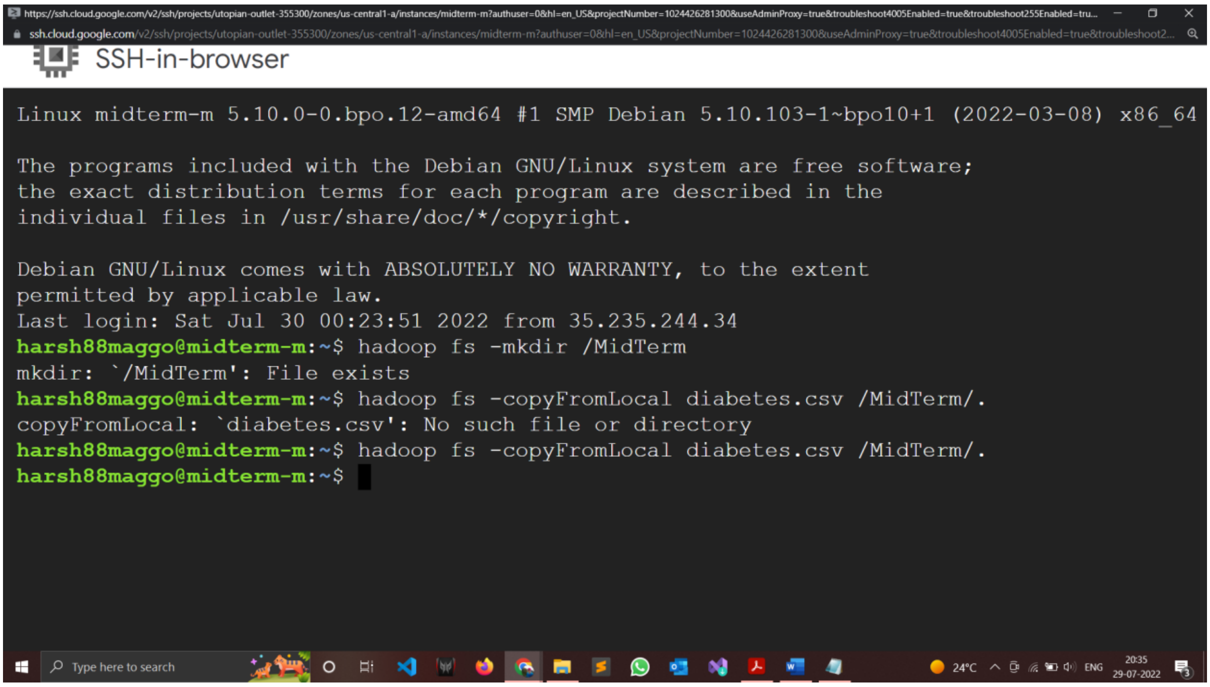
Diabetes Data (With Random Forest Classification)

Creating a Hadoop directory and loading the data from the local files system to Hadoop


https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
SSH-in-browser
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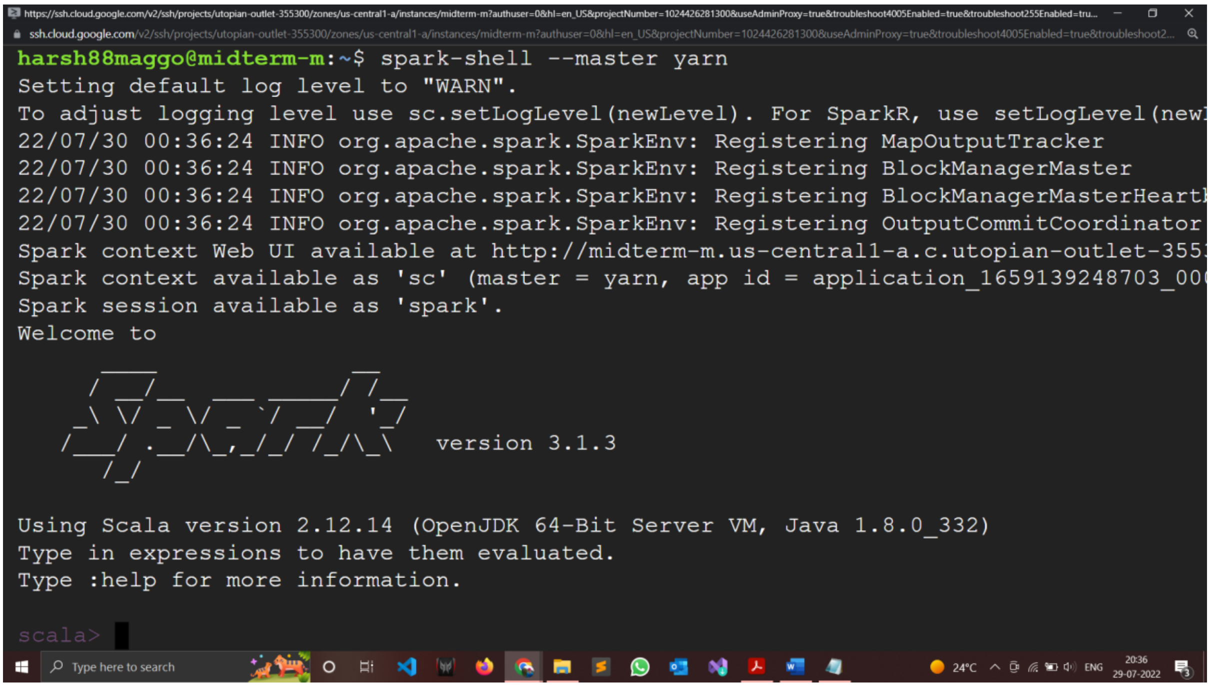
ENG
20:35
29-07-2022

```
Linux midterm-m 5.10.0-0.bpo.12-amd64 #1 SMP Debian 5.10.103-1~bpo10+1 (2022-03-08) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Sat Jul 30 00:23:51 2022 from 35.235.244.34
harsh88maggo@midterm-m:~$ hadoop fs -mkdir /MidTerm
mkdir: `/MidTerm': File exists
harsh88maggo@midterm-m:~$ hadoop fs -copyFromLocal diabetes.csv /MidTerm/.
copyFromLocal: `diabetes.csv': No such file or directory
harsh88maggo@midterm-m:~$ hadoop fs -copyFromLocal diabetes.csv /MidTerm/.
harsh88maggo@midterm-m:~$
```

Running the Spark Shell


https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
Type here to search
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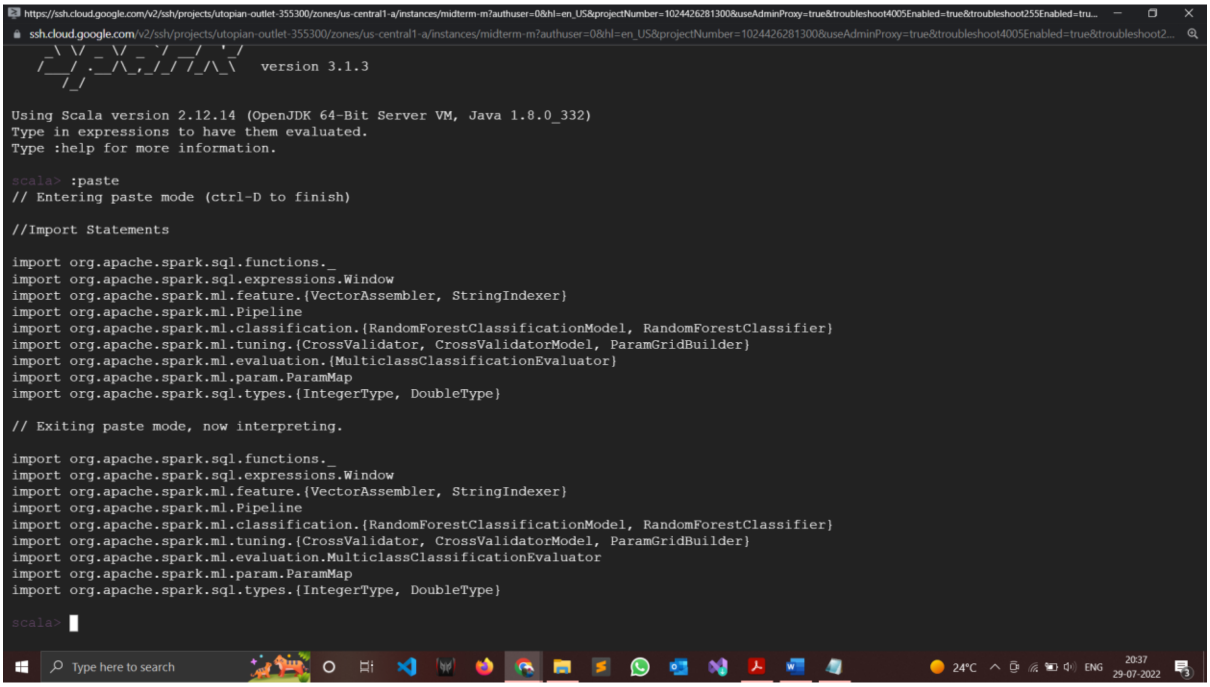
29-07-2022

```
harsh88maggo@midterm-m:~$ spark-shell --master yarn
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(newl
22/07/30 00:36:24 INFO org.apache.spark.SparkEnv: Registering MapOutputTracker
22/07/30 00:36:24 INFO org.apache.spark.SparkEnv: Registering BlockManagerMaster
22/07/30 00:36:24 INFO org.apache.spark.SparkEnv: Registering BlockManagerMasterHeartb
22/07/30 00:36:24 INFO org.apache.spark.SparkEnv: Registering OutputCommitCoordinator
Spark context Web UI available at http://midterm-m.us-central1-a.c.utopian-outlet-3553
Spark context available as 'sc' (master = yarn, app id = application_1659139248703_000
Spark session available as 'spark'.
Welcome to
      ____              __
     / __/__  ___ _____/ /__
    _\ \/ _ \/ _ `/ __/  '_/
   /___/ .__/\_,_/_/ /_/\_\   version 3.1.3
      /_/

Using Scala version 2.12.14 (OpenJDK 64-Bit Server VM, Java 1.8.0_332)
Type in expressions to have them evaluated.
Type :help for more information.

scala>
```

Import statements



https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
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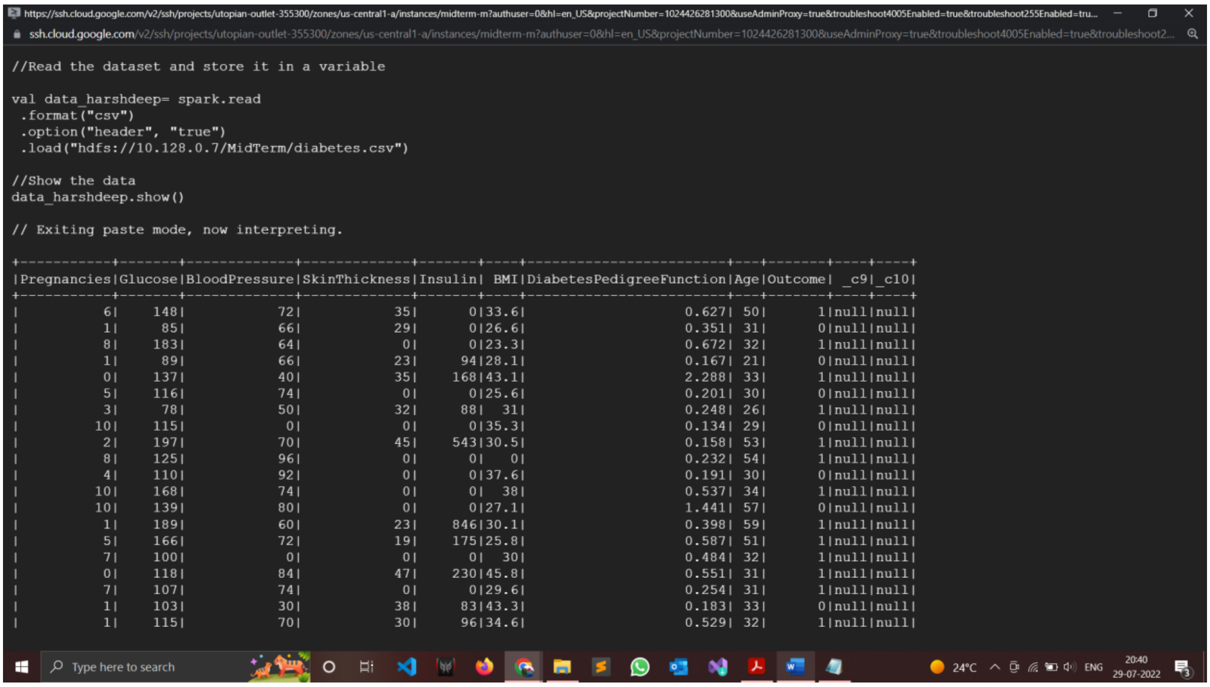
29-07-2022

```
   _\ \/ _ \/ _ `/ __/  '_/
  /___/ .__/\_,_/_/ /_/\_\   version 3.1.3
     /_/

Using Scala version 2.12.14 (OpenJDK 64-Bit Server VM, Java 1.8.0_332)
Type in expressions to have them evaluated.
Type :help for more information.

scala> :paste
// Entering paste mode (ctrl-D to finish)

//Import Statements

import org.apache.spark.sql.functions._
import org.apache.spark.sql.expressions.Window
import org.apache.spark.ml.feature.{VectorAssembler, StringIndexer}
import org.apache.spark.ml.Pipeline
import org.apache.spark.ml.classification.{RandomForestClassificationModel, RandomForestClassifier}
import org.apache.spark.ml.tuning.{CrossValidator, CrossValidatorModel, ParamGridBuilder}
import org.apache.spark.ml.evaluation.{MulticlassClassificationEvaluator}
import org.apache.spark.ml.param.ParamMap
import org.apache.spark.sql.types.{IntegerType, DoubleType}

// Exiting paste mode, now interpreting.

import org.apache.spark.sql.functions._
import org.apache.spark.sql.expressions.Window
import org.apache.spark.ml.feature.{VectorAssembler, StringIndexer}
import org.apache.spark.ml.Pipeline
import org.apache.spark.ml.classification.{RandomForestClassificationModel, RandomForestClassifier}
import org.apache.spark.ml.tuning.{CrossValidator, CrossValidatorModel, ParamGridBuilder}
import org.apache.spark.ml.evaluation.MulticlassClassificationEvaluator
import org.apache.spark.ml.param.ParamMap
import org.apache.spark.sql.types.{IntegerType, DoubleType}

scala> █
```

Reading the CSV file and checking the data



https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
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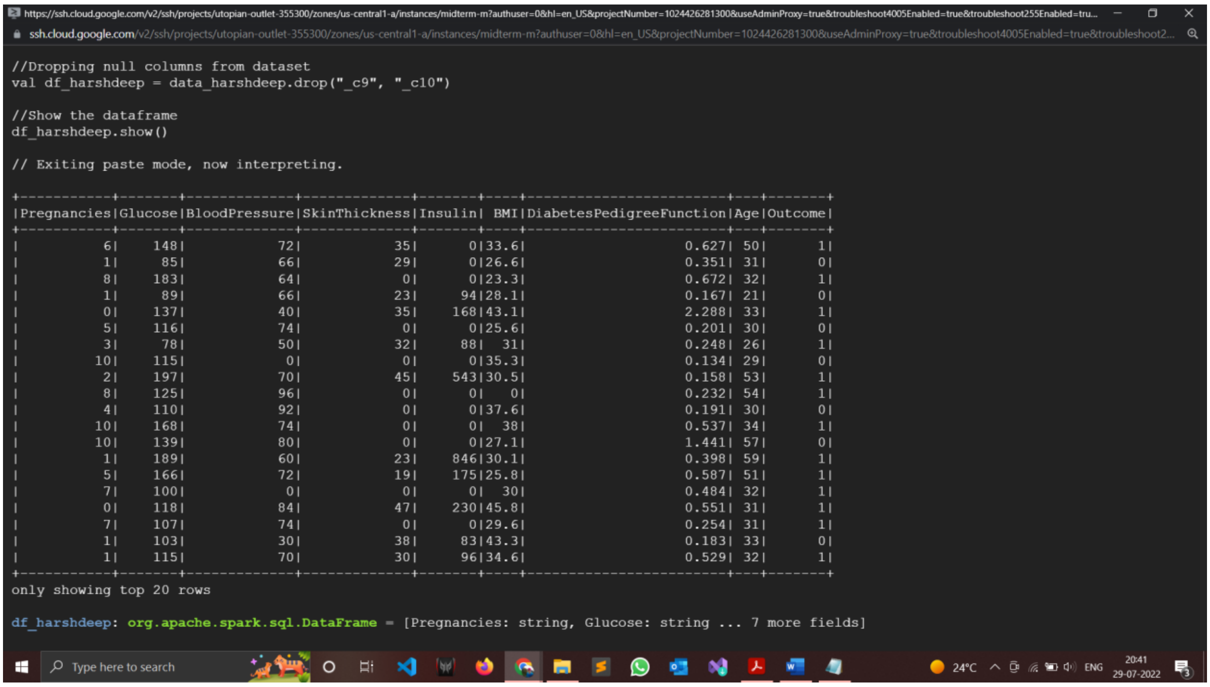
29-07-2022

```
//Read the dataset and store it in a variable

val data_harshdeep= spark.read
 .format("csv")
 .option("header", "true")
 .load("hdfs://10.128.0.7/MidTerm/diabetes.csv")

//Show the data
data_harshdeep.show()

// Exiting paste mode, now interpreting.

+-----------+-------+-------------+-------------+-------+----+------------------------+---+-------+----+----+
|Pregnancies|Glucose|BloodPressure|SkinThickness|Insulin| BMI|DiabetesPedigreeFunction|Age|Outcome| _c9|_c10|
+-----------+-------+-------------+-------------+-------+----+------------------------+---+-------+----+----+
|          6|    148|           72|           35|      0|33.6|                   0.627| 50|      1|null|null|
|          1|     85|           66|           29|      0|26.6|                   0.351| 31|      0|null|null|
|          8|    183|           64|            0|      0|23.3|                   0.672| 32|      1|null|null|
|          1|     89|           66|           23|     94|28.1|                   0.167| 21|      0|null|null|
|          0|    137|           40|           35|    168|43.1|                   2.288| 33|      1|null|null|
|          5|    116|           74|            0|      0|25.6|                   0.201| 30|      0|null|null|
|          3|     78|           50|           32|     88|  31|                   0.248| 26|      1|null|null|
|         10|    115|            0|            0|      0|35.3|                   0.134| 29|      0|null|null|
|          2|    197|           70|           45|    543|30.5|                   0.158| 53|      1|null|null|
|          8|    125|           96|            0|      0|   0|                   0.232| 54|      1|null|null|
|          4|    110|           92|            0|      0|37.6|                   0.191| 30|      0|null|null|
|         10|    168|           74|            0|      0|  38|                   0.537| 34|      1|null|null|
|         10|    139|           80|            0|      0|27.1|                   1.441| 57|      0|null|null|
|          1|    189|           60|           23|    846|30.1|                   0.398| 59|      1|null|null|
|          5|    166|           72|           19|    175|25.8|                   0.587| 51|      1|null|null|
|          7|    100|            0|            0|      0|  30|                   0.484| 32|      1|null|null|
|          0|    118|           84|           47|    230|45.8|                   0.551| 31|      1|null|null|
|          7|    107|           74|            0|      0|29.6|                   0.254| 31|      1|null|null|
|          1|    103|           30|           38|     83|43.3|                   0.183| 33|      0|null|null|
|          1|    115|           70|           30|     96|34.6|                   0.529| 32|      1|null|null|
```

Dropping null columns from the dataset


https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
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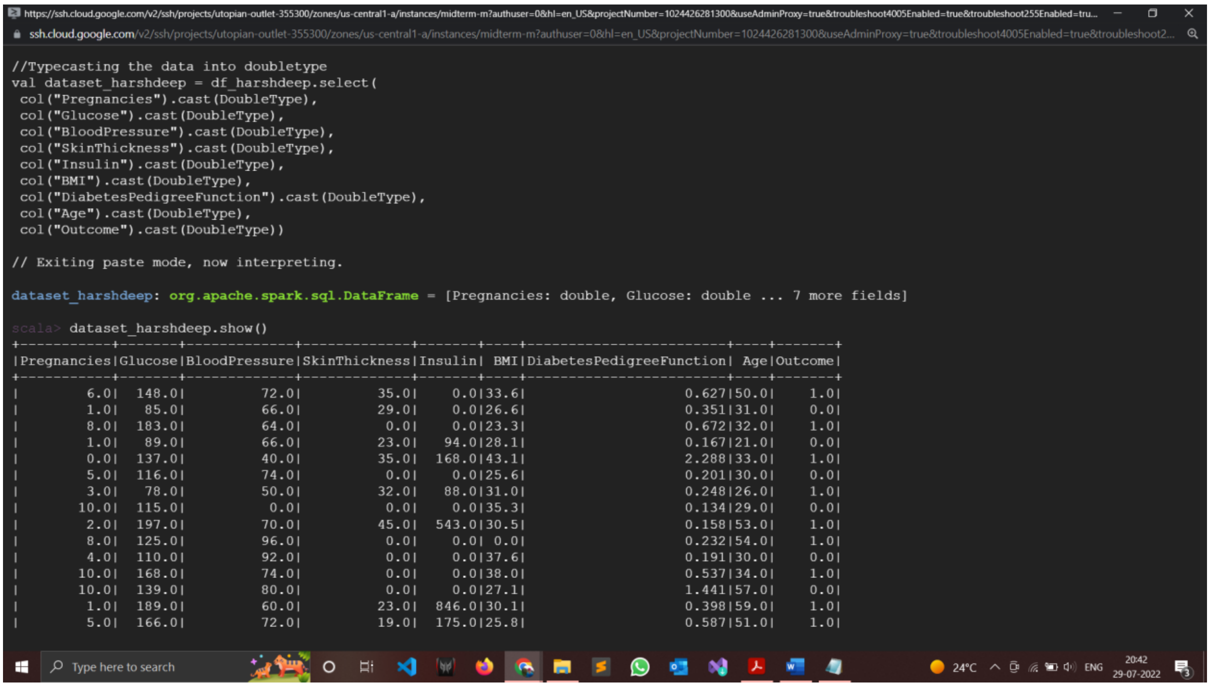
```
//Dropping null columns from dataset
val df_harshdeep = data_harshdeep.drop("_c9", "_c10")

//Show the dataframe
df_harshdeep.show()

// Exiting paste mode, now interpreting.

+-----------+-------+-------------+-------------+-------+----+------------------------+---+-------+
|Pregnancies|Glucose|BloodPressure|SkinThickness|Insulin| BMI|DiabetesPedigreeFunction|Age|Outcome|
+-----------+-------+-------------+-------------+-------+----+------------------------+---+-------+
|          6|    148|           72|           35|      0|33.6|                   0.627| 50|      1|
|          1|     85|           66|           29|      0|26.6|                   0.351| 31|      0|
|          8|    183|           64|            0|      0|23.3|                   0.672| 32|      1|
|          1|     89|           66|           23|     94|28.1|                   0.167| 21|      0|
|          0|    137|           40|           35|    168|43.1|                   2.288| 33|      1|
|          5|    116|           74|            0|      0|25.6|                   0.201| 30|      0|
|          3|     78|           50|           32|     88|  31|                   0.248| 26|      1|
|         10|    115|            0|            0|      0|35.3|                   0.134| 29|      0|
|          2|    197|           70|           45|    543|30.5|                   0.158| 53|      1|
|          8|    125|           96|            0|      0|   0|                   0.232| 54|      1|
|          4|    110|           92|            0|      0|37.6|                   0.191| 30|      0|
|         10|    168|           74|            0|      0|  38|                   0.537| 34|      1|
|         10|    139|           80|            0|      0|27.1|                   1.441| 57|      0|
|          1|    189|           60|           23|    846|30.1|                   0.398| 59|      1|
|          5|    166|           72|           19|    175|25.8|                   0.587| 51|      1|
|          7|    100|            0|            0|      0|  30|                   0.484| 32|      1|
|          0|    118|           84|           47|    230|45.8|                   0.551| 31|      1|
|          7|    107|           74|            0|      0|29.6|                   0.254| 31|      1|
|          1|    103|           30|           38|     83|43.3|                   0.183| 33|      0|
|          1|    115|           70|           30|     96|34.6|                   0.529| 32|      1|
+-----------+-------+-------------+-------------+-------+----+------------------------+---+-------+
only showing top 20 rows

df_harshdeep: org.apache.spark.sql.DataFrame = [Pregnancies: string, Glucose: string ... 7 more fields]
```

Typecasting the data into type Double for our model training


https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
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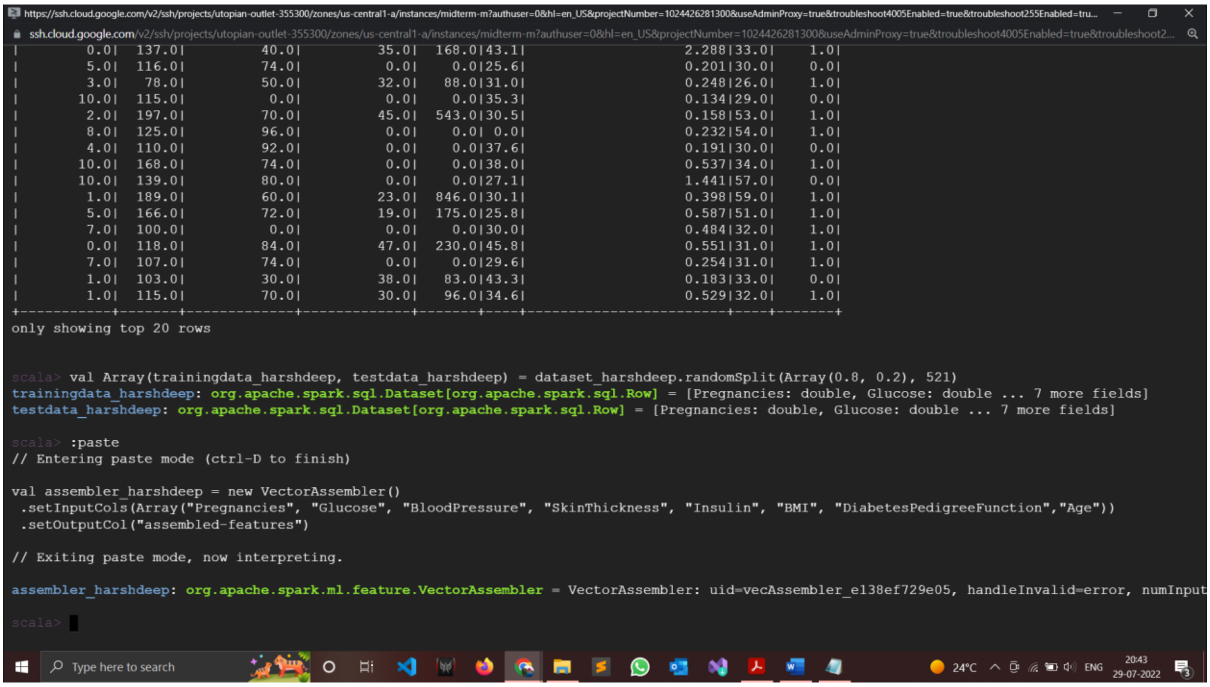
29-07-2022

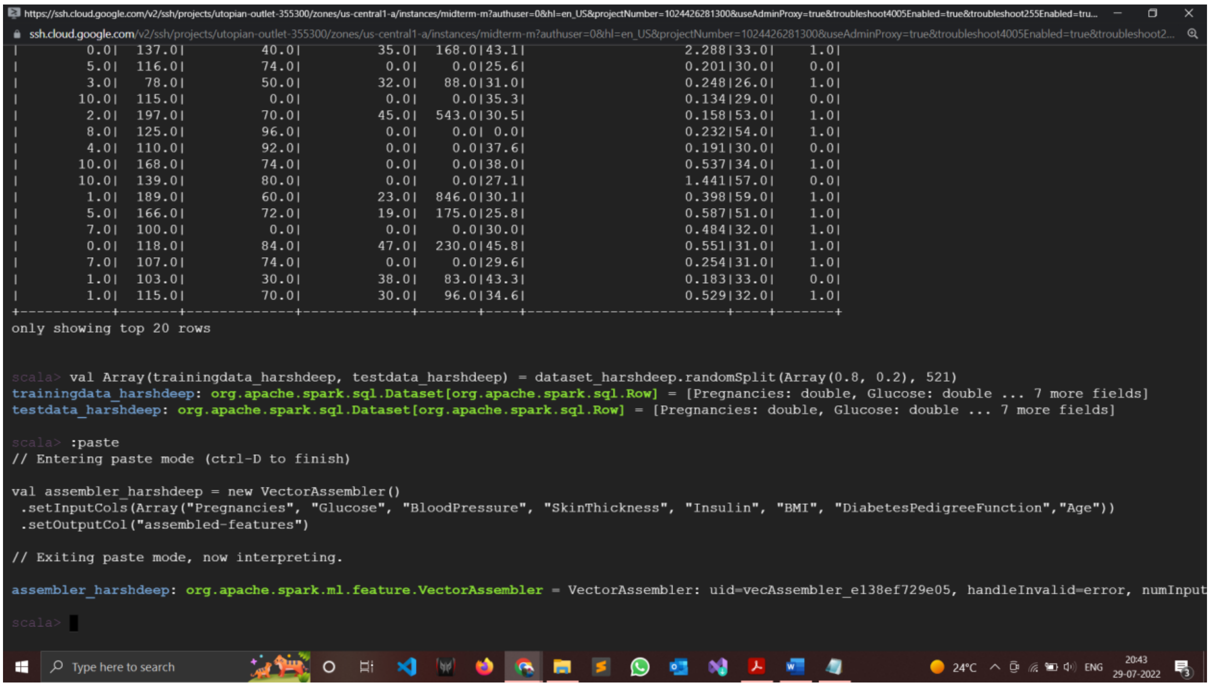
```
//Typecasting the data into doubletype
val dataset_harshdeep = df_harshdeep.select(
 col("Pregnancies").cast(DoubleType),
 col("Glucose").cast(DoubleType),
 col("BloodPressure").cast(DoubleType),
 col("SkinThickness").cast(DoubleType),
 col("Insulin").cast(DoubleType),
 col("BMI").cast(DoubleType),
 col("DiabetesPedigreeFunction").cast(DoubleType),
 col("Age").cast(DoubleType),
 col("Outcome").cast(DoubleType))

// Exiting paste mode, now interpreting.

dataset_harshdeep: org.apache.spark.sql.DataFrame = [Pregnancies: double, Glucose: double ... 7 more fields]

scala> dataset_harshdeep.show()
+-----------+-------+-------------+-------------+-------+----+------------------------+----+-------+
|Pregnancies|Glucose|BloodPressure|SkinThickness|Insulin| BMI|DiabetesPedigreeFunction| Age|Outcome|
+-----------+-------+-------------+-------------+-------+----+------------------------+----+-------+
|        6.0|  148.0|         72.0|         35.0|    0.0|33.6|                   0.627|50.0|    1.0|
|        1.0|   85.0|         66.0|         29.0|    0.0|26.6|                   0.351|31.0|    0.0|
|        8.0|  183.0|         64.0|          0.0|    0.0|23.3|                   0.672|32.0|    1.0|
|        1.0|   89.0|         66.0|         23.0|   94.0|28.1|                   0.167|21.0|    0.0|
|        0.0|  137.0|         40.0|         35.0|  168.0|43.1|                   2.288|33.0|    1.0|
|        5.0|  116.0|         74.0|          0.0|    0.0|25.6|                   0.201|30.0|    0.0|
|        3.0|   78.0|         50.0|         32.0|   88.0|31.0|                   0.248|26.0|    1.0|
|       10.0|  115.0|          0.0|          0.0|    0.0|35.3|                   0.134|29.0|    0.0|
|        2.0|  197.0|         70.0|         45.0|  543.0|30.5|                   0.158|53.0|    1.0|
|        8.0|  125.0|         96.0|          0.0|    0.0| 0.0|                   0.232|54.0|    1.0|
|        4.0|  110.0|         92.0|          0.0|    0.0|37.6|                   0.191|30.0|    0.0|
|       10.0|  168.0|         74.0|          0.0|    0.0|38.0|                   0.537|34.0|    1.0|
|       10.0|  139.0|         80.0|          0.0|    0.0|27.1|                   1.441|57.0|    0.0|
|        1.0|  189.0|         60.0|         23.0|  846.0|30.1|                   0.398|59.0|    1.0|
|        5.0|  166.0|         72.0|         19.0|  175.0|25.8|                   0.587|51.0|    1.0|
```

Split the dataset into train and test



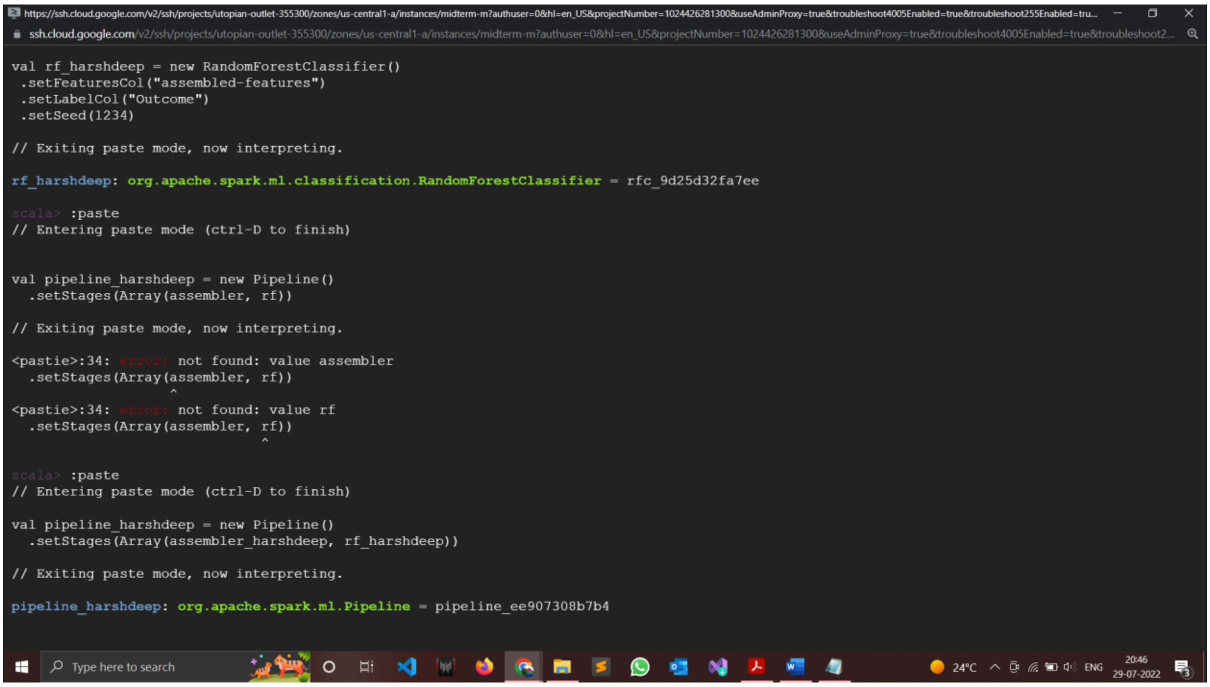
```
|       0.0|  137.0|        40.0|        35.0|  168.0|43.1|                   2.288|33.0|    1.0|
|       5.0|  116.0|        74.0|         0.0|    0.0|25.6|                   0.201|30.0|    0.0|
|       3.0|   78.0|        50.0|        32.0|   88.0|31.0|                   0.248|26.0|    1.0|
|      10.0|  115.0|         0.0|         0.0|    0.0|35.3|                   0.134|29.0|    0.0|
|       2.0|  197.0|        70.0|        45.0|  543.0|30.5|                   0.158|53.0|    1.0|
|       8.0|  125.0|        96.0|         0.0|    0.0| 0.0|                   0.232|54.0|    1.0|
|       4.0|  110.0|        92.0|         0.0|    0.0|37.6|                   0.191|30.0|    0.0|
|      10.0|  168.0|        74.0|         0.0|    0.0|38.0|                   0.537|34.0|    1.0|
|      10.0|  139.0|        80.0|         0.0|    0.0|27.1|                   1.441|57.0|    0.0|
|       1.0|  189.0|        60.0|        23.0|  846.0|30.1|                   0.398|59.0|    1.0|
|       5.0|  166.0|        72.0|        19.0|  175.0|25.8|                   0.587|51.0|    1.0|
|       7.0|  100.0|         0.0|         0.0|    0.0|30.0|                   0.484|32.0|    1.0|
|       0.0|  118.0|        84.0|        47.0|  230.0|45.8|                   0.551|31.0|    1.0|
|       7.0|  107.0|        74.0|         0.0|    0.0|29.6|                   0.254|31.0|    1.0|
|       1.0|  103.0|        30.0|        38.0|   83.0|43.3|                   0.183|33.0|    0.0|
|       1.0|  115.0|        70.0|        30.0|   96.0|34.6|                   0.529|32.0|    1.0|
+-----------+-------+-------------+-------------+-------+----+------------------------+----+-------+
only showing top 20 rows


scala> val Array(trainingdata_harshdeep, testdata_harshdeep) = dataset_harshdeep.randomSplit(Array(0.8, 0.2), 521)
trainingdata_harshdeep: org.apache.spark.sql.Dataset[org.apache.spark.sql.Row] = [Pregnancies: double, Glucose: double ... 7 more fields]
testdata_harshdeep: org.apache.spark.sql.Dataset[org.apache.spark.sql.Row] = [Pregnancies: double, Glucose: double ... 7 more fields]

scala> :paste
// Entering paste mode (ctrl-D to finish)

val assembler_harshdeep = new VectorAssembler()
 .setInputCols(Array("Pregnancies", "Glucose", "BloodPressure", "SkinThickness", "Insulin", "BMI", "DiabetesPedigreeFunction","Age"))
 .setOutputCol("assembled-features")

// Exiting paste mode, now interpreting.

assembler_harshdeep: org.apache.spark.ml.feature.VectorAssembler = VectorAssembler: uid=vecAssembler_e138ef729e05, handleInvalid=error, numInput

scala>
```

Assembling the features using VectorAssembler



```
|       0.0|  137.0|        40.0|        35.0|  168.0|43.1|                   2.288|33.0|    1.0|
|       5.0|  116.0|        74.0|         0.0|    0.0|25.6|                   0.201|30.0|    0.0|
|       3.0|   78.0|        50.0|        32.0|   88.0|31.0|                   0.248|26.0|    1.0|
|      10.0|  115.0|         0.0|         0.0|    0.0|35.3|                   0.134|29.0|    0.0|
|       2.0|  197.0|        70.0|        45.0|  543.0|30.5|                   0.158|53.0|    1.0|
|       8.0|  125.0|        96.0|         0.0|    0.0| 0.0|                   0.232|54.0|    1.0|
|       4.0|  110.0|        92.0|         0.0|    0.0|37.6|                   0.191|30.0|    0.0|
|      10.0|  168.0|        74.0|         0.0|    0.0|38.0|                   0.537|34.0|    1.0|
|      10.0|  139.0|        80.0|         0.0|    0.0|27.1|                   1.441|57.0|    0.0|
|       1.0|  189.0|        60.0|        23.0|  846.0|30.1|                   0.398|59.0|    1.0|
|       5.0|  166.0|        72.0|        19.0|  175.0|25.8|                   0.587|51.0|    1.0|
|       7.0|  100.0|         0.0|         0.0|    0.0|30.0|                   0.484|32.0|    1.0|
|       0.0|  118.0|        84.0|        47.0|  230.0|45.8|                   0.551|31.0|    1.0|
|       7.0|  107.0|        74.0|         0.0|    0.0|29.6|                   0.254|31.0|    1.0|
|       1.0|  103.0|        30.0|        38.0|   83.0|43.3|                   0.183|33.0|    0.0|
|       1.0|  115.0|        70.0|        30.0|   96.0|34.6|                   0.529|32.0|    1.0|
+-----------+-------+-------------+-------------+-------+----+------------------------+----+-------+
only showing top 20 rows


scala> val Array(trainingdata_harshdeep, testdata_harshdeep) = dataset_harshdeep.randomSplit(Array(0.8, 0.2), 521)
trainingdata_harshdeep: org.apache.spark.sql.Dataset[org.apache.spark.sql.Row] = [Pregnancies: double, Glucose: double ... 7 more fields]
testdata_harshdeep: org.apache.spark.sql.Dataset[org.apache.spark.sql.Row] = [Pregnancies: double, Glucose: double ... 7 more fields]

scala> :paste
// Entering paste mode (ctrl-D to finish)

val assembler_harshdeep = new VectorAssembler()
 .setInputCols(Array("Pregnancies", "Glucose", "BloodPressure", "SkinThickness", "Insulin", "BMI", "DiabetesPedigreeFunction","Age"))
 .setOutputCol("assembled-features")

// Exiting paste mode, now interpreting.

assembler_harshdeep: org.apache.spark.ml.feature.VectorAssembler = VectorAssembler: uid=vecAssembler_e138ef729e05, handleInvalid=error, numInput

scala>
```

Creating the Random Forest Object and passing the features


https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
Type here to search
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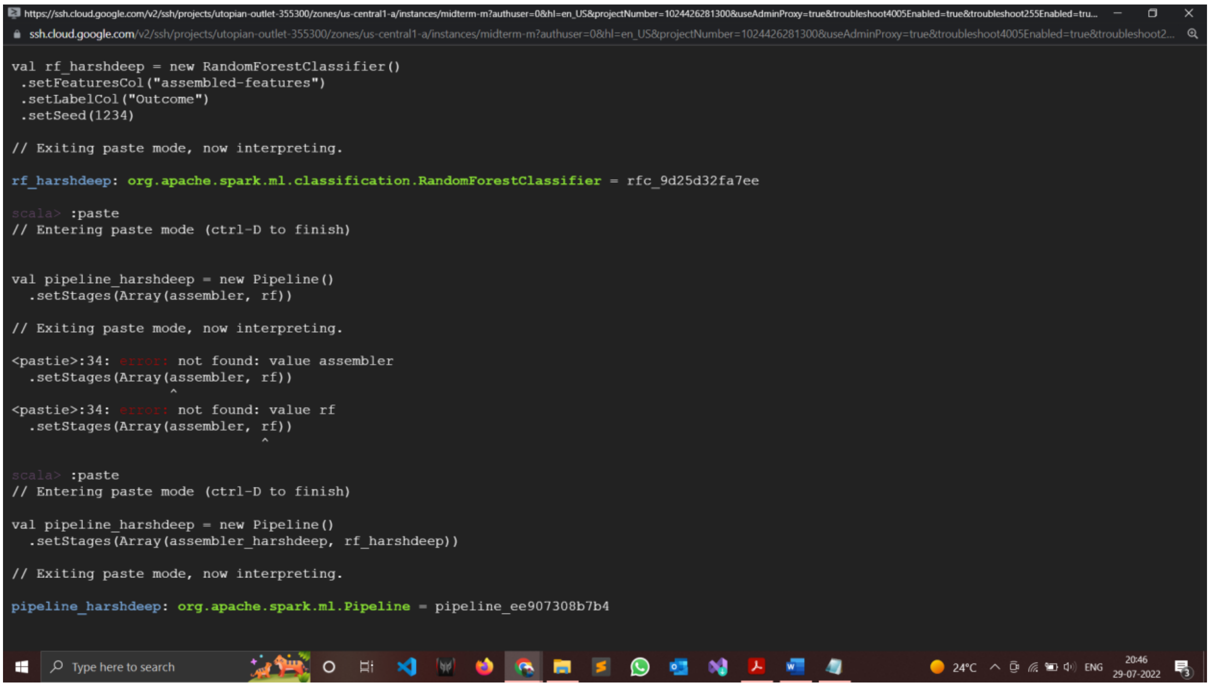
20:46
29-07-2022

```
val rf_harshdeep = new RandomForestClassifier()
 .setFeaturesCol("assembled-features")
 .setLabelCol("Outcome")
 .setSeed(1234)

// Exiting paste mode, now interpreting.

rf_harshdeep: org.apache.spark.ml.classification.RandomForestClassifier = rfc_9d25d32fa7ee

scala> :paste
// Entering paste mode (ctrl-D to finish)


val pipeline_harshdeep = new Pipeline()
  .setStages(Array(assembler, rf))

// Exiting paste mode, now interpreting.

<pastie>:34: error: not found: value assembler
  .setStages(Array(assembler, rf))
                   ^
<pastie>:34: error: not found: value rf
  .setStages(Array(assembler, rf))
                              ^

scala> :paste
// Entering paste mode (ctrl-D to finish)

val pipeline_harshdeep = new Pipeline()
  .setStages(Array(assembler_harshdeep, rf_harshdeep))

// Exiting paste mode, now interpreting.

pipeline_harshdeep: org.apache.spark.ml.Pipeline = pipeline_ee907308b7b4
```

Creating the pipeling


https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
Type here to search
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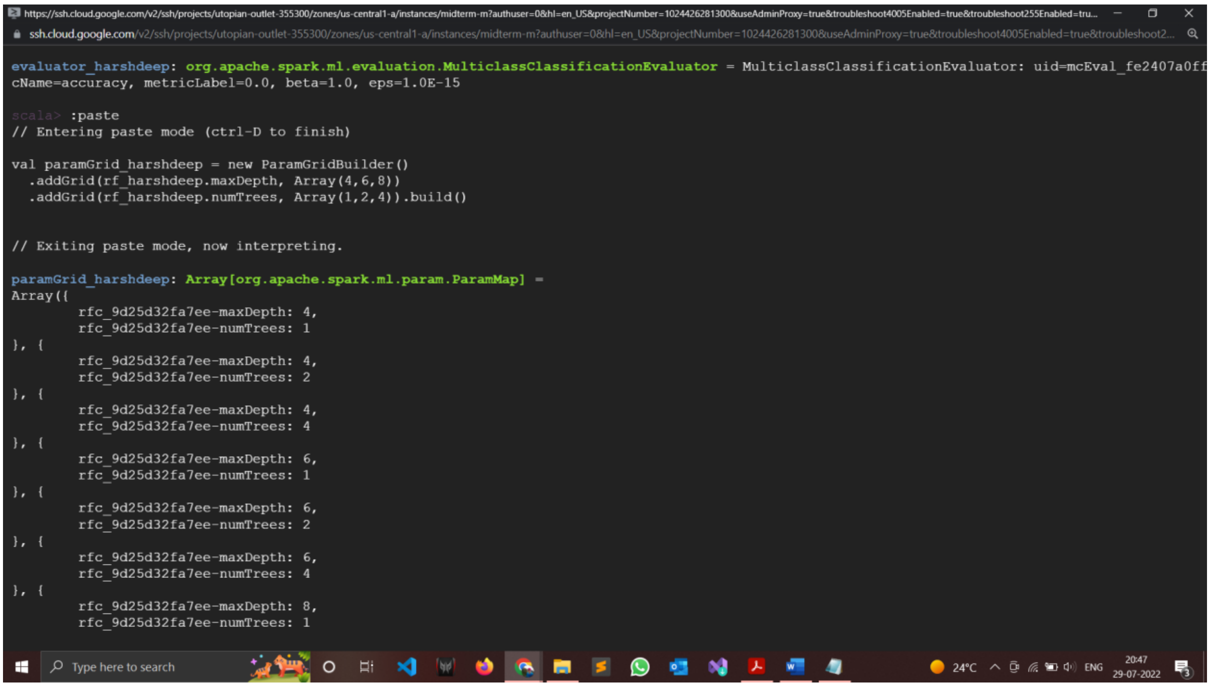
29-07-2022

```
val rf_harshdeep = new RandomForestClassifier()
 .setFeaturesCol("assembled-features")
 .setLabelCol("Outcome")
 .setSeed(1234)

// Exiting paste mode, now interpreting.

rf_harshdeep: org.apache.spark.ml.classification.RandomForestClassifier = rfc_9d25d32fa7ee

scala> :paste
// Entering paste mode (ctrl-D to finish)


val pipeline_harshdeep = new Pipeline()
  .setStages(Array(assembler, rf))

// Exiting paste mode, now interpreting.

<pastie>:34: error: not found: value assembler
  .setStages(Array(assembler, rf))
                   ^
<pastie>:34: error: not found: value rf
  .setStages(Array(assembler, rf))
                              ^

scala> :paste
// Entering paste mode (ctrl-D to finish)

val pipeline_harshdeep = new Pipeline()
  .setStages(Array(assembler_harshdeep, rf_harshdeep))

// Exiting paste mode, now interpreting.

pipeline_harshdeep: org.apache.spark.ml.Pipeline = pipeline_ee907308b7b4
```

Evaluator for our model


https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
Type here to search
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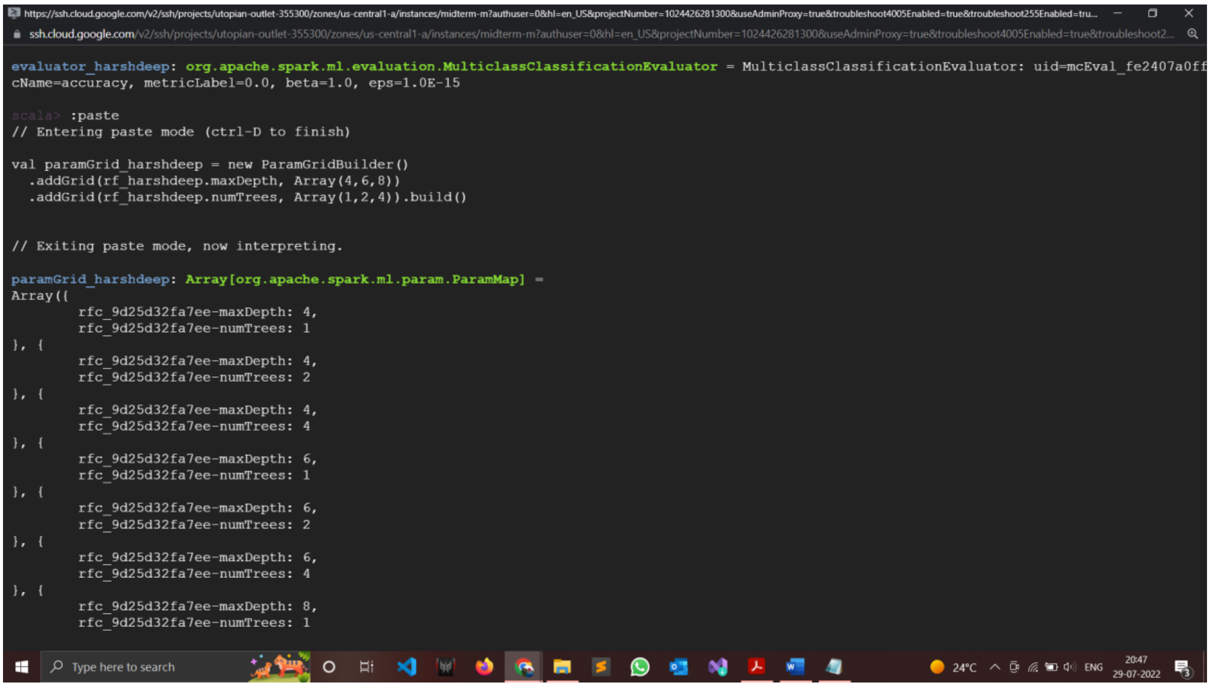
29-07-2022

```
evaluator_harshdeep: org.apache.spark.ml.evaluation.MulticlassClassificationEvaluator = MulticlassClassificationEvaluator: uid=mcEval_fe2407a0ff
cName=accuracy, metricLabel=0.0, beta=1.0, eps=1.0E-15

scala> :paste
// Entering paste mode (ctrl-D to finish)

val paramGrid_harshdeep = new ParamGridBuilder()
  .addGrid(rf_harshdeep.maxDepth, Array(4,6,8))
  .addGrid(rf_harshdeep.numTrees, Array(1,2,4)).build()


// Exiting paste mode, now interpreting.

paramGrid_harshdeep: Array[org.apache.spark.ml.param.ParamMap] =
Array({
        rfc_9d25d32fa7ee-maxDepth: 4,
        rfc_9d25d32fa7ee-numTrees: 1
}, {
        rfc_9d25d32fa7ee-maxDepth: 4,
        rfc_9d25d32fa7ee-numTrees: 2
}, {
        rfc_9d25d32fa7ee-maxDepth: 4,
        rfc_9d25d32fa7ee-numTrees: 4
}, {
        rfc_9d25d32fa7ee-maxDepth: 6,
        rfc_9d25d32fa7ee-numTrees: 1
}, {
        rfc_9d25d32fa7ee-maxDepth: 6,
        rfc_9d25d32fa7ee-numTrees: 2
}, {
        rfc_9d25d32fa7ee-maxDepth: 6,
        rfc_9d25d32fa7ee-numTrees: 4
}, {
        rfc_9d25d32fa7ee-maxDepth: 8,
        rfc_9d25d32fa7ee-numTrees: 1
```

Setting the hyperparameters


https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
Type here to search
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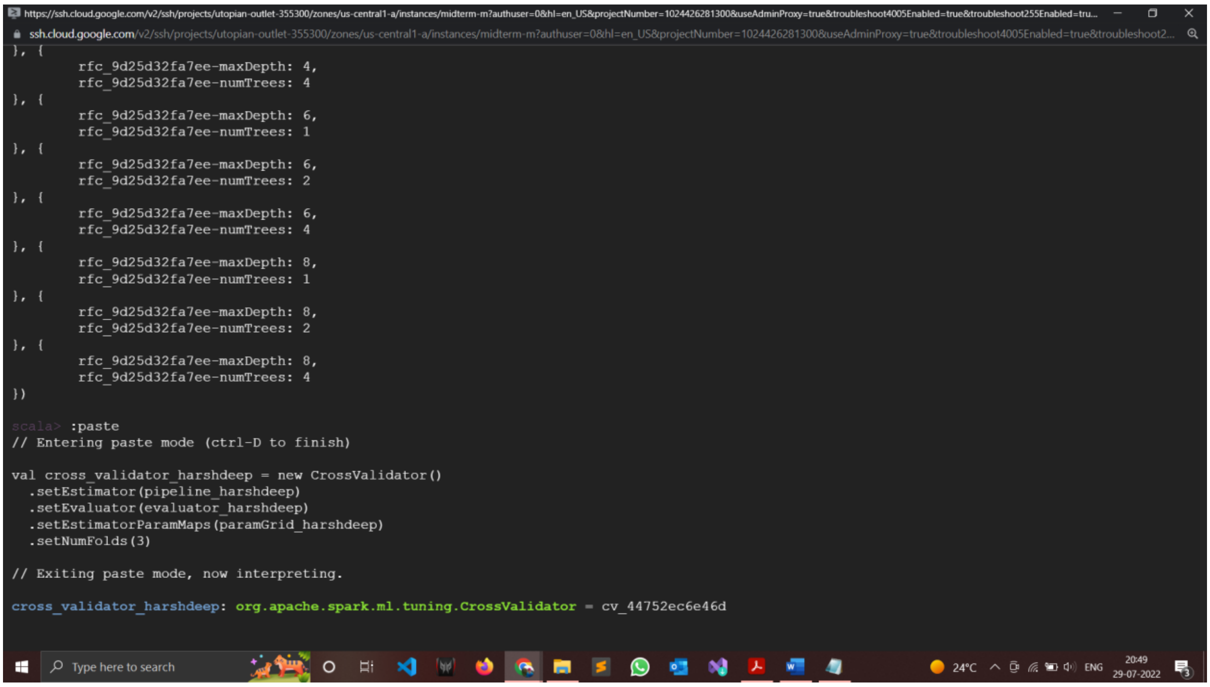
29-07-2022

```
evaluator_harshdeep: org.apache.spark.ml.evaluation.MulticlassClassificationEvaluator = MulticlassClassificationEvaluator: uid=mcEval_fe2407a0ff
cName=accuracy, metricLabel=0.0, beta=1.0, eps=1.0E-15

scala> :paste
// Entering paste mode (ctrl-D to finish)

val paramGrid_harshdeep = new ParamGridBuilder()
  .addGrid(rf_harshdeep.maxDepth, Array(4,6,8))
  .addGrid(rf_harshdeep.numTrees, Array(1,2,4)).build()


// Exiting paste mode, now interpreting.

paramGrid_harshdeep: Array[org.apache.spark.ml.param.ParamMap] =
Array({
        rfc_9d25d32fa7ee-maxDepth: 4,
        rfc_9d25d32fa7ee-numTrees: 1
}, {
        rfc_9d25d32fa7ee-maxDepth: 4,
        rfc_9d25d32fa7ee-numTrees: 2
}, {
        rfc_9d25d32fa7ee-maxDepth: 4,
        rfc_9d25d32fa7ee-numTrees: 4
}, {
        rfc_9d25d32fa7ee-maxDepth: 6,
        rfc_9d25d32fa7ee-numTrees: 1
}, {
        rfc_9d25d32fa7ee-maxDepth: 6,
        rfc_9d25d32fa7ee-numTrees: 2
}, {
        rfc_9d25d32fa7ee-maxDepth: 6,
        rfc_9d25d32fa7ee-numTrees: 4
}, {
        rfc_9d25d32fa7ee-maxDepth: 8,
        rfc_9d25d32fa7ee-numTrees: 1
```

Creating the Cross Validator


https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
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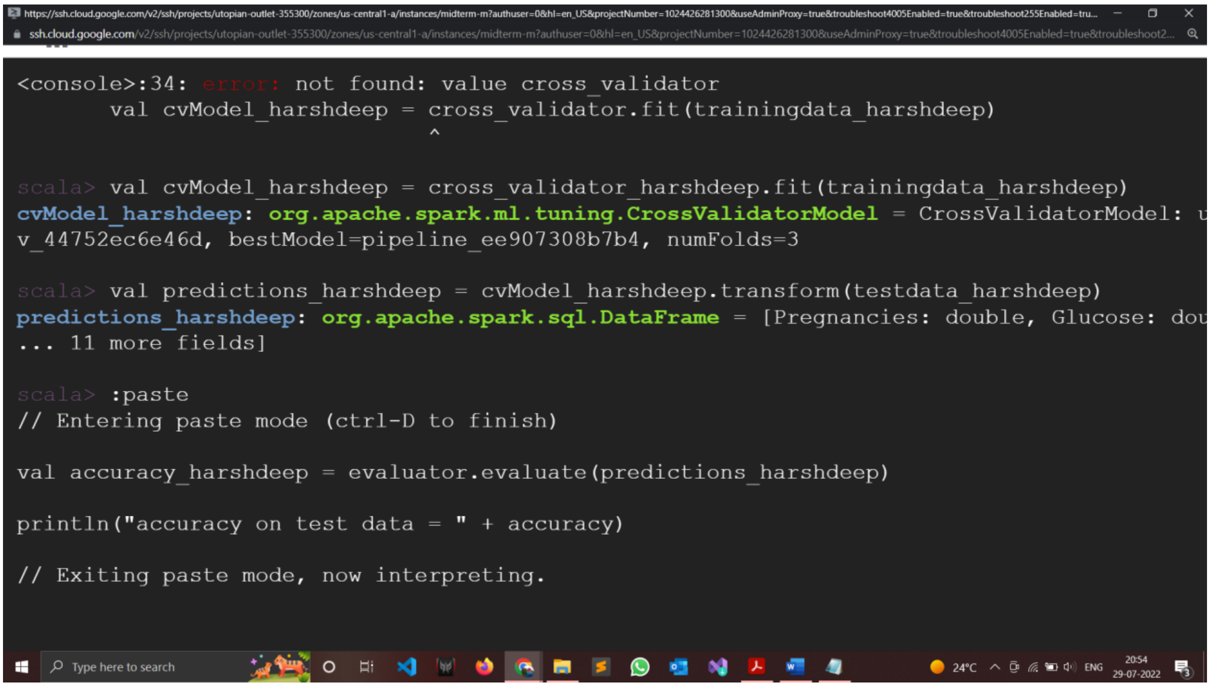
```
}, {
        rfc_9d25d32fa7ee-maxDepth: 4,
        rfc_9d25d32fa7ee-numTrees: 4
}, {
        rfc_9d25d32fa7ee-maxDepth: 6,
        rfc_9d25d32fa7ee-numTrees: 1
}, {
        rfc_9d25d32fa7ee-maxDepth: 6,
        rfc_9d25d32fa7ee-numTrees: 2
}, {
        rfc_9d25d32fa7ee-maxDepth: 6,
        rfc_9d25d32fa7ee-numTrees: 4
}, {
        rfc_9d25d32fa7ee-maxDepth: 8,
        rfc_9d25d32fa7ee-numTrees: 1
}, {
        rfc_9d25d32fa7ee-maxDepth: 8,
        rfc_9d25d32fa7ee-numTrees: 2
}, {
        rfc_9d25d32fa7ee-maxDepth: 8,
        rfc_9d25d32fa7ee-numTrees: 4
})

scala> :paste
// Entering paste mode (ctrl-D to finish)

val cross_validator_harshdeep = new CrossValidator()
  .setEstimator(pipeline_harshdeep)
  .setEvaluator(evaluator_harshdeep)
  .setEstimatorParamMaps(paramGrid_harshdeep)
  .setNumFolds(3)

// Exiting paste mode, now interpreting.

cross_validator_harshdeep: org.apache.spark.ml.tuning.CrossValidator = cv_44752ec6e46d
```

Training our model


https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
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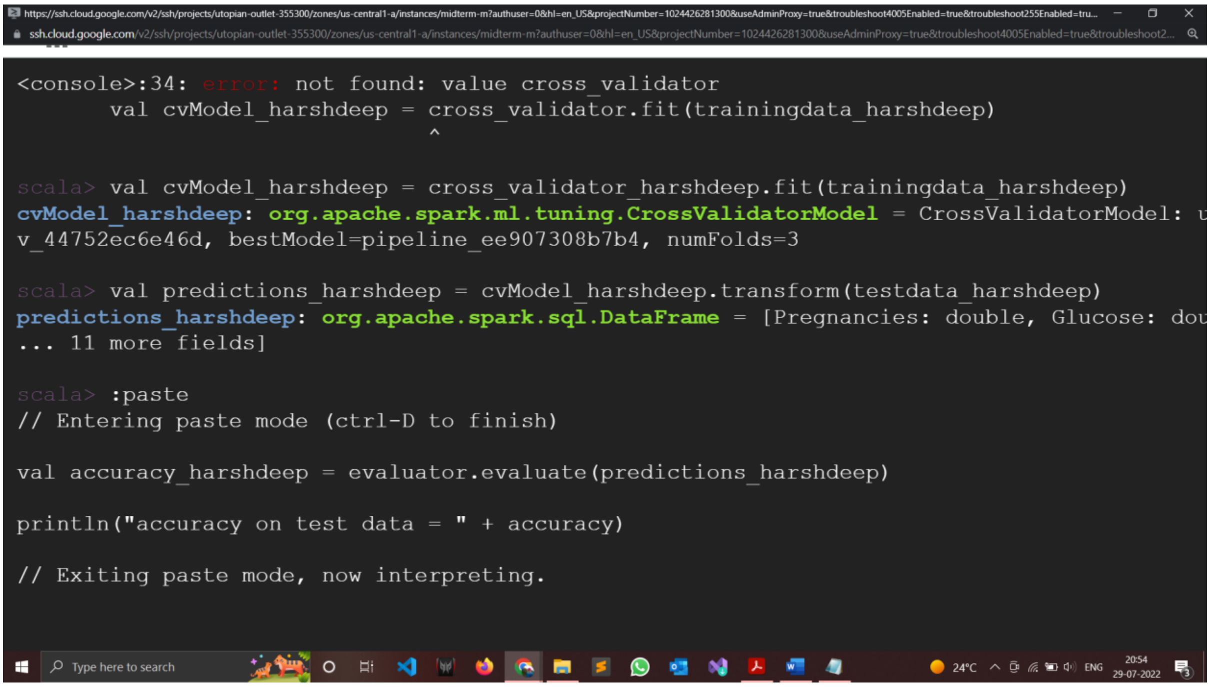
```
<console>:34: error: not found: value cross_validator
       val cvModel_harshdeep = cross_validator.fit(trainingdata_harshdeep)
                               ^

scala> val cvModel_harshdeep = cross_validator_harshdeep.fit(trainingdata_harshdeep)
cvModel_harshdeep: org.apache.spark.ml.tuning.CrossValidatorModel = CrossValidatorModel: u
v_44752ec6e46d, bestModel=pipeline_ee907308b7b4, numFolds=3

scala> val predictions_harshdeep = cvModel_harshdeep.transform(testdata_harshdeep)
predictions_harshdeep: org.apache.spark.sql.DataFrame = [Pregnancies: double, Glucose: dou
... 11 more fields]

scala> :paste
// Entering paste mode (ctrl-D to finish)

val accuracy_harshdeep = evaluator.evaluate(predictions_harshdeep)

println("accuracy on test data = " + accuracy)

// Exiting paste mode, now interpreting.
```

Prediction using testdata


https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
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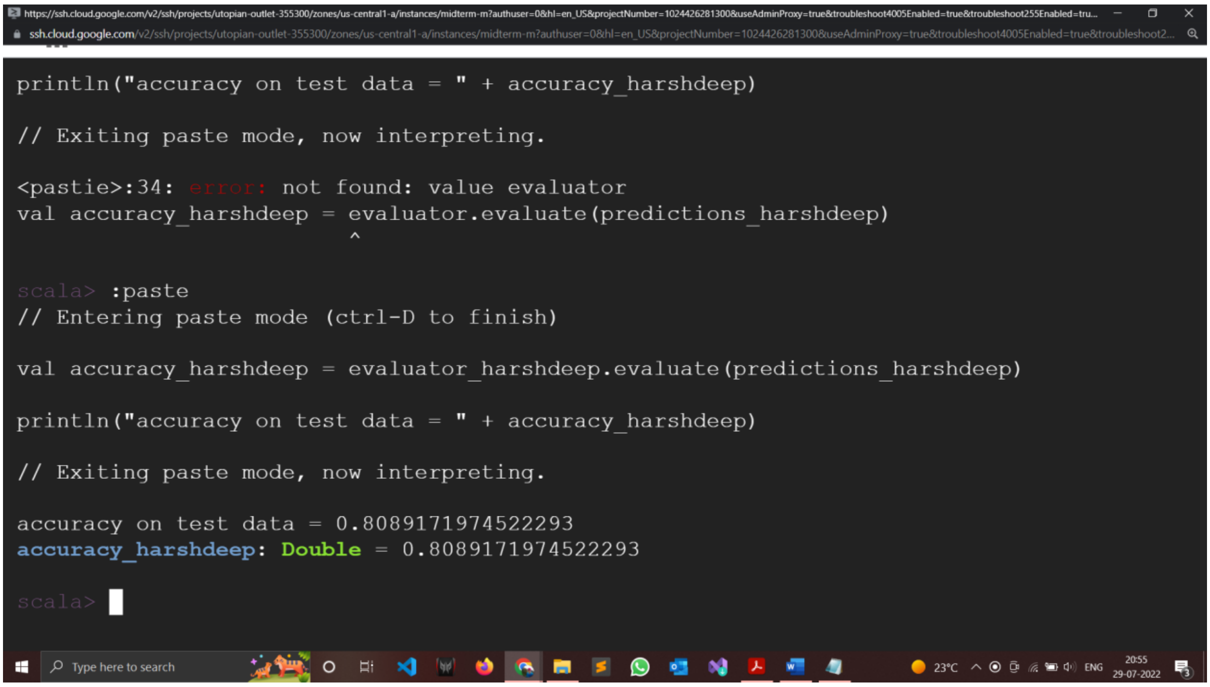
29-07-2022

```
<console>:34: error: not found: value cross_validator
       val cvModel_harshdeep = cross_validator.fit(trainingdata_harshdeep)
                               ^

scala> val cvModel_harshdeep = cross_validator_harshdeep.fit(trainingdata_harshdeep)
cvModel_harshdeep: org.apache.spark.ml.tuning.CrossValidatorModel = CrossValidatorModel: u
v_44752ec6e46d, bestModel=pipeline_ee907308b7b4, numFolds=3

scala> val predictions_harshdeep = cvModel_harshdeep.transform(testdata_harshdeep)
predictions_harshdeep: org.apache.spark.sql.DataFrame = [Pregnancies: double, Glucose: dou
... 11 more fields]

scala> :paste
// Entering paste mode (ctrl-D to finish)

val accuracy_harshdeep = evaluator.evaluate(predictions_harshdeep)

println("accuracy on test data = " + accuracy)

// Exiting paste mode, now interpreting.
```

Evaluating the performance of our model


https://ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot255Enabled=tru...
ssh.cloud.google.com/v2/ssh/projects/utopian-outlet-355300/zones/us-central1-a/instances/midterm-m?authuser=0&hl=en_US&projectNumber=1024426281300&useAdminProxy=true&troubleshoot4005Enabled=true&troubleshoot2...
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29-07-2022

```
println("accuracy on test data = " + accuracy_harshdeep)

// Exiting paste mode, now interpreting.

<pastie>:34: error: not found: value evaluator
val accuracy_harshdeep = evaluator.evaluate(predictions_harshdeep)
                         ^

scala> :paste
// Entering paste mode (ctrl-D to finish)

val accuracy_harshdeep = evaluator_harshdeep.evaluate(predictions_harshdeep)

println("accuracy on test data = " + accuracy_harshdeep)

// Exiting paste mode, now interpreting.

accuracy on test data = 0.8089171974522293
accuracy_harshdeep: Double = 0.8089171974522293

scala> 
```

ACCURACY: 80.89%