NETFLIX RECOMMENDATION SYSTEM

CSYE7200 34322 BIG-DATA SYS ENGR USING SCALA SEC 01 – SPRING 2018

Team - 1

Sonali Chaudhari-001285029
Praneeth Reddy-001225762

OUR PROPOSAL

- **WITH THE HELP OF USER DATA AND RATINGS.**
- **GENERATE A RELEVANT SUGGESTION BASED ON PAST AVAILABLE DATASET.**
- **RECOMMENDING HIGHEST PREDICTED RATING TO A PARTICULAR USER.**
- **MEETING THE DEADLINE OF THE PROJECT.**

USE CASE/ ACTOR

ACTOR

- **USER**
- **THE SYSTEM**

USE CASE

- **USER WILL BELOW OPERATIONS:**
  - **PROVIDING RATING FOR MOVIES**
- **THE APPLICATION WILL PROVIDE LIST OF MOVIES WITH HIGHLY PREDICTED RATINGS**

DETAILS OF DATA

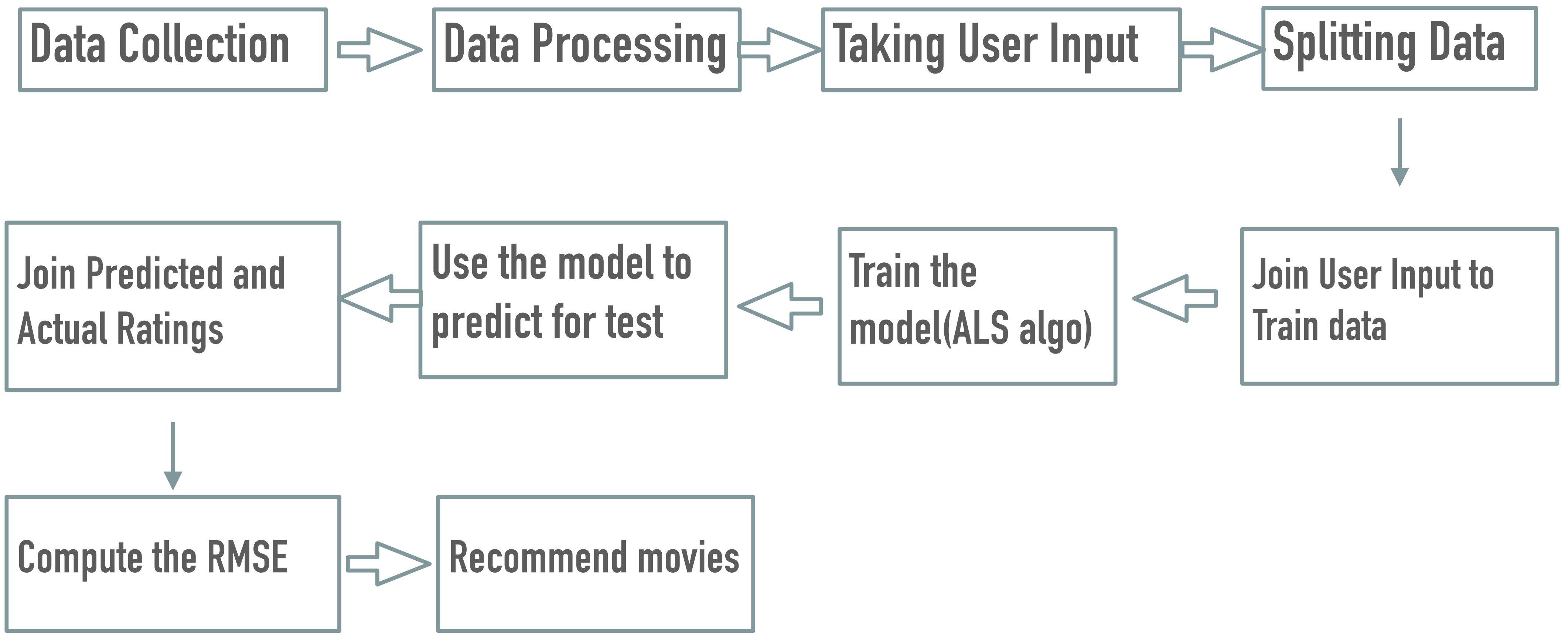
ACTUAL DATA:

- **RATINGS DATA : 10048050**
- **MOVIES : 17770**
- **USER: 480189**

DATA USED (HEAP SIZE ISSUE):

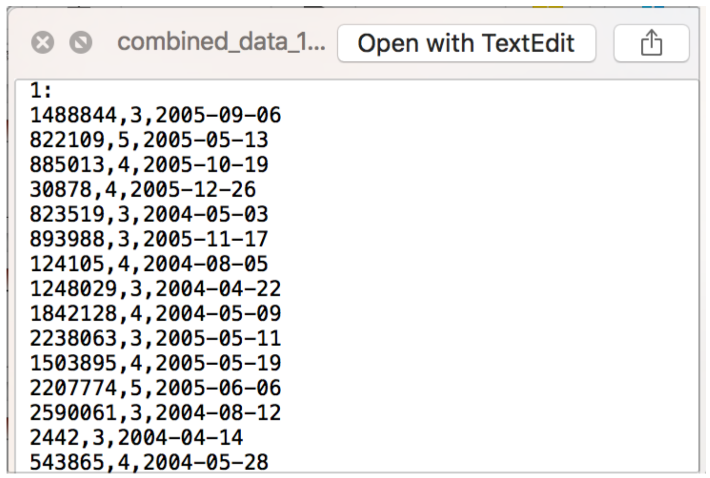
- **RATING DATA : 5010199**
- **MOVIES : 1000**
- **USERS: 404555**

WORKFLOW


Data Collection
Data Processing
Taking User Input
Splitting Data
Join User Input to Train data
Train the model(ALS algo)
Use the model to predict for test
Join Predicted and Actual Ratings
Compute the RMSE
Recommend movies

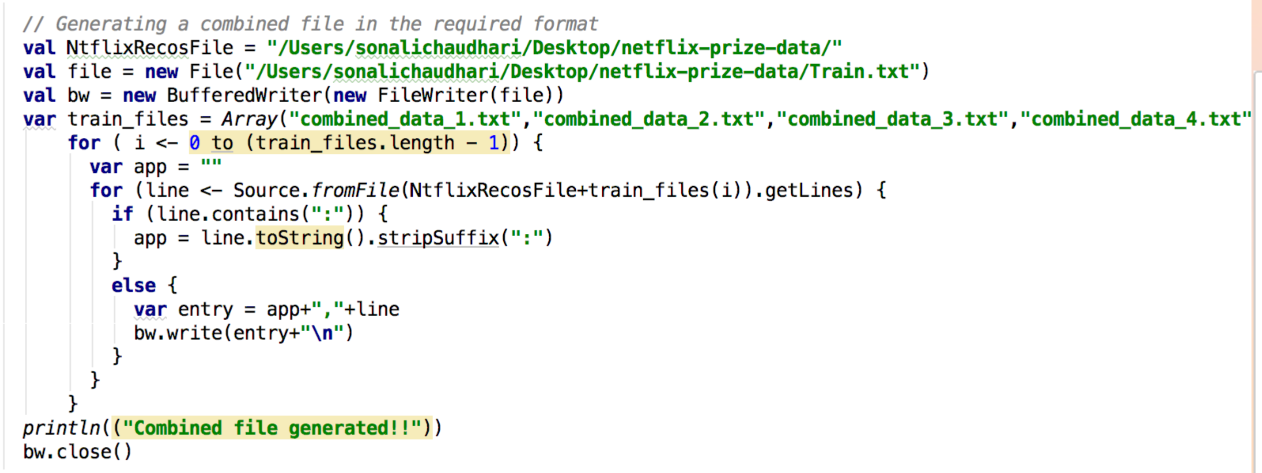
DATA CLEANING

- The train data is contained in 4 different text files in the format shown ->

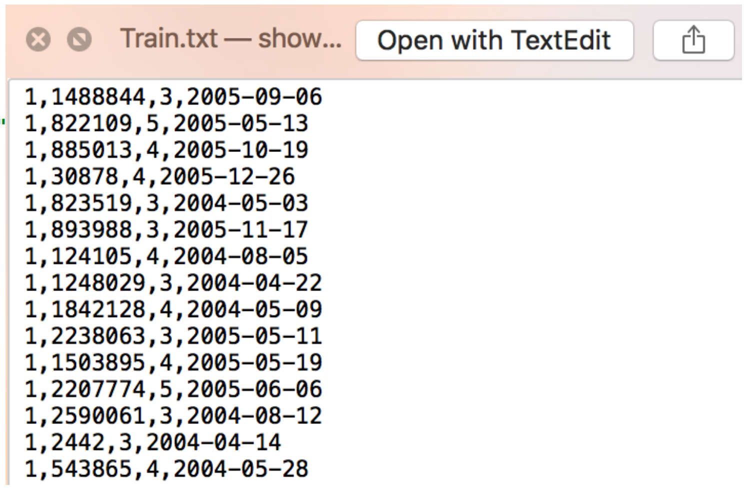

combined_data_1... Open with TextEdit

```
1:
1488844,3,2005-09-06
822109,5,2005-05-13
885013,4,2005-10-19
30878,4,2005-12-26
823519,3,2004-05-03
893988,3,2005-11-17
124105,4,2004-08-05
1248029,3,2004-04-22
1842128,4,2004-05-09
2238063,3,2005-05-11
1503895,4,2005-05-19
2207774,5,2005-06-06
2590061,3,2004-08-12
2442,3,2004-04-14
543865,4,2004-05-28
```

- The four txt file data are converted into the required format and combine into Train.txt file



```
// Generating a combined file in the required format
val NtflixRecosFile = "/Users/sonalichaudhari/Desktop/netflix-prize-data/"
val file = new File("/Users/sonalichaudhari/Desktop/netflix-prize-data/Train.txt")
val bw = new BufferedWriter(new FileWriter(file))
var train_files = Array("combined_data_1.txt","combined_data_2.txt","combined_data_3.txt","combined_data_4.txt")
    for ( i <- 0 to (train_files.length - 1)) {
      var app = ""
      for (line <- Source.fromFile(NtflixRecosFile+train_files(i)).getLines) {
        if (line.contains(":")) {
          app = line.toString().stripSuffix(":")
        }
        else {
          var entry = app+","+line
          bw.write(entry+"\n")
        }
      }
    }
println(("Combined file generated!!"))
bw.close()
```


Train.txt — show... Open with TextEdit

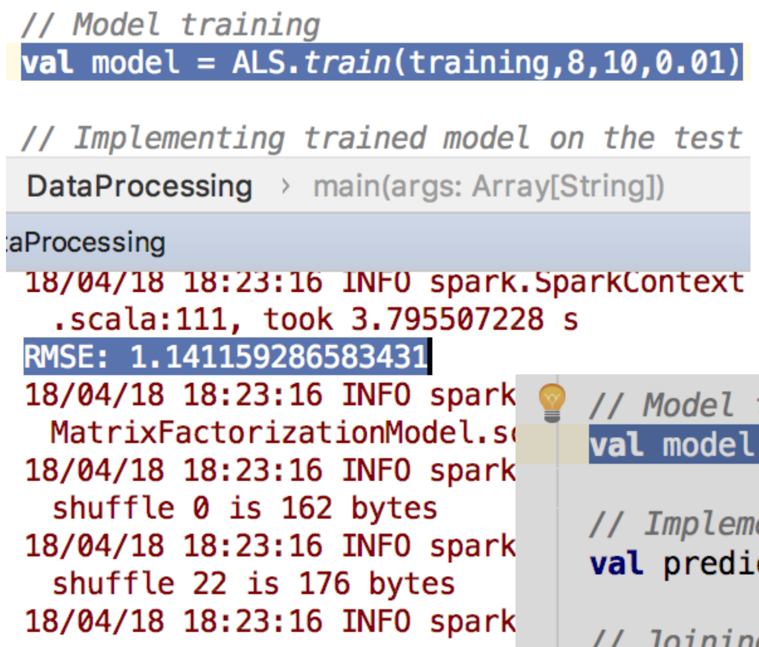
```
1,1488844,3,2005-09-06
1,822109,5,2005-05-13
1,885013,4,2005-10-19
1,30878,4,2005-12-26
1,823519,3,2004-05-03
1,893988,3,2005-11-17
1,124105,4,2004-08-05
1,1248029,3,2004-04-22
1,1842128,4,2004-05-09
1,2238063,3,2005-05-11
1,1503895,4,2005-05-19
1,2207774,5,2005-06-06
1,2590061,3,2004-08-12
1,2442,3,2004-04-14
1,543865,4,2004-05-28
```

TUNING THE MODEL

- ALS algorithm
- Parameters used in the model ALS(rank,iteration, regularization factor)
- Following is how the rise vary with different values of ALS parameters.

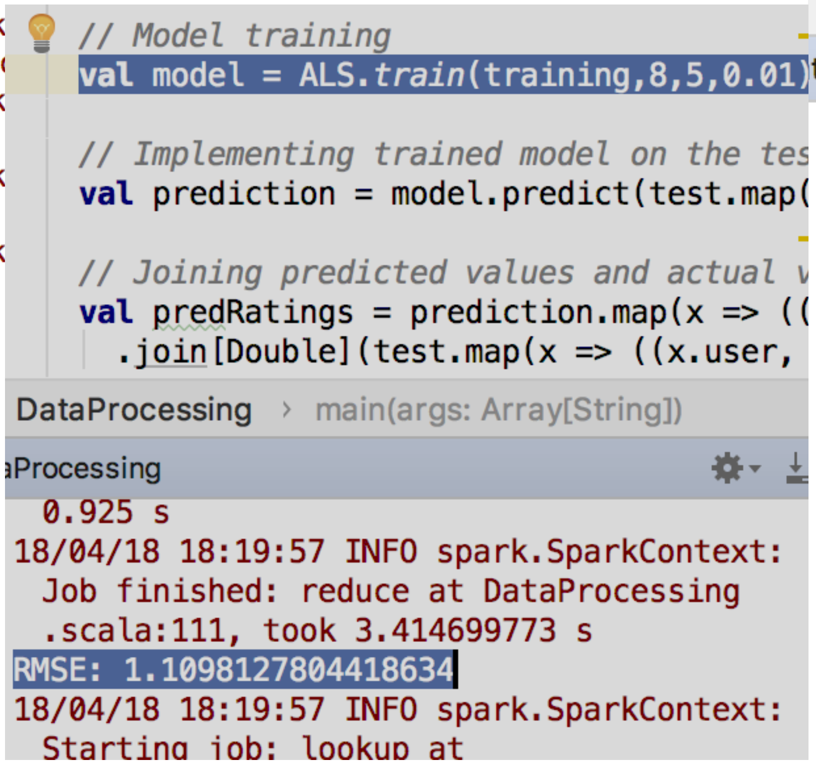
ALS(rank, iteration,regularization factor)	RMSE
8,5,0.02	1.10
9, 4, 0.02	1.09
8,10,0.01	1.14
8, 20, 0.01	1.16
10, 5, 0.02	1.09
12, 5, 0.03	1.08
8, 5, 0.05	1.03
8,4,0.05	1.02
8, 4, 0.06	1.015
8, 4, 0.07	1.006
8,5,0.01	1.10
8,5,0.099	**0.97**

RMSE FOR DIFFERENT RUNS



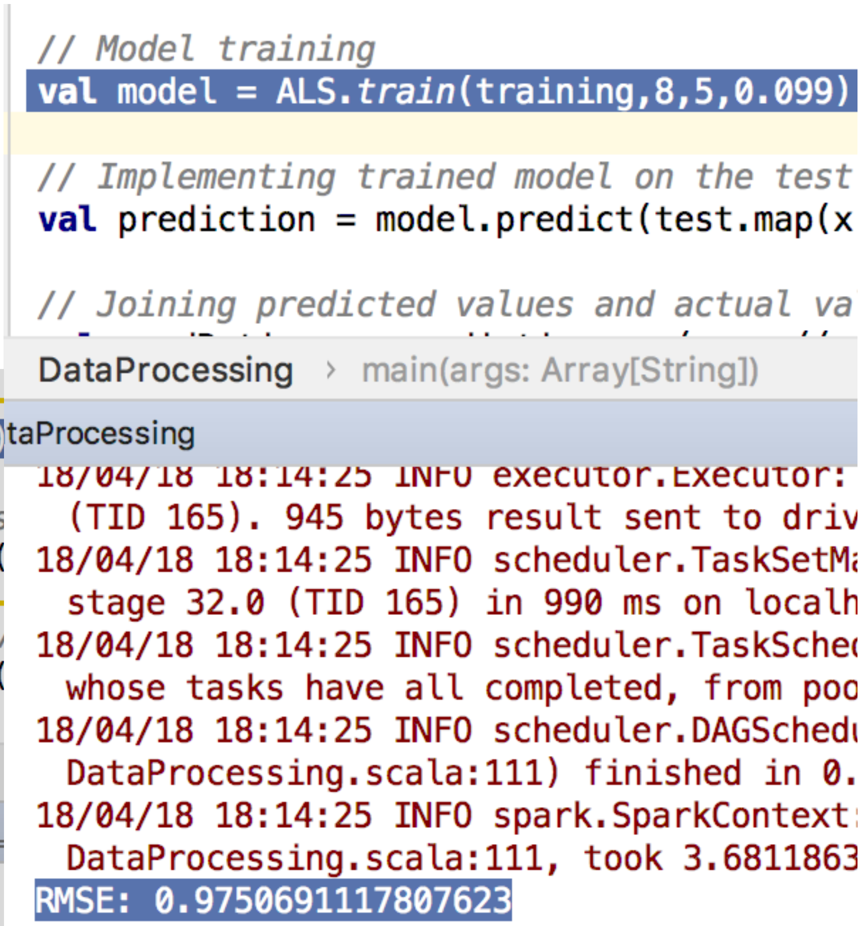
```
// Model training
val model = ALS.train(training,8,10,0.01)

// Implementing trained model on the test
```

```
18/04/18 18:23:16 INFO spark.SparkContext
  .scala:111, took 3.795507228 s
RMSE: 1.141159286583431
18/04/18 18:23:16 INFO spark
  MatrixFactorizationModel.s
18/04/18 18:23:16 INFO spark
  shuffle 0 is 162 bytes
18/04/18 18:23:16 INFO spark
  shuffle 22 is 176 bytes
18/04/18 18:23:16 INFO spark
```



```
// Model training
val model = ALS.train(training,8,5,0.01)

// Implementing trained model on the tes
val prediction = model.predict(test.map(

// Joining predicted values and actual v
val predRatings = prediction.map(x => ((
  .join[Double](test.map(x => ((x.user,
```

```
  0.925 s
18/04/18 18:19:57 INFO spark.SparkContext:
  Job finished: reduce at DataProcessing
  .scala:111, took 3.414699773 s
RMSE: 1.1098127804418634
18/04/18 18:19:57 INFO spark.SparkContext:
  Starting job: lookup at
```



```
// Model training
val model = ALS.train(training,8,5,0.099)

// Implementing trained model on the test
val prediction = model.predict(test.map(x

// Joining predicted values and actual va
```

```
18/04/18 18:14:25 INFO executor.Executor:
  (TID 165). 945 bytes result sent to driv
18/04/18 18:14:25 INFO scheduler.TaskSetMa
  stage 32.0 (TID 165) in 990 ms on localh
18/04/18 18:14:25 INFO scheduler.TaskSched
  whose tasks have all completed, from poo
18/04/18 18:14:25 INFO scheduler.DAGSched
  DataProcessing.scala:111) finished in 0.
18/04/18 18:14:25 INFO spark.SparkContext:
  DataProcessing.scala:111, took 3.6811863
RMSE: 0.9750691117807623
```

PREDICTION ACCURACY

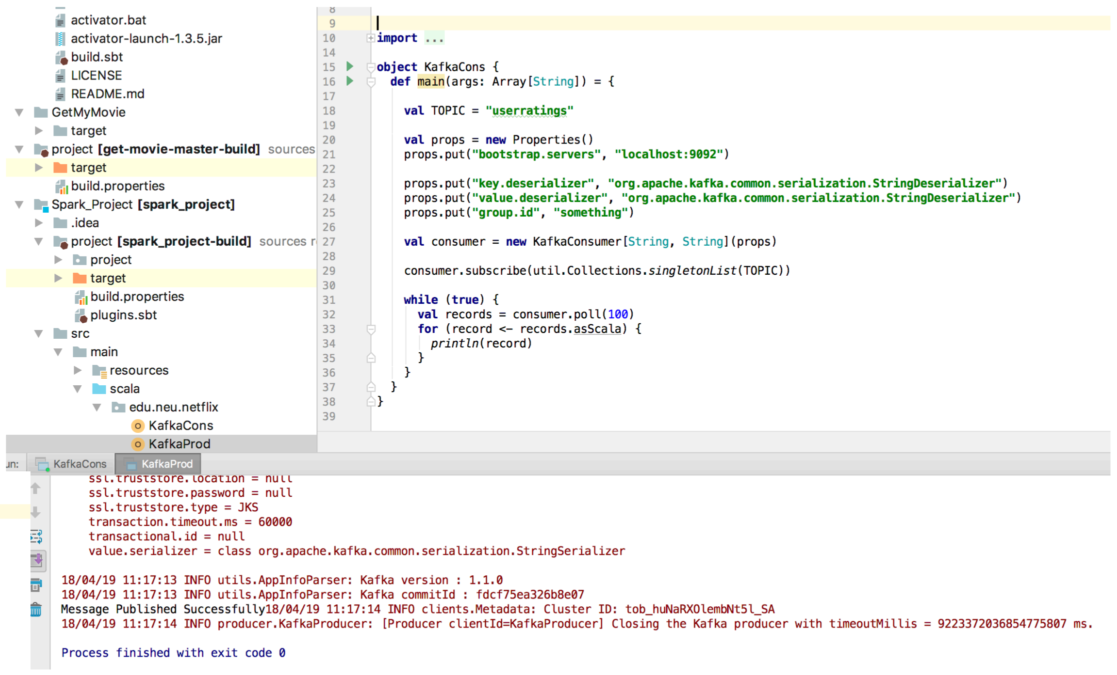
ROOT MEAN SQUARE ERROR(RMSE)

RMSE IS THE PARAMETER USED TO MEASURE THE DIFFERENCE BETWEEN THE PREDICTED VALUES AND THE ACTUAL VALUES.

$$\text{RMSE} = \sqrt{\sum \frac{(y_{pred} - y_{ref})^2}{N}}$$

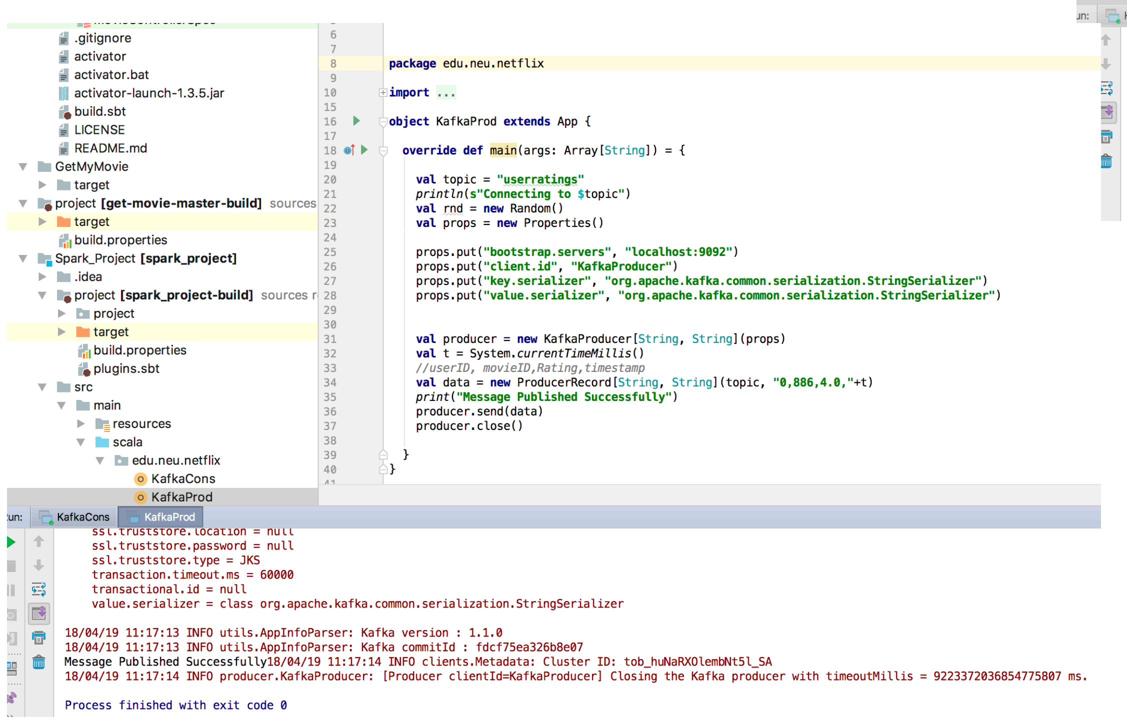
APPLICATION AND USER INTERFACE

KAFKA PRODUCER AND CONSUMER



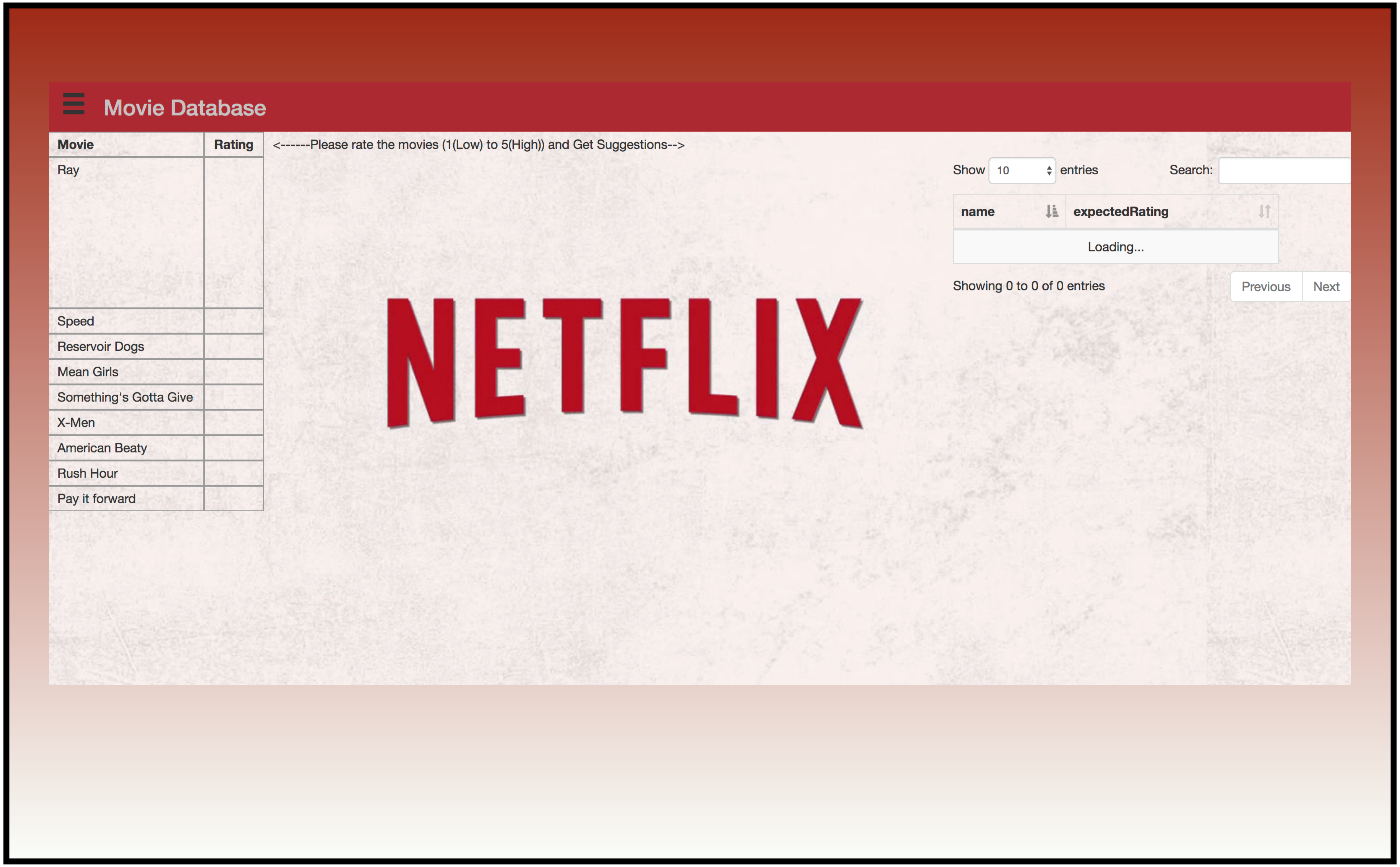
```scala

import ...

object KafkaCons {
  def main(args: Array[String]) = {

    val TOPIC = "userratings"

    val props = new Properties()
    props.put("bootstrap.servers", "localhost:9092")

    props.put("key.deserializer", "org.apache.kafka.common.serialization.StringDeserializer")
    props.put("value.deserializer", "org.apache.kafka.common.serialization.StringDeserializer")
    props.put("group.id", "something")

    val consumer = new KafkaConsumer[String, String](props)

    consumer.subscribe(util.Collections.singletonList(TOPIC))

    while (true) {
      val records = consumer.poll(100)
      for (record <- records.asScala) {
        println(record)
      }
    }
  }
}
```

```
    ssl.truststore.location = null
    ssl.truststore.password = null
    ssl.truststore.type = JKS
    transaction.timeout.ms = 60000
    transactional.id = null
    value.serializer = class org.apache.kafka.common.serialization.StringSerializer

18/04/19 11:17:13 INFO utils.AppInfoParser: Kafka version : 1.1.0
18/04/19 11:17:13 INFO utils.AppInfoParser: Kafka commitId : fdcf75ea326b8e07
Message Published Successfully18/04/19 11:17:14 INFO clients.Metadata: Cluster ID: tob_huNaRXOlembNt5l_SA
18/04/19 11:17:14 INFO producer.KafkaProducer: [Producer clientId=KafkaProducer] Closing the Kafka producer with timeoutMillis = 9223372036854775807 ms.

Process finished with exit code 0
```



```scala


package edu.neu.netflix

import ...

object KafkaProd extends App {

  override def main(args: Array[String]) = {

    val topic = "userratings"
    println(s"Connecting to $topic")
    val rnd = new Random()
    val props = new Properties()

    props.put("bootstrap.servers", "localhost:9092")
    props.put("client.id", "KafkaProducer")
    props.put("key.serializer", "org.apache.kafka.common.serialization.StringSerializer")
    props.put("value.serializer", "org.apache.kafka.common.serialization.StringSerializer")


    val producer = new KafkaProducer[String, String](props)
    val t = System.currentTimeMillis()
    //userID, movieID,Rating,timestamp
    val data = new ProducerRecord[String, String](topic, "0,886,4.0,"+t)
    print("Message Published Successfully")
    producer.send(data)
    producer.close()

  }
}
```

```
    ssl.truststore.location = null
    ssl.truststore.password = null
    ssl.truststore.type = JKS
    transaction.timeout.ms = 60000
    transactional.id = null
    value.serializer = class org.apache.kafka.common.serialization.StringSerializer

18/04/19 11:17:13 INFO utils.AppInfoParser: Kafka version : 1.1.0
18/04/19 11:17:13 INFO utils.AppInfoParser: Kafka commitId : fdcf75ea326b8e07
Message Published Successfully18/04/19 11:17:14 INFO clients.Metadata: Cluster ID: tob_huNaRXOlembNt5l_SA
18/04/19 11:17:14 INFO producer.KafkaProducer: [Producer clientId=KafkaProducer] Closing the Kafka producer with timeoutMillis = 9223372036854775807 ms.

Process finished with exit code 0
```



Movie Database

Movie	Rating
Ray	
Speed	
Reservoir Dogs	
Mean Girls	
Something's Gotta Give	
X-Men	
American Beaty	
Rush Hour	
Pay it forward	

<------Please rate the movies (1(Low) to 5(High)) and Get Suggestions-->

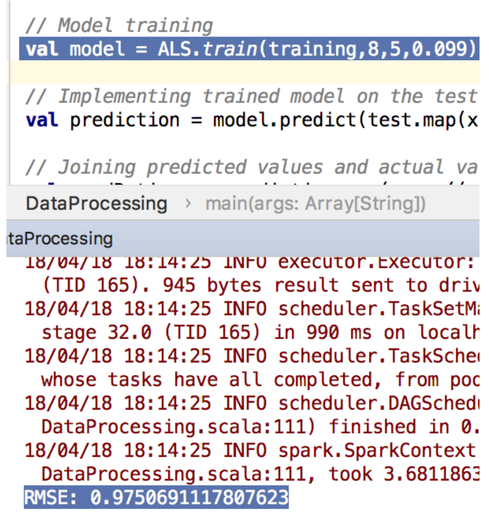
Show 10 entries Search:

name	expectedRating
Loading...	

Showing 0 to 0 of 0 entries

ACCEPTANCE CRITERIA

- **APPLICATION SHOULD BE ABLE TO HANDLE AT LEAST 2500 REQUESTS SIMULTANEOUSLY AND THE MODEL SHOULD BE SCALABLE TO ADD NEW DATA SOURCES AS AND WHEN REQUIRED.**
- **ACHIEVE >90% ACCURACY**



```
// Model training
val model = ALS.train(training,8,5,0.099)

// Implementing trained model on the test
val prediction = model.predict(test.map(x

// Joining predicted values and actual va
```

```
18/04/18 18:14:25 INFO executor.Executor:
  (TID 165). 945 bytes result sent to driv
18/04/18 18:14:25 INFO scheduler.TaskSetMa
  stage 32.0 (TID 165) in 990 ms on localh
18/04/18 18:14:25 INFO scheduler.TaskSche
  whose tasks have all completed, from poo
18/04/18 18:14:25 INFO scheduler.DAGSchedu
  DataProcessing.scala:111) finished in 0.
18/04/18 18:14:25 INFO spark.SparkContext
  DataProcessing.scala:111, took 3.6811863
RMSE: 0.9750691117807623
```

CHALLENGES FACED

- SPARK, SCALA, KAFKA AND PLAY FRAMEWORK COMPATIBILITY ISSUE
- RESTRUCTURING DATA TO USE INTO CORRECT FORMAT
- OVERFITTING OF THE MODEL
- TUNING THE MODEL
- HEAP SIZE ISSUE

USING PLAY FRAMEWORK

- IMPLEMENTED MVC
- INTEGRATING SPARK
- IMPLEMENTED MOCKITO FOR APPLICATION ,MOVIE CONTROLLER SPEC TO TEST VARIOUS FEATURES

USING PLAY FRAMEWORK

- **TASK COMPLETED**
  - DATA PROCESSING
  - TAKING USER INPUT
  - PREDICTION GENERATING
- **TASK TO BE COMPLETED**
  - USER INTERFACE

GITHUB REPOSITORY LINK

https://github.com/reddyse/Big-Data-Engineering-Using-Scala

THANK YOU...