

Lab 9

In this laboratory, we will apply some classification algorithms to the Amazon fine-foods dataset we have been exploring so far, exploiting SparkSQL to create the input DataFrame of the machine learning algorithms.

Your goal is to produce a classification model able to label reviews as “useful” or “useless” (i.e., you will produce a binary classification model). For each review on Amazon.com, users are able to vote the helpfulness of such review, with a thumb up/down. Our dataset provides this information through two columns: the number of users who have voted the content of a review (helpfulness denominator) and the number of users that have thumbed up (helpfulness numerator). The helpfulness index of a review is given by the ratio of the two ($\text{HelpfulnessNumerator}/\text{HelpfulnessDenominator}$), and it can be computed only for the reviews that have been voted at least one time ($\text{HelpfulnessDenominator}>0$). For this task, a review belongs to the “useful” class if its helpfulness index is above 90% (0.9). Otherwise, the review is labeled as “useless”. We are interested in predicting the class label (useful or useless) of the reviews that have never been voted in order to automatically predict if they are useful or useless.

There are different ways to evaluate the quality of the built classification model. Here, we choose one of the simplest: we divide the labeled input dataset (i.e., the reviews for which the label is known) in two splits, we train the dataset on the first one and then we test it on the second part, computing the average precision of the result.

For your ease, you are provided of a template to fill, which covers already the evaluation part (split of the dataset and testing phase, print of the results).

Your task is to:

1. Read and preprocess the dataset and store it into a DataFrame with columns label and features;
2. Create a Pipeline that builds a classification model that can predict the labels of the (unlabeled) reviews (i.e., it predicts if a review is helpful or useless).

Ex. 1 Preprocessing

The first step of this task consists of generating a DataFrame characterized by two fields: label (it is the target attribute of the classification problem) and features (it is a vector of doubles containing the values of the predictive attributes that are used to infer the value of the target attribute). Each record of the data frame is a labeled record and the DataFrame can be used as input of a classification algorithm to infer a classification model.

Specifically, in the preprocessing step, you have to read the Amazon fine-foods dataset ([/data/students/bigdata-01QYD/Lab9/ReviewsNewfile.csv](#)) and create a `JavaRDD<LabeledPoint>` RDD based on the input dataset. Then, store the content of the `JavaRDD<LabeledPoint>` RDD into a SparkSQL DataFrame. Remind that each object of type `LabeledPoint` is characterized by two fields: label (it is a double) and features (it is a vector of doubles). In this task, set the value of label to 1.0 for representing the class label “helpful” and to 0.0 for representing the class label “useless”. For the (predictive) features, we **initially choose as only feature the length of the field “Text”** (i.e., the vector features contains one single double value for each record that is set to the length of “Text”).

Since not all the reviews have been rated, you must **filter out the reviews that have never been rated** (i.e., those having 0 as helpfulness denominator) before creating the JavaRDD<LabeledPoint> RDD. Remove also the header of the input file.

Ex.2 Creating a Pipeline

Now create a Pipeline for generating the classification model. Remember that one of the steps of the pipeline will be a classification algorithm (e.g., a logistic regression algorithm or a Decision Tree), and that you might need other pre-processing and post-processing steps to treat textual fields.

When you have created the pipeline, run and take note of the final precision/quality of the built model displayed on the stdout by the evaluation code provided at the end of the SparkDriver.java file.

Create two versions of your application. One version based on the Decision tree algorithm and another one based on the Logistic regression algorithm. Finally, compare the quality of the two generated models.

Ex.3 Adding features

Now it is your turn to improve the classifier you have implemented so far. Try to generate 3-4 other features (to be included in the features vector) based on the original review features, and re-run the pipeline. Generate the features that you think could be useful for predicting the value of the class label (useful/useless). What is the quality of your classification model?

Ex.4 Use the content of the review

Try to create a classification model based on the content of the field "Text" (i.e., the words occurring in Text). Use the code titled "Textual data classification example code" (available on the web site of the course) as reference code.

Is the quality of the generated model better than the previous ones?