)
```

```
Out[10]:          long        lat
         0  -78.381653  41.509402
         4  -81.015102  37.073376
         2  -88.187754  29.105460
         1 -116.889558  36.136694
         3 -122.005904  46.875027
```

The cluster center points are very close to the R k-means results than the RHadoop ones. Basically, PySpark MLlib is also not classifying Hawaii points as their own cluster, unlike the RHadoop implementation shown earlier.