

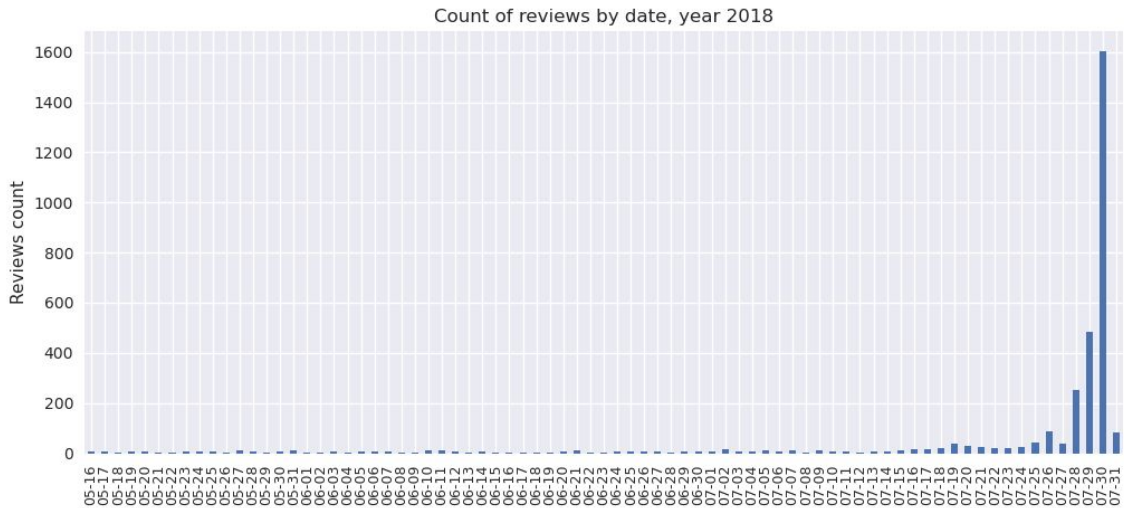
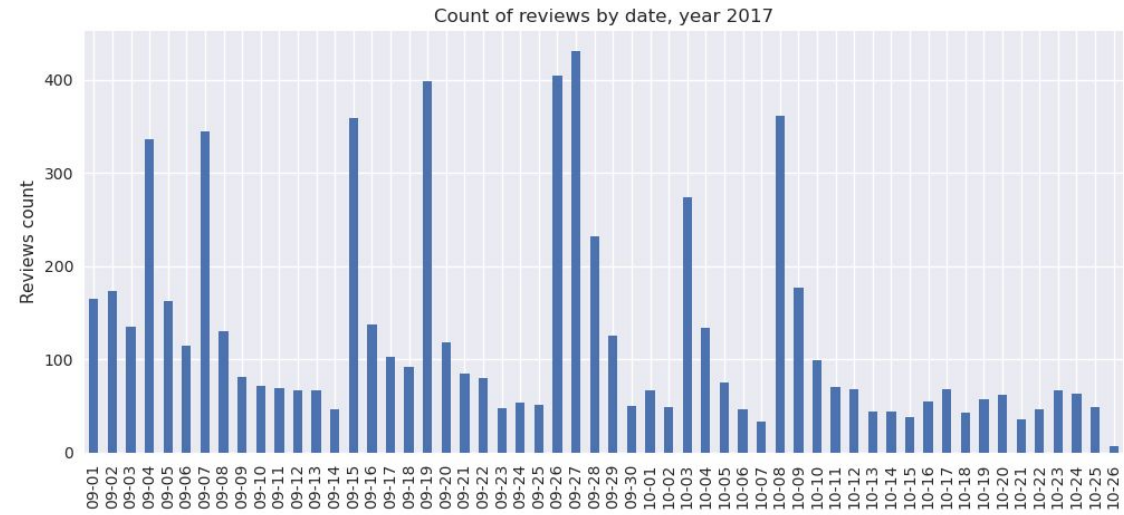
INFO-656 Machine Learning

# **Predicting User Satisfaction with Amazon Alexa**

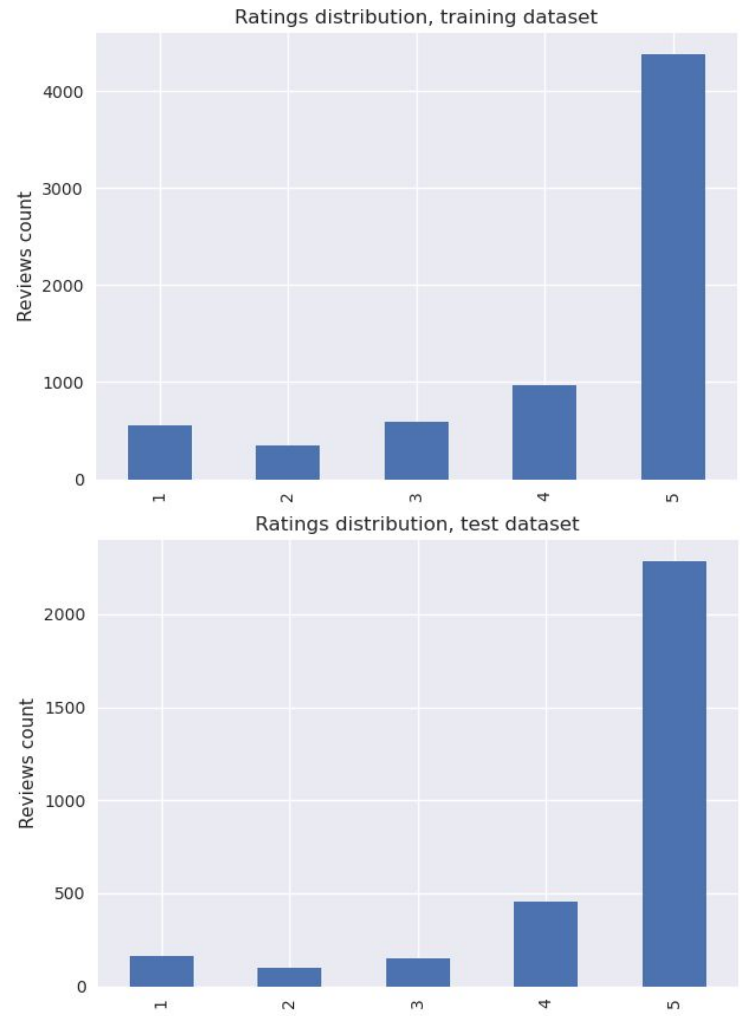
*Elena Korshakova and Diedre Brown*

*8 December 2020*

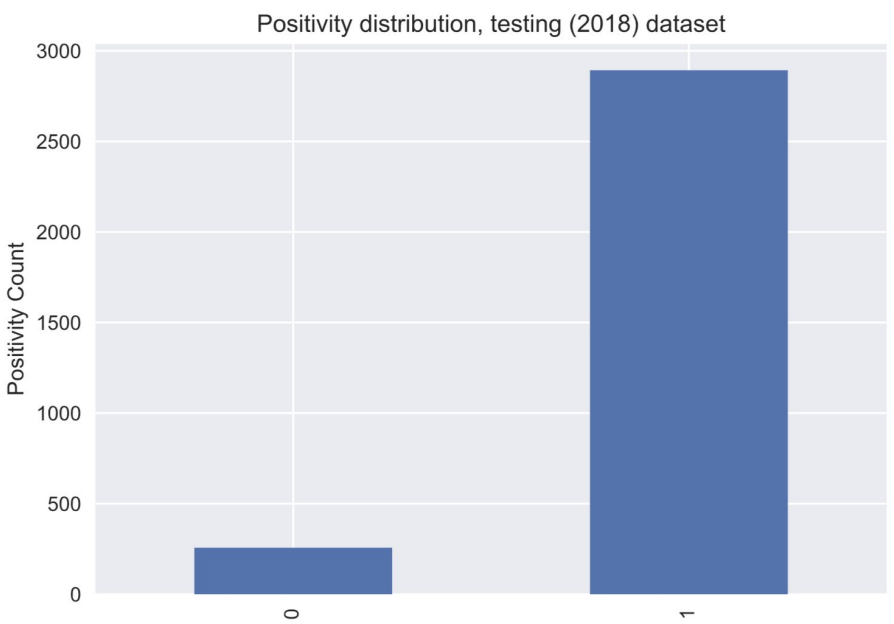
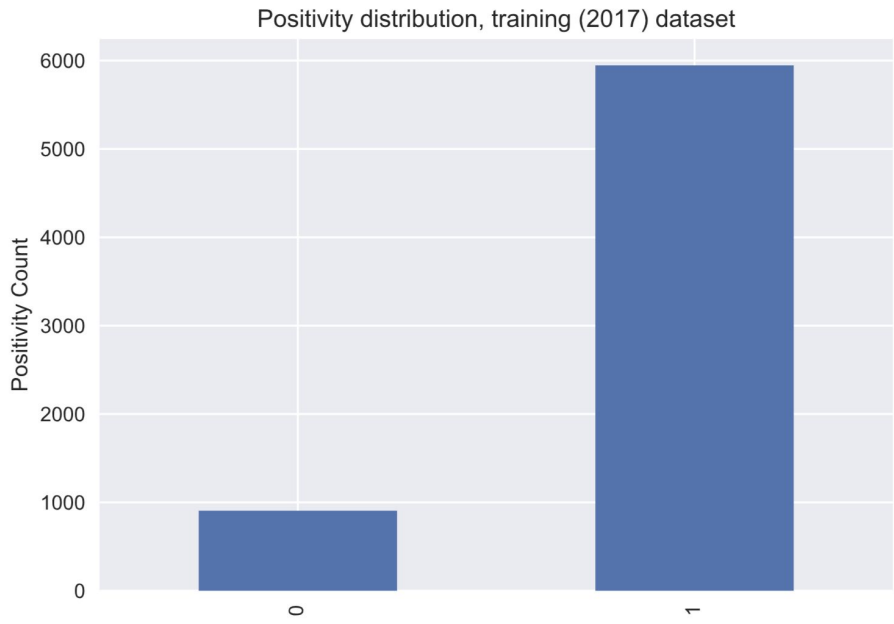
# COUNT REVIEWS BY DATE



# STAR RATING DISTRIBUTION



# POSITIVITY DISTRIBUTION



# POSITIVITY AND REVIEW LENGTH

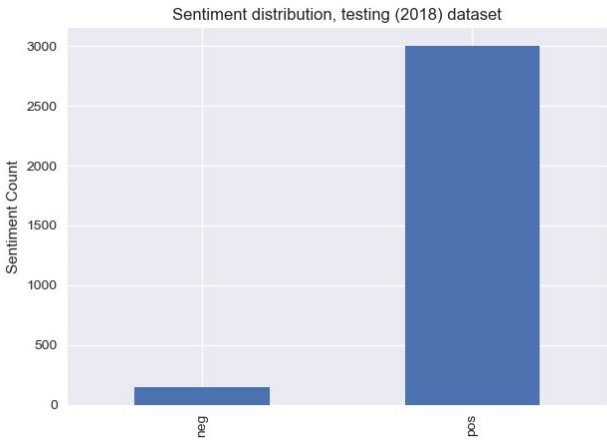
## 2017 USER REVIEW - 4860 CHARACTERS

"The Amazon Echo Dot brings Alexa to every room in your home. The Echo Dot is an excellent addition to the Alexa enabled family, the original Echo, the wireless Tap, the small Dot, the new video enabled Show, and the Amazon Fire devices. Echo - <http://amzn.to/2wCwxUuDot> - <http://amzn.to/2wCQMIOShow> - <http://amzn.to/2w3qWCZTap> - <http://amzn.to/2wCbn8UI> received my first Echo Dot at the AWS ReInvent conference. About the size of a hockey puck, I opened it up and set it up in my hotel room. I was already familiar with Alexa as I owned an Echo and Echo Tap. Now I had an Echo that would fit in my backpack. I had wanted a device that I could connect to my home theater and make it smart, to play music and enable automation. Echo Dot fit the bill. I wanted to share Echo with others, who were unlikely to buy it themselves but the original Echo and Echo Tap were too expensive. Again, the Echo Dot made it easy to share my enjoyment of Echo. I immediately ordered a six pack of Echo Dot's. I setup the device using the Alexa App and started playing with Alexa. Alexa App - <http://amzn.to/2eIn3kuThe> Echo Dot is a bit different from the Echo and Echo Tap. It has a small built in speaker that is not great for playing music. However, it has a 3.5mm output that allows you to connect Echo Dot to any external speaker, even a Home theater. I have connected an Echo Dot to a couple of my Pioneer receivers, one uses Infinity Primus speakers, the other uses Klipsch Reference speakers. I have also connected Dot to a Yamaha sound bar that I have in my bedroom. To be clear, connecting to a sound bar does not require an amplifier, however an amplifier is required to connect to any non-amplified speaker. Pioneer Receiver - <http://amzn.to/2x7WSeuInfinity> Primus - <http://amzn.to/2vIcSPKlipsch> Reference - <http://amzn.to/2vILaXwYamaha> Sound Bar - <http://amzn.to/2eCs4mThe> Echo Dot can be used as a bluetooth speaker, bringing bluetooth so sound systems that do not have bluetooth. The Echo Dot can also connect to bluetooth speakers itself and use them to output its sound. Echo Dot is great for listening to streaming music on other speakers. My one frustration with Dot is an issue that I am having with using it near my computer. In order to share speakers with my computer speakers, which use a small mini amp connected to a pair of Infinity Bookshelves, I am using a 3.5mm Y connector. When both the computer and the Echo Dot are connected, it creates a fair amount of undesirable noise. I suspect this is a ground isolation issue, though it does not have the common sound associated with that but rather is more of a static hiss, with some digital noise. I have tried powering the Dot from a USB on the computer to insure a common ground, but that did not resolve the issue. Sadly I had to resort to disconnecting my Dot from my computer speakers, so it is now more of a personal assistant, and not useful for listening to music. I am considering using a small headphone mixer to try to isolate the inputs and fix this issue. When the computer is not connected, there is no noise and Alexa sounds great, so this is perhaps not an issue directly with the Echo Dot. Given that it sounds great without the computer connected I do recommend using this small amp with a set of bookshelves connected to an Echo Dot DTA-120 Amp - <http://amzn.to/2x82BBbPrimus> Bookshelf - <http://amzn.to/2wEFsmJKlipsch> Bookshelf - <http://amzn.to/2vIbL6Wl> am considering this Mixer to resolve my multi input noise issue. <http://amzn.to/2eI6mWiAlexa> becomes a part of your life. Alexa is like Siri, Cortana or Google Assistant, except that Alexa is always there in your room listening and waiting to respond. Alexa will play music for you, play games with you, ask you trivia questions, manage your calendar, set alarms and timers, and answer many different types of questions. Looking for an NFL update, just ask. Having a discussion about which actors were in a movie, ask Alexa. Want to know the weather, ask Alexa. Occasionally, Alexa will even butt into your conversation, thinking you have addressed her, but this is not common, more comedic when it happens. Alexa has an ever growing library of "Skills", add-on features/apps that extend the conversational abilities. Alexa Skills - <http://amzn.to/2vINAW8Alexa> can be extended using skills to communicate with with other devices that have been Alexa enabled. From the Wemo wall outlets to the Neato Botvac. There is a wide range of home automation products, and the list is growing as developers find new ways to build on Alexa capabilities. M.Way - <http://amzn.to/2eCaSC1Neato> Botvac - <http://amzn.to/2w3f5xKWemo> Devices - <http://amzn.to/2w3vVDJAlexa> Smart Home - <http://amzn.to/2eHtjEEcho> Dot has made it possible to have Alexa in every room in my home and to be able to share Alexa with others."

## 2018 USER REVIEW - 2851 CHARACTERS

"Incredible piece of technology. I have this right center of my living room on an island kitchen counter. The mic and speaker goes in every direction and the quality of the sound is quite good. I connected the Echo via Bluetooth to my Sony soundbar on my TV but find the Echo placement and 360 sound more appealing. It's no audiophile equipment but there is good range and decent bass. The sound is more than adequate for any indoor entertaining and loud enough to bother neighbors in my building. The knob on the top works great for adjusting volume. This is my first Echo device and I would imagine having to press volume buttons (on the Echo 2) a large inconvenience and not as precise. For that alone I would recommend this over the regular Echo (2nd generation). The piece looks quality and is quite sturdy with some weight on it. The rubber material on the bottom has a good grip on the granite counter-- my cat can even rub her scent on it without tipping it over. This order came with a free Philips Hue Bulb which I installed along with an extra one I bought. I put the 2 bulbs into my living room floor lamp, turned on the light, and all I had to do was say "Alexa, connect my devices". The default names for each bulb was assigned as "First light" and "Second light", so I can have a dimmer floor lamp if I just turned on/off one of the lights by saying "Alexa, turn off the second light". In the Alexa app, I created a 'Group' with "First light" and "Second light", and named the group "The light", so to turn on the lamp with both bulbs shining I just say "Alexa, turn on The light". I was surprised how easily the bulbs connected to the Echo Plus with its built in hub. I thought I would have to buy a hub bridge to connect to my floor lamp power plug. Apparently there is some technology built directly inside the bulb! I was surprised by that. Awesome. You will feel like Tony Stark on this device. I added quite a few "Skills" like "Thunderstorm sounds" and "Quote of the day". Alexa always loads them up quickly. Adding songs that you hear to specific playlists on Amazon Music is also a great feature. I can go on and on and this is only my second day of ownership. I was lucky to buy this for \$100 on Prime Day, but I think for \$150 is it pretty expensive considering the Echo 2 is only \$100. In my opinion, you will be paying a premium for the Echo Plus and you have to decide if the value is there for you: 1) Taller and 360 sound unit. 2) Volume knob on top that you spin (I think this is a huge benefit over buttons). 3) Built in hub for Hue bulbs. After researching more, there are some cons to this setup if you plan on having more advanced light setups. For me and my floor lamp, it's just perfect. I highly recommend it and will buy an Echo dot for my bedroom now."

# SENTIMENT ANALYSIS



	PREC.	RECALL	F1		PREC.	RECALL	F1
neg	0.60	0.33	0.43	neg	0.43	0.25	0.31
pos	0.90	0.97	0.93	pos	0.94	0.97	0.95
ACC.			0.88	ACC.			0.91

# TOPIC MODELING

## 2017 Topic Models

### 5-TOPIC MODEL TOP 10 WORDS PER TOPIC

**TOPIC #1 - Versatility of Use:** ['versatility', 'total', 'external', 'outlet', 'work', 'black', 'training', 'dropping', 'bulb', 'hit']

**TOPIC #2 - Interaction:** ['blast', 'dropping', 'wake', 'versatility', 'course', 'management', 'work', 'speaking', 'interaction', 'start']

**TOPIC #3 - Member Purchase Deal:** ['reason', 'member', 'deal', 'blast', 'purchase', 'forward', 'outstanding', 'spot', 'half', 'hope']

**TOPIC #4 - Features Used:** ['unit', 'training', 'mean', 'outside', 'management', 'auxiliary', 'weather', 'versatility', 'prefer', 'older']

**TOPIC #5 - Where Used:** ['auxiliary', 'simultaneously', 'artist', 'management', 'half', 'versatility', 'everyday', 'ran', 'works', 'household']

### 2-TOPIC MODEL TOP 10 WORDS PER TOPIC

**TOPIC #1 - Features Used:** ['weather', 'literate', 'training', 'auxiliary', 'management', 'prefer', 'half', 'versatility', 'household', 'older']

**TOPIC #2 - ?:** ['item', 'ran', 'work', 'spot', 'dropping', 'interaction', 'works', 'household', 'hope', 'start']

## 2018 Topic Models

### 5-TOPIC MODEL TOP 10 WORDS PER TOPIC

**TOPIC #1 - How & Where Used:** ['house', 'work', 'time', 'best', 'far', 'music', 'like', 'bought', 'use', 'new']

**TOPIC #2 - Initial Uses:** ['able', 'learning', 'stick', 'fun', 'music', 'phone', 'setup', 'set', 'use', 'easy']

**TOPIC #3 - Smart Home Use:** ['control', 'work', 'light', 'working', 'music', 'product', 'plus', 'smart', 'hub', 'home']

**TOPIC #4 - Features Used:** ['weather', 'alarm', 'room', 'spot', 'clock', 'prime', 'screen', 'play', 'like', 'music']

**TOPIC #5 - Quality of Product:** ['little', 'like', 'better', 'quality', 'product', 'good', 'speaker', 'sound', 'works', 'great']

### 2-TOPIC MODEL TOP 10 WORDS PER TOPIC

**TOPIC #1 - Quality of Product:** ['quality', 'better', 'new', 'product', 'speaker', 'good', 'like', 'sound', 'works', 'great']

**TOPIC #2 - Setup & Use:** ['device', 'learning', 'fun', 'play', 'time', 'like', 'set', 'easy', 'music', 'use']

# METHODS

## Feature Encoding

- TF-IDF
- BERT

## Rating Predictions Models

- Logistic Regression
- Random Forest
- LSTM Neural Network



# RESULTS

METHOD		ACCURACY	F-1 SCORE
TF-IDF + Log Reg	—————→	0.68	0.68
BERT + Log Reg	—————→	0.49	0.56
TF-IDF + RF	—————→	0.72	0.68
BERT + RF	—————→	0.65	0.59
LSTM	—————→	0.71	0.69
Multinomial Naive Bayes + Log Reg	—————→	0.92	0.53

# REFLECTION

## LIMITATIONS

- Small datasets
- Outlier reviews in the both datasets
- Different time frames in the train and test datasets
- Reviews covered different Alexa devices

## FUTURE WORK

- Collect more data/Use larger datasets (+2019 possibly) or create our own via web scraping
- Try other encoding methods such as GloVe
- Run an RNN for text processing
- Extend experiments with the hyperparameter tuning for Log Reg and RF as well as NN parameters

**THANKS!**

*Any Questions?*