Session 19: SPARK SQL

Assignment 19.2

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Assignment 19.2– Introduction to Spark SQL and UDF.

Contents

Introduction

In this assignment, we are going to perform SPARK SQL concepts.

Dataset

```
[acadgild@localhost hadoop]$ cat Sports_data.txt
lisa,cudrow,javellin,gold,34,2015,USA
mathew,louis,javellin,gold,34,2015,RUS
michael,phelps,swimming,silver,32,2016,USA
usha,pt,running,silver,30,2016,IND
serena,williams,running,gold,31,2014,FRA
roger,federer,tennis,silver,32,2016,CHN
jenifer,cox,swimming,silver,32,2014,IND
fernando,johnson,swimming,silver,32,2016,CHN
lisa,cudrow,javellin,gold,34,2017,USA
mathew,louis,javellin,gold,34,2015,RUS
michael,phelps,swimming,silver,32,2017,USA
usha,pt,running,silver,30,2014,IND
serena,williams,running,gold,31,2016,FRA
roger,federer,tennis,silver,32,2017,CHN
jenifer,cox,swimming,silver,32,2014,IND
fernando,johnson,swimming,silver,32,2017,CHN
lisa,cudrow,javellin,gold,34,2014,USA
mathew,louis,javellin,gold,34,2014,RUS
michael,phelps,swimming,silver,32,2017,USA
usha,pt,running,silver,30,2014,IND
serena,williams,running,gold,31,2016,FRA
roger,federer,tennis,silver,32,2014,CHN
jenifer,cox,swimming,silver,32,2017,IND
fernando,johnson,swimming,silver,32,2017,CHN[acadgild@localhost hadoop]$
```

Problem Statement

Using udfs on dataframe

1. Change firstname, lastname columns into

Mr.first_two_letters_of_firstname<space>lastname

for example - michael, phelps becomes Mr.mi phelps

2. Add a new column called ranking using udfs on dataframe, where:

gold medalist, with age >= 32 are ranked as pro

gold medalists, with age <= 31 are ranked amateur

silver medalist, with age >= 32 are ranked as expert

silver medalists, with age <= 31 are ranked rookie

Task – 1 - Change firstname, lastname columns

Mr.first_two_letters_of_firstname<space>lastname

For example - michael, phelps becomes Mr.mi phelps

Please see the codes used below,

1. ***val SportsData = sc.textFile("/home/acadgild/hadoop/Sports_data.txt")***
2. ***val schemaString = "firstname:string,lastname:string,sports:string,medal_type:string,age:string,year:string,country:string"***
3. ***val schema = StructType(schemaString.split(",").map(x => StructField(x.split(":")(0),if(x.split(":")(1).equals("string"))StringType else IntegerType, true)))***
4. ***val rowRDD = SportsData.map(_.split(",")).map(r => Row(r(0), r(1), r(2), r(3), r(4), r(5), r(6)))***
5. ***val SportsDataDF = spark.createDataFrame(rowRDD, schema)***
6. ***SportsDataDF.createOrReplaceTempView("Sports_Data")***
7. ***val Name = udf((firstname:String, lastname:String)=>"Mr. ".concat(firstname.substring(0,2)).concat(" ")concat(lastname))***
8. ***spark.udf.register("Full_Name", Name)***
9. ***val fname = spark.sql("SELECT Full_Name(firstname, lastname) FROM SportsData").show()***

We will proceed with the tasks,

In order to proceed we need to import some dependencies as shown below,

- ***import org.apache.spark.sql.Row;***
- ***import org.apache.spark.sql.types.{StructType,StructField,StringType,NumericType,IntegerType};***
- ***import org.apache.spark.sql.functions.udf***

```
scala> import org.apache.spark.sql.Row;
import org.apache.spark.sql.Row

scala> import org.apache.spark.sql.types.{StructType,StructField,StringType,NumericType,IntegerType};
import org.apache.spark.sql.types.{StructType, StructField, StringType, NumericType, IntegerType}
```

Step -1 – we are creating a RDD from Input DataSet,

```
scala> val SportsData = sc.textFile("/home/acadgild/hadoop/Sports_data.txt")
18/01/11 16:52:56 WARN SizeEstimator: Failed to check whether UseCompressedOops is set; assuming yes
SportsData: org.apache.spark.rdd.RDD[String] = /home/acadgild/hadoop/Sports_data.txt MapPartitionsRDD[1] at textFile at <console>:26

scala> SportsData.foreach(println)
firstname,lastname,sports,medal_type,age,year,country
lisa,cudrow,javellin,gold,34,2015,USA
mathew,louis,javellin,gold,34,2015,RUS
michael,phelps,swimming,silver,32,2016,USA
usha,pt,running,silver,30,2016,IND
serena,williams,running,gold,31,2014,FRA
roger,federer,tennis,silver,32,2016,CHN
jenifer,cox,swimming,silver,32,2014,IND
fernando,johnson,swimming,silver,32,2016,CHN
lisa,cudrow,javellin,gold,34,2017,USA
mathew,louis,javellin,gold,34,2015,RUS
michael,phelps,swimming,silver,32,2017,USA
usha,pt,running,silver,30,2014,IND
serena,williams,running,gold,31,2016,FRA
roger,federer,tennis,silver,32,2017,CHN
jenifer,cox,swimming,silver,32,2014,IND
fernando,johnson,swimming,silver,32,2017,CHN
lisa,cudrow,javellin,gold,34,2014,USA
mathew,louis,javellin,gold,34,2014,RUS
michael,phelps,swimming,silver,32,2017,USA
usha,pt,running,silver,30,2014,IND
serena,williams,running,gold,31,2016,FRA
roger,federer,tennis,silver,32,2014,CHN
jenifer,cox,swimming,silver,32,2017,IND
fernando,johnson,swimming,silver,32,2017,CHN
```

Step -2 – we are defining a schema since it is a text file and splitting the input file using the delimiters and extracting the rows from it.

```
scala> val schemaString = "firstname:string,lastname:string,sports:string,medal_type:string,age:string,year:string,country:string"
schemaString: String = firstname:string,lastname:string,sports:string,medal_type:string,age:string,year:string,country:string

scala> val schema = StructType(schemaString.split(",").map(x => StructField(x.split(":")(0),if(x.split(":")(1).equals("string"))StringType else
 IntegerType, true)))
schema: org.apache.spark.sql.types.StructType = StructType(StructField(firstname,StringType,true), StructField(lastname,StringType,true), Struc
tField(sports,StringType,true), StructField(medal_type,StringType,true), StructField(age,StringType,true), StructField(year,StringType,true), S
tructField(country,StringType,true))
```

```
scala> val rowRDD = SportsData.map(_.split(",")).map(r => Row(r(0), r(1), r(2), r(3), r(4), r(5), r(6)))
rowRDD: org.apache.spark.rdd.RDD[org.apache.spark.sql.Row] = MapPartitionsRDD[3] at map at <console>:28

scala> rowRDD.foreach(println)
[firstname,lastname,sports,medal_type,age,year,country]
[lisa,cudrow,javellin,gold,34,2015,USA]
[mathew,louis,javellin,gold,34,2015,RUS]
[michael,phelps,swimming,silver,32,2016,USA]
[usha,pt,running,silver,30,2016,IND]
[serena,williams,running,gold,31,2014,FRA]
[roger,federer,tennis,silver,32,2016,CHN]
[jenifer,cox,swimming,silver,32,2014,IND]
[fernando,johnson,swimming,silver,32,2016,CHN]
[lisa,cudrow,javellin,gold,34,2017,USA]
[mathew,louis,javellin,gold,34,2015,RUS]
[michael,phelps,swimming,silver,32,2017,USA]
[usha,pt,running,silver,30,2014,IND]
[serena,williams,running,gold,31,2016,FRA]
[roger,federer,tennis,silver,32,2017,CHN]
[jenifer,cox,swimming,silver,32,2014,IND]
[fernando,johnson,swimming,silver,32,2017,CHN]
[lisa,cudrow,javellin,gold,34,2014,USA]
[mathew,louis,javellin,gold,34,2014,RUS]
[michael,phelps,swimming,silver,32,2017,USA]
[usha,pt,running,silver,30,2014,IND]
[serena,williams,running,gold,31,2016,FRA]
[roger,federer,tennis,silver,32,2014,CHN]
[jenifer,cox,swimming,silver,32,2017,IND]
[fernando,johnson,swimming,silver,32,2017,CHN]
```

We have created the **dataframe** by passing the RDD which reads the file and schema to spark session object-

The schema of the created **Dataframe** can be seen below.

```
scala> val SportsDataDF = spark.createDataFrame(rowRDD, schema)
SportsDataDF: org.apache.spark.sql.DataFrame = [firstname: string, lastname: string ... 5 more fields]

scala> SportsDataDF.printSchema()
root
 |-- firstname: string (nullable = true)
 |-- lastname: string (nullable = true)
 |-- sports: string (nullable = true)
 |-- medal_type: string (nullable = true)
 |-- age: string (nullable = true)
 |-- year: string (nullable = true)
 |-- country: string (nullable = true)
```

Step – 3 - Here we are defining the UDF which will take 2 strings (columns) as input and will concatenate them with Mr. appended in it and now we need to register the UDF. Here we doing the same and giving it an alias as **Full_Name.**

Finally we can apply this UDF on the columns to give the required result-

Expected Output

```
scala> val Name = udf((firstname:String, lastname:String)=>"Mr. ".concat(firstname.substring(0,2)).concat(" ")concat(lastname))
Name: org.apache.spark.sql.expressions.UserDefinedFunction = UserDefinedFunction(<function2>,StringType,Some(List(StringType, StringType)))

scala> spark.udf.register("Full_Name", Name)
res11: org.apache.spark.sql.expressions.UserDefinedFunction = UserDefinedFunction(<function2>,StringType,Some(List(StringType, StringType)))

scala> val fname = spark.sql("SELECT Full_Name(firstname, lastname) FROM SportsData").show()
+-----------------------+
|UDF(firstname, lastname)|
+-----------------------+
|         Mr. fi lastname|
|           Mr. li cudrow|
|            Mr. ma louis|
|           Mr. mi phelps|
|               Mr. us pt|
|         Mr. se williams|
|           Mr. ro federer|
|               Mr. je cox|
|           Mr. fe johnson|
|            Mr. li cudrow|
|             Mr. ma louis|
|            Mr. mi phelps|
|               Mr. us pt|
|         Mr. se williams|
|           Mr. ro federer|
|               Mr. je cox|
|           Mr. fe johnson|
|            Mr. li cudrow|
|             Mr. ma louis|
|            Mr. mi phelps|
+-----------------------+
only showing top 20 rows

fname: Unit = ()
```

Task – 2 - Add a new column called ranking using udfs on dataframe, where:

- gold medalist, with age >= 32 are ranked as pro
- gold medalists, with age <= 31 are ranked amateur
- silver medalist, with age >= 32 are ranked as expert
- silver medalists, with age <= 31 are ranked rookie

The UDF below, UDF that we have used to define the new column

val Ranking = udf((medal: String, age: Int) => (medal,age) match

{

case (medal,age) if medal == "gold" && age >= 32 => "Pro"

case (medal,age) if medal == "gold" && age <= 32 => "amateur"

case (medal,age) if medal == "silver" && age >= 32 => "expert"

case (medal,age) if medal == "silver" && age <= 32 => "rookie"

})

Here we are classifying each player based on age and the medal he has got,

```
scala> val Ranking = udf((medal: String, age: Int) => (medal,age) match
     | {
     | case (medal,age) if medal == "gold" && age >= 32 => "Pro"
     | case (medal,age) if medal == "gold" && age <= 32 => "amateur"
     | case (medal,age) if medal == "silver" && age >= 32 => "expert"
     | case (medal,age) if medal == "silver" && age <= 32 => "rookie"
     | })
Ranking: org.apache.spark.sql.expressions.UserDefinedFunction = UserDefinedFunction(<function2>,StringType,Some(List(StringType, IntegerType)))
```

Below code shows the registering of UDF and command to add a new column,

- ***spark.udf.register("Ranks", Ranking)***
- ***val RankingRDD = SportsDataDF.withColumn("Ranks", Ranking(SportsDataDF.col("medal"),SportsDataDF.col("age")))***

```
scala> spark.udf.register("Ranks", Ranking)
res3: org.apache.spark.sql.expressions.UserDefinedFunction = UserDefinedFunction(<function2>,StringType,Some(List(StringType, IntegerType)))

scala> val RankingRDD = SportsDataDF.withColumn("Ranks", Ranking(SportsDataDF.col("medal"),SportsDataDF.col("age")))
RankingRDD: org.apache.spark.sql.DataFrame = [firstname: string, lastname: string ... 6 more fields]
```

And the desired result is shown in the below screen shot,

Expected Output

```
scala> RankingRDD.show()
+---------+--------+--------+------+---+----+-------+-------+
|firstname|lastname|  sports| medal|age|year|country|  Ranks|
+---------+--------+--------+------+---+----+-------+-------+
|     lisa|  cudrow|javellin|  gold| 34|2015|    USA|    Pro|
|   mathew|   louis|javellin|  gold| 34|2015|    RUS|    Pro|
|  michael|  phelps|swimming|silver| 32|2016|    USA| expert|
|     usha|      pt| running|silver| 30|2016|    IND| rookie|
|   serena|williams| running|  gold| 31|2014|    FRA|amateur|
|    roger| federer|  tennis|silver| 32|2016|    CHN| expert|
|  jenifer|     cox|swimming|silver| 32|2014|    IND| expert|
| fernando| johnson|swimming|silver| 32|2016|    CHN| expert|
|     lisa|  cudrow|javellin|  gold| 34|2017|    USA|    Pro|
|   mathew|   louis|javellin|  gold| 34|2015|    RUS|    Pro|
|  michael|  phelps|swimming|silver| 32|2017|    USA| expert|
|     usha|      pt| running|silver| 30|2014|    IND| rookie|
|   serena|williams| running|  gold| 31|2016|    FRA|amateur|
|    roger| federer|  tennis|silver| 32|2017|    CHN| expert|
|  jenifer|     cox|swimming|silver| 32|2014|    IND| expert|
| fernando| johnson|swimming|silver| 32|2017|    CHN| expert|
|     lisa|  cudrow|javellin|  gold| 34|2014|    USA|    Pro|
|   mathew|   louis|javellin|  gold| 34|2014|    RUS|    Pro|
|  michael|  phelps|swimming|silver| 32|2017|    USA| expert|
|     usha|      pt| running|silver| 30|2014|    IND| rookie|
+---------+--------+--------+------+---+----+-------+-------+
only showing top 20 rows
```