

**RURAL FEDERAL UNIVERSITY OF PERNAMBUCO  
SOFTWARE ENGINEERING GROUNDS - 2019.2**

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***HeyFood***

**ALGORITHM SLOPE ONE**

**RECIFE  
2019**

## **SUMMARY**

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## 1. WHAT IS SLOPE ONE ALGORITHM?

The Slope One algorithm is a collaborative item-based filtering system. That is, it means that it is completely based on the ranking of user items. When we calculate similarity between objects, we only know the history of classifications, not the content itself. This similarity is then used to predict possible user ratings for pairs of user items not present in the dataset.

Initially, users sort different items in the system. Then the algorithm calculates the similarities. After that, the system makes predictions for user item ratings, which the user has not yet rated.

The algorithm operates assuming that a user has given non-binary notes to items. These grades are placed in an array of UsersItems, such that each row corresponds to a user's grades  $j$  to  $N$  items. If a user  $j$  has not rated an item  $i$ , the element  $x_{i,j}$  is equal to 0.

For more data analysis, the average of the differences between the users' grades would be obtained. The general formula for calculating predictions is as follows:

$$P(A,i) = \frac{(R(A,j) + \text{Diff}(i,j)) + (R(A,k) + \text{Diff}(i,k)) + \dots + (R(A,z) + \text{Diff}(i,z))}{N}$$

Where  $\text{Diff}(i, j)$  is the average of the differences in ratings between items  $i$  and  $j$  for other users,  $R(A, j)$  is how much the user rated item  $j$ , and assuming we have  $N$  items and that items vary. Yacht

References:

BAELDUNG (Romênia). **A Collaborative Filtering Recommendation System in Java**. 2018. Available in: [https://www.baeldung.com/java-collaborative-filtering-recommendations?fbclid=IwAR1yZ-TigrucytGKv-r-Cs4W\\_QhzgzouXnCBNOm\\_1VTix4Sm5fxa1y8qA](https://www.baeldung.com/java-collaborative-filtering-recommendations?fbclid=IwAR1yZ-TigrucytGKv-r-Cs4W_QhzgzouXnCBNOm_1VTix4Sm5fxa1y8qA). Access on: 05 jul. 2019.

SOUZA, Renata Ghislotti Duarte de. **Recommendation Systems: Applying Recommendation Systems in Practical Situations**. 2014. Available in: [https://www.ibm.com/developerworks/br/local/data/sistemas\\_recomendacao/index.html](https://www.ibm.com/developerworks/br/local/data/sistemas_recomendacao/index.html). Access on: 05 jul. 2019.

## 2. APPLYING TO THE PROJECT HEYFOOD

Initially we created the recommendation package and within this package we added two classes: SlopeOne and Recommendation.

In the builder of the Recommendation class will first be generated a list with all registered customers. The `createClientArray ()` method will generate a map where the key is objects of type Customer and the value is another map where the key is objects of type Restaurant and the values are the ratings that the customer has assigned to the restaurant.

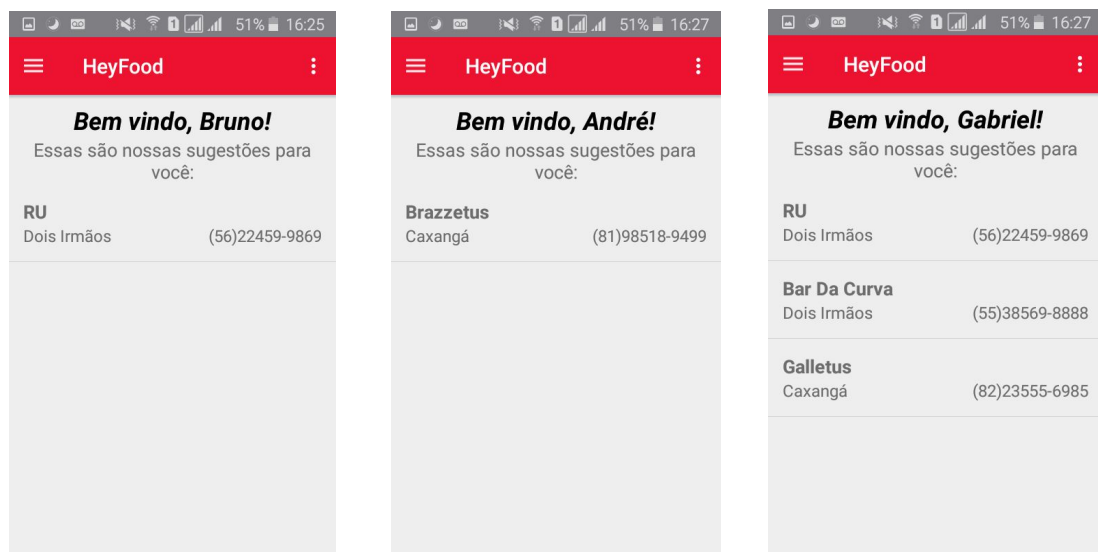
The generated matrix will be passed as an argument to the static method `SlopeOne.slopeOne ()`, this method is called the `buildDifferenceMatrix ()` method, which based on the available data, calculates the relationship between the items and the number of occurrences. After calling the `buildDifferenceMatrix ()` method the `predict ()` method is called which based on existing data predicts all restaurant evaluations that were not made by the customer, if the prediction is not possible, the values will not be entered in the matrix.

### 3. CASOS DE TESTE

In this test case we simulate the evaluation of some restaurants, the cells that are green are the possible grades that Slope One gave.

	Brazzetus	Galletus	RU	Bar da Curva
Bruno	2	1	4,63	3
Jonathas	3	2	5	4
André	2,23	1,16	2	1
Gabriel	3	2	5	4

In the app we took the possible notes that Slope One generated and made a list in the customer's home with the restaurants that the customer has not rated yet and sorted down the restaurants according to the possible notes.



Note: The restaurants that will be shown in the home are the restaurants that obtained a grade greater than or equal to 2, according to the possible grade that Slope One generated, so Brazzetus will not be shown to André.

Now let's suppose that client Bruno rated the UK with a grade of 4, Jonathas reevaluated the UK with a score of 2 and André rated the Galletus as a 1. (cells in blue)

	Brazzetus	Galletus	RU	Bar da Curva
Bruno	2	1	4	3
Jonathas	3	2	2	4
André	2,25	1	2	1
Gabriel	3	2	3,5	4

Note that the note that Slope One has generated for one of the restaurants that customer Gabriel has not rated (UK) has changed, as well as a subtle note change from the Brazzetus restaurant in André.

In the following case we will show an example where there are 7 customers and 7 restaurants.

	Brazzetus 0	Galletus 1	RU 2	Bar da Curva 3	Deggustah 4	Bob's 5	Habib's 6
Bruno	1	3,50	5	3	3,02	4,58	2
Jonathas	1,96	4	2,86	4,2	2	4,61	4
André	1,95	3,6	4	4,27	5	4,62	4
Gabriel	1	3	3	4	1	3	2
João	2	4	1	5	4	5	1
José	1,89	1	2,82	4,13	3	5	2,15
Maria	3	3,27	2,63	3	4	4,32	2

<p><b>Bem vindo, Bruno!</b></p> <p>Essas são nossas sugestões para você:</p> <p><b>Bob's</b> Boa Vista (86)47565-8255</p> <p><b>Galletus</b> Caxangá (82)23555-6985</p> <p><b>Deggustah</b> Várzea (56)58965-5566</p>	<p><b>Bem vindo, Jonathas!</b></p> <p>Essas são nossas sugestões para você:</p> <p><b>Bob's</b> Boa Vista (86)47565-8255</p> <p><b>Bar Da Curva</b> Dois Irmãos (55)38569-8888</p> <p><b>RU</b> Dois Irmãos (56)22459-9869</p>	<p><b>Bem vindo, André!</b></p> <p>Essas são nossas sugestões para você:</p> <p><b>Bob's</b> Boa Vista (86)47565-8255</p> <p><b>Bar Da Curva</b> Dois Irmãos (55)38569-8888</p> <p><b>Galletus</b> Caxangá (82)23555-6985</p>
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<p><b>Bem vindo, José!</b></p> <p>Essas são nossas sugestões para você:</p> <p><b>Bar Da Curva</b> Dois Irmãos (55)38569-8888</p> <p><b>RU</b> Dois Irmãos (56)22459-9869</p> <p><b>Habib's</b> Aflitos (86)63589-9688</p>
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<p><b>Bem vindo, Maria!</b></p> <p>Essas são nossas sugestões para você:</p> <p><b>Bob's</b> Boa Vista (86)47565-8255</p> <p><b>Galletus</b> Caxangá (82)23555-6985</p> <p><b>RU</b> Dois Irmãos (56)22459-9869</p>
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