

Airbnb Reviews Analysis: The Relationship Between Rating Scores and Reviews ?

By: Evelyn Li



Garden Retreat steps from Haight St

San Francisco

Entire house

3 guests 1 bedroom 2 beds 1 bath

Sara is a Superhost

Superhosts are experienced, highly rated hosts who are committed to providing great stays for guests.



Sara

\$185 per night

★★★★★ 273

Dates

Check-in

→ Checkout

Guests

1 guest

**273 Reviews**  Search reviews

Accuracy



Location



Communication



Check-in



Cleanliness



Value

**Chad**

May 2019

This place was amazing and in a great location. Sara was super helpful and easy talk to. My family will definitely be staying here again in the future!.

**Amber**

April 2019

Sara was very accommodating ! She was very friendly and a great hostess !! I enjoyed the coziness, brightness and the cute garden :) I would def recommend

**Georgeanna**

April 2019

Sara's place was a cozy and tranquil home base, a peaceful break away from the hustle and bustle of the big city. Whether she was offering tips on where to go/eat/avoid, or morning greetings from her adorable pups, Sara met our needs and was super friendly without encroaching on...[Read more](#)

**Jeff**

April 2019

Sara's place is as described. Great private space to call home for a few days. Great communication for check-in process. Would recommend. Bathroom is a little tired but gets the job done.

\$185 per night 273

Dates

Check-in

→ Checkout

Guests

1 guest

Request to Book

You won't be charged yet

It's been listed 1 times in the past week.

 Report this listing



Problem Statement:

- ◀ **Is there a relationship between rating scores and reviews?**
 - ◀ **Can we use review content to predict rating score for Airbnb hosts?**
- 

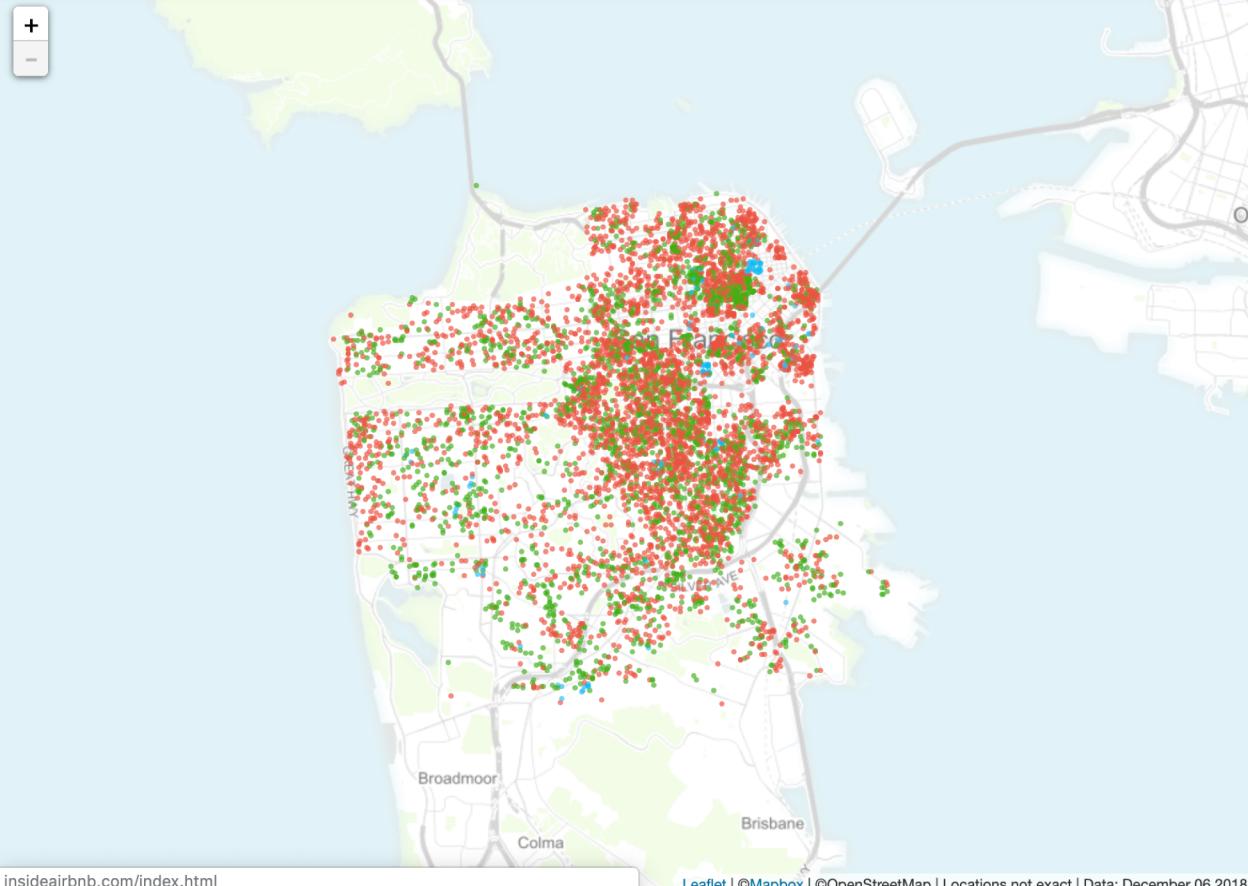
Agenda:

- ◀ **Data Introduction**
- ◀ **EDA Walkthrough**
- ◀ **Hidden Topics Analysis**
- ◀ **Review Score Prediction Model**
- ◀ **Key Takeaways**
- ◀ **Recommendations**



The Data





San Francisco

Filter by:

San Francisco

7,072
out of 7,072 listings (100%)

[About Airbnb in San Francisco](#)

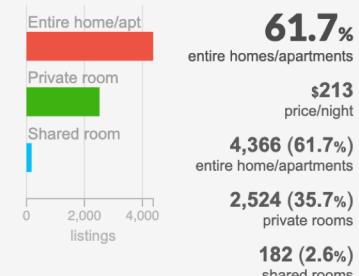
How is Airbnb really being used in and affecting your neighborhoods?

Room Type

Only entire homes/apartments

Airbnb hosts can list entire homes/apartments, private or shared rooms.

Depending on the room type, **availability**, and **activity**, an airbnb listing could be more like a hotel, disruptive for neighbors, taking away housing, and **illegal**.



Activity

Only recent and frequently booked

Airbnb guests may leave a review after their stay, and these can be used as an indicator of airbnb activity.

153
estimated nights/year



Data Used

◀ Listing Dataset

- ◀ Listing ID
- ◀ Review Scores Rating
- ◀ Neighborhood

◀ Review Dataset

- ◀ Listing ID
- ◀ Comments

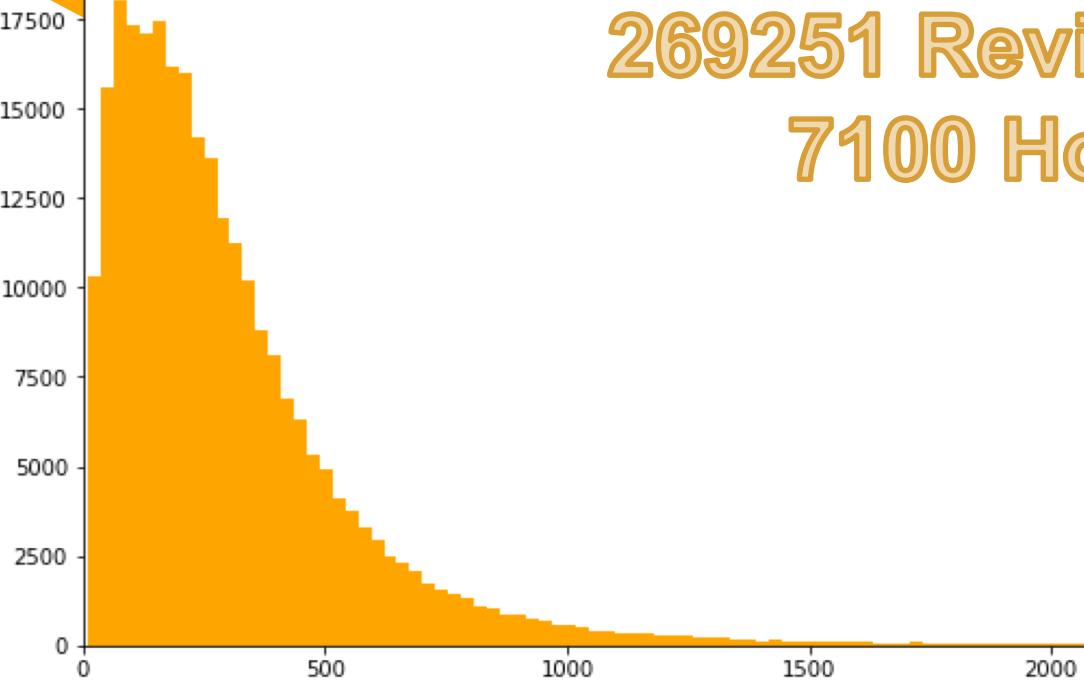
Preprocessing & EDA



Reviews

Review Length Distribution

269251 Reviews For
7100 Hosts





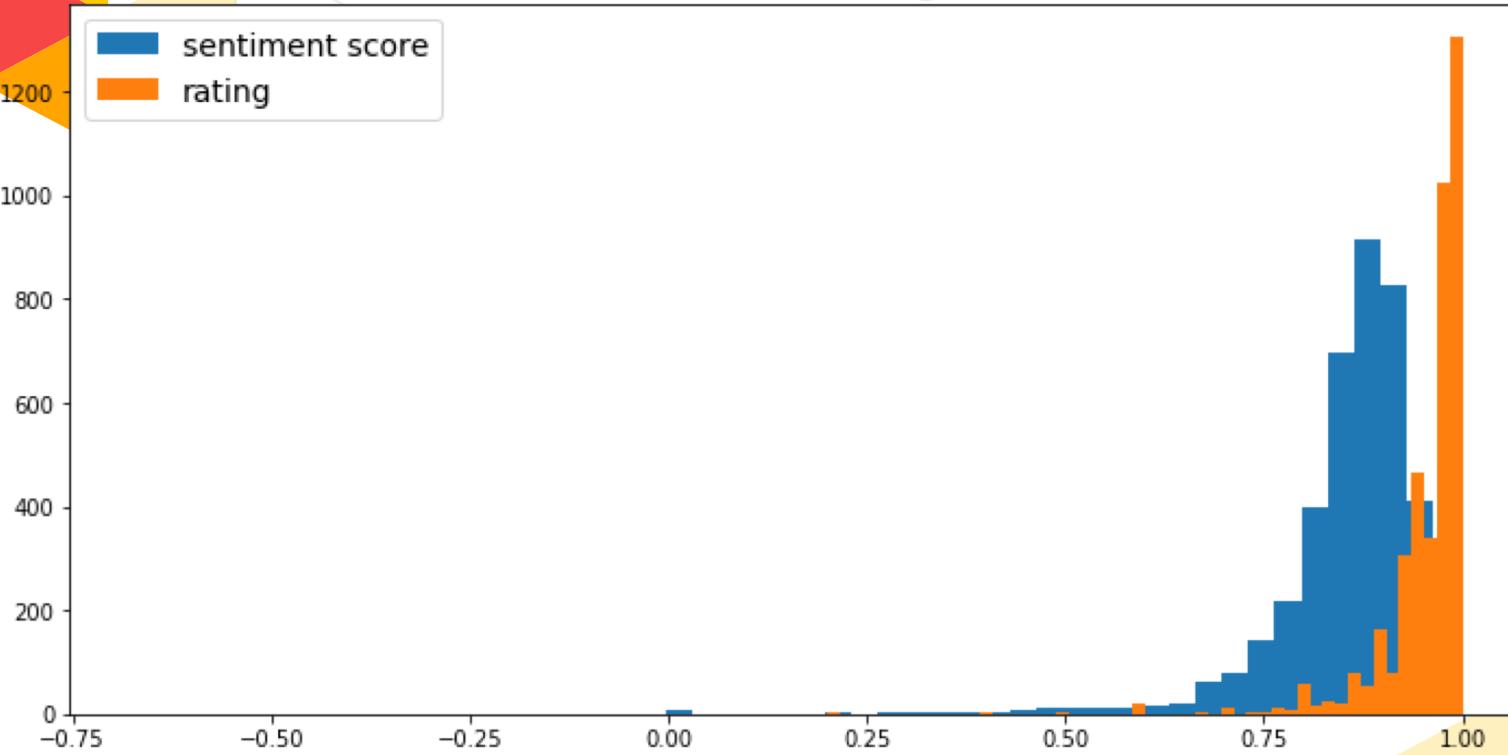
Preprocessing

key_0	listing_id	id	date	reviewer_id	reviewer_name	comments	language	overall_rating	compound	neg	neu	pos	
0	0	958	5977	2009-07-23	15695	Edmund C	Our experience was, without a doubt, a five st...	en	97.0	0.9590	0.000	0.788	0.212
1	1	958	6660	2009-08-03	26145	Simon	Returning to San Francisco is a rejuvenating t...	en	97.0	0.9819	0.000	0.697	0.303
2	2	958	11519	2009-09-27	25839	Denis	We were very pleased with the accommodations a...	en	97.0	0.7600	0.134	0.710	0.156
3	3	958	16282	2009-11-05	33750	Anna	We highly recommend this accomodation and agre...	en	97.0	0.9840	0.035	0.646	0.319
4	4	958	26008	2010-02-13	15416	Venetia	Holly's place was great. It was exactly what I...	en	97.0	0.9617	0.000	0.613	0.387

Exploratory Data Analysis

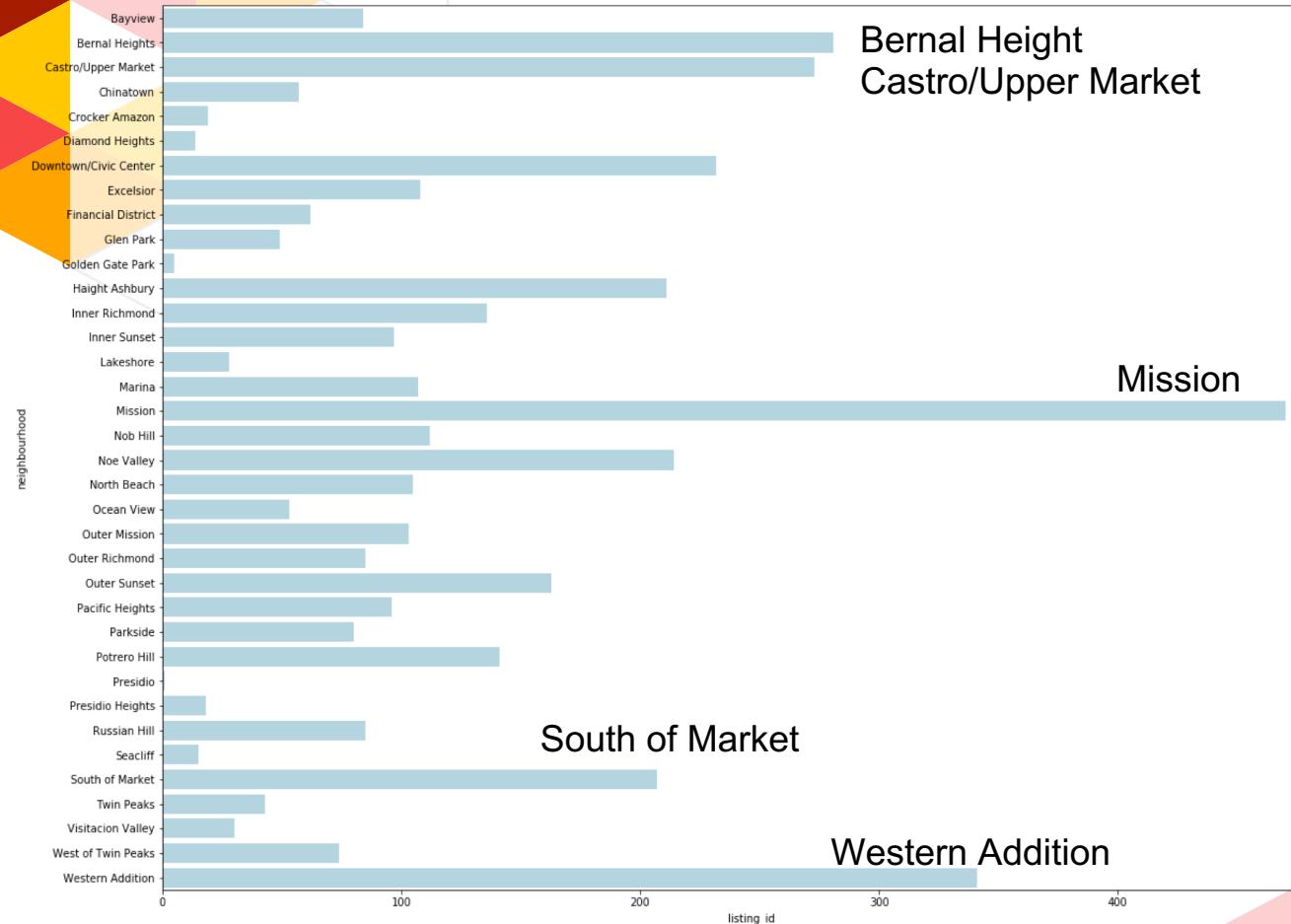
Rating & Sentiment

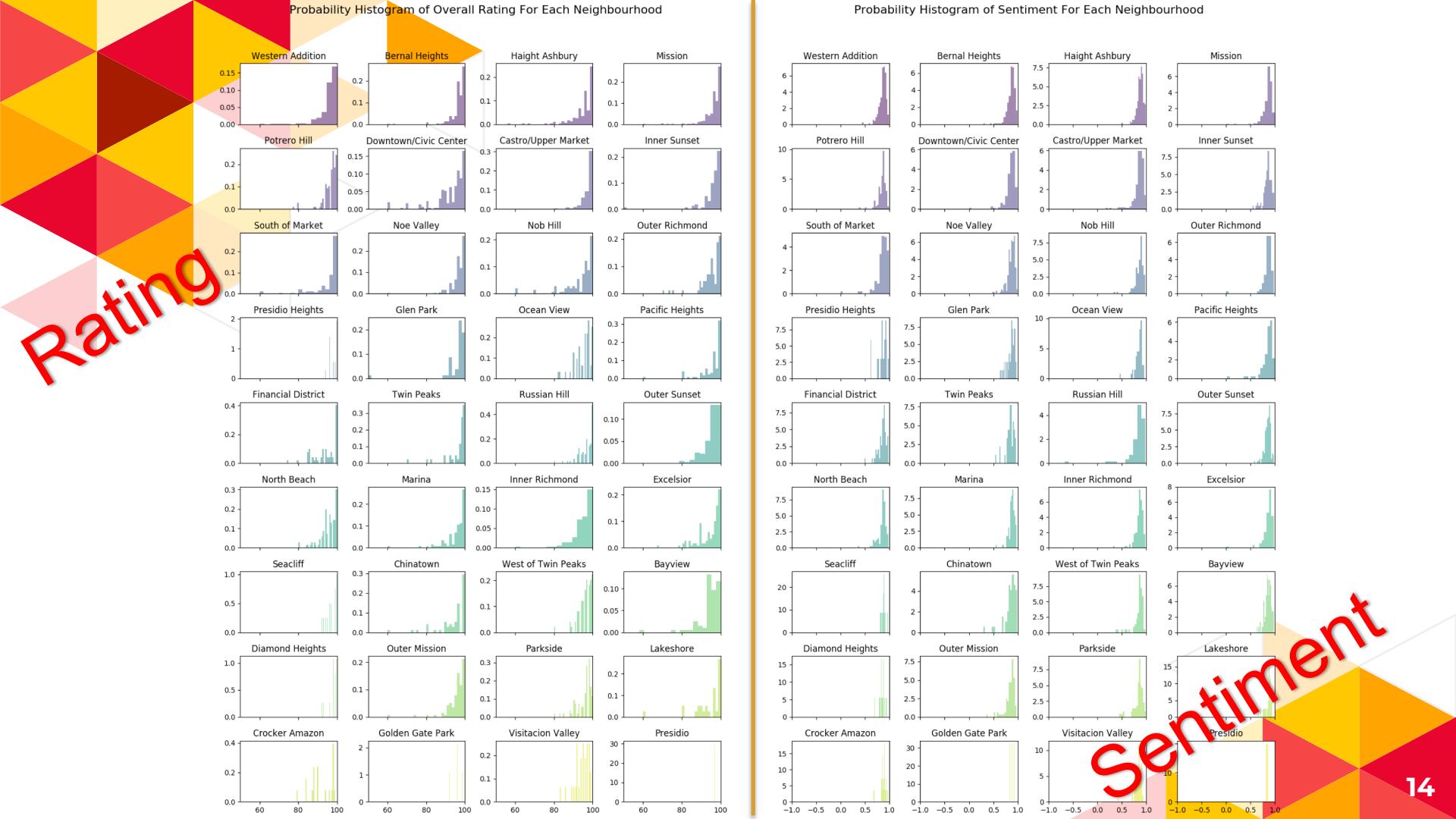
Sentiment Score vs Rating Distribution



Exploratory Data Analysis

32 Locations





Unsupervised Learning: Latent Dirichlet Allocation



Why LDA?

- ◀ It is used as a topic model to discover the underlying topics that are covered by a text document. LDA assumes that a corpus of text documents cover a collection of K topics.
- ◀ Discover hidden topics among all reviews



1. LDA Based On Rating Score

Topics For Listing With 80 Points and Higher

Topic 1 (11.2%)	Topic 2 (9.9%)	Topic 3 (9.5%)	Topic 4(9.3%)
Definitely stay	Great location	Walking distance	Quick respond
Highly recommend	Like home	Public transportation	Clean comfortable
Look forward	Feel like	Shop restaurants	Great place
Host responsive	Best Airbnb	Short walk	Great host

Topics For Listing With 80 Points and Lower

Topics 1 (10.6%)	Topics 2 (9.9%)	Topics 3 (8.9%)	Topics 4 (6.2%)
Great host	Arrival automated	Good location	Homeless people
Location great	Automated posting	Location close	Surrounded homeless
Good experience	Host canceled	Location really	Drug addicts
Good price	Canceled reservation	Room got	Homeless drug

2. LDA Based On Sentiment Intensity

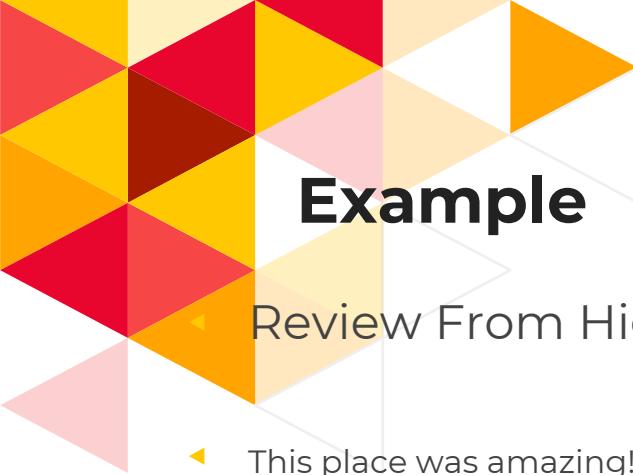
Topics For Comments With Sentiment > 0.5

Topic 1 (16.3%)	Topic 2 (9.8%)	Topic 4 (7.5%)	Topic 8(6.7%)
Definitely stay	Public Transportation	Room Clean	Quick respond
Highly recommend	Easy Access	Clean Nice	Respond Questions
Perfect Stay	Public transport	Clean Comfortable	Great hospitality
Definitely recommend	Clean Quiet	House Clean	Great host

Topics For Comments With Sentiment < -0.3

Topics 1 (10.3%)	Topics 2 (10%)	Topics 3 (9.6%)	Topics 4 (6.2%)
Great Location	Location stay	Location near	Quiet Neighborhood
Location great	Automated posting	Location close	Place Quiet
Great Stay	Host canceled	Location perfect	Quiet Street
Good price	Canceled reservation	Great Restaurants	Room comfortable





Example

Review From High Rating

- ▶ This place was amazing! It was stylish, comfortable, and convenient. William and Hope were always available to answer questions or concerns. The neighborhood is **very residential**, so it was **quiet and relaxing**. It's a **very easy** drive to the busier parts of the city. I had my car, so I didn't have to use **public transportation** much, but the few times I used the buses and the rails, they were **very convenient** and easy to use. The apartment had everything I needed, and I think anyone would be happy to spend some time here!" ,

Review From Low Rating

- ▶ "This is not an apartment for a woman by herself. The club down below is **very noisy** and its patrons are drunk and disorderly. The stand alone apartment is secluded and is on three levels with the entrance being **very dark and uninviting** at night. It does not feel at all safe and I had to throw away \$3000 as I had to rent another apartment for my wife. She is currently Staying in a high end apartment in the Mission and whilst the area is rather gritty with **a homeless shelter** half a block away, she feels far safer there than in James' apartment.",

8 LDA Subtopics:

Positive Topics

- ◀ Positive Sentiment Topics
- ◀ Convenience
- ◀ Host Attitude
- ◀ Amenities Compliment
- ◀ Cleanliness

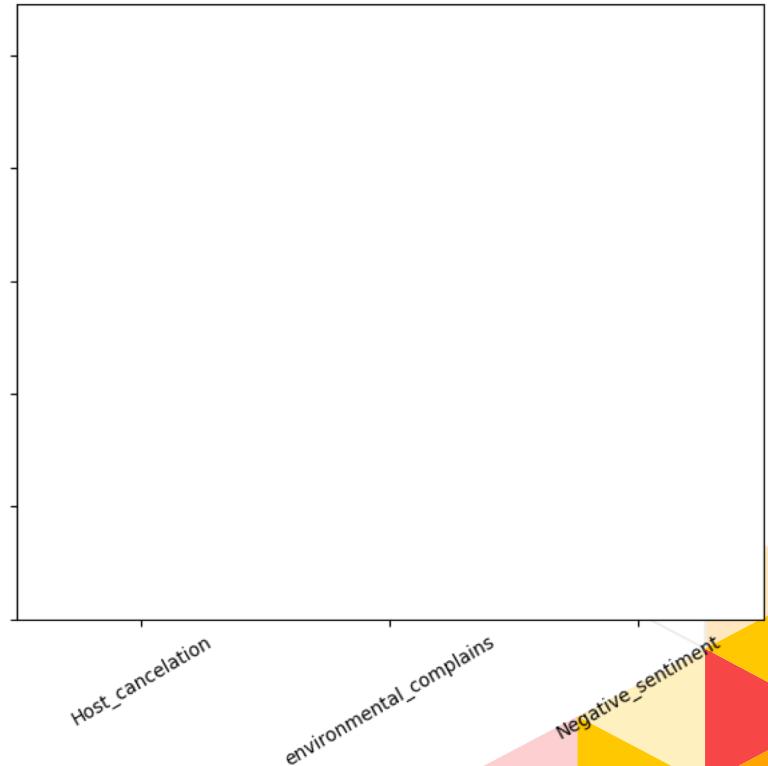
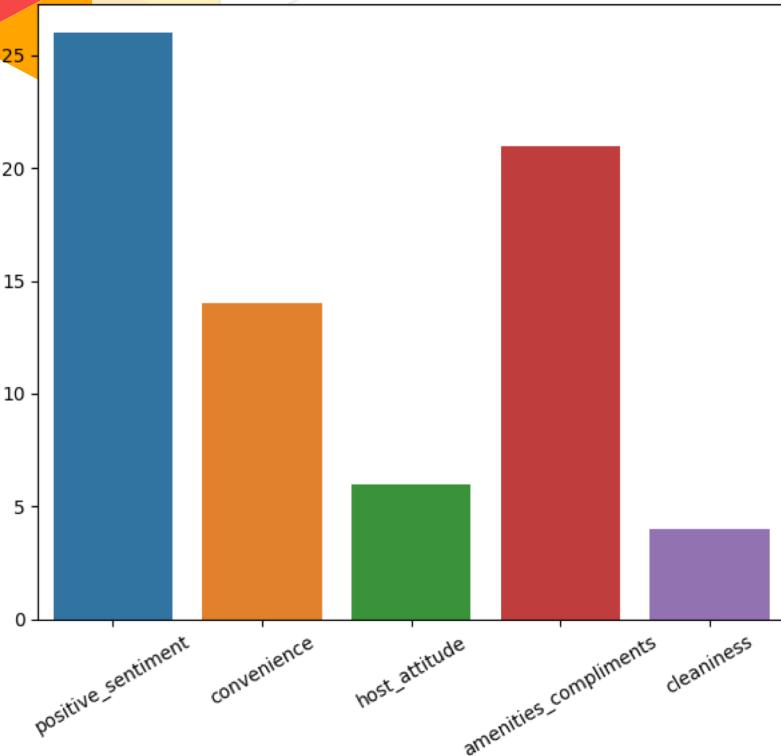
Negative Topics

- ◀ Host Cancelation
- ◀ Environment Concerns
- ◀ Negative Sentiment Topics



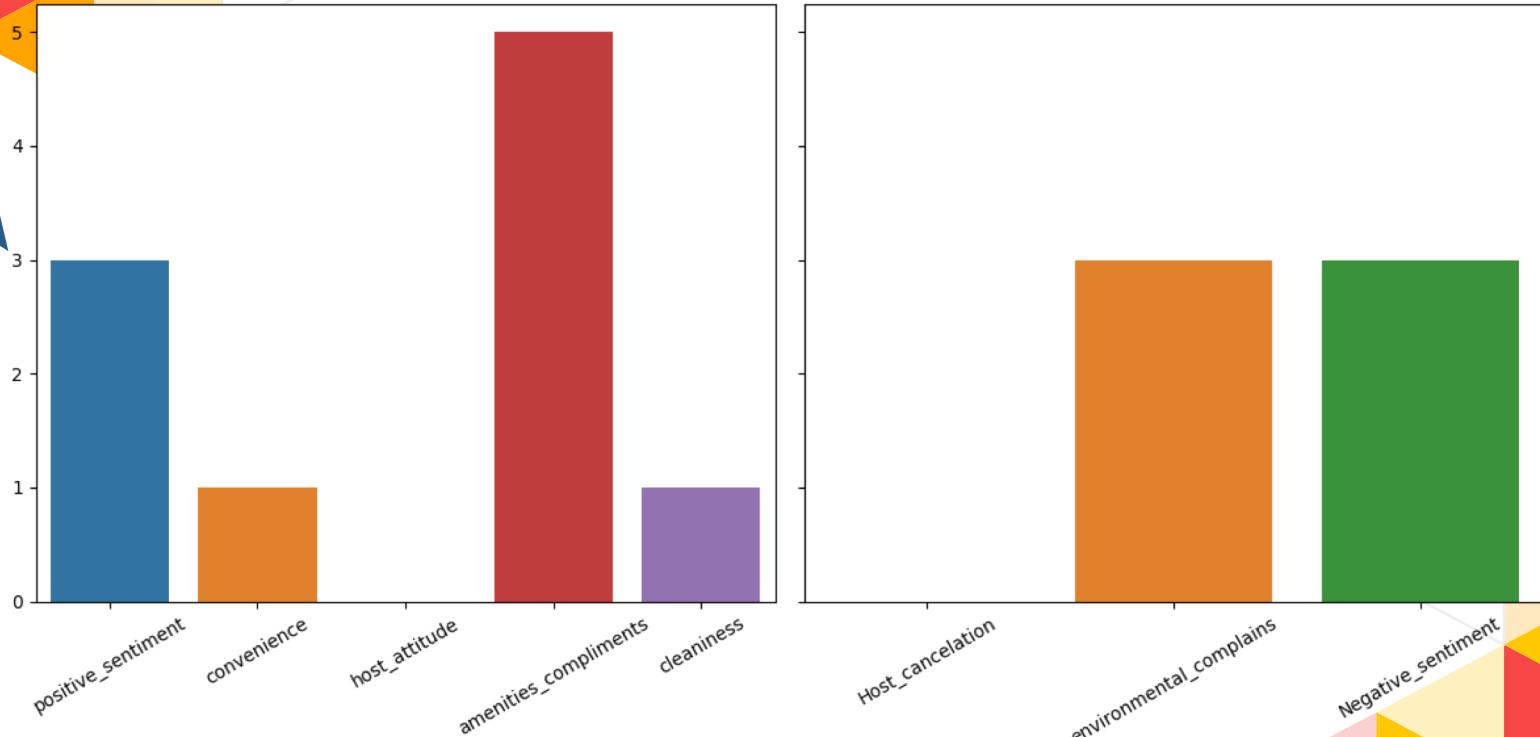
High Rating Reviews Content

Hidden Topics Relevancy



Low Rating Reviews Content

Hidden Topics Relevancy



Null Hypothesis:

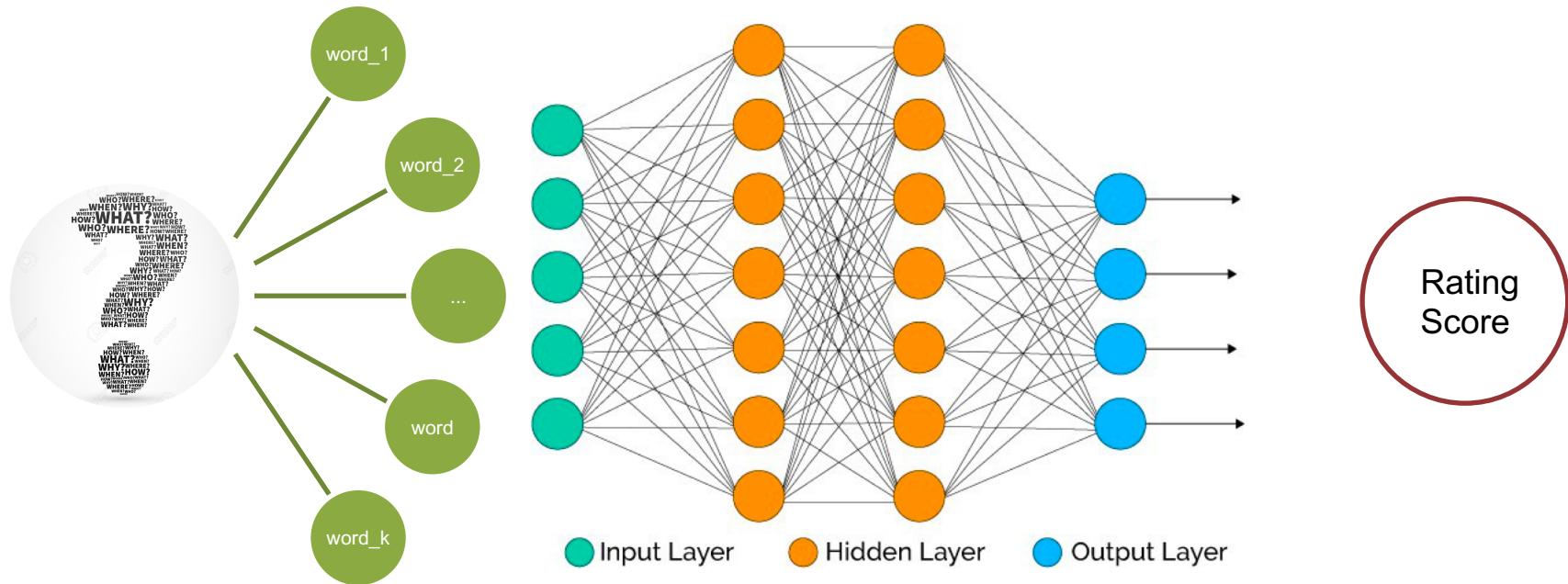
There Is a relationship between rating scores and review content

Prediction Models

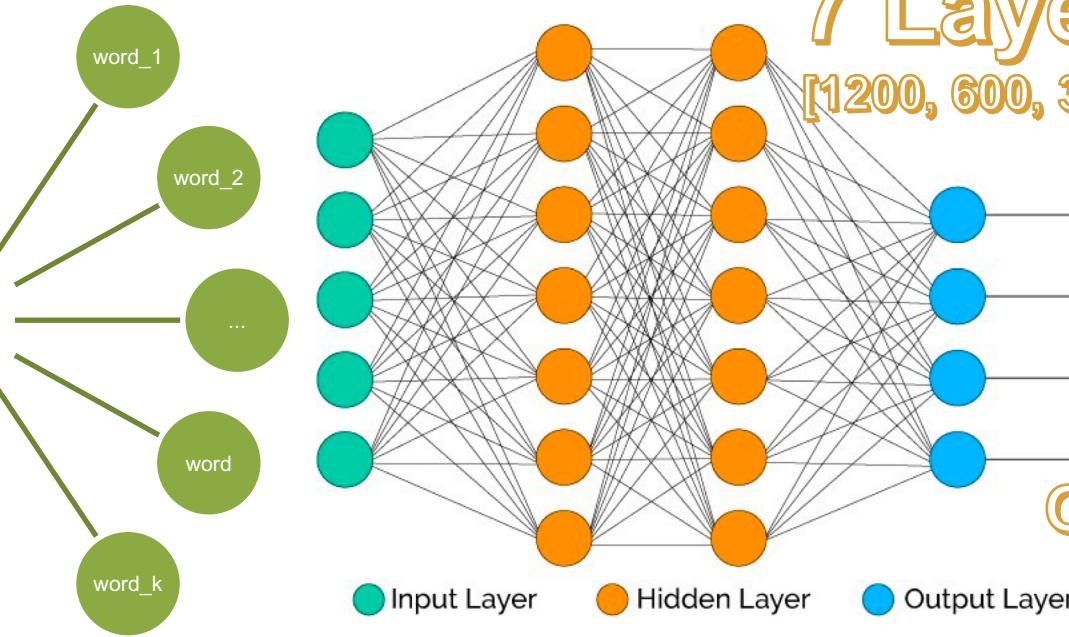
Use review content to predict
review scores rating



Feedforward Neural Network



Feedforward Neural Network



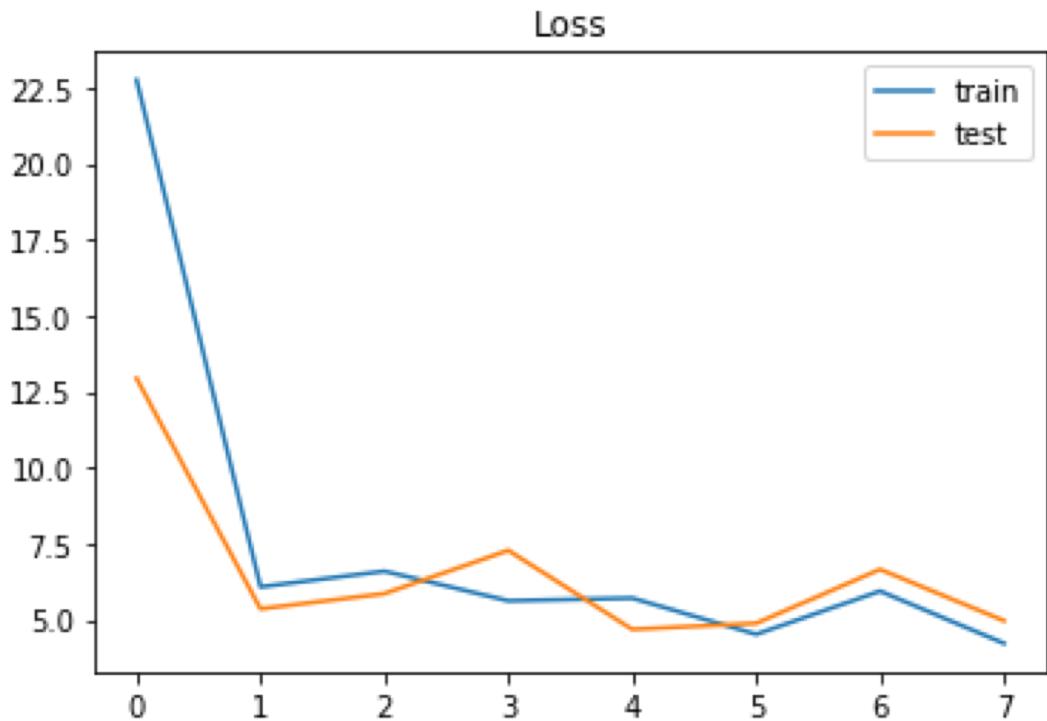
7 Layers
[1200, 600, 300, 120, 64, 32, 12, 1]



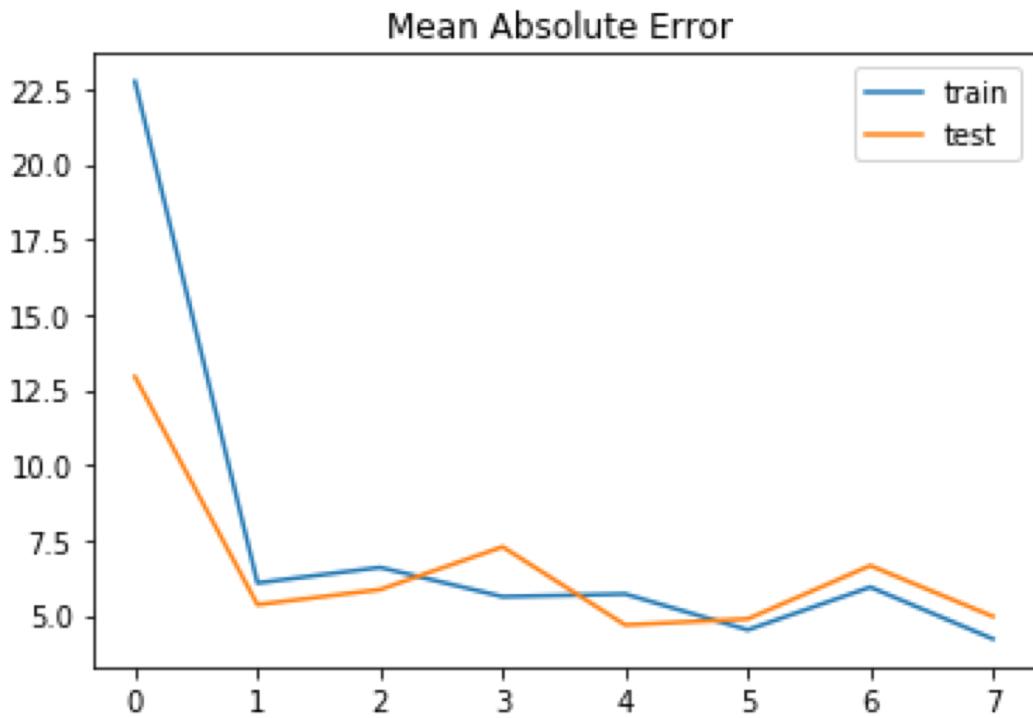
Optimizer: Adam
Loss: Mean
Absolute Error



Result?



Result?



Result?



Why Negative R²?





Let's Take A Step Back...

Approach?

- ◀ Possible to use words as features

Tokenizer?

- ◀ Perhaps need to use Word2vec embedding to capture the relationship between words?

Unbalance Class?

- ◀ Score range from 80 to 100, highly skewed data
- ◀ If try balancing class, then lose lots of data

Rating Score?

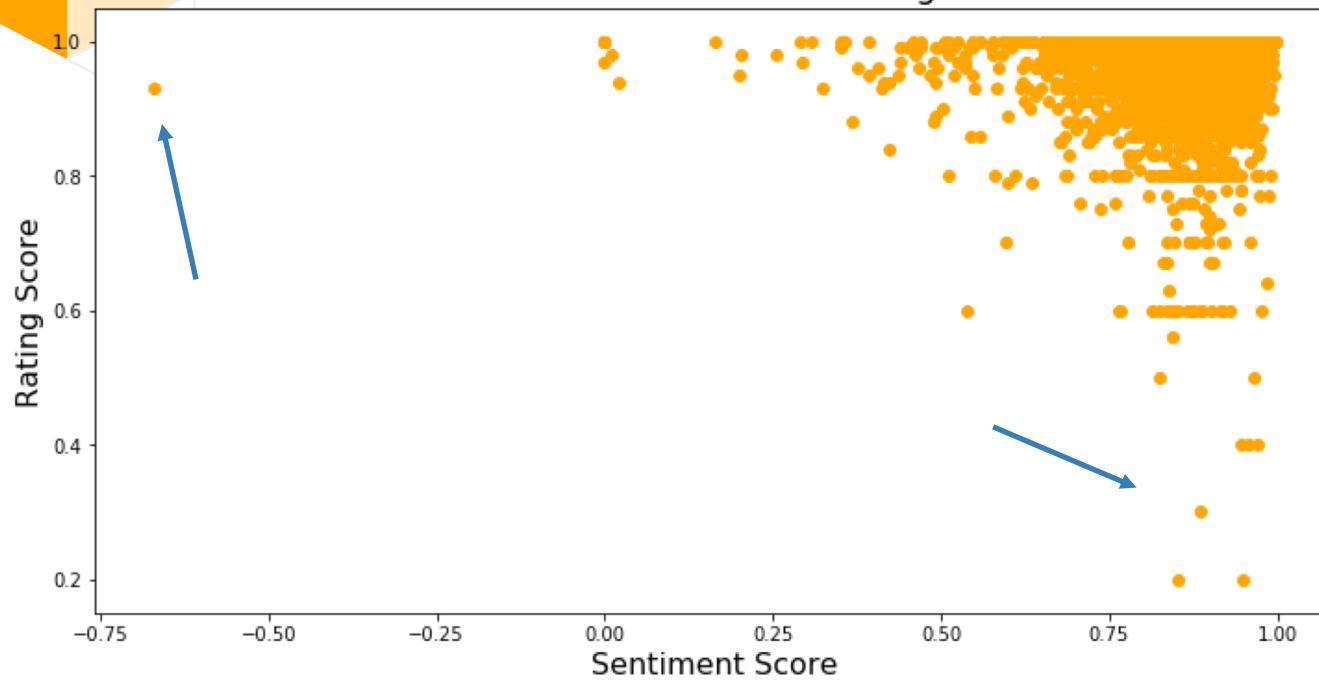
- ◀ While comments are from individual guests, the rating score is an average
- ◀ Can't average the comments

Or, review content is somewhat independent from the review scores rating.



Sentiment Analysis Score vs. Rating Score

Sentiment Score vs Rating





Outlier Examples

Outlier left

street and castro street scenes was great the only negative for us was **the difficulty in finding on-street parking** due to both the density of the neighborhood and the construction work going on a few evenings we **had to park about 4 blocks away** for people who need to use private vehicles this problem does restrict their plans somewhat for people who can use public transportation and or walk this is no problem we highly recommend this accomodation and agree with the previous postings holly and david were extremely helpful and friendly, but not at all intrusive the unit itself is just superb and in a wonderful location unlike some other airbnb accommodation options this is a dedicated rental unit furnished with consumables dishwashing liquid etc and **you don't have to contend with someone else belongings or mess**

Outlier Right

"I am going to be as subjective as possible. The good: * **Great location.** The house is in the center of the city. A few blocks away from Uber, (Hidden by Airbnb) HQ etc. * **Great place to network and make friends.** Most are working or studying in tech. The bad:\n* Filthy house: Mouses, dirty bathroom, dirty kitchen. House never got cleaned while I was there.\n* Price is super high for what you're getting. Although SF is expensive to begin with, but you can find a better place for cheaper."



Conclusion:
With the current method, we cannot predict star rating with comments only

Key Takeaways



Rating Score is Different From Review Content

- Rating: click a button
- Comments: more detailed and specifics and focus on similar topics such as location, cleanliness, attitude and so on.
- Give a descent rating but talk about things to improve

Sentiment is Hard to Measure

- Packages are able to do the work, but measuring the accuracy of the sentiment is still subjective.



Business Suggestion:

Use content based sentiment score to measure satisfaction instead of rating score.

Comments are valuable to both hosts and guests, how can we extract the information and make it easier to understand?

Future Work





Topic Extraction From Comments:

- ▶ extract the subtopics from all comments.
 - ▶ If using all the words from all comments doesn't work, next thing we should try to do is to extract out the sentences that are related to the common them.
- 

Thanks!

Any questions?

