SMOKE TEST

Spark 2.3.1

Date Prepared: Sept 2019

	Smoke Test Document **Spark 2.3.1**	Hewlett Packard Enterprise

Document Information

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1 NOTE

Set **SPARK_HOME** to **$PATH** or "***cd /usr/lib/spark//spark-2.3.1-bin-hadoop2.7/***" and run the following examples:

All the Spark examples related to Python, Scala, and Java & R are under this location ***"/usr/lib/spark//spark-2.3.1-bin-hadoop2.7/examples/src/main***"

Replace ***<Spark-master-IP>*** with the actual IP address.

2 SAMPLE TEST CASE FOR SPARK-SUBMIT

In this section, we will test some sample test case for Spark submit.

1. Run application locally on 8 cores

```
./bin/spark-submit \
  --class org.apache.spark.examples.SparkPi \
  --master local[8] \
  /usr/lib/spark/spark-2.3.1-bin-hadoop2.7/examples/jars/spark-
examples_2.11-2.4.0.jar \
  100
```

2. Run below command on a Spark standalone cluster in client deploy mode

```
./bin/spark-submit \
  --class org.apache.spark.examples.SparkPi \
  --master spark://<Spark-master-IP>:7077 \
  --executor-memory 20G \
  --total-executor-cores 100 \
 /usr/lib/spark//spark-2.3.1-bin-hadoop2.7/examples/jars/spark-
examples_2.11-2.3.1.jar \
  1000
```

3. Run below command on a Spark standalone cluster in client deploy mode with supervise

```
./bin/spark-submit \
  --class org.apache.spark.examples.SparkPi \
  --master spark://<Spark-master-IP>:7077 \
  --deploy-mode cluster \
  --supervise \
```

4. Run a python application on a Spark standalone cluster

```
./bin/spark-submit \
  --class org.apache.spark.examples.SparkPi \
  --master spark://<Spark-master-IP>:7077 \
  --deploy-mode cluster \
  --supervise \
```

3 SAMPLE TEST CASE FOR SPARK-SHELL

We will first introduce the API through Spark's interactive shell (in Python or Scala) and then show how to write applications in Java, Scala and Python.

3.1 Interactive analysis with the Spark Shell

Spark's shell provides a simple way to learn the API, as well as a powerful tool to analyze data interactively. It is available in either Scala (which runs on the Java VM and is thus a good way to use existing Java libraries) or Python. Start it by running the following in the Spark directory:

```
./bin/spark-shell
```

1. Make a new Dataset from the text of the README file in the Spark source directory:

   ```
   val textFile = spark.read.textFile("README.md")
   ```

   Output:

   ```
   textFile: org.apache.spark.sql.Dataset[String] = [value:
   string]
   ```

2. Get values from Dataset directly, by calling some actions, or transform the Dataset to get new one

   ```
   textFile.count() // Number of items in this Dataset
   ```

   Output:

   ```
   res0: Long = 126 // May be different from yours as README.md
   ```

   ```
   textFile.first() // First item in this Dataset
   ```

   Output:

   ```
   res1: String = # Apache Spark
   ```

3. Transform this Dataset into a new one

```
val linesWithSpark = textFile.filter(line
=>line.contains("Spark"))
```

Output:

```
linesWithSpark: org.apache.spark.sql.Dataset[String] =[value:
string]
```

4. Chain together transformations and actions

```
textFile.filter(line    =>line.contains("Spark")).count() //
How many lines contain    "Spark"?
```

Output:

```
res3: Long = 15
```

3.2 Caching Operations on Spark Shell

Spark also supports pulling data sets into a cluster-wide in-memory cache. This is very useful when data is accessed repeatedly.

```
linesWithSpark.cache()
```

Output:

```
res7: linesWithSpark.type = [value: string]
```

```
linesWithSpark.count()
```

Output:

```
res8: Long = 15
```

```
linesWithSpark.count()
```

Output:

```
res9: Long = 15
```

3.3 Example for Scala Word Count Program

Following are the commands that we shall use for Word Count Example in Spark Shell:

1. Using Spark context variable, sc to read a text file

```
sc.textFile("usr/lib/spark//spark-2.3.1-bin-
hadoop2.7/word.txt”)
```

2. Split each line using space “ “ as separator

```
flatMap(line => line.split(" "))
```

3. Map each work to a tuple (word, 1), 1 being the number of occurrences for word

```
map(word => (word,1))
```

4. Reduce all the words based on Key

```
var counts = map.reduceByKey(_ + _);
```

5. Save counts to local file

```
counts.saveAsTextFile("usr/lib/spark//spark-2.3.1-bin-
hadoop2.7/result.txt”)
```

4 TEST CASES FOR JUPYTERHUB

From EPIC cluster page, navigate to JupyterHub service. Login to JupyterHub.

Note: From the Menu bar, click on **Help** and then click on **Select Launch classic notebook**.

Note: All the Spark examples related to Python, Scala, and Java & R are under this location ***"/usr/lib/spark//spark-2.3.1-bin-hadoop2.7/examples/src/main/***"

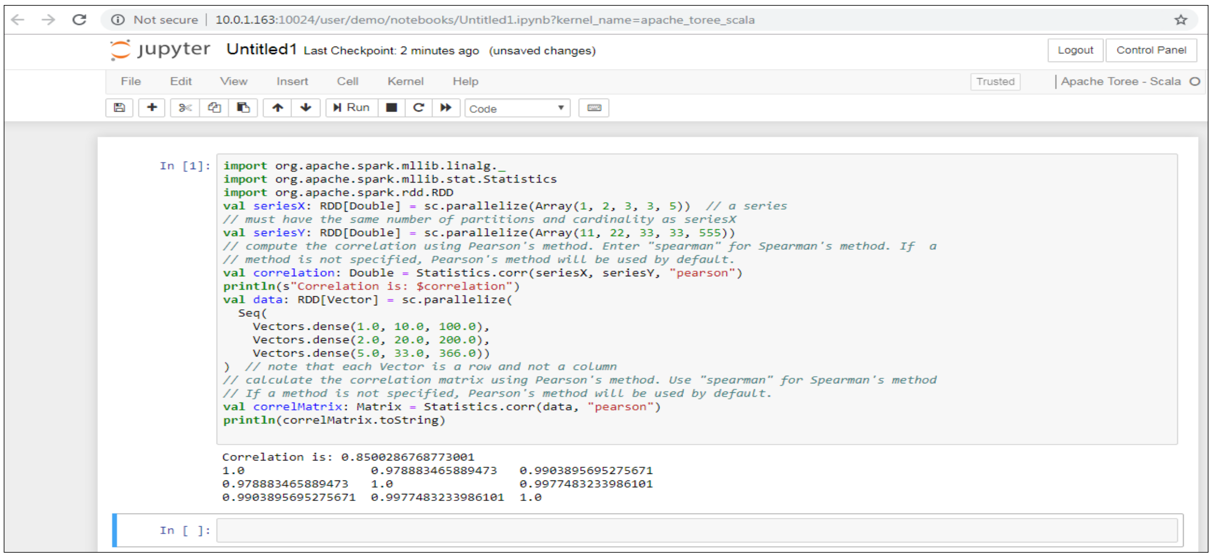
4.1 Spark Scala Testing

Start a Toree Scala kernel, wait till kernel creates a spark shell. Run following Pearson's correlation. You can run up to 4 Spark shells with current configurations. If your shell doesn't start, you may have used up all the cores.

```
import org.apache.spark.mllib.linalg._

import org.apache.spark.mllib.stat.Statistics

import org.apache.spark.rdd.RDD

val seriesX: RDD[Double] = sc.parallelize(Array(1, 2, 3, 3, 5))

val seriesY: RDD[Double] = sc.parallelize(Array(11, 22, 33, 33, 555))

val correlation: Double = Statistics.corr(seriesX, seriesY, "pearson")

println(s"Correlation is: $correlation")

val data: RDD[Vector] = sc.parallelize(

  Seq(

    Vectors.dense(1.0, 10.0, 100.0),

    Vectors.dense(2.0, 20.0, 200.0),

    Vectors.dense(5.0, 33.0, 366.0))

)

val correlMatrix: Matrix = Statistics.corr(data, "pearson")

println(correlMatrix.toString)
```

Input: Input is generated within the code. No external input is provided.

Output:


Not secure | 10.0.1.163:10024/user/demo/notebooks/Untitled1.ipynb?kernel_name=apache_toree_scala
jupyter Untitled1 Last Checkpoint: 2 minutes ago (unsaved changes)
Logout
Control Panel
File Edit View Insert Cell Kernel Help
Trusted
Apache Toree - Scala
Run
Code

```
In [1]: import org.apache.spark.mllib.linalg._
        import org.apache.spark.mllib.stat.Statistics
        import org.apache.spark.rdd.RDD
        val seriesX: RDD[Double] = sc.parallelize(Array(1, 2, 3, 3, 5))  // a series
        // must have the same number of partitions and cardinality as seriesX
        val seriesY: RDD[Double] = sc.parallelize(Array(11, 22, 33, 33, 555))
        // compute the correlation using Pearson's method. Enter "spearman" for Spearman's method. If  a
        // method is not specified, Pearson's method will be used by default.
        val correlation: Double = Statistics.corr(seriesX, seriesY, "pearson")
        println(s"Correlation is: $correlation")
        val data: RDD[Vector] = sc.parallelize(
          Seq(
            Vectors.dense(1.0, 10.0, 100.0),
            Vectors.dense(2.0, 20.0, 200.0),
            Vectors.dense(5.0, 33.0, 366.0))
        )  // note that each Vector is a row and not a column
        // calculate the correlation matrix using Pearson's method. Use "spearman" for Spearman's method
        // If a method is not specified, Pearson's method will be used by default.
        val correlMatrix: Matrix = Statistics.corr(data, "pearson")
        println(correlMatrix.toString)

        Correlation is: 0.8500286768773001
        1.0                 0.978883465889473   0.9903895695275671
        0.978883465889473   1.0                 0.9977483233986101
        0.9903895695275671  0.9977483233986101  1.0

In [ ]:
```

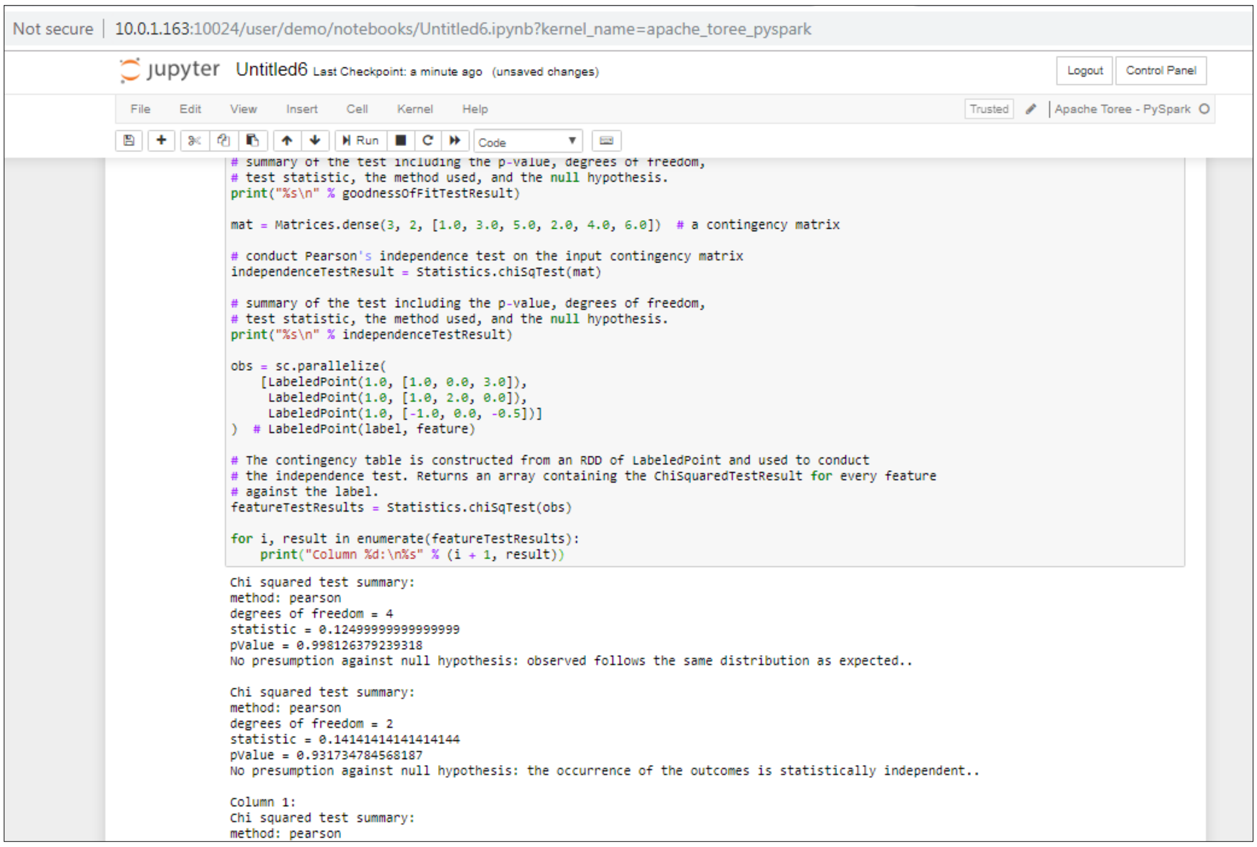
4.2 PySpark Testing

Start a Toree PySpark kernel, wait till kernel creates a spark shell. You can run up to 4 Spark shells with current configurations. If your shell doesn't start, you may have used up all the cores. Kill unused Kernels to release resources.

```
from pyspark.mllib.linalg import Matrices, Vectors

from pyspark.mllib.regression import LabeledPoint

from pyspark.mllib.stat import Statistics

vec = Vectors.dense(0.1, 0.15, 0.2, 0.3, 0.25)

goodnessOfFitTestResult = Statistics.chiSqTest(vec)

print("%s\n" % goodnessOfFitTestResult)

mat = Matrices.dense(3, 2, [1.0, 3.0, 5.0, 2.0, 4.0, 6.0])

independenceTestResult = Statistics.chiSqTest(mat)

print("%s\n" % independenceTestResult)

obs = sc.parallelize(
    [LabeledPoint(1.0, [1.0, 0.0, 3.0]),
     LabeledPoint(1.0, [1.0, 2.0, 0.0]),
     LabeledPoint(1.0, [-1.0, 0.0, -0.5])]
)
featureTestResults = Statistics.chiSqTest(obs)
for i, result in enumerate(featureTestResults):
    print("Column %d:\n%s" % (i + 1, result))
```

Input: No input files used. Data is generated in the code.

Output:


Not secure | 10.0.1.163:10024/user/demo/notebooks/Untitled6.ipynb?kernel_name=apache_toree_pyspark
jupyter Untitled6 Last Checkpoint: a minute ago (unsaved changes)
Logout
Control Panel
File Edit View Insert Cell Kernel Help
Trusted
Apache Toree - PySpark
Run
Code

```
# summary of the test including the p-value, degrees of freedom,
# test statistic, the method used, and the null hypothesis.
print("%s\n" % goodnessOfFitTestResult)

mat = Matrices.dense(3, 2, [1.0, 3.0, 5.0, 2.0, 4.0, 6.0])  # a contingency matrix

# conduct Pearson's independence test on the input contingency matrix
independenceTestResult = Statistics.chiSqTest(mat)

# summary of the test including the p-value, degrees of freedom,
# test statistic, the method used, and the null hypothesis.
print("%s\n" % independenceTestResult)

obs = sc.parallelize(
    [LabeledPoint(1.0, [1.0, 0.0, 3.0]),
     LabeledPoint(1.0, [1.0, 2.0, 0.0]),
     LabeledPoint(1.0, [-1.0, 0.0, -0.5])]
)  # LabeledPoint(label, feature)

# The contingency table is constructed from an RDD of LabeledPoint and used to conduct
# the independence test. Returns an array containing the ChiSquaredTestResult for every feature
# against the label.
featureTestResults = Statistics.chiSqTest(obs)

for i, result in enumerate(featureTestResults):
    print("Column %d:\n%s" % (i + 1, result))
```

```
Chi squared test summary:
method: pearson
degrees of freedom = 4
statistic = 0.12499999999999999
pValue = 0.998126379239318
No presumption against null hypothesis: observed follows the same distribution as expected..

Chi squared test summary:
method: pearson
degrees of freedom = 2
statistic = 0.14141414141414144
pValue = 0.931734784568187
No presumption against null hypothesis: the occurrence of the outcomes is statistically independent..

Column 1:
Chi squared test summary:
method: pearson
```

4.3 Execute Spark Submit Job on JupyterHub

Start a Toree PySpark kernel and execute the following:

```
##sh
./bin/spark-submit \
  --class org.apache.spark.examples.SparkPi \
  --master local[8] \
   /usr/lib/spark//spark-2.3.1-bin-hadoop2.7/examples/jars/spark-examples_2.11-2.4.0.jar \
  100
```

Output: Check Spark master GUI that job is running under Running Application Section.

5 SAMPLE TEST CASES FOR SPARK WITH NOTEBOOKS

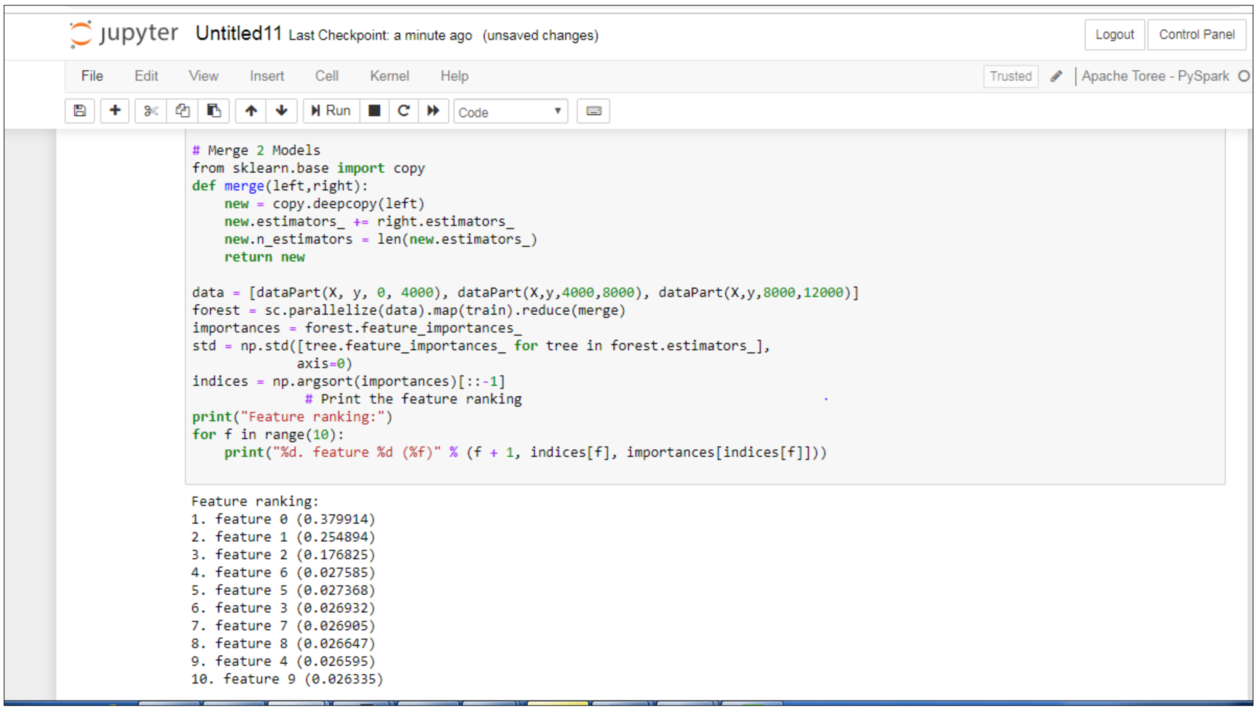
In this section, we will test some sample test cases for Spark with Notebooks.

5.1 PySpark Testing

Start a Toree PySpark Kernel -> Wait till kernel creates a spark shell. You can run up to 4 Spark shells with current configurations. If your shell doesn't start, you may have used up all the cores. Kill unused Kernels to release resources.

```
from pyspark import SparkConf, SparkContext

from sklearn.datasets import make_classification

from sklearn.ensemble import ExtraTreesClassifier

import pandas as pd

import numpy as np

# Build a classification task using 3 informative features

X, y = make_classification(n_samples=12000,

                           n_features=10,

                           n_informative=3,

                           n_redundant=0,

                           n_repeated=0,

                           n_classes=2,

                           random_state=0,

                           shuffle=False)

# Partition data

def dataPart(X, y, start, stop): return dict(X=X[start:stop, :],
y=y[start:stop])

def train(data):
    X = data['X']

    y = data['y']

    return
ExtraTreesClassifier(n_estimators=100,random_state=0).fit(X,y)

# Merge 2 Models

from sklearn.base import copy

def merge(left,right):

    new = copy.deepcopy(left)

    new.estimators_ += right.estimators_

    new.n_estimators = len(new.estimators_)

    return new

data = [dataPart(X, y, 0, 4000), dataPart(X,y,4000,8000),
dataPart(X,y,8000,12000)]

forest = sc.parallelize(data).map(train).reduce(merge)

importances = forest.feature_importances_

std = np.std([tree.feature_importances_ for tree in
forest.estimators_],

             axis=0)

indices = np.argsort(importances)[::-1]

              # Print the feature ranking

print("Feature ranking:")

for f in range(10):

    print("%d. feature %d (%f)" % (f + 1, indices[f],
importances[indices[f]]))
```

Output:


jupyter
Untitled11 Last Checkpoint: a minute ago (unsaved changes)
Logout
Control Panel
File Edit View Insert Cell Kernel Help
Trusted
Apache Toree - PySpark
Run
Code

```
# Merge 2 Models
from sklearn.base import copy
def merge(left,right):
    new = copy.deepcopy(left)
    new.estimators_ += right.estimators_
    new.n_estimators = len(new.estimators_)
    return new

data = [dataPart(X, y, 0, 4000), dataPart(X,y,4000,8000), dataPart(X,y,8000,12000)]
forest = sc.parallelize(data).map(train).reduce(merge)
importances = forest.feature_importances_
std = np.std([tree.feature_importances_ for tree in forest.estimators_],
             axis=0)
indices = np.argsort(importances)[::-1]
              # Print the feature ranking
print("Feature ranking:")
for f in range(10):
    print("%d. feature %d (%f)" % (f + 1, indices[f], importances[indices[f]]))
```

```
Feature ranking:
1. feature 0 (0.379914)
2. feature 1 (0.254894)
3. feature 2 (0.176825)
4. feature 6 (0.027585)
5. feature 5 (0.027368)
6. feature 3 (0.026932)
7. feature 7 (0.026905)
8. feature 8 (0.026647)
9. feature 4 (0.026595)
10. feature 9 (0.026335)
```

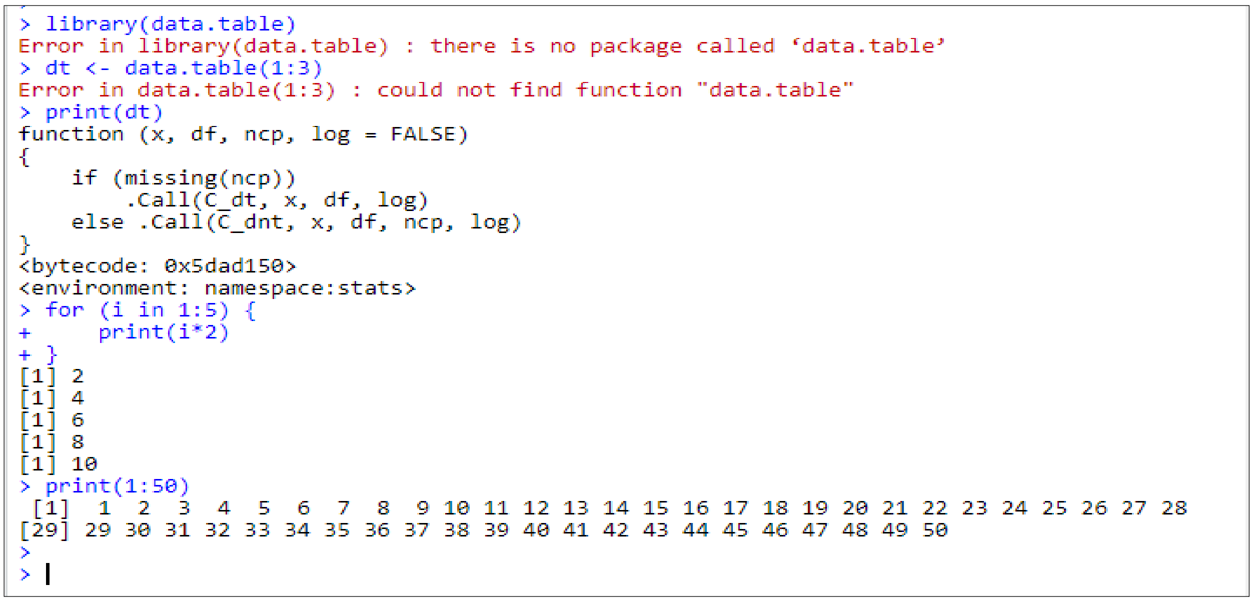
5.2 Spark Scala Testing

Start a Toree Scala kernel -> Wait till kernel creates a spark shell. Run following Pearson’s correlation. You can run up to 4 Spark shells with current configurations. If your shell doesn’t start, you may have used up all the cores. Kill unused Kernels to release resources

```
import org.apache.spark.mllib.linalg._

import org.apache.spark.mllib.stat.Statistics

import org.apache.spark.rdd.RDD

val seriesX: RDD[Double] = sc.parallelize(Array(1, 2, 3, 3, 5))

val seriesY: RDD[Double] = sc.parallelize(Array(11, 22, 33, 33,
555))

// compute the correlation using Pearson's method. Enter "spearman"
for Spearman's method. If a method is not specified, Pearson's
method will be used by default.
```

```
val correlation: Double = Statistics.corr(seriesX, seriesY,
"pearson")

println(s"Correlation is: $correlation")

                 val data: RDD[Vector] = sc.parallelize(

  Seq(

    Vectors.dense(1.0, 10.0, 100.0),

    Vectors.dense(2.0, 20.0, 200.0),

    Vectors.dense(5.0, 33.0, 366.0))

)

val correlMatrix: Matrix = Statistics.corr(data, "pearson")

println(correlMatrix.toString)

Spark R-studio test on jupyter notebook

Open R-studio GUI and execute the following scrip

library(data.table)

dt <- data.table(1:3)

print(dt)

for (i in 1:5) {

  print(i*2)

}

print(1:50)
```

Output:


```
> library(data.table)
Error in library(data.table) : there is no package called ‘data.table’
> dt <- data.table(1:3)
Error in data.table(1:3) : could not find function "data.table"
> print(dt)
function (x, df, ncp, log = FALSE)
{
    if (missing(ncp))
        .Call(C_dt, x, df, log)
    else .Call(C_dnt, x, df, ncp, log)
}
<bytecode: 0x5dad150>
<environment: namespace:stats>
> for (i in 1:5) {
+     print(i*2)
+ }
[1] 2
[1] 4
[1] 6
[1] 8
[1] 10
> print(1:50)
 [1]  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
[29] 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
>
> |
```

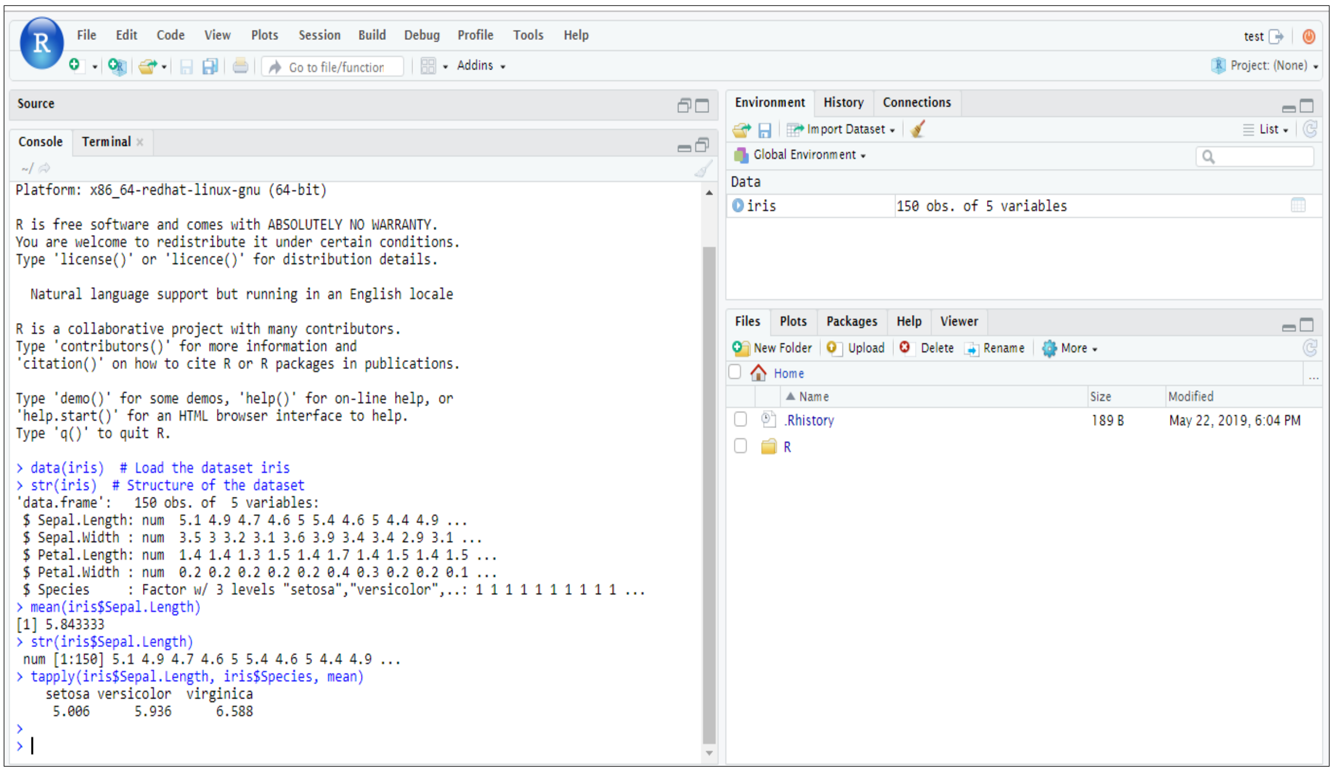
6 TEST CASES FOR SPARK WITH RSTUDIO

In this section, we will test some sample test cases for Spark with RStudio. From EPIC Cluster page, click on RStudio service. A new tab will appear with RStudio login page.

6.1 Base-R Testing on RStudio GUI

```
data(iris)  # Load the dataset iris

str(iris)  # Structure of the dataset

mean(iris$Sepal.Length)

str(iris$Sepal.Length)

tapply(iris$Sepal.Length, iris$Species, mean)
```

Output:



```
Platform: x86_64-redhat-linux-gnu (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

  Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> data(iris)  # Load the dataset iris
> str(iris)  # Structure of the dataset
'data.frame':   150 obs. of  5 variables:
 $ Sepal.Length: num  5.1 4.9 4.7 4.6 5 5.4 4.6 5 4.4 4.9 ...
 $ Sepal.Width : num  3.5 3 3.2 3.1 3.6 3.9 3.4 3.4 2.9 3.1 ...
 $ Petal.Length: num  1.4 1.4 1.3 1.5 1.4 1.7 1.4 1.5 1.4 1.5 ...
 $ Petal.Width : num  0.2 0.2 0.2 0.2 0.2 0.4 0.3 0.2 0.2 0.1 ...
 $ Species     : Factor w/ 3 levels "setosa","versicolor",..: 1 1 1 1 1 1 1 1 1 1 ...
> mean(iris$Sepal.Length)
[1] 5.843333
> str(iris$Sepal.Length)
 num [1:150] 5.1 4.9 4.7 4.6 5 5.4 4.6 5 4.4 4.9 ...
> tapply(iris$Sepal.Length, iris$Species, mean)
    setosa versicolor  virginica
     5.006      5.936      6.588
>
> |
```

Data	
iris	150 obs. of 5 variables

Name	Size	Modified
.Rhistory	189 B	May 22, 2019, 6:04 PM
R		

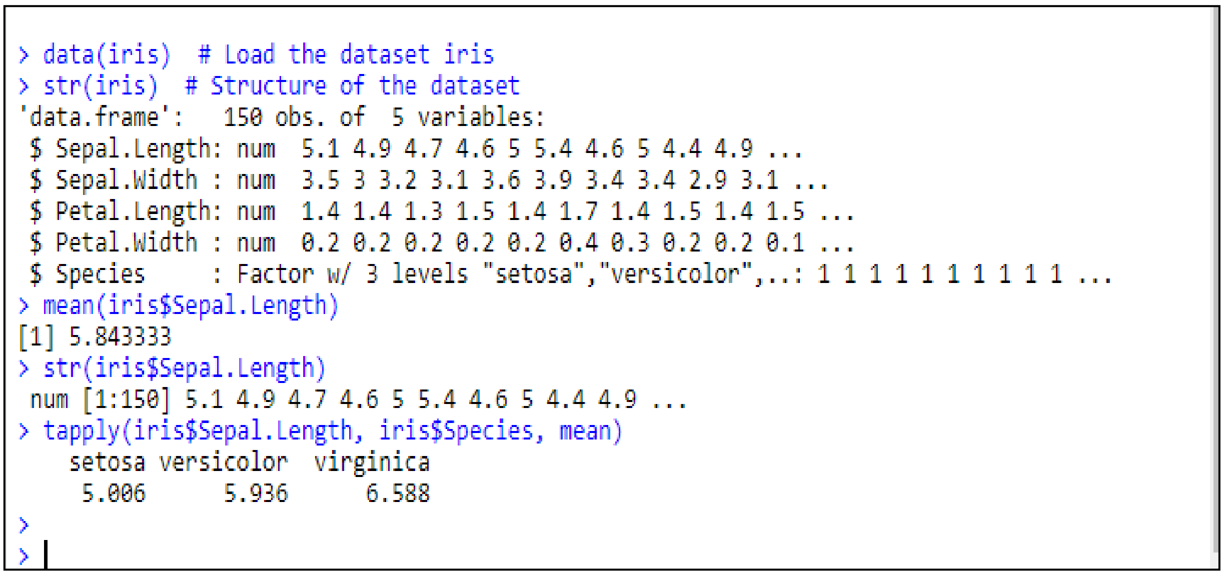
6.2 Sparklyr Testing on RStudio GUI

```
install.packages("sparklyr")

sparklyr::spark_install()

library(sparklyr)

sc <- spark_connect(master = 'local')
```

6.3 Simple test on RStudio GUI

```
data(iris)  # Load the dataset iris

str(iris)  # Structure of the dataset

mean(iris$Sepal.Length)

str(iris$Sepal.Length)

tapply(iris$Sepal.Length, iris$Species, mean)
```

Output:

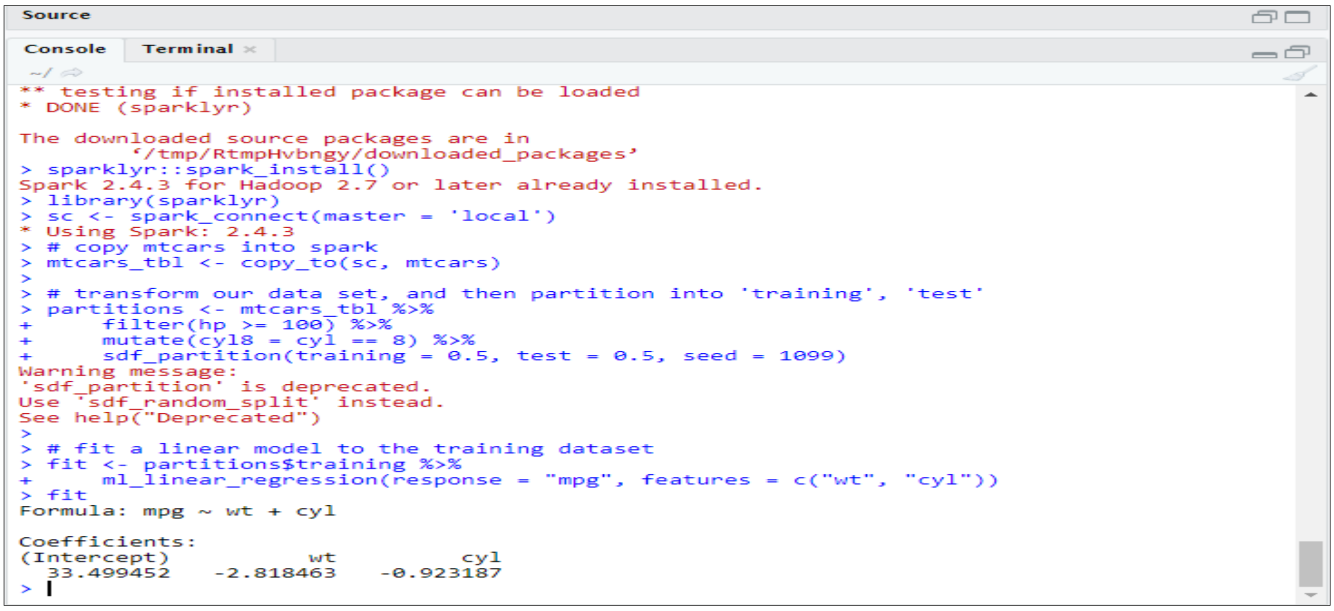


```
> data(iris)  # Load the dataset iris
> str(iris)  # Structure of the dataset
'data.frame':	150 obs. of  5 variables:
 $ Sepal.Length: num  5.1 4.9 4.7 4.6 5 5.4 4.6 5 4.4 4.9 ...
 $ Sepal.Width : num  3.5 3 3.2 3.1 3.6 3.9 3.4 3.4 2.9 3.1 ...
 $ Petal.Length: num  1.4 1.4 1.3 1.5 1.4 1.7 1.4 1.5 1.4 1.5 ...
 $ Petal.Width : num  0.2 0.2 0.2 0.2 0.2 0.4 0.3 0.2 0.2 0.1 ...
 $ Species     : Factor w/ 3 levels "setosa","versicolor",..: 1 1 1 1 1 1 1 1 1 1 ...
> mean(iris$Sepal.Length)
[1] 5.843333
> str(iris$Sepal.Length)
 num [1:150] 5.1 4.9 4.7 4.6 5 5.4 4.6 5 4.4 4.9 ...
> tapply(iris$Sepal.Length, iris$Species, mean)
    setosa versicolor  virginica 
     5.006      5.936      6.588 
>
> 
```

6.4 MLLib usage test on RStudio GUI

```
>install.packages("sparklyr")

>sparklyr::spark_install()

>library(sparklyr)

>sc <- spark_connect(master = 'local')

> library(dplyr)

# copy mtcars into spark

> mtcars_tbl <- copy_to(sc, mtcars)

 #  ** May show an error regarding problem with database. Seems to
work OK after that

>src_tbls(sc)

# transform our data set, and then partition into 'training', 'test'

> partitions <- mtcars_tbl %>%

  filter(hp >= 100) %>%

  mutate(cyl8 = cyl == 8) %>%

  sdf_partition(training = 0.5, test = 0.5, seed = 1099)


# fit a linear model to the training dataset

> fit <- partitions$training %>%

  ml_linear_regression(response = "mpg", features = c("wt", "cyl"))

> summary(fit)
```

Output:



Source

Console Terminal

~/

```
** testing if installed package can be loaded
* DONE (sparklyr)

The downloaded source packages are in
        '/tmp/RtmpHvbngy/downloaded_packages'
> sparklyr::spark_install()
Spark 2.4.3 for Hadoop 2.7 or later already installed.
> library(sparklyr)
> sc <- spark_connect(master = 'local')
* Using Spark: 2.4.3
> # copy mtcars into spark
> mtcars_tbl <- copy_to(sc, mtcars)
>
> # transform our data set, and then partition into 'training', 'test'
> partitions <- mtcars_tbl %>%
+     filter(hp >= 100) %>%
+     mutate(cyl8 = cyl == 8) %>%
+     sdf_partition(training = 0.5, test = 0.5, seed = 1099)
Warning message:
'sdf_partition' is deprecated.
Use 'sdf_random_split' instead.
See help("Deprecated")
>
> # fit a linear model to the training dataset
> fit <- partitions$training %>%
+     ml_linear_regression(response = "mpg", features = c("wt", "cyl"))
> fit
Formula: mpg ~ wt + cyl

Coefficients:
(Intercept)          wt         cyl
  33.499452   -2.818463   -0.923187
> 
```

7 TEST CASES FOR SPARK WITH SQL

Spark SQL allows relational queries expressed in SQL or Scala to be executed using Spark. At the core of this component is a new type of RDD, SchemaRDD. SchemaRDDs are composed of Row objects, along with a schema that describes the data types of each column in the row. A SchemaRDD is similar to a table in a traditional relational database. The SchemaRDD can be created from an existing RDD, a Parquet file, a JSON dataset.

Follow these tests for testing spark-sql for your cluster:

7.1 Testing with user defined functions

1. Creating a dataset “hello world”

```
val dataset = Seq((0, "hello"),(1, "world")).toDF("id","text")
```

2. Defining a function ‘upper’ which converts a string into upper case

```
val upper: String => String =_.toUpperCase
```

3. We now import the ‘udf’ package into Spark

```
import org.apache.spark.sql.functions.udf
```

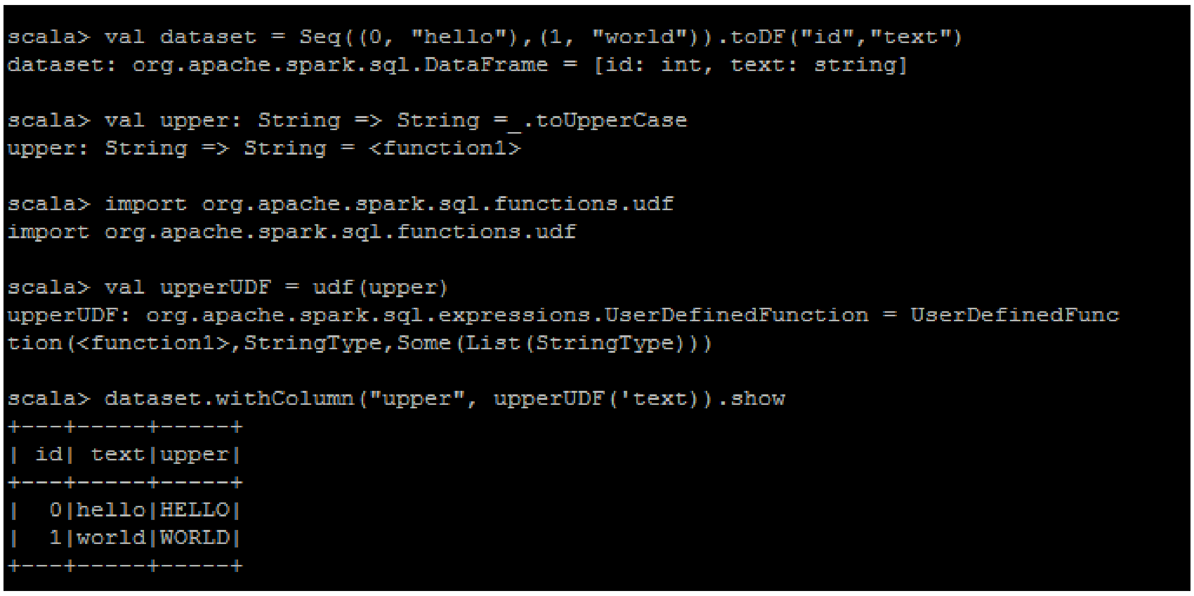
4. Defining our UDF, ‘upperUDF’ and importing our function ‘upper’

```
val upperUDF = udf(upper)
```

5. Displaying the results of our User Defined Function in a new column ‘upper’

```
dataset.withColumn("upper", upperUDF('text)).show
```

Output:



```
scala> val dataset = Seq((0, "hello"),(1, "world")).toDF("id","text")
dataset: org.apache.spark.sql.DataFrame = [id: int, text: string]

scala> val upper: String => String =_.toUpperCase
upper: String => String = <function1>

scala> import org.apache.spark.sql.functions.udf
import org.apache.spark.sql.functions.udf

scala> val upperUDF = udf(upper)
upperUDF: org.apache.spark.sql.expressions.UserDefinedFunction = UserDefinedFunc
tion(<function1>,StringType,Some(List(StringType)))

scala> dataset.withColumn("upper", upperUDF('text)).show
+---+-----+-----+
| id| text|upper|
+---+-----+-----+
|  0|hello|HELLO|
|  1|world|WORLD|
+---+-----+-----+
```

7.2 Starting a Spark session and displaying DataFrame of people.json

For the querying examples, we will be using files, **’people.txt**’ and **’people.json**’. These file stored at ***‘/usr/lib/spark//spark-2.3.1-bin-hadoop2.7/examples/src/main/resources/’***

1. We first import a Spark Session into Apache Spark

```
import org.apache.spark.sql.SparkSession
```

2. Creating a Spark Session ‘spark’ using the ‘builder()’ function

```
val spark = SparkSession.builder().appName("Spark SQL
basic example").config("spark.some.config.option", "some-
value").getOrCreate()
```

3. Importing the Implicts class into our ‘spark’ Session.

```
import spark.implicits._
```

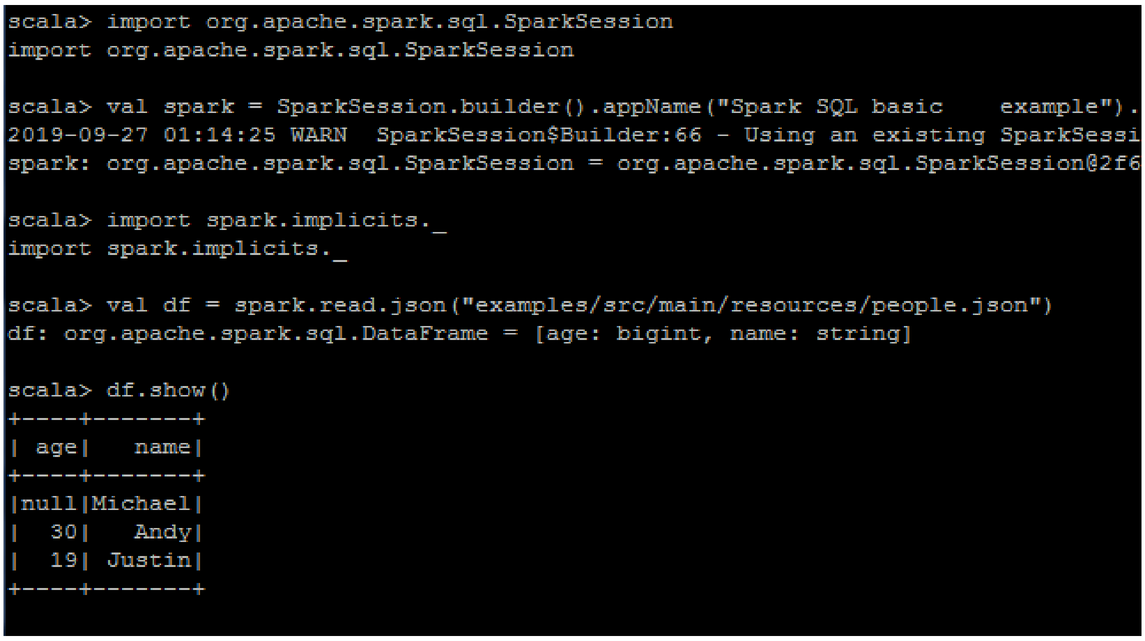
4. We now create a DataFrame ‘df’ and import data from the ’employee.json’ file.

```
val df =
spark.read.json("examples/src/main/resources/people.json")
```

5. Displaying the DataFrame ‘df’. The result is a table of 5 rows of ages and names from our ’employee.json’ file.

```
df.show()
```

Output:



```
scala> import org.apache.spark.sql.SparkSession
import org.apache.spark.sql.SparkSession

scala> val spark = SparkSession.builder().appName("Spark SQL basic    example").
2019-09-27 01:14:25 WARN  SparkSession$Builder:66 - Using an existing SparkSessi
spark: org.apache.spark.sql.SparkSession = org.apache.spark.sql.SparkSession@2f6

scala> import spark.implicits._
import spark.implicits._

scala> val df = spark.read.json("examples/src/main/resources/people.json")
df: org.apache.spark.sql.DataFrame = [age: bigint, name: string]

scala> df.show()
+----+-------+
| age|   name|
+----+-------+
|null|Michael|
|  30|   Andy|
|  19| Justin|
+----+-------+
```

7.3 Creating a Dataset

1. Creating a class ‘Employee’ to store name and age of an employee

```
case class Employee(name: String, age: Long)
```

2. Assigning a Dataset ‘caseClassDS’ to store the record of Andrew

```
val caseClassDS = Seq(Employee("Andrew", 55)).toDS()
```

3. Displaying the Dataset ‘caseClassDS’

```
caseClassDS.show()
```

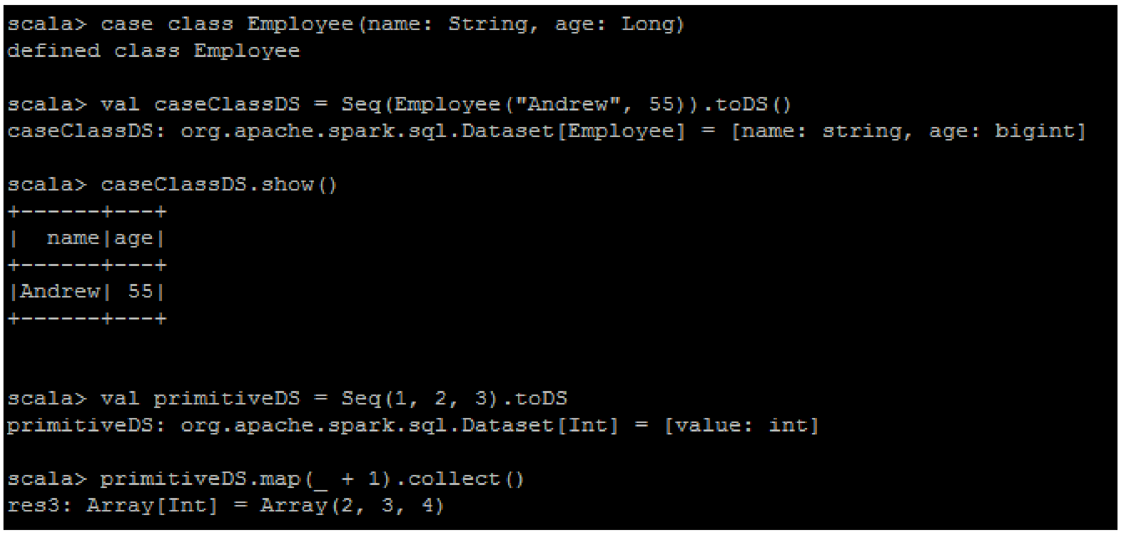
4. Creating a primitive Dataset to demonstrate mapping of DataFrames into Datasets

```
val primitiveDS = Seq(1, 2, 3).toDS
```

5. Assigning the above sequence into an array

```
primitiveDS.map(_ + 1).collect()
```

Output:



```
scala> case class Employee(name: String, age: Long)
defined class Employee

scala> val caseClassDS = Seq(Employee("Andrew", 55)).toDS()
caseClassDS: org.apache.spark.sql.Dataset[Employee] = [name: string, age: bigint]

scala> caseClassDS.show()
+------+---+
|  name|age|
+------+---+
|Andrew| 55|
+------+---+


scala> val primitiveDS = Seq(1, 2, 3).toDS
primitiveDS: org.apache.spark.sql.Dataset[Int] = [value: int]

scala> primitiveDS.map(_ + 1).collect()
res3: Array[Int] = Array(2, 3, 4)
```