UMKC

School of Computing
and Engineering

CS5560 Knowledge Discovery and Management

Dynamic Intelligent Q/A System

PROJECT 2 REPORT

SUMMER 2017

Team – 3

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Motivation:

We the Team Innovators 2.0 are in a search of data and knowledge. But Importantly we have a lot of difference between information, data, statistics and knowledge. When we speak about Information intruding and a semantic google search is more improvised and we can retrieve relevant information sitting in home. “Question Answering” is a dynamic way of retrieving Information, which learns knowledge. The main focus is particular in obtaining the respective documents but also particular in obtaining the respective response to query we post. Question and Answer system is capable of performing the NLP Processing, Information gathering, topic discovery, Machine Learning and Sematic Search. Question and answer system itself is the beauty of NLP and same instance have a bit of science in its essence. Question and Answer System is required every aspect, let be in the field of health and sciences, an intelligent learned system for children at schools, professional assistant etc. So, this is necessary in each case when we require some help from computer as well. It goes without saying that it is worth exploring the exciting field of question answering.

Objective:

Our Project critically deals with the building of typical model of information knowledge retrieval, named Question & Answering model. If suppose any given query asked in natural human language, Our question and answer system is implemented in such a way to extract the reality possible answer in the form of a pre-defined named-entity type, that is a human person, or may be an organization, a location, etc. Thus, we are connecting the question objects with live entities in a given radius is important in question and answer system. The projects main motto is to enhance the performance of the Question Answering system by using the knowledge and data from the natural grouping of word in the document files.

Significance:

We are constructing a knowledge graph such a way to build the question and answering system to deliver answers very effectively. To give better the results from the system designed we are applying different techniques such as NLP operations, Information retrieval, topic discovery and knowledge discovery.

Q/A System:

For this project, we have taken the Data set from BBC sports concentrating on the sport Cricket. From this Data set we try to construct knowledge graph and making system dynamic to answer all possible questions on sports questions.

Related Work:

Knowledge graph refinement:

Firstly, Knowledge graph is the one of the advanced and trending concepts today. By making use of it, we can build dynamic systems which can precisely answer our questions contrary to the existing search engines which gives us information and a set of related links which makes the user to spend more time on the web for the obtaining the information one was looking for.

Almost as every technology with the usage it needs refinement the same applies to the knowledge graph too. In this paper, the technologies used to evaluate knowledge graph are Partial gold standard, Silver standard, Retrospective evaluation. Each of this technology is a trade-off between reliability and cost. Completeness aims at increasing the coverage of the knowledge graph & various models are used to evaluate completeness and correctness which cannot be both achieved at the same time. This paper is based on the survey results.

Knowledge vault:

The knowledge Vault is a database of what google would call the facts that has been scraped from across the entire web. Unlike the traditional ranking system which relies on the incoming links and number of those links to determine the quality of a source, the knowledge vault allows google to develop this system whereby they count the number of true or false facts, where a true or false is determined by how often that appears on the rest of the web. So, its kind of like querying our collective consciousness to ask us what’s true or not.

Controversial facts are going to trip up algorithms like this and create even more controversy about what should be surfaced at the top and what should be lowered down depending on sort of objective opinions. The knowledge vault is mainly of extracting triplets and giving the score to them and it has advantages of to automatically crawl, index and organize information across the web.

Knowledge base Construction:

We are at that point of life where Data is growing day by day. There is a lot of unstructured data in various organizations and medical fields. A need for dark data extraction & KBC - Knowledge base construction is increasing every moment. So Deep Dive is a solution to establish a SQL database with data from various unknown sources like images, emails, static web pages etc. In every Q/A system its been a long standing problem and Deep dive provides a better solution to it. Currently in this project, Deep dive gives a choice to domain experts to design each ones own KBC systems. Gibbs sampling is used in the processing of data which has high accuracy. The output is the probability of the words which are needed to be present in the data set.

Semantic data integration for knowledge graph construction:

The introduction of Web documents in to a Webservices and data has definitely reulted in the increment availabity of data from each type of domain networks. A new Semantic-Data-Integration approach called "FUHSEN" has been invented which this system can exploit use the key words and structured strengths of webdata sources and can generate quality know;edge graphs by amalgaming the data collected from various data sources.This system FUHSEN depends on two things. i) RESOURCE DESCRIPTION FRAMEWORK (RDF) : for semantically describing the collection of entities

ii) Semantic similarity measures among the collected entities and establishing the relation between them.

The results of the Fuhsen integration system arfe evaluated from DBpedia knowledge base. So in the current project, using the Fuhsen data intergration technique, we can accurately integrate the various similar data entities semantically and transform them in to quality knowledge graphs.

Knowledge Base Construction from Richly Formatted Data:

In this framework. the entities , relation between them and the attributes are related via tabular, textual, structured and visualized expression. This FONDUER intriduces a uniuqe model for KNOWLEDGE BASE CONSTRUCTION built on a unified data representation. This is a new KBC system for the RFIE - richly formatted information data extraction and it also use human loop algorithm in order to train machine learning systems. In our project, we can use FONDUER to ease the burden of traditional approaches. This model in addition with data programming allows the end users to supervise and help to implement Knowledge Base Construction process over the ricjly formatted data.

Datasets:

BBC Sports domain:

We have taken BBC sports dataset as one of our dataset for the design of Question and Answering system. This dataset consists of all kind of sports which includes athletic, cricket, football ,rugby and tennis.

We have mainly focused on the cricket dataset for designing and extracting information using Natural language processing, word2vec, N-gram and TF-IDf techniques

http://mlg.ucd.ie/datasets/bbc.html

BBC News:

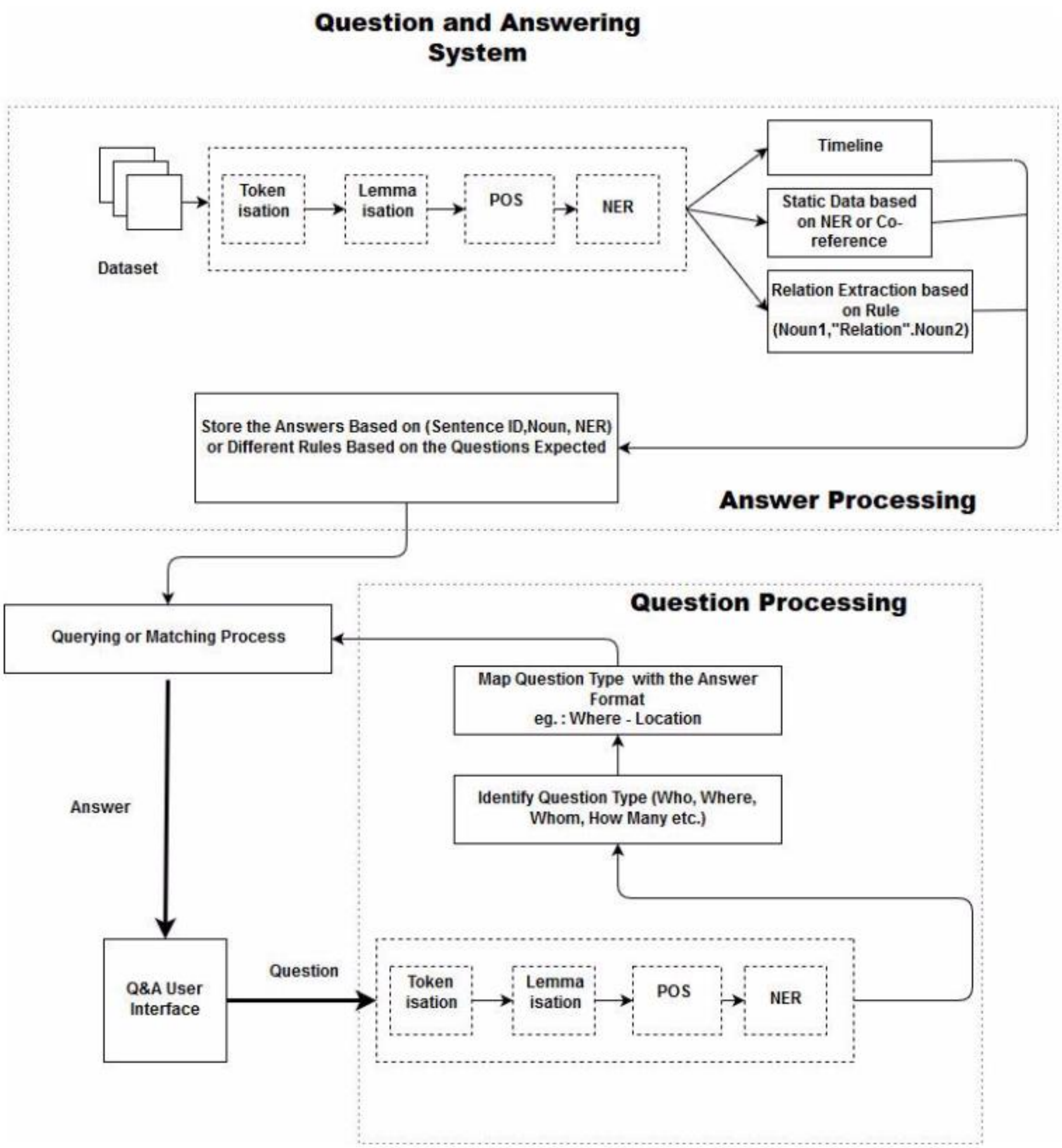
We have taken BBC news dataset as one of second dataset for the design of Question and Answering system. This dataset consists of all kind of news which includes business, entertainment, politics, sports and technology.

We have mainly focused ont the sports dataset for designing and extracting information using Natural language processing, word2vec, N-gram and TF-IDf techniques.

http://mlg.ucd.ie/datasets/bbc.html

Design:

Workflow:


Question and Answering System
Dataset
Token isation
Lemma isation
POS
NER
Timeline
Static Data based on NER or Co-reference
Relation Extraction based on Rule (Noun1,"Relation".Noun2)
Store the Answers Based on (Sentence ID,Noun, NER) or Different Rules Based on the Questions Expected
Answer Processing
Querying or Matching Process
Question Processing
Map Question Type with the Answer Format eg. : Where - Location
Identify Question Type (Who, Where, Whom, How Many etc.)
Answer
Q&A User Interface
Question
Token isation
Lemma isation
POS
NER

NLP:

Open NLP is a toolkit available in variety of programming languages which supports most of the Natural Language Processing tasks like tokenization, pos tagging, chunking, name recognition, sentence segmentation. These tasks are generally required to produce services that require more advanced text processing

Information Retrieval:

Skip-gram negative sampling (or Word2Vec) is an algorithm based on a shallow neural network which aims to learn a word embedding. It is highly efficient, as it avoids dense matrix multiplication and does not require the full term co-occurrence matrix. Given some target word wt, the intermediate goal is to train the neural network to predict the words in the c-neighborhood of wt: wt − c, …, wt − 1, wt + 1, …, wt + c. First, the word is directly associated to its respective vector, which as used as input for a (multinomial) logistic regression to predict the words in the c-neighborhood. Then, the weights for the logistic regression are adjusted, as well as the vector itself (by back-propagation). The Word2Vec algorithm employs negative sampling: additional k noise words which do not appear in the c-neighborhood are introduced as possible outputs, for which the desired output is known to be false. Thus, the model does not reduce the weights to all other vocabulary words but only to those sampled k noise words. When these noise words appear in a similar context as wt, the model gets more and more fine-grained over the training epoch.

Information Extraction:

Word net is a software package developed at Princeton University providing a lexical data base of English words meaning and categorization. It provides the means to determine the categorization of a word which is used in answer ranking phase.

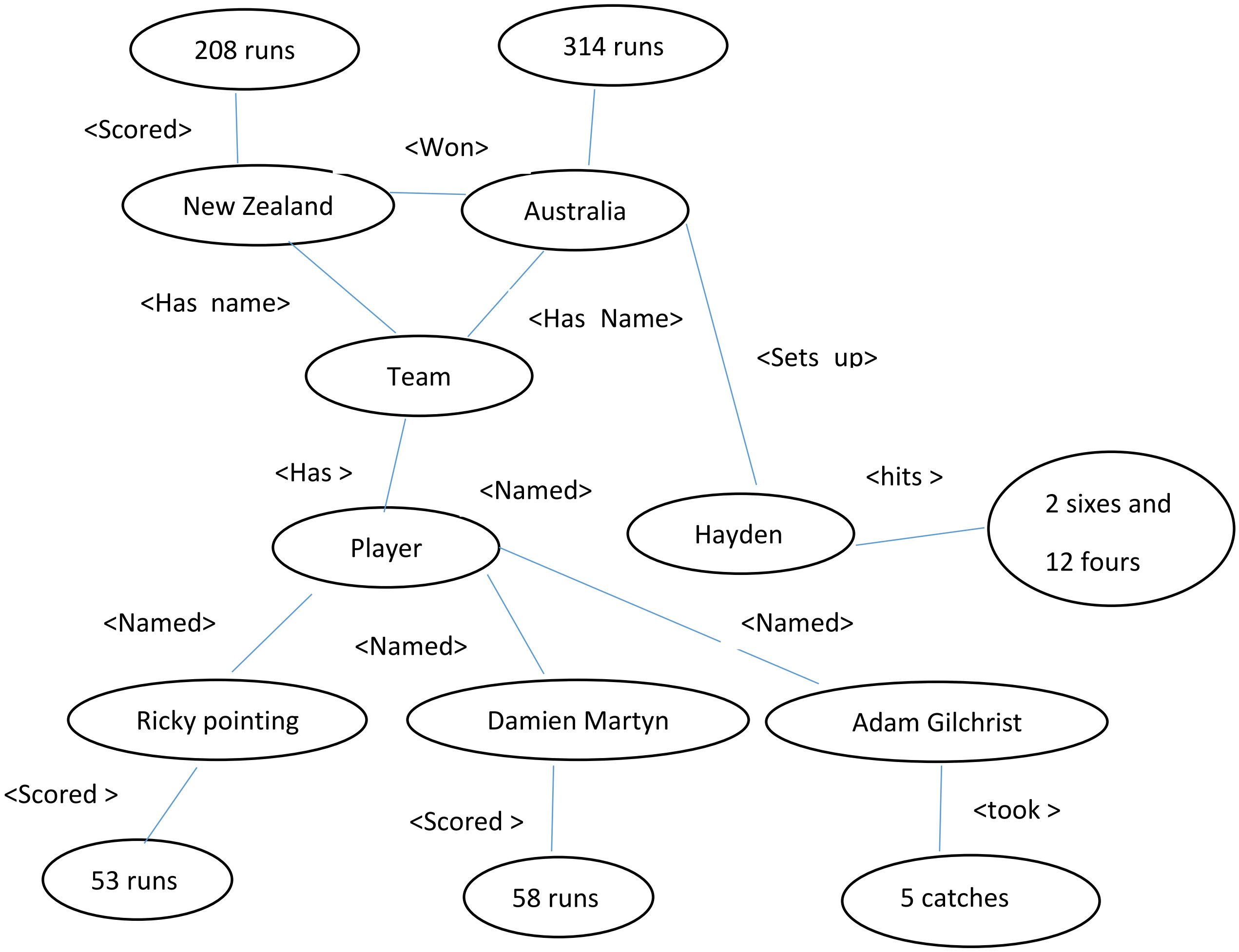
Machine Learning:

Classification is the result of supervised learning which means that there is a known label that you want the system to generate. For example, if you built a fruit classifier, it would say “this is an orange, this is an apple”, based on you showing it examples of apples and oranges.

Clustering is the result of unsupervised learning which means that you’ve seen lots of examples, but don’t have labels. In this case, the clustering might return with “fruits with soft skin and lots of dimples”, “fruits with shiny hard skin” and “elongated yellow fruits” based not simply showing lots of fruit to the system, but not identifying the names of different types of fruit.

Knowledge Graph:

A knowledge graph is mainly organised as a graph, which is not always true of knowledge bases. The primary benefits of a graph are that relationships in the data are first-class citizens, you can easily connect new data items as they are injected into the data pool, and, finally, you can easily traverse links to discover how remote parts of a domain relate to each other there's a huge value in linking information. A graph is one of the most flexible formal data structures, so you can easily map other data formats to graphs using generic tools and pipelines.



Questions and Answers:

1) Who all played between nez vs aus

Answer:

S P Fleming, N J Astle, M S Sinclair, J Wilson, C D McMillan, H J H Marshall, C L Cairns, B B McCullum, K D Mills, D L Vettori, DTuffey

M L Hayden, A C Gilchrist, R T Ponting, D R Martyn, A Symonds, M J Clarke, M E K Hussey, G B Hogg, B Lee, J Gillespie, G D McGrath

2) When nez vs Aus match happened

Answer:

March 1993

3) Where nez vs aus match was held

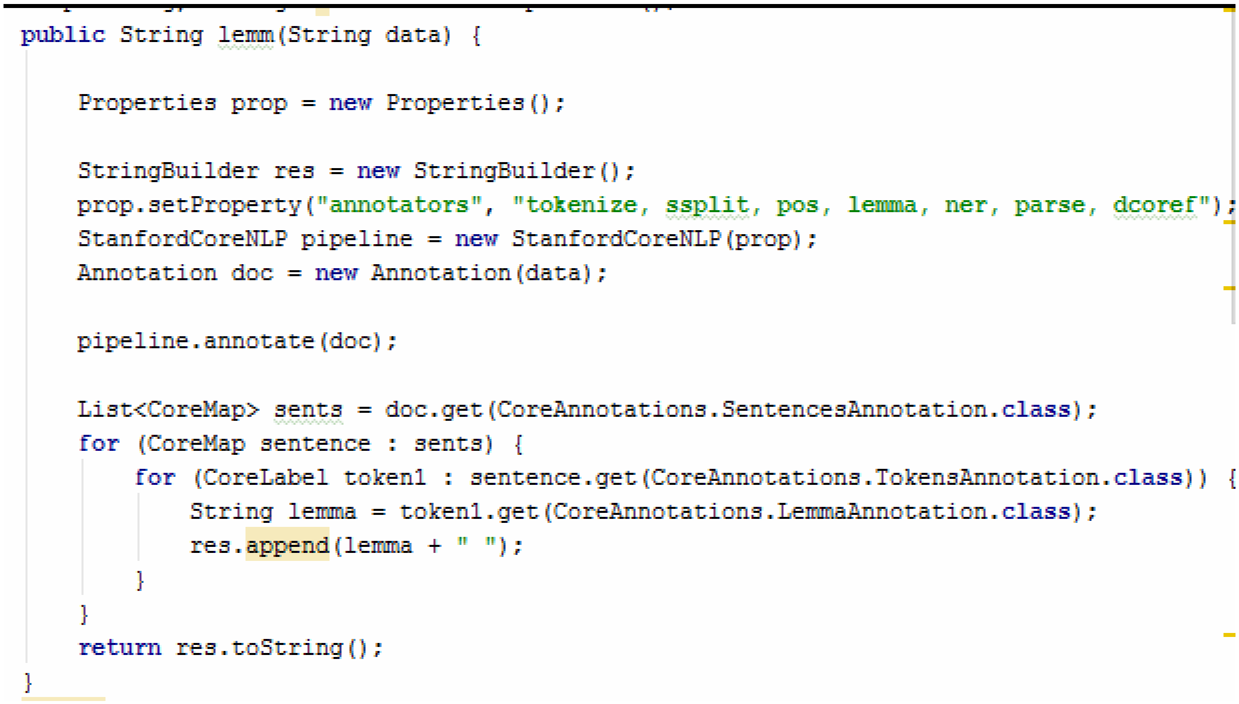
Answer:

Jade Stadium

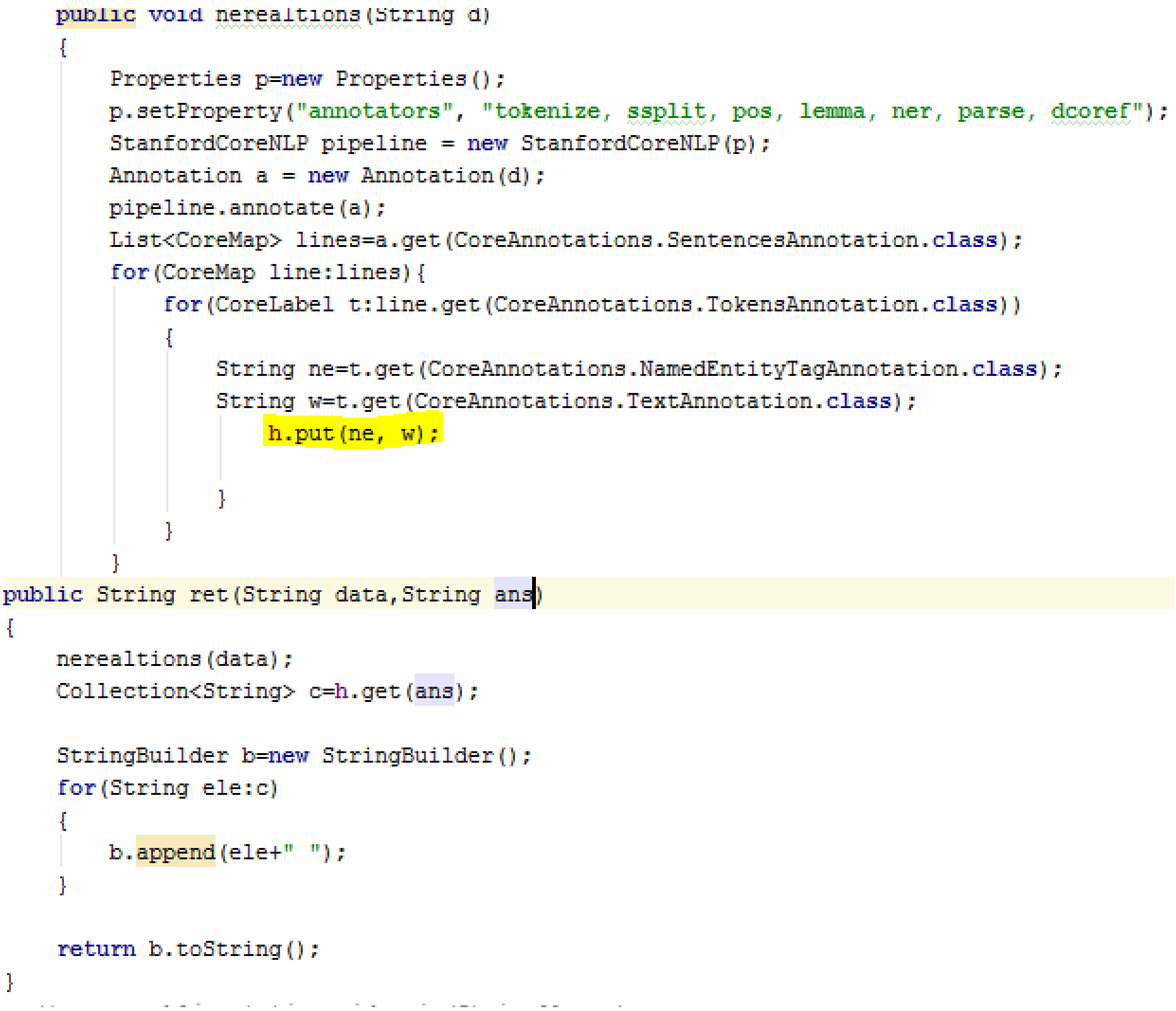
Implementation:

NLP Process:

1) Doing NLP processing of tokenizing, lemmatization and extracting named entity relations and storing it in HashMap.



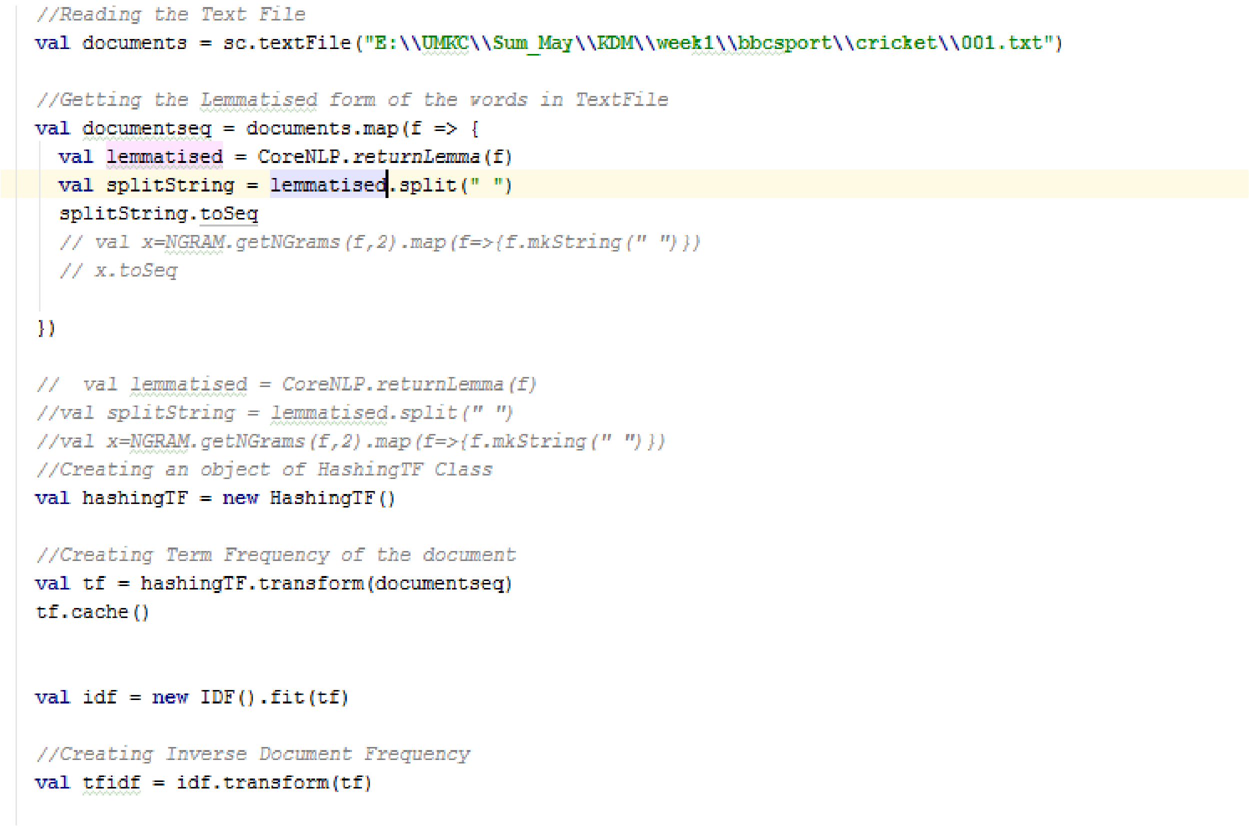
```
public String lemm(String data) {

    Properties prop = new Properties();

    StringBuilder res = new StringBuilder();
    prop.setProperty("annotators", "tokenize, ssplit, pos, lemma, ner, parse, dcoref");
    StanfordCoreNLP pipeline = new StanfordCoreNLP(prop);
    Annotation doc = new Annotation(data);

    pipeline.annotate(doc);

    List<CoreMap> sents = doc.get(CoreAnnotations.SentencesAnnotation.class);
    for (CoreMap sentence : sents) {
        for (CoreLabel token1 : sentence.get(CoreAnnotations.TokensAnnotation.class)) {
            String lemma = token1.get(CoreAnnotations.LemmaAnnotation.class);
            res.append(lemma + " ");
        }
    }
    return res.toString();
}
```



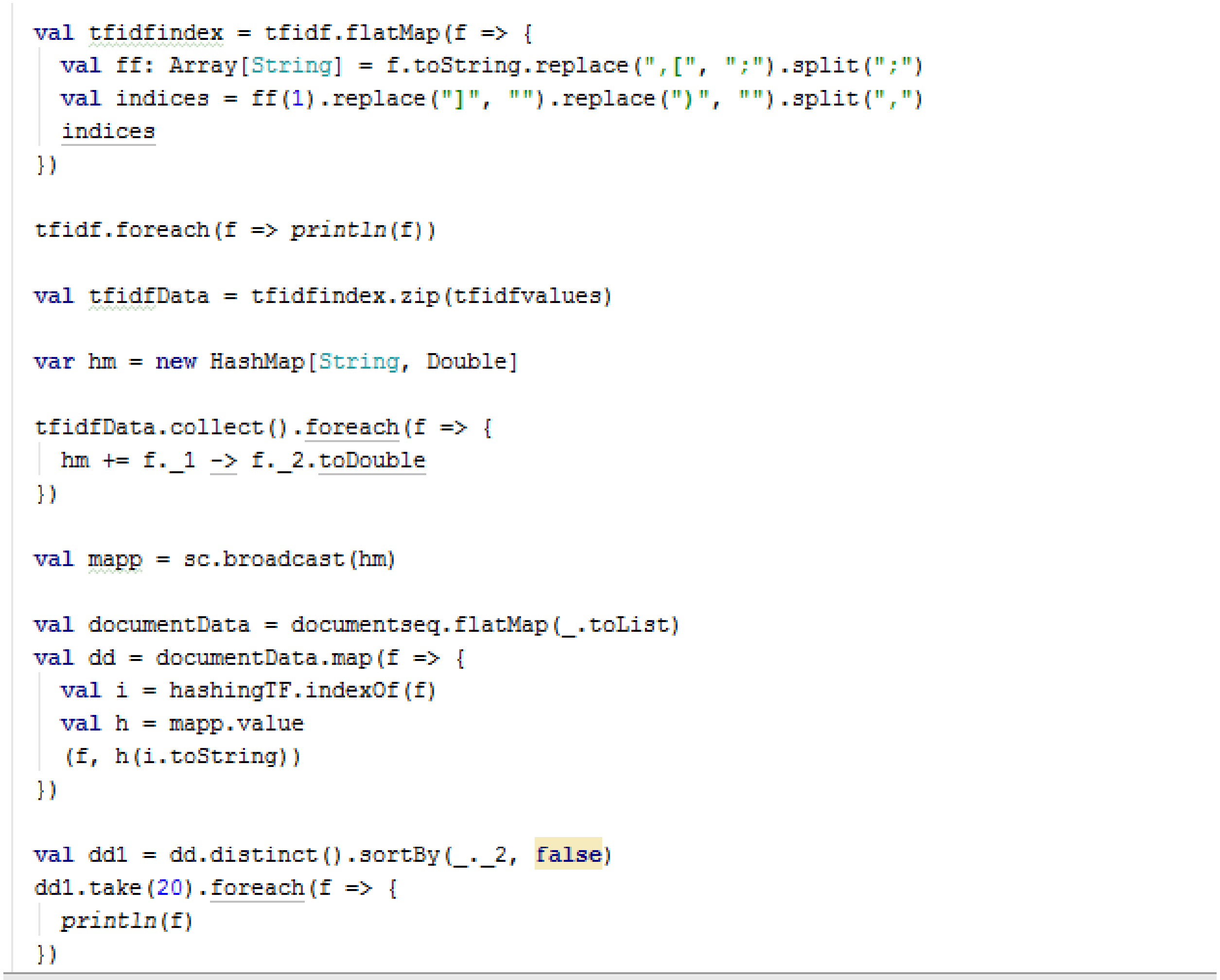
```
    public void nerealtions(String d)
    {
        Properties p=new Properties();
        p.setProperty("annotators", "tokenize, ssplit, pos, lemma, ner, parse, dcoref");
        StanfordCoreNLP pipeline = new StanfordCoreNLP(p);
        Annotation a = new Annotation(d);
        pipeline.annotate(a);
        List<CoreMap> lines=a.get(CoreAnnotations.SentencesAnnotation.class);
        for(CoreMap line:lines){
            for(CoreLabel t:line.get(CoreAnnotations.TokensAnnotation.class))
            {
                String ne=t.get(CoreAnnotations.NamedEntityTagAnnotation.class);
                String w=t.get(CoreAnnotations.TextAnnotation.class);
                    h.put(ne, w);

                }
            }
        }
public String ret(String data,String ans)
{
    nerealtions(data);
    Collection<String> c=h.get(ans);

    StringBuilder b=new StringBuilder();
    for(String ele:c)
    {
        b.append(ele+" ");
    }

    return b.toString();
}
```

Information Retrieval:

TF-IDF:

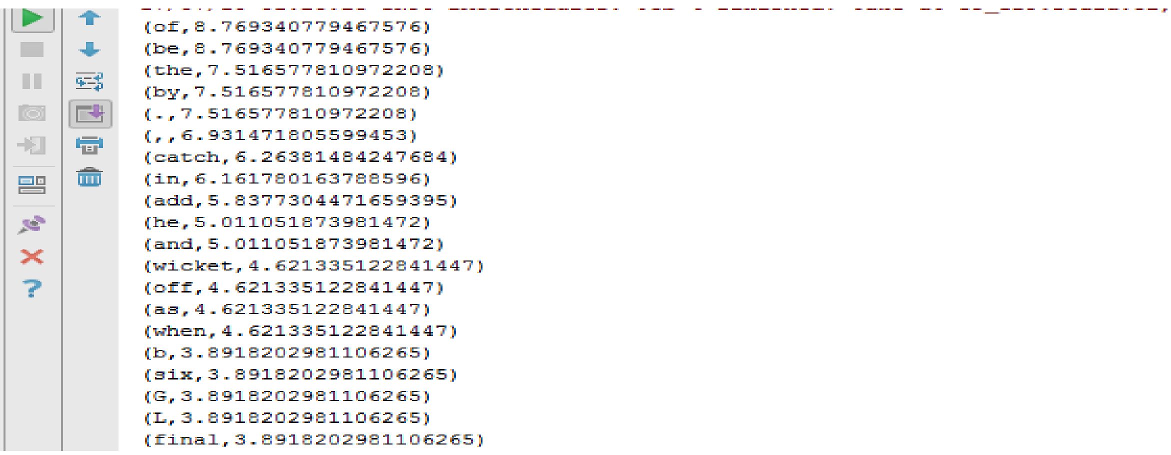


```
//Reading the Text File
val documents = sc.textFile("E:\\UMKC\\Sum_May\\KDM\\week1\\bbcsport\\cricket\\001.txt")

//Getting the Lemmatised form of the words in TextFile
val documentseq = documents.map(f => {
  val lemmatised = CoreNLP.returnLemma(f)
  val splitString = lemmatised.split(" ")
  splitString.toSeq
  // val x=NGRAM.getNGrams(f,2).map(f=>{f.mkString(" ")})
  // x.toSeq

})

//  val lemmatised = CoreNLP.returnLemma(f)
//val splitString = lemmatised.split(" ")
//val x=NGRAM.getNGrams(f,2).map(f=>{f.mkString(" ")})
//Creating an object of HashingTF Class
val hashingTF = new HashingTF()

//Creating Term Frequency of the document
val tf = hashingTF.transform(documentseq)
tf.cache()


val idf = new IDF().fit(tf)

//Creating Inverse Document Frequency
val tfidf = idf.transform(tf)
```



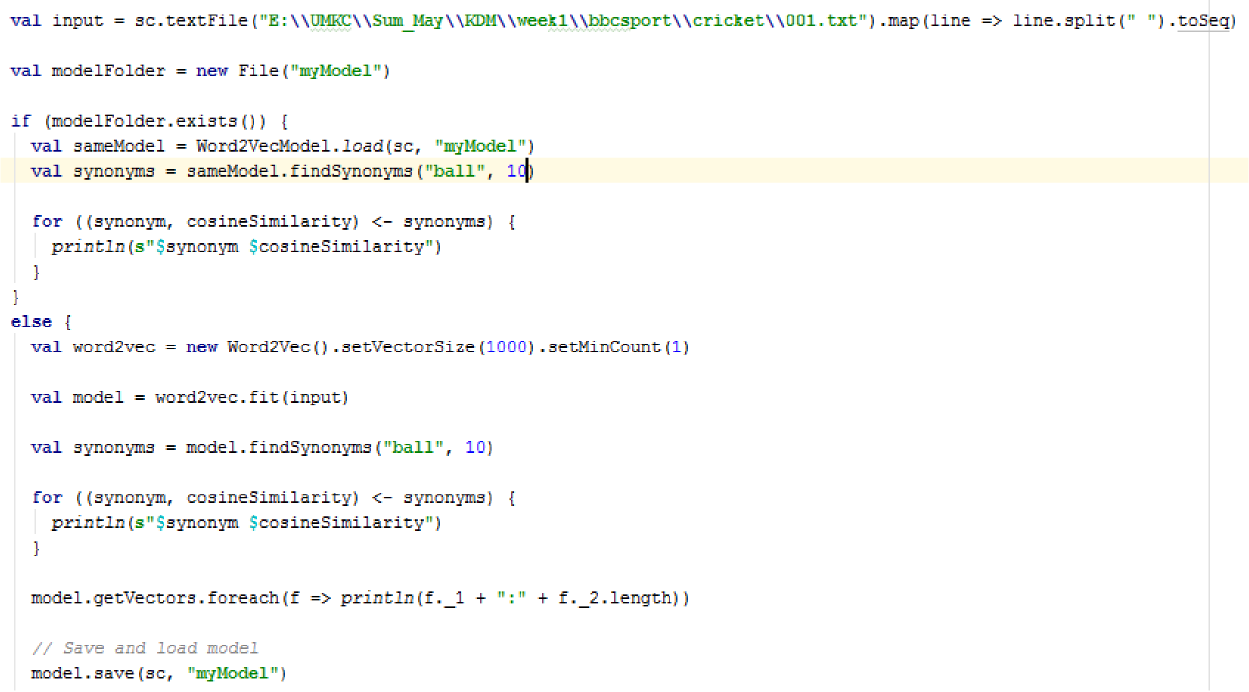
```
val tfidfindex = tfidf.flatMap(f => {
  val ff: Array[String] = f.toString.replace(",[", ";").split(";")
  val indices = ff(1).replace("]", "").replace(")", "").split(",")
  indices
})

tfidf.foreach(f => println(f))

val tfidfData = tfidfindex.zip(tfidfvalues)

var hm = new HashMap[String, Double]

tfidfData.collect().foreach(f => {
  hm += f._1 -> f._2.toDouble
})

val mapp = sc.broadcast(hm)

val documentData = documentseq.flatMap(_.toList)
val dd = documentData.map(f => {
  val i = hashingTF.indexOf(f)
  val h = mapp.value
  (f, h(i.toString))
})

val dd1 = dd.distinct().sortBy(_._2, false)
dd1.take(20).foreach(f => {
  println(f)
})
```

Output:



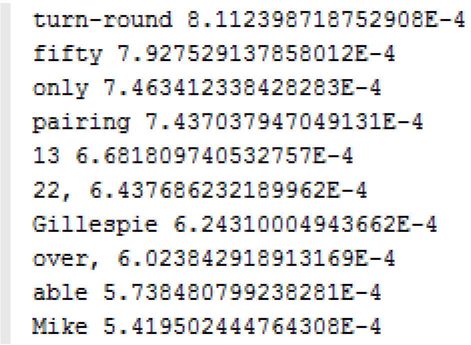
```
(of,8.769340779467576)
(be,8.769340779467576)
(the,7.516577810972208)
(by,7.516577810972208)
(.,7.516577810972208)
(,,6.931471805599453)
(catch,6.263814842476884)
(in,6.161780163788596)
(add,5.837730447165939 5)
(he,5.011051873981472)
(and,5.011051873981472)
(wicket,4.621335122841447)
(off,4.621335122841447)
(as,4.621335122841447)
(when,4.621335122841447)
(b,3.8918202981106265)
(six,3.8918202981106265)
(G,3.8918202981106265)
(L,3.8918202981106265)
(final,3.8918202981106265)
```

Word2Vec:



```
val input = sc.textFile("E:\\UMKC\\Sum_May\\KDM\\week1\\bbcsport\\cricket\\001.txt").map(line => line.split(" ").toSeq)

val modelFolder = new File("myModel")

if (modelFolder.exists()) {
  val sameModel = Word2VecModel.load(sc, "myModel")
  val synonyms = sameModel.findSynonyms("ball", 10)

  for ((synonym, cosineSimilarity) <- synonyms) {
    println(s"$synonym $cosineSimilarity")
  }
}
else {
  val word2vec = new Word2Vec().setVectorSize(1000).setMinCount(1)

  val model = word2vec.fit(input)

  val synonyms = model.findSynonyms("ball", 10)

  for ((synonym, cosineSimilarity) <- synonyms) {
    println(s"$synonym $cosineSimilarity")
  }

  model.getVectors.foreach(f => println(f._1 + ":" + f._2.length))

  // Save and load model
  model.save(sc, "myModel")
```

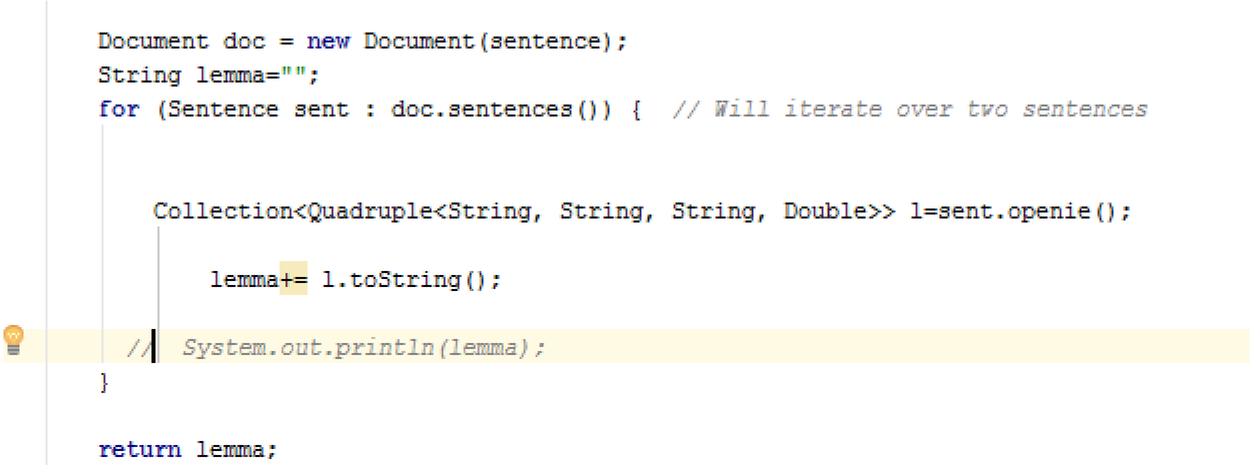
Output:



```
turn-round 8.112398718752908E-4
fifty 7.927529137858012E-4
only 7.463412338428283E-4
pairing 7.437037947049131E-4
13 6.681809740532757E-4
22, 6.437686232189962E-4
Gillespie 6.24310004943662E-4
over, 6.023842918913169E-4
able 5.738480799238281E-4
Mike 5.419502444764308E-4
```

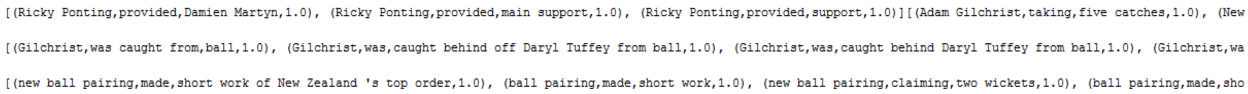
Information extraction:

OpenIE:



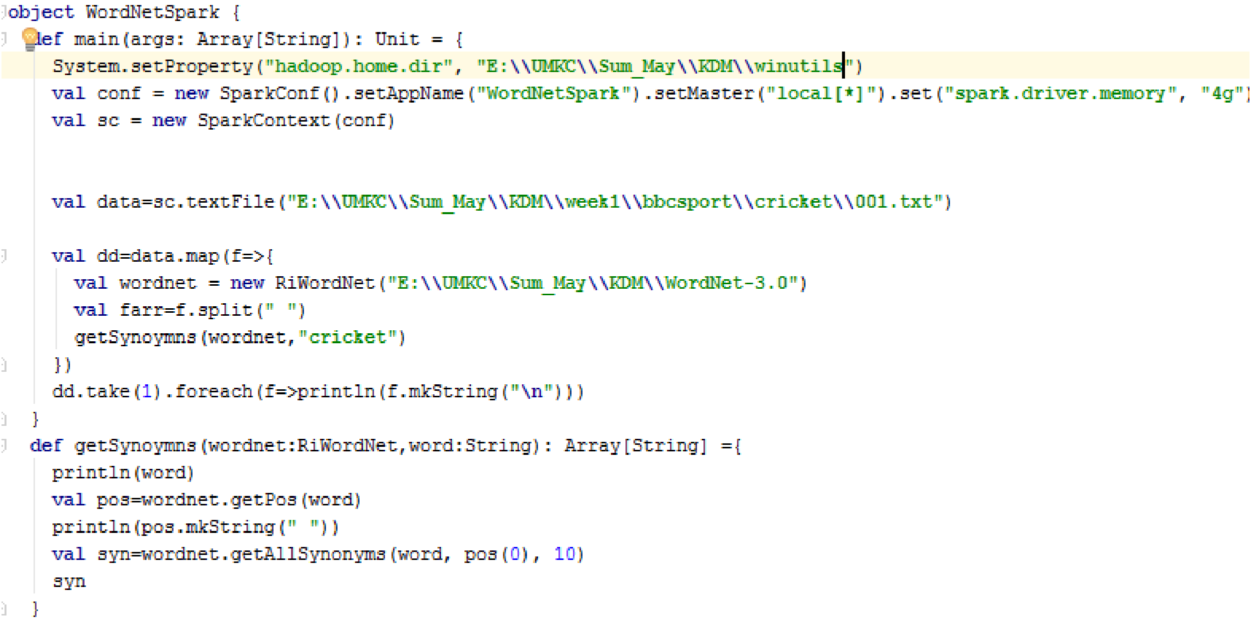
```
Document doc = new Document(sentence);
String lemma="";
for (Sentence sent : doc.sentences()) {  // Will iterate over two sentences


    Collection<Quadruple<String, String, String, Double>> l=sent.openie();

        lemma+= l.toString();

  //  System.out.println(lemma);
}

return lemma;
```

Output:



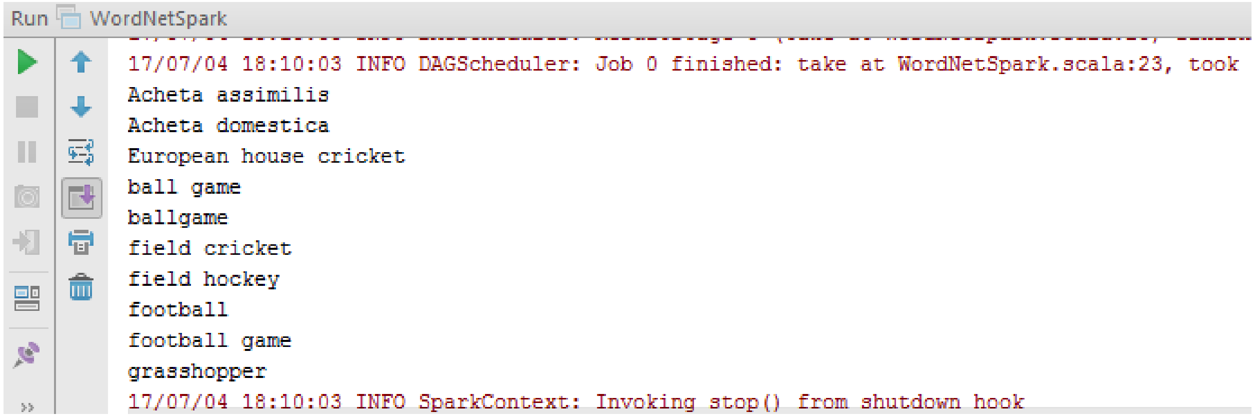
```
[(Ricky Ponting,provided,Damien Martyn,1.0), (Ricky Ponting,provided,main support,1.0), (Ricky Ponting,provided,support,1.0)][(Adam Gilchrist,taking,five catches,1.0), (New

[(Gilchrist,was caught from,ball,1.0), (Gilchrist,was,caught behind off Daryl Tuffey from ball,1.0), (Gilchrist,was,caught behind Daryl Tuffey from ball,1.0), (Gilchrist,wa

[(new ball pairing,made,short work of New Zealand 's top order,1.0), (ball pairing,made,short work,1.0), (new ball pairing,claiming,two wickets,1.0), (ball pairing,made,sho
```

Wordnet:



```
object WordNetSpark {
  def main(args: Array[String]): Unit = {
    System.setProperty("hadoop.home.dir", "E:\\UMKC\\Sum_May\\KDM\\winutils")
    val conf = new SparkConf().setAppName("WordNetSpark").setMaster("local[*]").set("spark.driver.memory", "4g")
    val sc = new SparkContext(conf)


    val data=sc.textFile("E:\\UMKC\\Sum_May\\KDM\\week1\\bbcsport\\cricket\\001.txt")

    val dd=data.map(f=>{
      val wordnet = new RiWordNet("E:\\UMKC\\Sum_May\\KDM\\WordNet-3.0")
      val farr=f.split(" ")
      getSynoymns(wordnet,"cricket")
    })
    dd.take(1).foreach(f=>println(f.mkString("\n")))
  }
  def getSynoymns(wordnet:RiWordNet,word:String): Array[String] ={
    println(word)
    val pos=wordnet.getPos(word)
    println(pos.mkString(" "))
    val syn=wordnet.getAllSynonyms(word, pos(0), 10)
    syn
  }
```

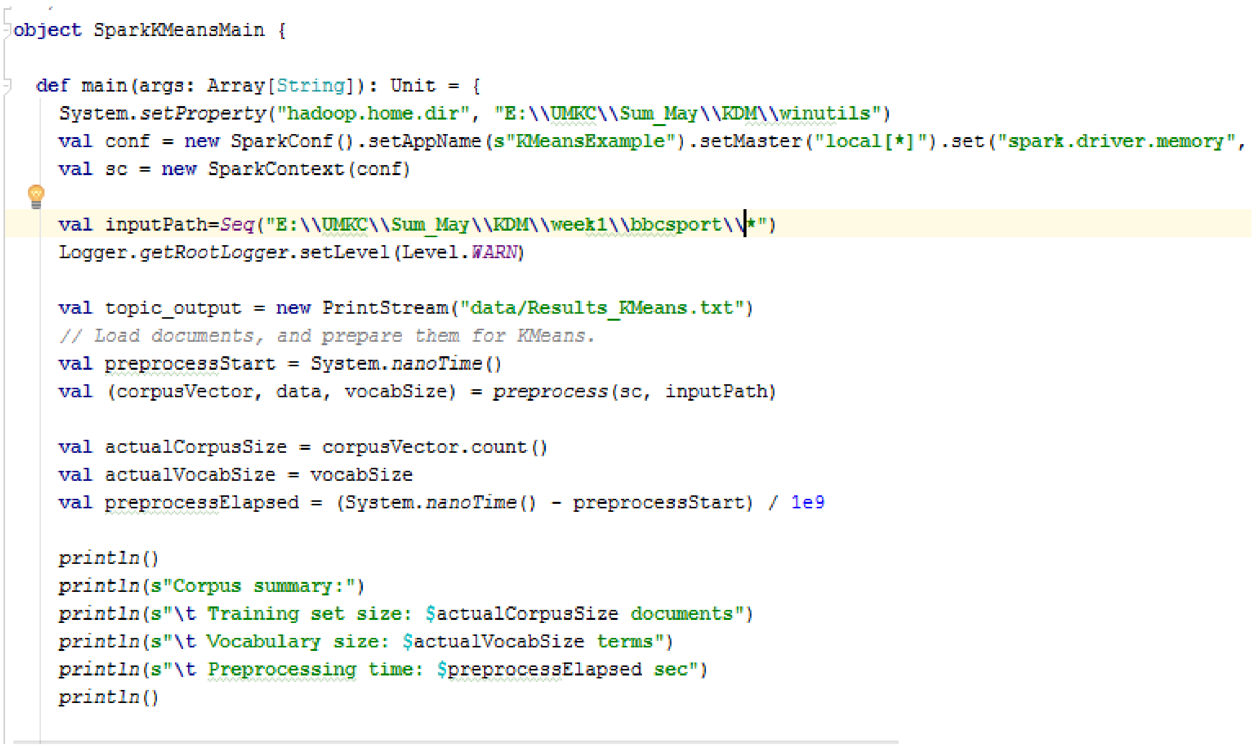
Output:



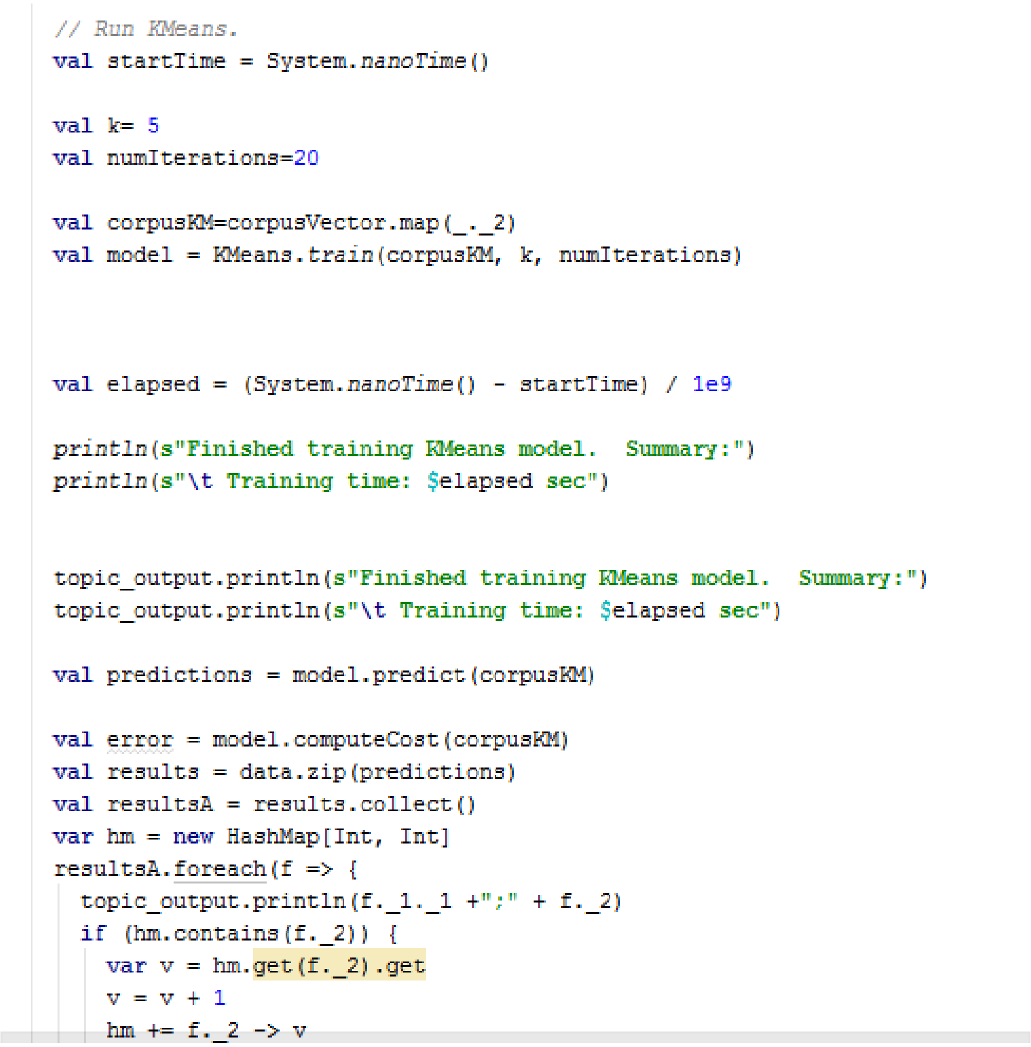
```
17/07/04 18:10:03 INFO DAGScheduler: Job 0 finished: take at WordNetSpark.scala:23, took
Acheta assimilis
Acheta domestica
European house cricket
ball game
ballgame
field cricket
field hockey
football
football game
grasshopper
17/07/04 18:10:03 INFO SparkContext: Invoking stop() from shutdown hook
```

Machine Learning:

Clustering:

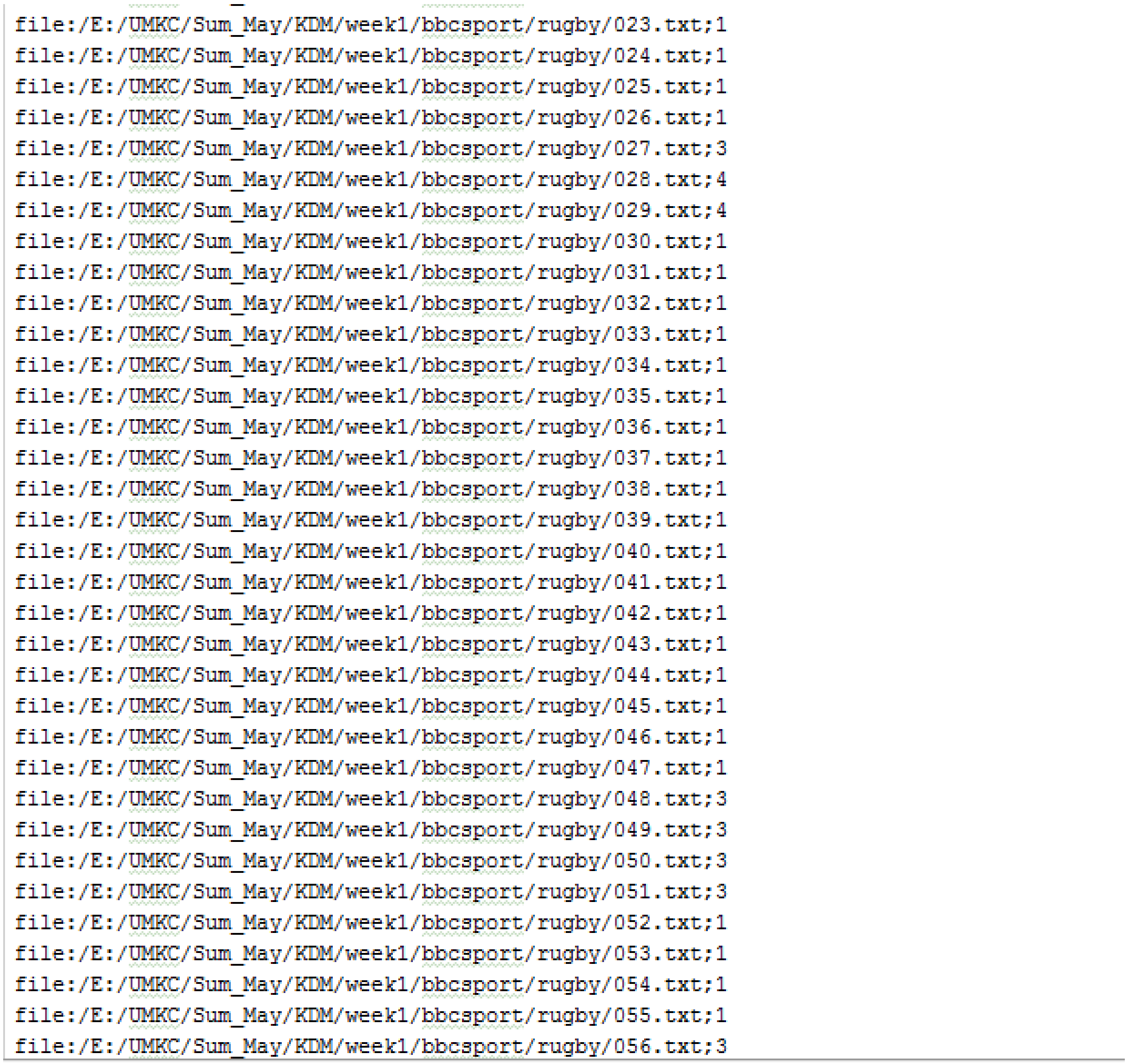


```
object SparkKMeansMain {

  def main(args: Array[String]): Unit = {
    System.setProperty("hadoop.home.dir", "E:\\UMKC\\Sum_May\\KDM\\winutils")
    val conf = new SparkConf().setAppName(s"KMeansExample").setMaster("local[*]").set("spark.driver.memory",
    val sc = new SparkContext(conf)

    val inputPath=Seq("E:\\UMKC\\Sum_May\\KDM\\week1\\bbcsport\\*")
    Logger.getRootLogger.setLevel(Level.WARN)

    val topic_output = new PrintStream("data/Results_KMeans.txt")
    // Load documents, and prepare them for KMeans.
    val preprocessStart = System.nanoTime()
    val (corpusVector, data, vocabSize) = preprocess(sc, inputPath)

    val actualCorpusSize = corpusVector.count()
    val actualVocabSize = vocabSize
    val preprocessElapsed = (System.nanoTime() - preprocessStart) / 1e9

    println()
    println(s"Corpus summary:")
    println(s"\t Training set size: $actualCorpusSize documents")
    println(s"\t Vocabulary size: $actualVocabSize terms")
    println(s"\t Preprocessing time: $preprocessElapsed sec")
    println()
```



```
// Run KMeans.
val startTime = System.nanoTime()

val k= 5
val numIterations=20

val corpusKM=corpusVector.map(_._2)
val model = KMeans.train(corpusKM, k, numIterations)



val elapsed = (System.nanoTime() - startTime) / 1e9

println(s"Finished training KMeans model.  Summary:")
println(s"\t Training time: $elapsed sec")


topic_output.println(s"Finished training KMeans model.  Summary:")
topic_output.println(s"\t Training time: $elapsed sec")

val predictions = model.predict(corpusKM)

val error = model.computeCost(corpusKM)
val results = data.zip(predictions)
val resultsA = results.collect()
var hm = new HashMap[Int, Int]
resultsA.foreach(f => {
  topic_output.println(f._1._1 +";" + f._2)
  if (hm.contains(f._2)) {
    var v = hm.get(f._2).get
    v = v + 1
    hm += f._2 -> v
```

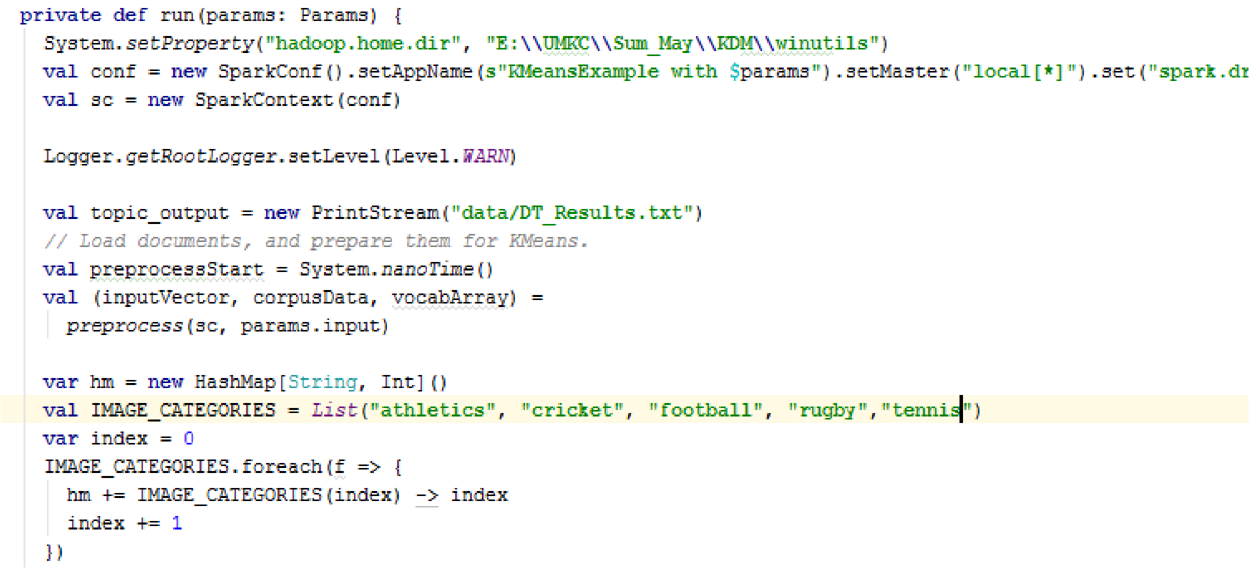
Output:



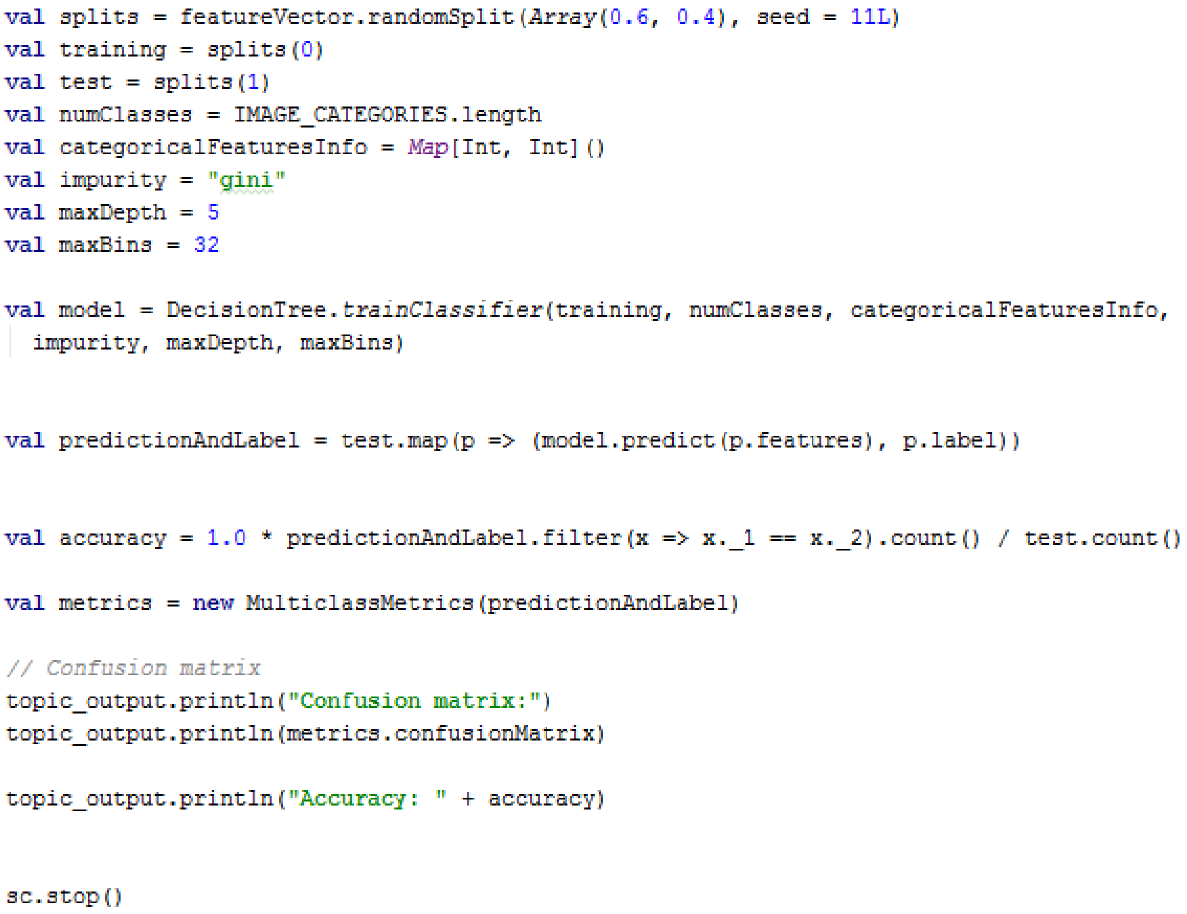
```
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/023.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/024.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/025.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/026.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/027.txt;3
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/028.txt;4
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/029.txt;4
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/030.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/031.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/032.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/033.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/034.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/035.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/036.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/037.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/038.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/039.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/040.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/041.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/042.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/043.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/044.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/045.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/046.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/047.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/048.txt;3
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/049.txt;3
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/050.txt;3
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/051.txt;3
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/052.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/053.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/054.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/055.txt;1
file:/E:/UMKC/Sum_May/KDM/week1/bbcsport/rugby/056.txt;3
```

Classification:

Decision tree:

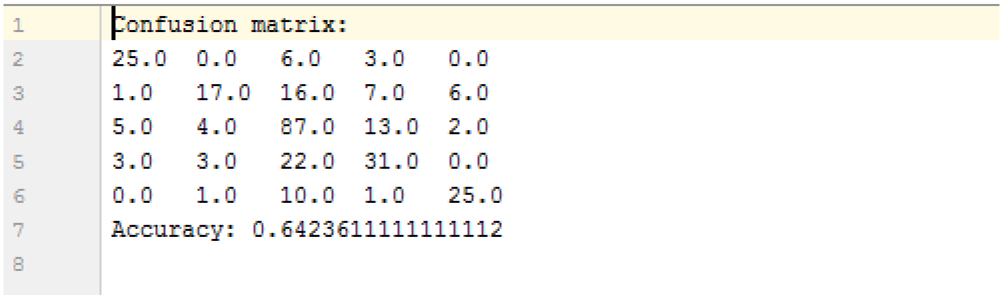


```
private def run(params: Params) {
  System.setProperty("hadoop.home.dir", "E:\\UMKC\\Sum_May\\KDM\\winutils")
  val conf = new SparkConf().setAppName(s"KMeansExample with $params").setMaster("local[*]").set("spark.dr
  val sc = new SparkContext(conf)

  Logger.getRootLogger.setLevel(Level.WARN)

  val topic_output = new PrintStream("data/DT_Results.txt")
  // Load documents, and prepare them for KMeans.
  val preprocessStart = System.nanoTime()
  val (inputVector, corpusData, vocabArray) =
    preprocess(sc, params.input)

  var hm = new HashMap[String, Int]()
  val IMAGE_CATEGORIES = List("athletics", "cricket", "football", "rugby","tennis")
  var index = 0
  IMAGE_CATEGORIES.foreach(f => {
    hm += IMAGE_CATEGORIES(index) -> index
    index += 1
  })
```



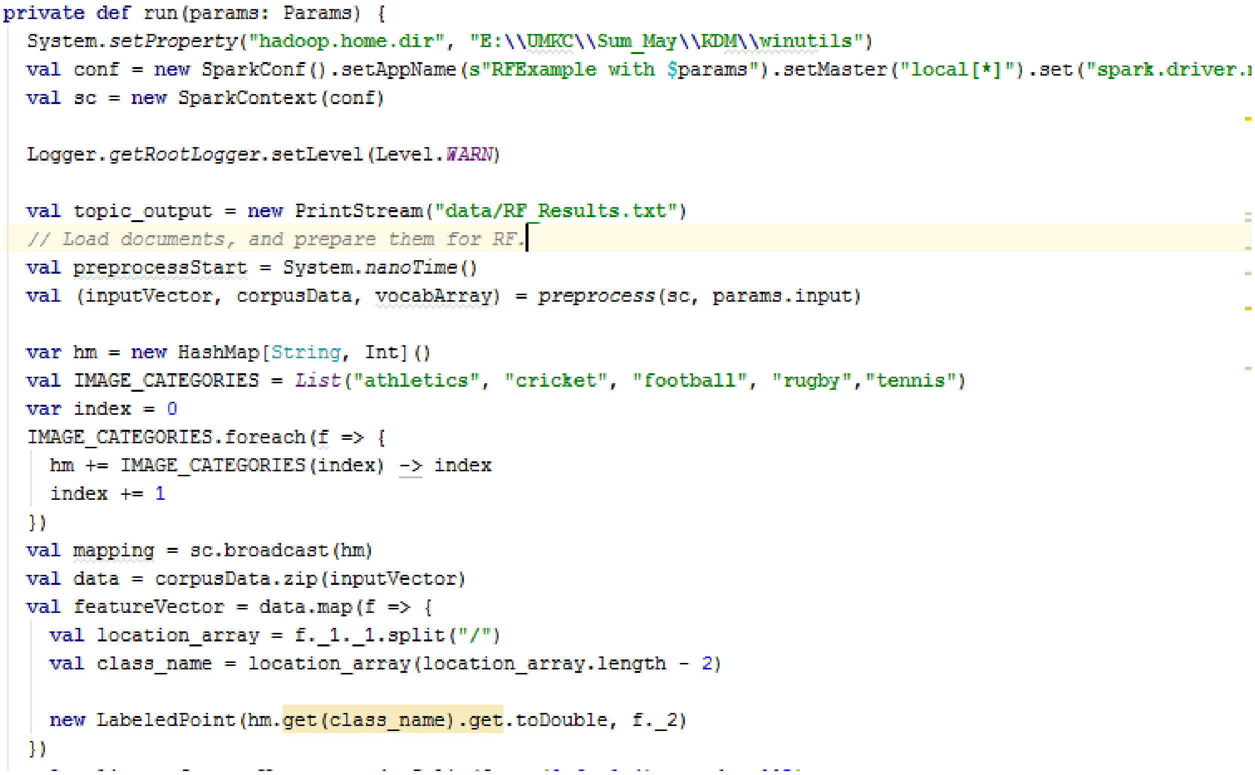
```
val splits = featureVector.randomSplit(Array(0.6, 0.4), seed = 11L)
val training = splits(0)
val test = splits(1)
val numClasses = IMAGE_CATEGORIES.length
val categoricalFeaturesInfo = Map[Int, Int]()
val impurity = "gini"
val maxDepth = 5
val maxBins = 32

val model = DecisionTree.trainClassifier(training, numClasses, categoricalFeaturesInfo,
  impurity, maxDepth, maxBins)


val predictionAndLabel = test.map(p => (model.predict(p.features), p.label))


val accuracy = 1.0 * predictionAndLabel.filter(x => x._1 == x._2).count() / test.count()

val metrics = new MulticlassMetrics(predictionAndLabel)

// Confusion matrix
topic_output.println("Confusion matrix:")
topic_output.println(metrics.confusionMatrix)

topic_output.println("Accuracy: " + accuracy)


sc.stop()
```

Output:

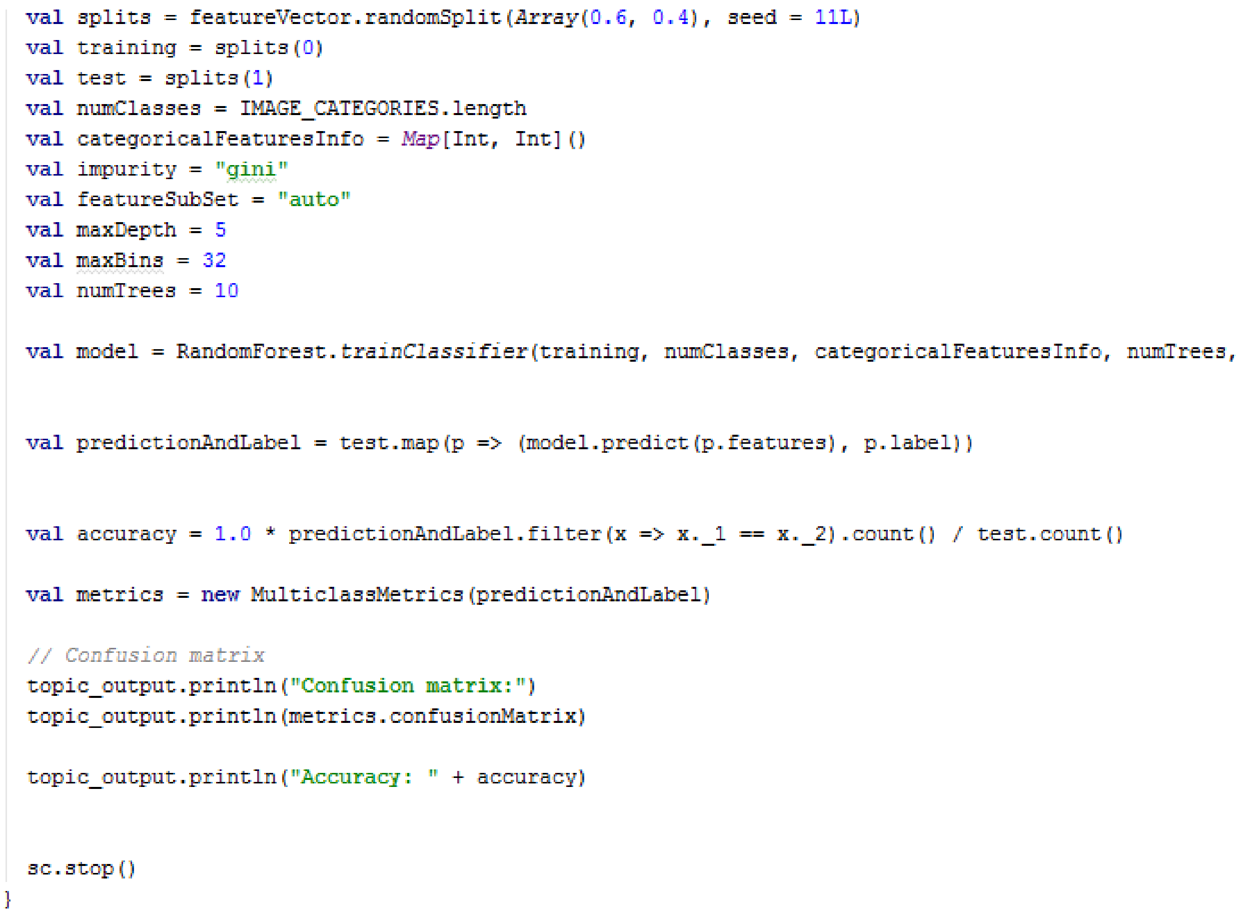


```
Confusion matrix:
25.0   0.0    6.0    3.0    0.0
1.0    17.0   16.0   7.0    6.0
5.0    4.0    87.0   13.0   2.0
3.0    3.0    22.0   31.0   0.0
0.0    1.0    10.0   1.0    25.0
Accuracy: 0.6423611111111112
```

RandomForest:

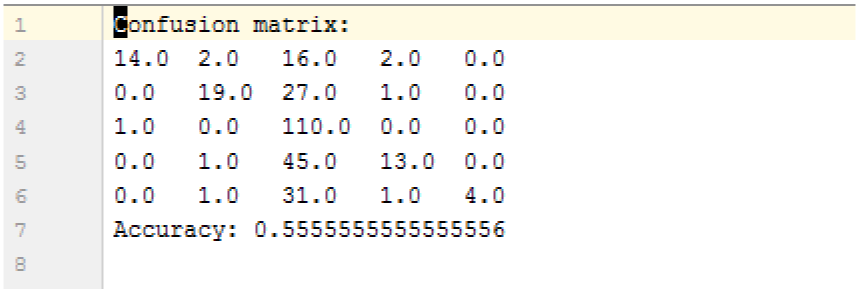


```
private def run(params: Params) {
  System.setProperty("hadoop.home.dir", "E:\\UMKC\\Sum_May\\KDM\\winutils")
  val conf = new SparkConf().setAppName(s"RFExample with $params").setMaster("local[*]").set("spark.driver.ı
  val sc = new SparkContext(conf)

  Logger.getRootLogger.setLevel(Level.WARN)

  val topic_output = new PrintStream("data/RF_Results.txt")
  // Load documents, and prepare them for RF.
  val preprocessStart = System.nanoTime()
  val (inputVector, corpusData, vocabArray) = preprocess(sc, params.input)

  var hm = new HashMap[String, Int]()
  val IMAGE_CATEGORIES = List("athletics", "cricket", "football", "rugby","tennis")
  var index = 0
  IMAGE_CATEGORIES.foreach(f => {
    hm += IMAGE_CATEGORIES(index) -> index
    index += 1
  })
  val mapping = sc.broadcast(hm)
  val data = corpusData.zip(inputVector)
  val featureVector = data.map(f => {
    val location_array = f._1._1.split("/")
    val class_name = location_array(location_array.length - 2)

    new LabeledPoint(hm.get(class_name).get.toDouble, f._2)
  })
```



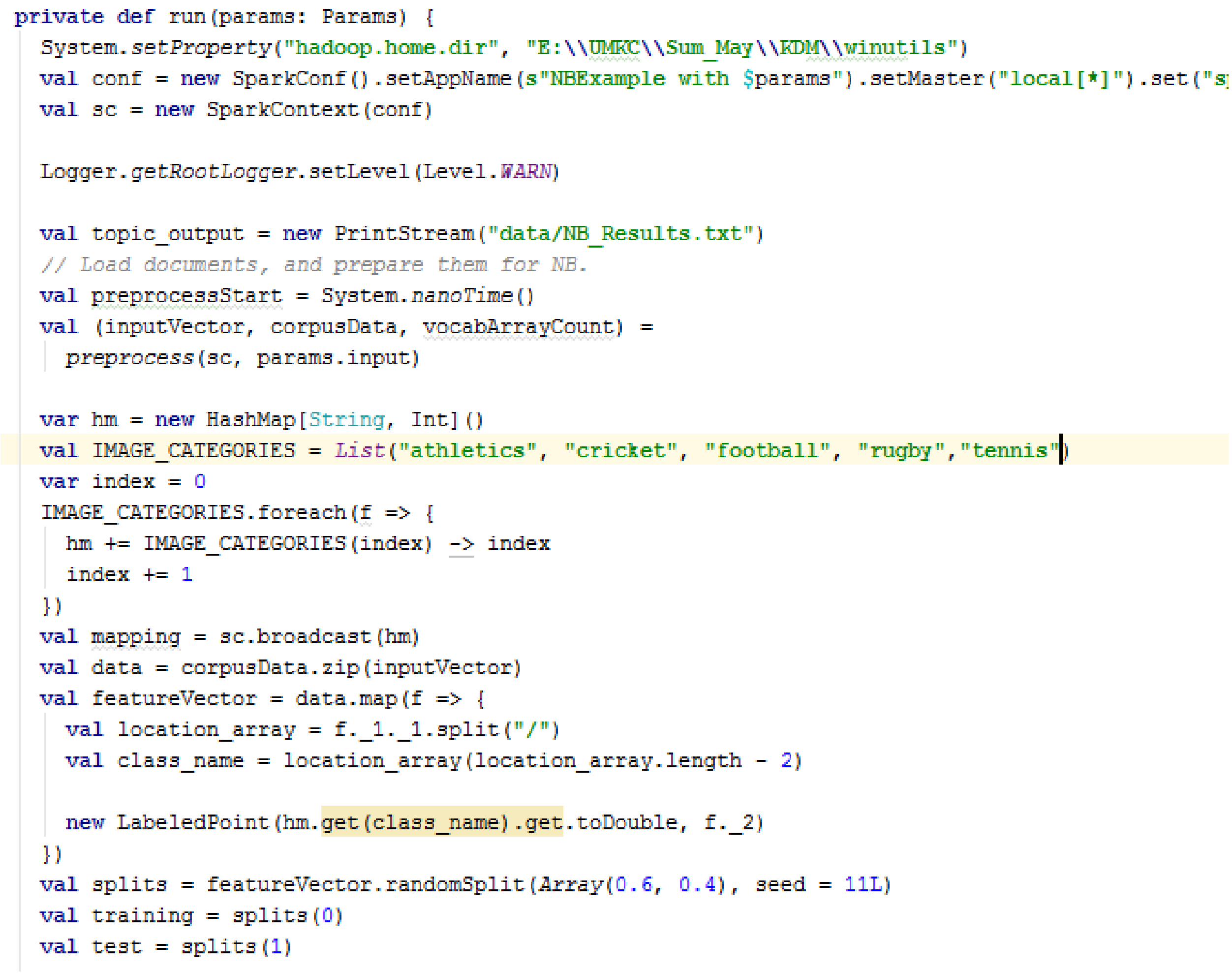
```
  val splits = featureVector.randomSplit(Array(0.6, 0.4), seed = 11L)
  val training = splits(0)
  val test = splits(1)
  val numClasses = IMAGE_CATEGORIES.length
  val categoricalFeaturesInfo = Map[Int, Int]()
  val impurity = "gini"
  val featureSubSet = "auto"
  val maxDepth = 5
  val maxBins = 32
  val numTrees = 10

  val model = RandomForest.trainClassifier(training, numClasses, categoricalFeaturesInfo, numTrees,


  val predictionAndLabel = test.map(p => (model.predict(p.features), p.label))


  val accuracy = 1.0 * predictionAndLabel.filter(x => x._1 == x._2).count() / test.count()

  val metrics = new MulticlassMetrics(predictionAndLabel)

  // Confusion matrix
  topic_output.println("Confusion matrix:")
  topic_output.println(metrics.confusionMatrix)

  topic_output.println("Accuracy: " + accuracy)


  sc.stop()
}
```

Output:

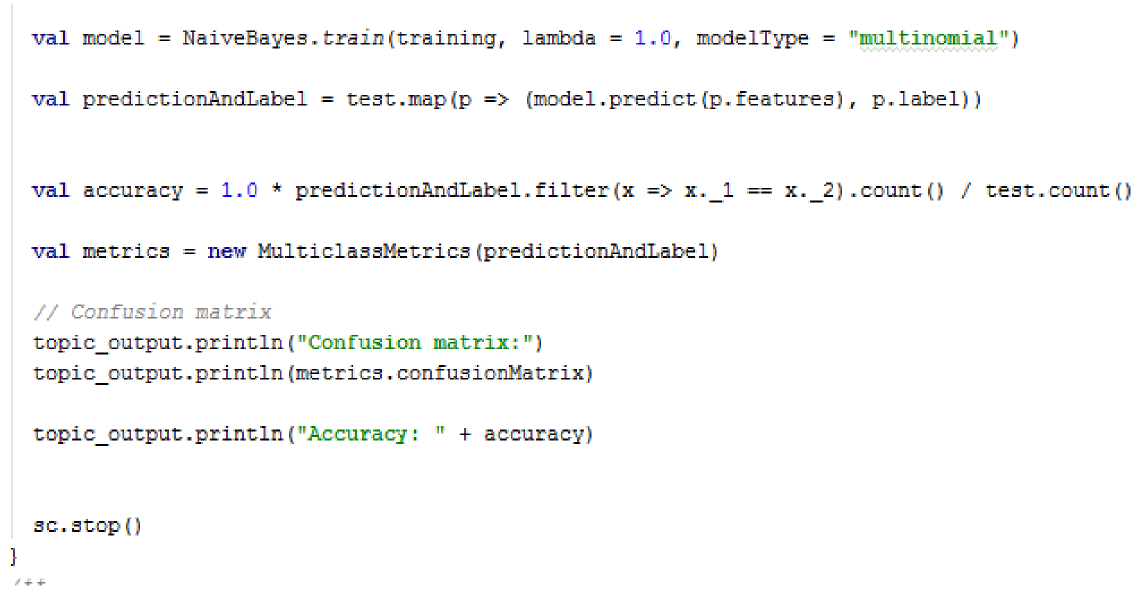


```
Confusion matrix:
14.0  2.0   16.0   2.0   0.0
0.0   19.0  27.0   1.0   0.0
1.0   0.0   110.0  0.0   0.0
0.0   1.0   45.0   13.0  0.0
0.0   1.0   31.0   1.0   4.0
Accuracy: 0.5555555555555556
```

Naïve Bayes:

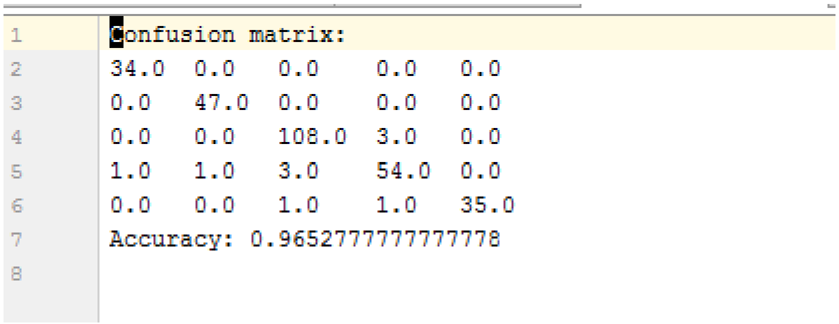


```
private def run(params: Params) {
  System.setProperty("hadoop.home.dir", "E:\\UMKC\\Sum_May\\KDM\\winutils")
  val conf = new SparkConf().setAppName(s"NBExample with $params").setMaster("local[*]").set("s
  val sc = new SparkContext(conf)

  Logger.getRootLogger.setLevel(Level.WARN)

  val topic_output = new PrintStream("data/NB_Results.txt")
  // Load documents, and prepare them for NB.
  val preprocessStart = System.nanoTime()
  val (inputVector, corpusData, vocabArrayCount) =
    preprocess(sc, params.input)

  var hm = new HashMap[String, Int]()
  val IMAGE_CATEGORIES = List("athletics", "cricket", "football", "rugby","tennis")
  var index = 0
  IMAGE_CATEGORIES.foreach(f => {
    hm += IMAGE_CATEGORIES(index) -> index
    index += 1
  })
  val mapping = sc.broadcast(hm)
  val data = corpusData.zip(inputVector)
  val featureVector = data.map(f => {
    val location_array = f._1._1.split("/")
    val class_name = location_array(location_array.length - 2)

    new LabeledPoint(hm.get(class_name).get.toDouble, f._2)
  })
  val splits = featureVector.randomSplit(Array(0.6, 0.4), seed = 11L)
  val training = splits(0)
  val test = splits(1)
```



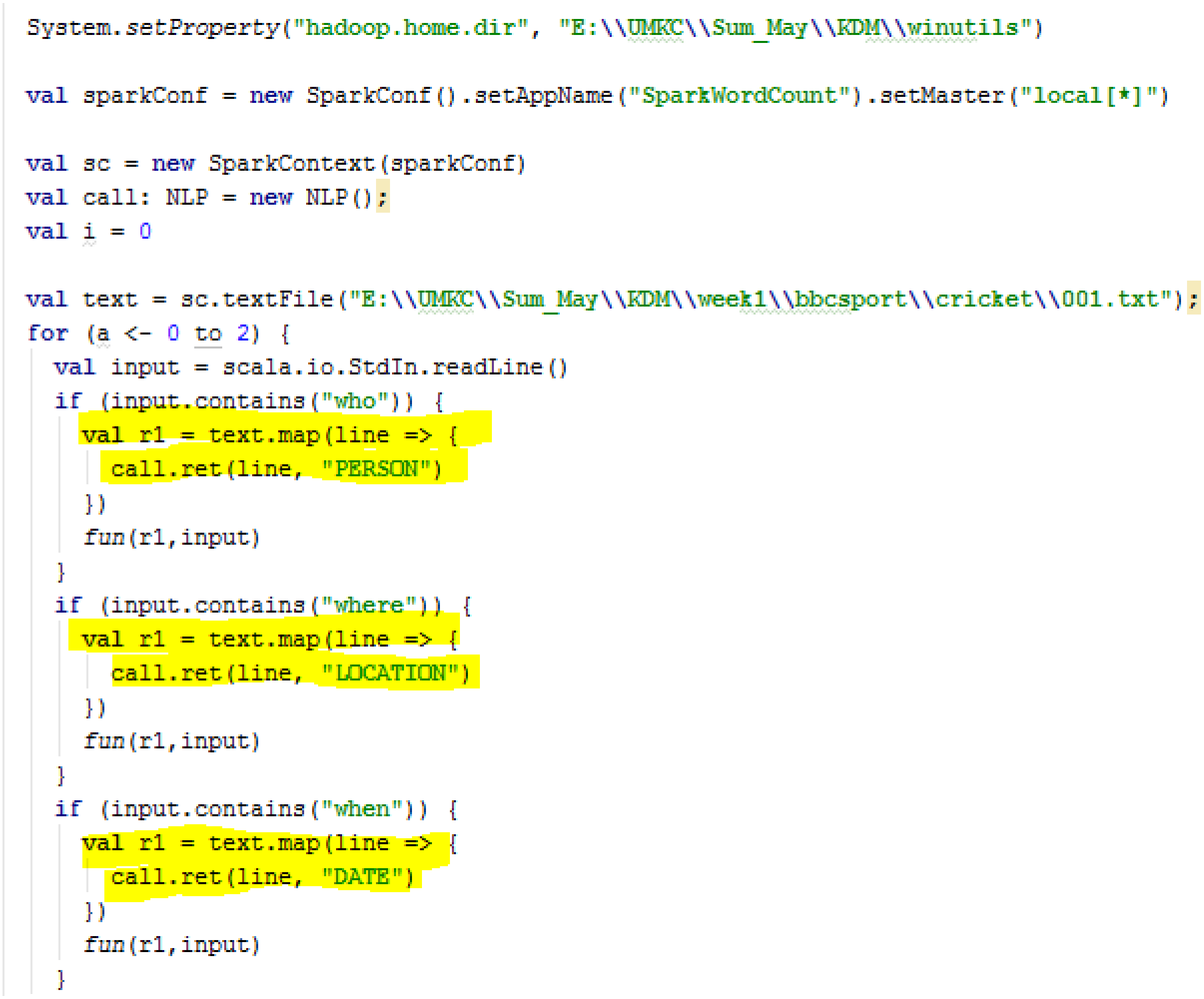
```
  val model = NaiveBayes.train(training, lambda = 1.0, modelType = "multinomial")

  val predictionAndLabel = test.map(p => (model.predict(p.features), p.label))


  val accuracy = 1.0 * predictionAndLabel.filter(x => x._1 == x._2).count() / test.count()

  val metrics = new MulticlassMetrics(predictionAndLabel)

  // Confusion matrix
  topic_output.println("Confusion matrix:")
  topic_output.println(metrics.confusionMatrix)

  topic_output.println("Accuracy: " + accuracy)


  sc.stop()
}
/**
```

Output:



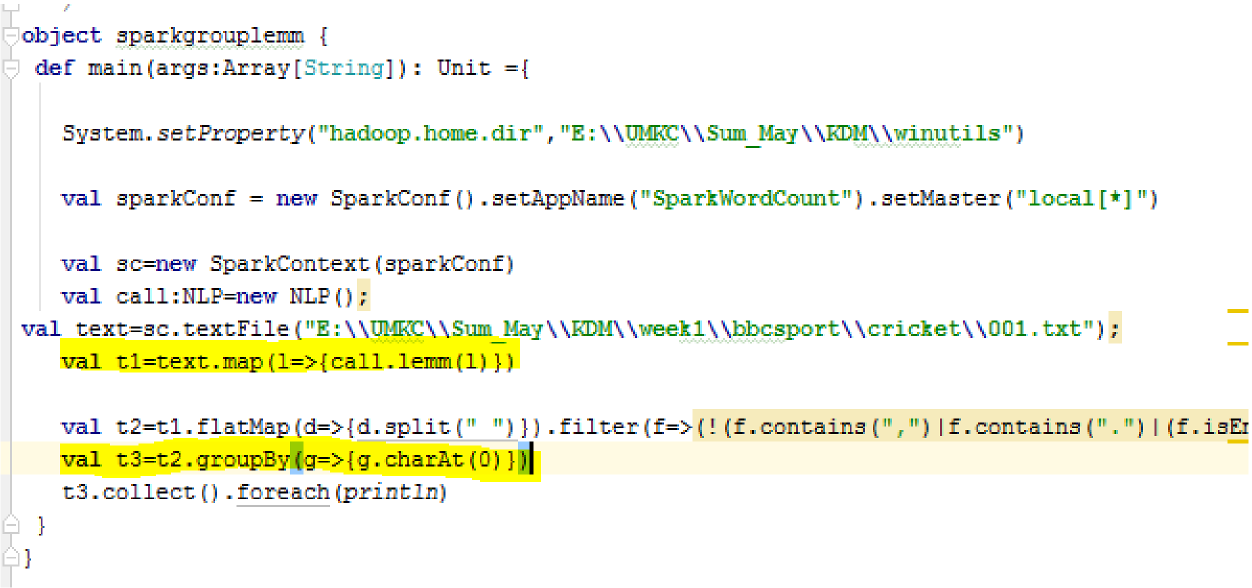
```
Confusion matrix:
34.0  0.0   0.0    0.0   0.0
0.0   47.0  0.0    0.0   0.0
0.0   0.0   108.0  3.0   0.0
1.0   1.0   3.0    54.0  0.0
0.0   0.0   1.0    1.0   35.0
Accuracy: 0.9652777777777778
```

Asking questions and finding answer type based on “wh” words



```
System.setProperty("hadoop.home.dir", "E:\\UMKC\\Sum_May\\KDM\\winutils")

val sparkConf = new SparkConf().setAppName("SparkWordCount").setMaster("local[*]")

val sc = new SparkContext(sparkConf)
val call: NLP = new NLP();
val i = 0

val text = sc.textFile("E:\\UMKC\\Sum_May\\KDM\\week1\\bbcsport\\cricket\\001.txt");
for (a <- 0 to 2) {
  val input = scala.io.StdIn.readLine()
  if (input.contains("who")) {
    val r1 = text.map(line => {
      call.ret(line, "PERSON")
    })
    fun(r1,input)
  }
  if (input.contains("where")) {
    val r1 = text.map(line => {
      call.ret(line, "LOCATION")
    })
    fun(r1,input)
  }
  if (input.contains("when")) {
    val r1 = text.map(line => {
      call.ret(line, "DATE")
    })
    fun(r1,input)
  }
```

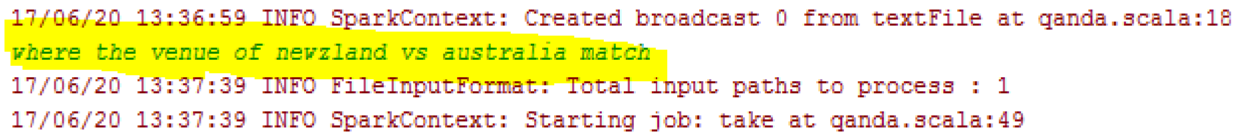
And based on answer type, we are calling particular document who is responsible to answer.



```
object sparkgrouplemm {
 def main(args:Array[String]): Unit ={

   System.setProperty("hadoop.home.dir","E:\\UMKC\\Sum_May\\KDM\\winutils")

   val sparkConf = new SparkConf().setAppName("SparkWordCount").setMaster("local[*]")

   val sc=new SparkContext(sparkConf)
   val call:NLP=new NLP();
 val text=sc.textFile("E:\\UMKC\\Sum_May\\KDM\\week1\\bbcsport\\cricket\\001.txt");
   val t1=text.map(l=>{call.lemm(l)})

   val t2=t1.flatMap(d=>{d.split(" ")}).filter(f=>(!(f.contains(",")|f.contains(".")|(f.isEr
   val t3=t2.groupBy(g=>{g.charAt(0)})
   t3.collect().foreach(println)
 }
}
```

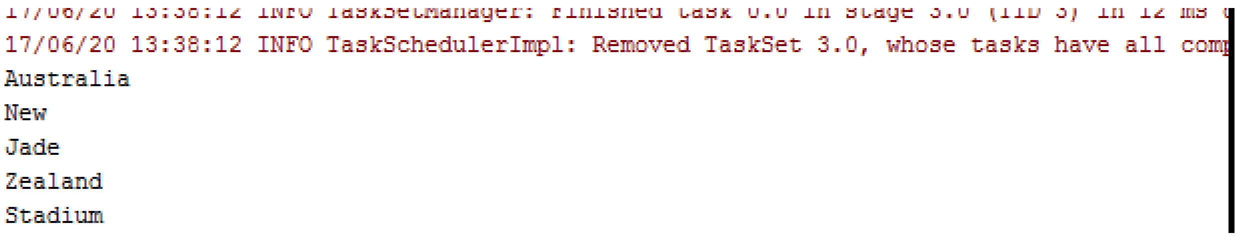
Question and answers:

Question 1:



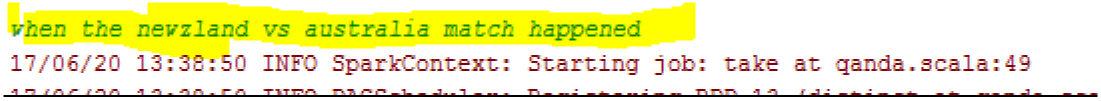
```
17/06/20 13:36:59 INFO SparkContext: Created broadcast 0 from textFile at qanda.scala:18
where the venue of newzland vs australia match
17/06/20 13:37:39 INFO FileInputFormat: Total input paths to process : 1
17/06/20 13:37:39 INFO SparkContext: Starting job: take at qanda.scala:49
```

Answer:



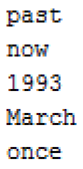
```
17/06/20 13:38:12 INFO TaskSetManager: Finished task 0.0 in stage 3.0 (TID 3) in 12 ms o
17/06/20 13:38:12 INFO TaskSchedulerImpl: Removed TaskSet 3.0, whose tasks have all comp
Australia
New
Jade
Zealand
Stadium
```

Question 2:



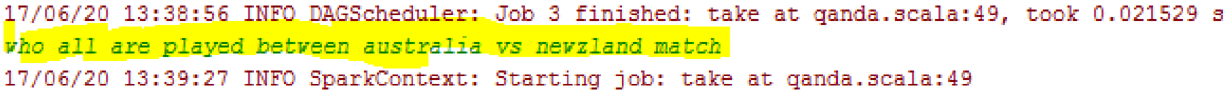
```
when the newzland vs australia match happened
17/06/20 13:38:50 INFO SparkContext: Starting job: take at qanda.scala:49
```

Answer:



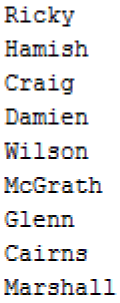
```
past
now
1993
March
once
```

Question 3:



```
17/06/20 13:38:56 INFO DAGScheduler: Job 3 finished: take at qanda.scala:49, took 0.021529 s
who all are played between australia vs newzland match
17/06/20 13:39:27 INFO SparkContext: Starting job: take at qanda.scala:49
```

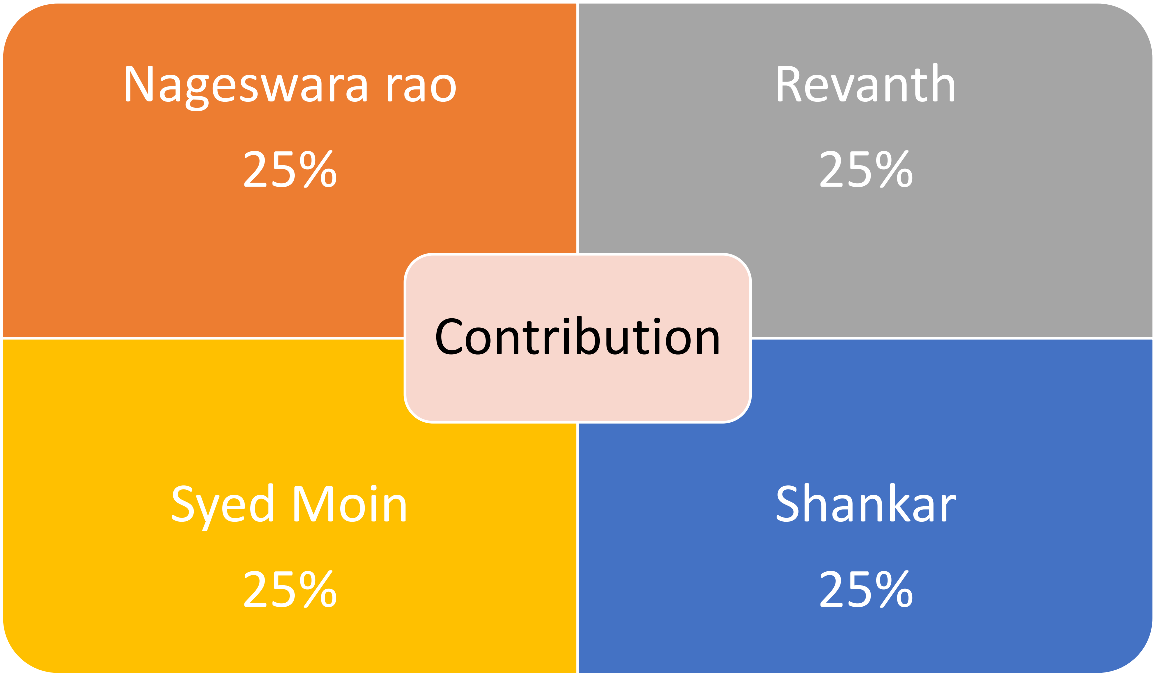
Answer:



```
Ricky
Hamish
Craig
Damien
Wilson
McGrath
Glenn
Cairns
Marshall
```

Project Management:

Contribution:



Nageswara rao

25%

Revanth

25%

Contribution

Syed Moin

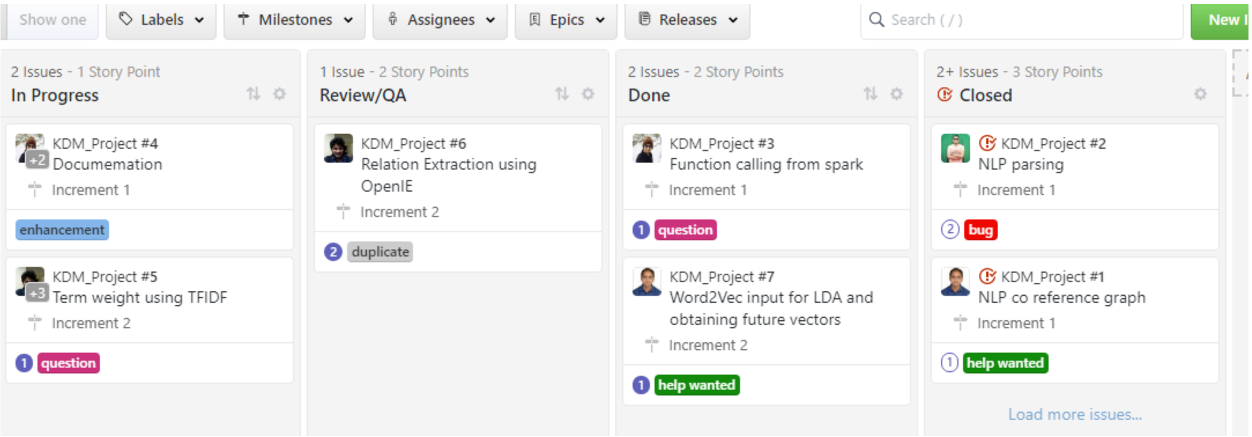
25%

Shankar

25%

GitHub screens:

Board:



2 Issues - 1 Story Point
In Progress

KDM_Project #4
+2 Documemation
Increment 1
enhancement

KDM_Project #5
+3 Term weight using TFIDF
Increment 2
1 question

1 Issue - 2 Story Points
Review/QA

KDM_Project #6
Relation Extraction using OpenIE
Increment 2
2 duplicate

2 Issues - 2 Story Points
Done

KDM_Project #3
Function calling from spark
Increment 1
1 question

KDM_Project #7
Word2Vec input for LDA and obtaining future vectors
Increment 2
1 help wanted

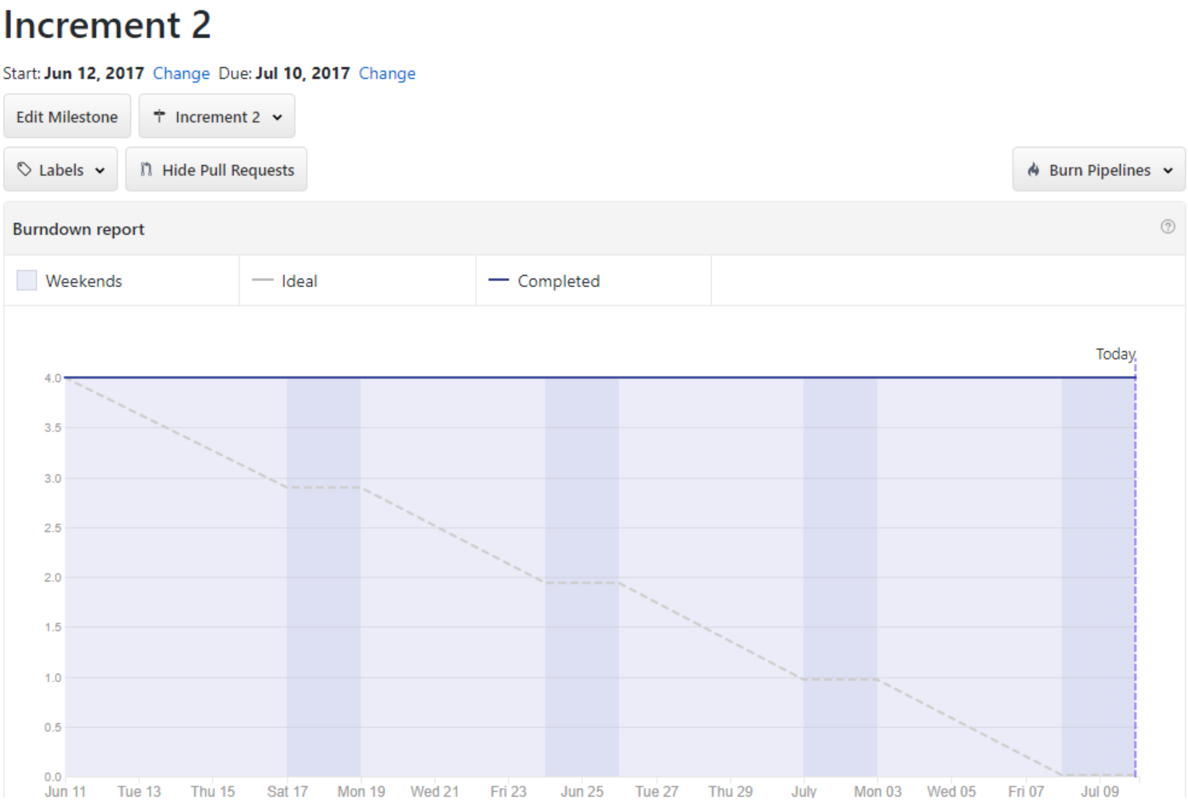
2+ Issues - 3 Story Points
Closed

KDM_Project #2
NLP parsing
Increment 1
2 bug

KDM_Project #1
NLP co reference graph
Increment 1
1 help wanted

Load more issues...

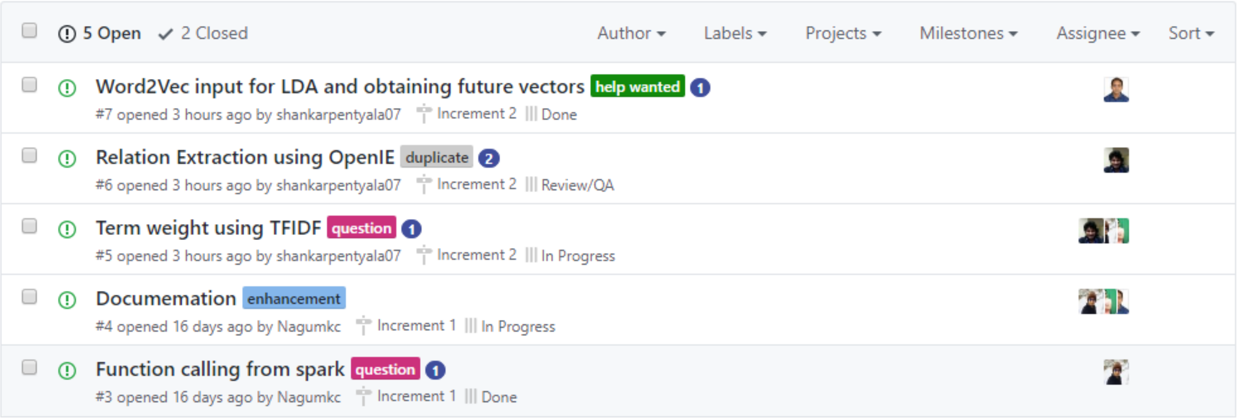
Burndown report:



Increment 2

Start: **Jun 12, 2017** Change Due: **Jul 10, 2017** Change

Issues:



□ Word2Vec input for LDA and obtaining future vectors help wanted 1
#7 opened 3 hours ago by shankarpentyala07 Increment 2 Done

□ Relation Extraction using OpenIE duplicate 2
#6 opened 3 hours ago by shankarpentyala07 Increment 2 Review/QA

□ Term weight using TFIDF question 1
#5 opened 3 hours ago by shankarpentyala07 Increment 2 In Progress

□ Documemation enhancement
#4 opened 16 days ago by Nagumkc Increment 1 In Progress

□ Function calling from spark question 1
#3 opened 16 days ago by Nagumkc Increment 1 Done

Future work:

Till now, we have extracted the data statically from the Data set using the NLP techniques and have created question and answering system based on the extracted data.

The Future scope is to generate the Question and Answering based on the Knowledge graph dynamically by parsing data and finding out the entities and relationship between the entities. The main Entity extraction information is implicitly done using Natural language and explicitly done using structured data markup.