



Helpful Or Not?

Tal Azaria



Agenda

Overview

Problems to solve

The ML approach

Dataset

Data Exploration

Evaluation Method

Baseline

Learning Algorithm

Iterations

Next steps



Ranking Online Reviews

With the growing popularity of e-commerce, online retailers such as Amazon.com are relying on user's reviews to provide:

- information to consumers
- feedback to manufacturers.





The problem



Judy

★☆☆☆☆ **Melted!!!!**

February 11, 2016

Style: Gold Ballotin | Size: 19 Count

It was a gift and I was so embarrassed when I found out it arrived completely melted!! Ugh!!! Really? No cooler packs in a Godiva high fat content chocolate shipped to California? So upset. Waste of money.



The fraction of customers who deemed the review as helpful is displayed with the review



[Comment](#)

153 people found this helpful. Was this review helpful to you?

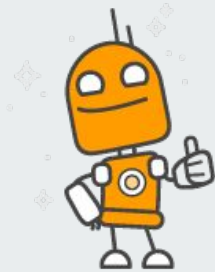
Yes

No

[Report abuse](#)

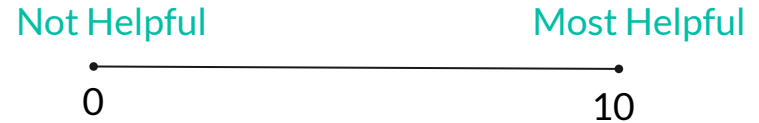


The Task



We aimed to develop a machine learning approach to automatically assess and rank the reviews by their helpfulness

- Given a set of reviews we want to rank them from the most helpful to the least
- There are 11 levels of **Helpfulness**:



We approach this problem with **classification** algorithms



The Dataset

- This dataset consists of reviews of fine foods from [Amazon](#).
- The data span a period of more than 10 years, including all ~500,000 reviews up to October 2012.
- Reviews include product and user information, ratings, and a plaintext review.

Let's say we
want to order
some dried fruits
because we miss
Tu-Bishvat

Golden State Fruit Pacific Coast Classic Dried Fruit Tray Gift Golden State Fruit



619 customer reviews

24 answered questions

Amazon's Choice

for "fruit and nut gift baskets"



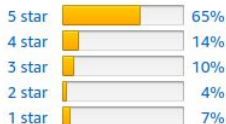
About the product

- Great healthy gift with dried fruits and nuts.
- Kosher Certified OU.

Customer reviews

★★★★☆ 619

4.2 out of 5 stars ▾



[See all 619 customer reviews](#) ▶

Share your thoughts with other customers

[Write a customer review](#)

Read reviews that mention



Top customer reviews

Rachelle A

★★★★☆ **Embarrassing as a gift**

July 14, 2015

Verified Purchase

I purchased this as a gift for a coworker, on behalf of my company. I asked her for her honest feedback, so I could know whether to send this to others. She felt awkward telling me that, while the pistachio's were good, the fruit was soggy and some of the nuts were stale. I felt very embarrassed to have given this as a gift.

[Comment](#) | 157 people found this helpful. Was this review helpful to you? [Yes](#) [No](#) [Report abuse](#)

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March 29, 2016

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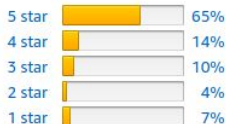
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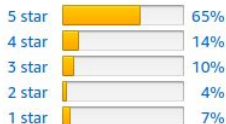
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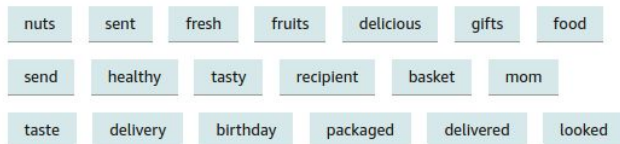


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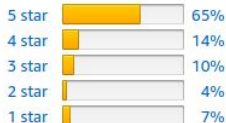
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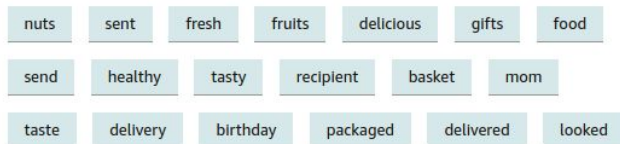


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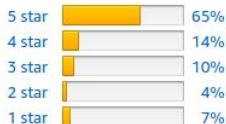
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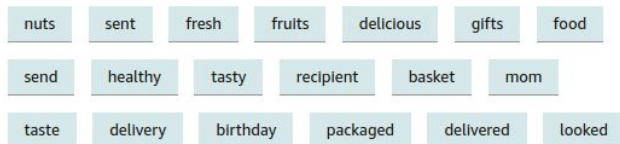


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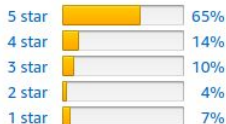
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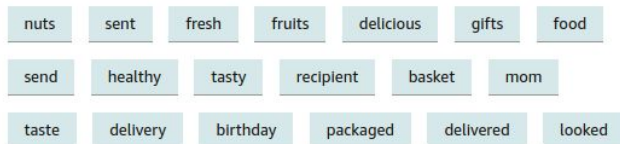


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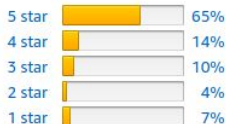
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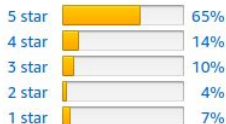
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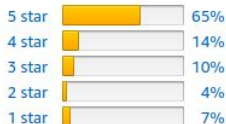
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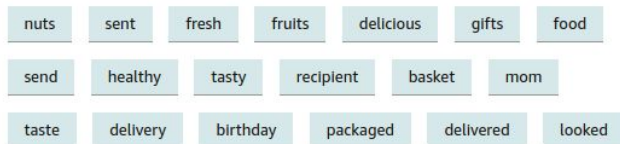


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We want to predict the

Helpfulness score:

Helpfulness Numerator /

Helpfulness Denominator

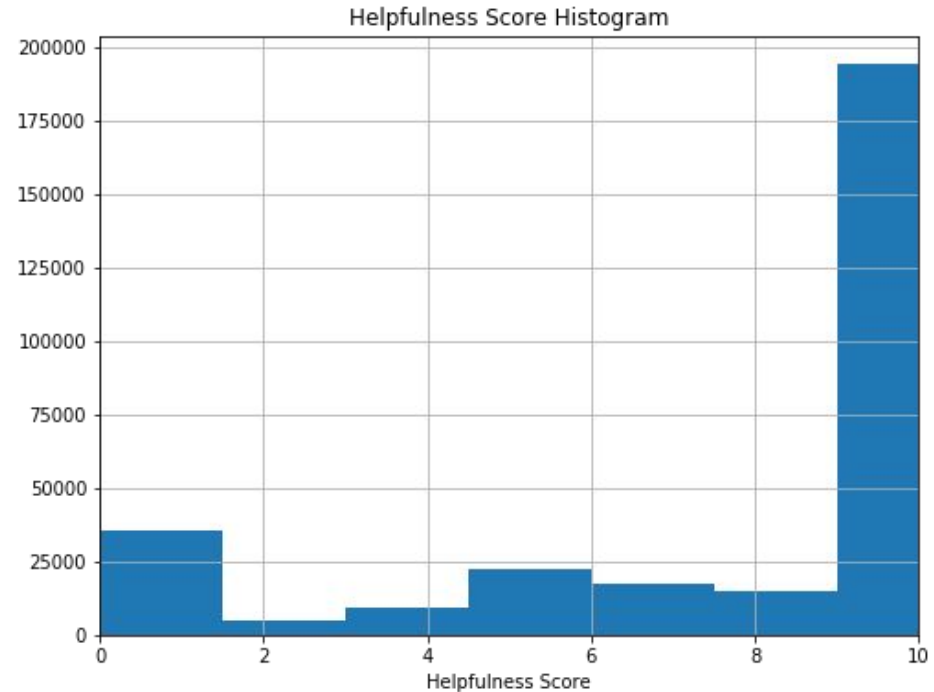


Data Exploration

01

Highly Imbalanced Data

We found that ~70% of the data
consists of the label - 10





What makes a review helpful?

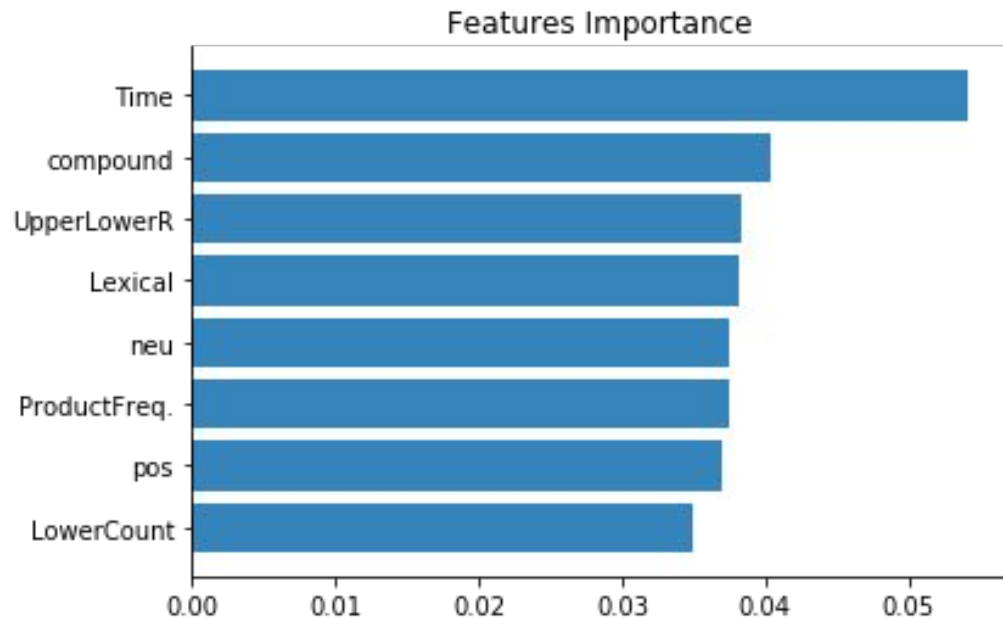
The answer is very **subjective** since what may be useful to one can be totally useless to the other...





What makes a review helpful?

However, we witnessed that
Most important features are:





Pre-Processing

02



- **Duplicates** and **reviews with no helpfulness score** were removed because it's hard to gain information from such records
- We have chosen to limit our learning to products which have **at least 10 reviews**
- The review's **text was cleaned**



Measure Ranking

03

The **Kendall tau distance** is a [metric](#) that counts the number of pairwise disagreements between two ranking lists. The **larger** the distance, the more **dissimilar** the two lists are.

Suppose we rank a group of five people by height and by weight:

Person	A	B	C	D	E
Rank by Height	1	2	3	4	5
Rank by Weight	3	4	1	2	5

Here person A is tallest and third-heaviest, and so on.

In order to calculate the Kendall tau distance, pair each person with every other person and count the number of times the values in list 1 are in the opposite order of the values in list 2.

Pair	Height	Weight	Count
(A,B)	1 < 2	3 < 4	
(A,C)	1 < 3	3 > 1	X
(A,D)	1 < 4	3 > 2	X
(A,E)	1 < 5	3 < 5	
(B,C)	2 < 3	4 > 1	X
(B,D)	2 < 4	4 > 2	X
(B,E)	2 < 5	4 < 5	
(C,D)	3 < 4	1 < 2	
(C,E)	3 < 5	1 < 5	
(D,E)	4 < 5	2 < 5	

Since there are 4 pairs whose values are in opposite order, the Kendall tau distance is 4. The normalized Kendall tau distance is

$$\frac{4}{5(5 - 1)/2} = 0.4.$$

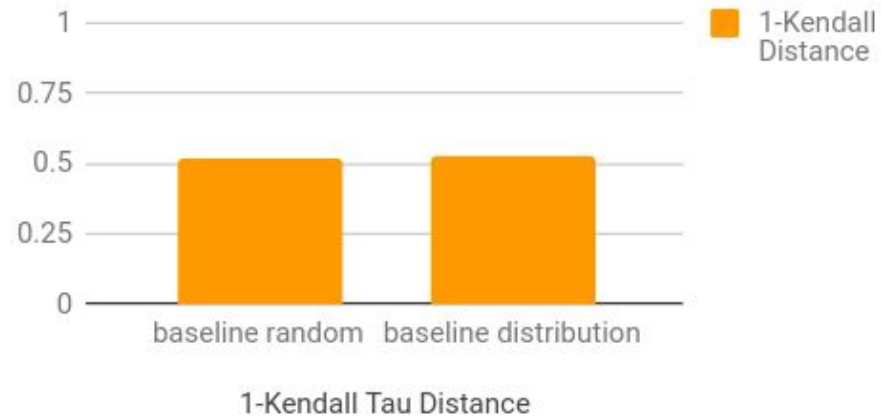
A value of 0.4 indicates that 40% of pairs differ in ordering between the two lists.



Baseline Approach

04

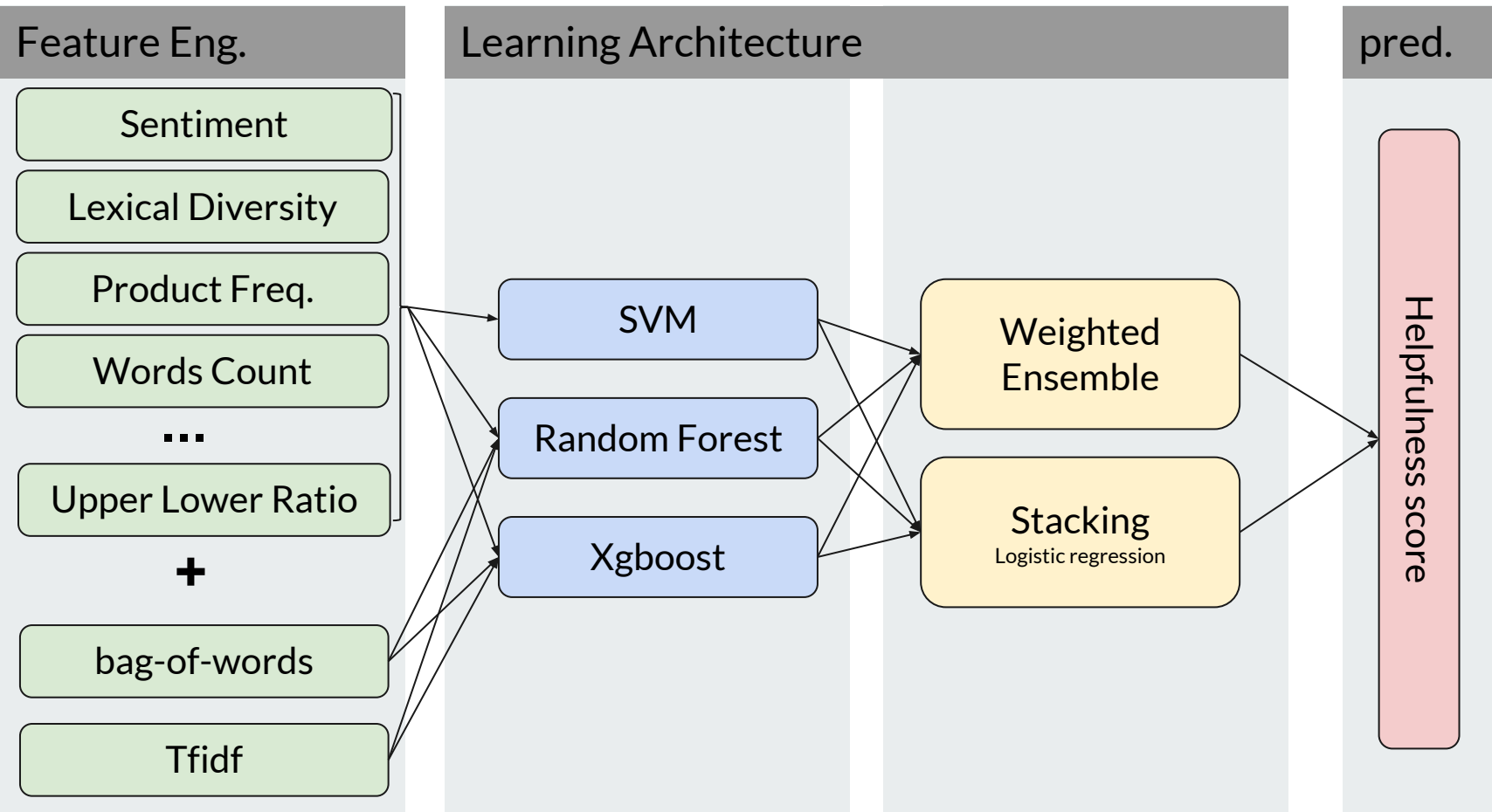
- Random guess values [0-10]
- Label prediction according to the training's labels distribution





ML Approach

05

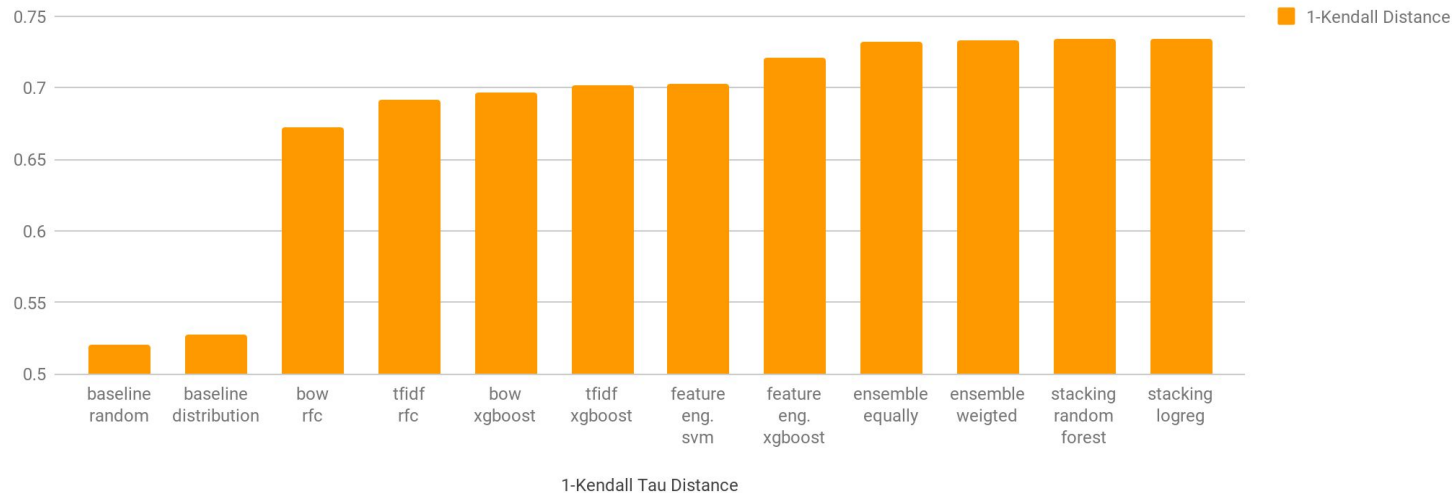




Accuracy

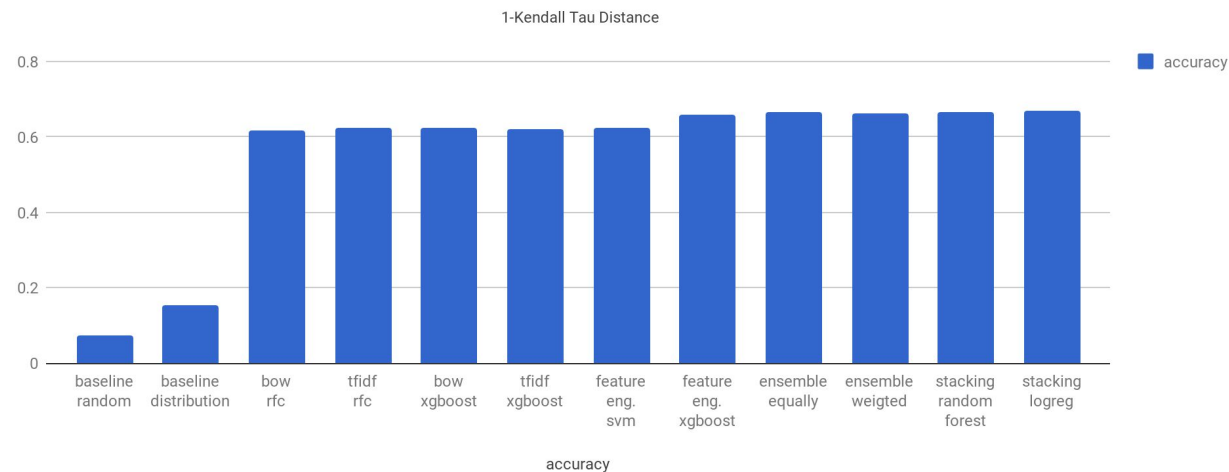
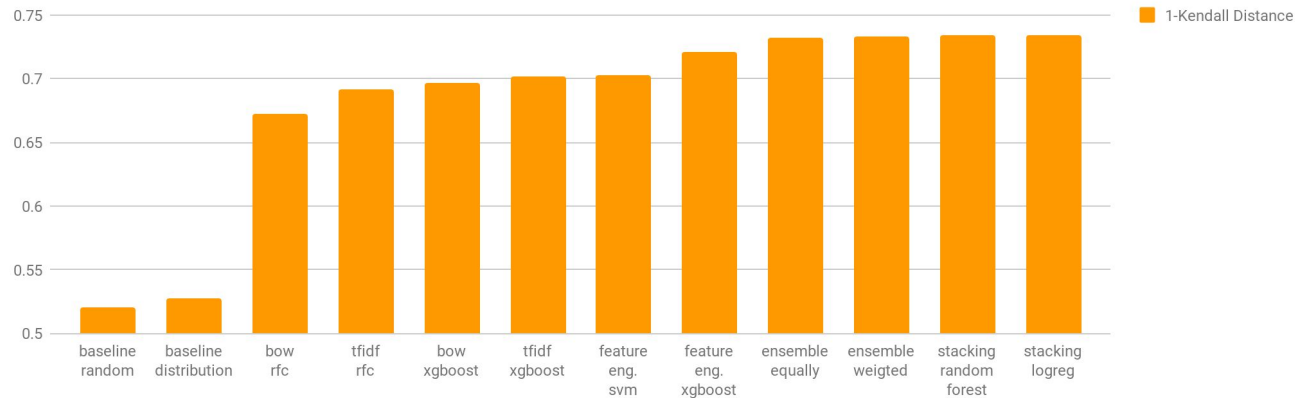
06

The best results achieved using stacking with logistic regression:



Accuracy

06





Iterations

08

- 01 | Got accuracy ~80% but realized that it is a result of imbalanced data
- 02 | Down sampled randomly the high rank reviews to balance the data
- 03 | Upon balancing, the accuracy had dropped to ~60%
- 04 | Random forest, svm and xgboost classifiers were tested
- 05 | Used ensemble and stacking methods



Next Steps

So much to do, So little time...

- 01 | Improve feature engineering
- 02 | Use deep learning models to process text reviews
- 03 | Pairwise ranking
- 04 | Generalize Classifier
- 05 | Immediate feedback for the reviewer





Thank you.

