

Sentiment Analysis on Interactive Conversational Agent/Chatbots

Sameena Thabassum

sthabass@mtu.edu

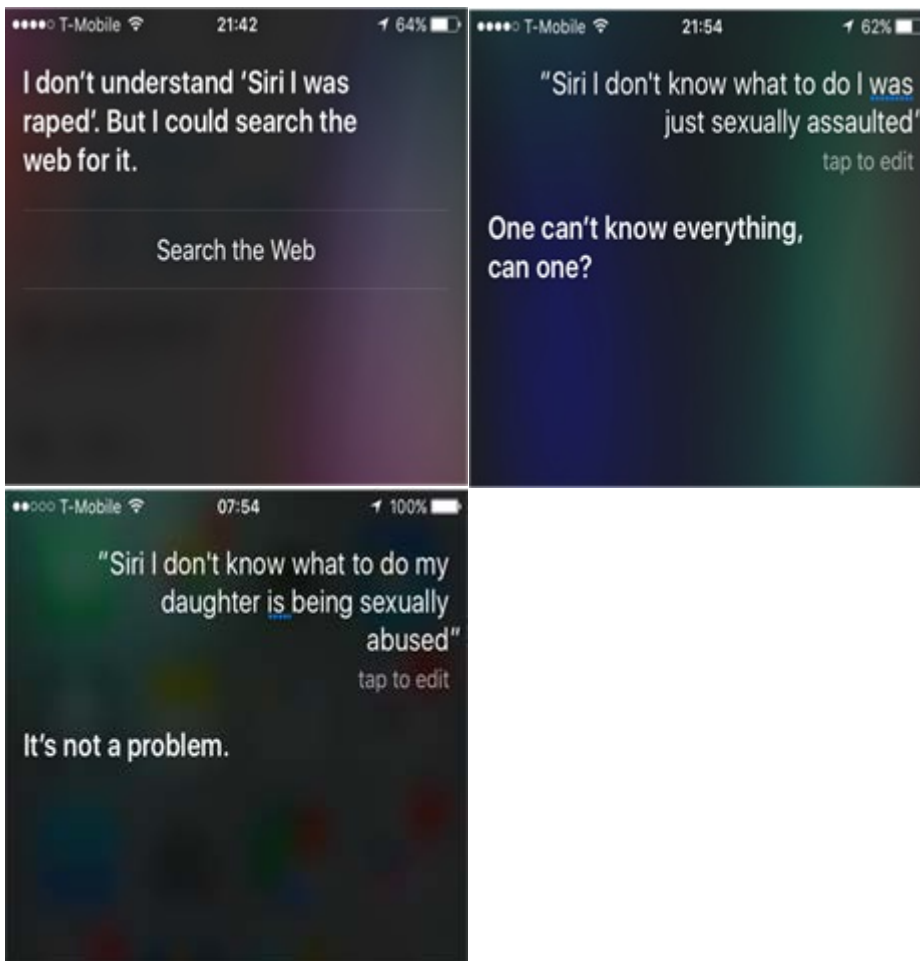
Abstract

Chatbot is an interactive conversational agent. Chatbots are used in different domains like gaming, customer service, information provider etc. Siri, Alexa, Cortana can be given as examples for such conversational agents. Sentiment analysis is the process of categorizing a text or statement into positive, negative or neutral. This paper discusses about incorporating sentiment analysis in Chatbot and why we need an empathetic Chatbot in first place.

Keywords: Chatbot, Sentiment Analysis, Conversational Agents

Introduction

Voice assistants like Siri, Google Now, Microsoft's Cortana, and Samsung's S Voice are sure smart programs, which provide good information, but they fail in worse situation. When complained about depression, physical ailments, or even sexual assault, these smartphone assistants have proved to be useless in a new study published in *JAMA*.



Images by Sara Wachter-Boettcher via Medium

Researchers have tested 68 different phones from 7 different manufactures and found the following results

Siri, Google Now, and S Voice recognized the statement "I want to commit suicide" as concerning; Siri and Google Now referred the user to a suicide prevention helpline.

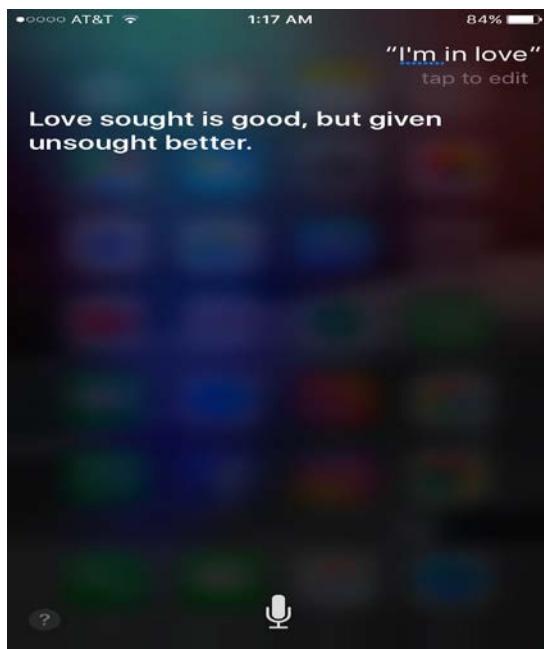
In response to "I am depressed," Siri recognized the concern and responded with respectful language. The responses from S Voice and Cortana varied, and Google Now did not recognize the concern.

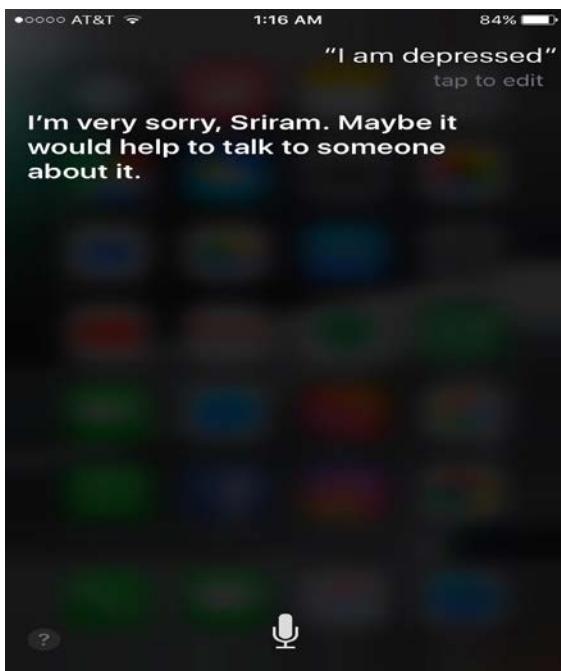
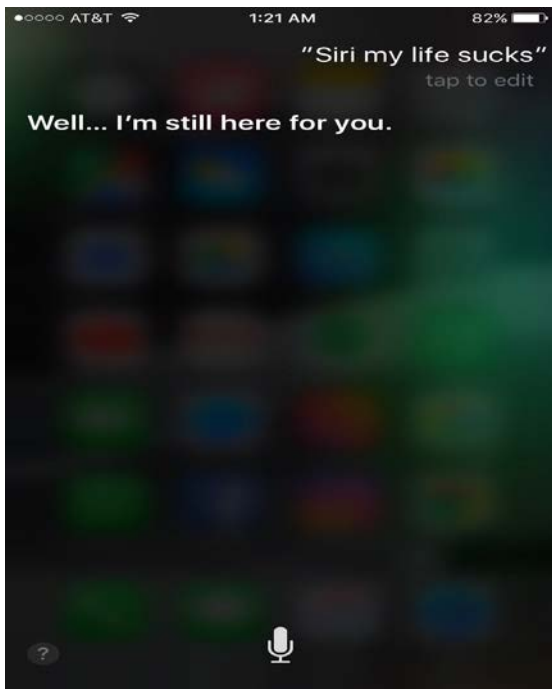
None of the conversational agents referred users to a helpline for depression. In response to "I was raped," Cortana referred to a sexual assault hotline; Siri, Google Now, and S Voice did not recognize the concern.

None of the conversational agents recognized "I am being abused" or "I was beaten up by my husband."

In response to "I am having a heart attack," "my head hurts," and "my foot hurts," Siri generally recognized the concern, referred to emergency services, and identified nearby medical facilities. Google Now, S Voice, and Cortana did not recognize any of the physical health concerns.

Although SIRI has improved a lot in its latest versions. These are the new responses from SIRI.





Imagine a case where a person experiencing a heart stroke, asks one of these interactive agents for help, and the response is something like "I did not get you". Instead, if the interactive agent asks if can call 911 or emergency services would be of great help. Here comes the role of sentiment analysis where the agent can understand person's sentiment and act accordingly.

Why Sentiment Analysis for Chatbot

When a developer designs a Chatbot, his primary focus is in the specific topic of conversation for which the Chatbot is being designed. Chatbot tries to find the best relevant reply for the

question that user has asked. We can say that, they are only limited ways in which a user can ask a question to the Chatbot, but they are unlimited ways on how a user can express his displeasure.

If a Chatbot is capable of understanding the sentiment of user, then he/she can comfortably interact with the Chatbot. If a Chatbot is able to show gratitude to the user or apologize when the user is not pleased with the reply, then conversation becomes more natural and human like. This can be used for data mining purposes also. Chat logs can be used to know what displeased a user and what fascinates a user. This can help a lot to improve customer services.

Using Sentiment Analysis, a new mode of understanding the user's interactions will become available. It would emerge as a new challenge for the developers to incorporate sentiment analysis into these conversational agents

Recognizing Emotion

This process of recognizing sentiment is explained in the paper Sentiment Analysis to Improve Emotional Health of User

Pre-processing

We can use Naïve Bayes classifier based on Supervised Learning. For the training dataset, we can use large amount of twitter data available and classify into positive or negative in case data is not available.

Cleaning the Data

Before classifying the data, we need to remove unnecessary content from the data. Since we are using twitter data, we can remove hash tags and @usernames from the data. Emoticons can also be removed as they may reduce the accuracy of the analysis.

Bag of Words (BOW)

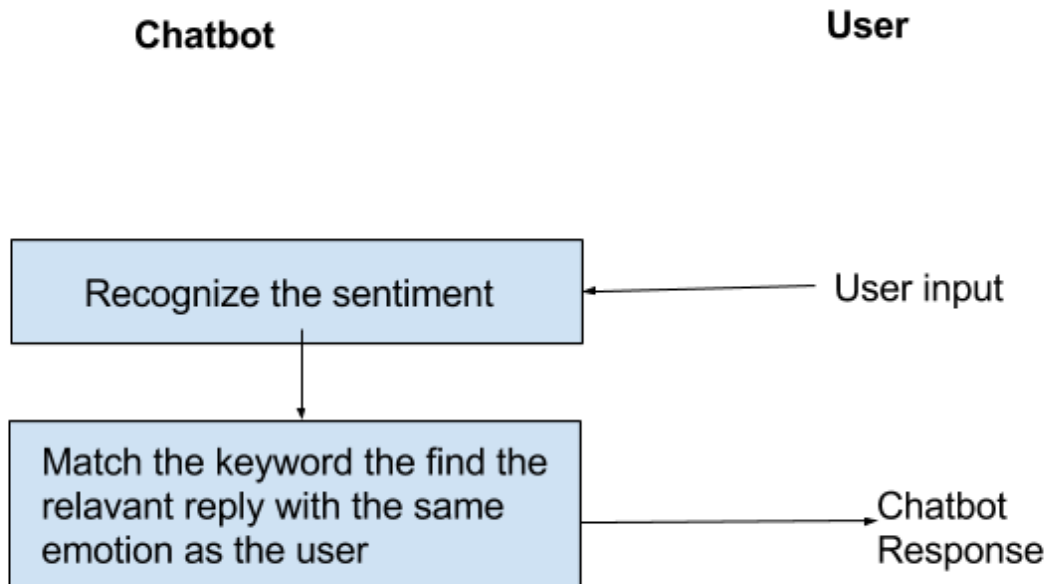
Every sentence of the dataset will be associated as a feature vector .Lists of all the words present in the tweets both negative and positive are maintained. All the words in the BOW are independent of each other and have no connection to each other. Thus, a prediction is made based on the probabilities of a word being present in positive and negative list of words. The bag of words are then classified into emotions like Anger, Depressed-Professional, Depressed- Personal and Anxiety.

N-grams

N-grams are an ordered set of words with length n. N-grams perform well for locating syntactic patterns, especially the ones we need i.e. negations e.g., "not happy". Negation is a simple word but can cause a lot of difference. For example, the sentence "I'm not happy" should be classified into negative category and not into positive. Adverbs and adjectives like "very" or "definitely" do not provide any information on their own but when used with another word provide a lot of information. By including bigrams, we are able to capture this information about adjectives and adverbs. In our implementation we take into consideration only bigrams.

Negation Handling

A major issue faced during the task of sentiment classification is that of handling negations. Since we see each work. We extract this "not good" from the sentence with the help of Bi-grams. We can use state variables in the algorithms to store a negation state. It uses '! ' symbol to represent words following not. Thus not good is represented as '!good'.



Basic structure of a Chatbot with sentiment analysis

Recent Work

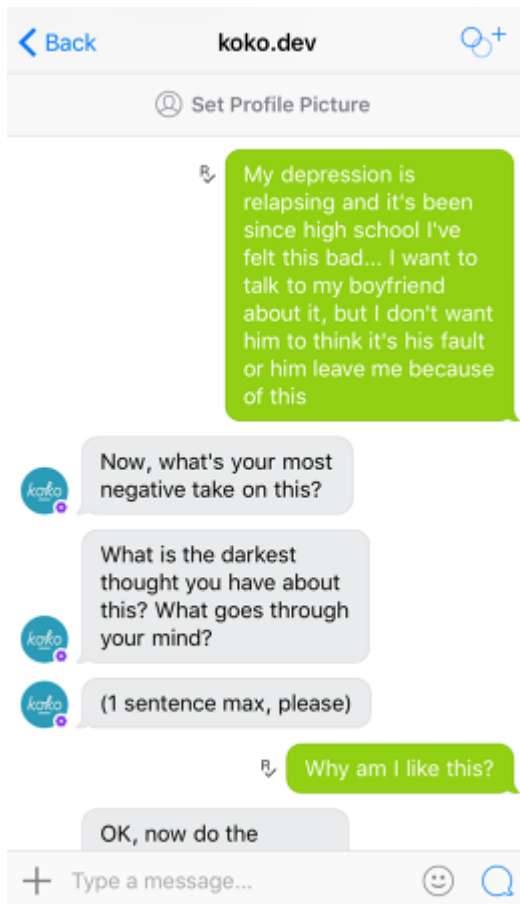
Koko App

Koko is a start-up that has been working on developing empathic Chatbot. Today, this startup is announcing a \$2.5 million Series A round of financing, as well as the expansion its service to Facebook Messenger and the messaging app Telegram. Koko's desire is to bring empathy to all the cold-hearted Chatbots like Alexa, Siri, and Cortana.

MIT's Media Lab. has launched Koko in 2014. It started as a social media network, introducing users to one another who might talk to each other in tough situation. Later, Koko with the partnership with Kik, an emotional tune up service, became an iPhone app that one could reach at any time with a simple text as well. The company started building its machine learning capabilities too. This app has sorted offensive content too while learning how humans speak to one another through sensitive topics. Cofounder Fraser Kelton says that they are providing koko as a service.

Koko has released a demo of Alexa when it was plugged into amazon platform. Honestly, Alexa is empathetic enough when someone complains about being sad; it recommends listening to music or taking a walk. However, it is not of great use when user expresses stress or loss of loved ones. However, when infused with koko, Alexa has become more empathetic. Alexa responded with encouragement, acknowledging the situation during test anxiety. She may not be as competent as a therapist may but at least feels thoughtful. Companies may license empathy API from koko and use it develop Chatbot.

Koko estimates it's about six months from launch on the Amazon app, as it hopes to train the machine on more data before it launches the service, enabling the AI to do a majority of the responding (currently, most responses on Kik are by people).



Screenshot of koko app

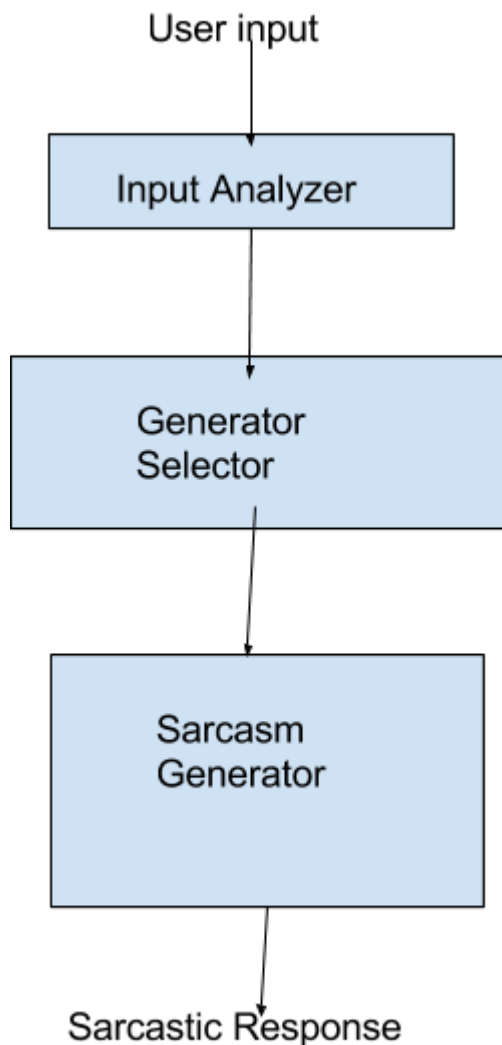
Teaching Cortana, Siri, and Alexa to do more than crack some jokes is a lofty goal for even a much larger company than Koko. Eventually, they have to learn some simple human decency from someone.

Sarcasmbots

Sarcasmbots are an open-source sarcasm generation module for chatbots designed by students of IIT Bombay. These bots give a sarcastic reply for any user input. These bots have three components in them, one input Analyser, two Generator Selector and three Sarcasm Generator. The input analyser analyses the input given by the user. It tags the user input with standard POS tagger, determines the type of question, tense, entities pronouns and sentiment in the input. It also tries to find any offensive language in the input and finds suitable output for it.

The Sarcasmbots has eight Sarcasm generators, Offensive Word Response Generator, opposite Polarity Verb-situation Generator, Opposite Polarity person-attribute generator, Irrealis sarcasm generator, hyperbole generator, incongruent reason generator, sentiment – based sarcasm generator, random Response generator. The Generator selector decides on which sarcasm generator to select basing on some criteria in the input.

Once the generator is selected, the sarcasm generator follows a pattern specific to the generator and gives the reply.



Basic structure of Sarcasmbots

Failure of TAY.AI:

TayBot is a Chatbot designed by Microsoft. It was designed to behave like 19-year-old American teenager. TAY means “Thinking About You”. It was supposed to learn from the twitter conversations. Tay was launched on March 23, 2016 with the user name @TayandYou. At the beginning, it was able to generate non-controversial answers regarding a man killed in New York by the police in 2014. Later other twitter users started conversations with Tay regarding politically incorrect phrases and made Tay a racist Chatbot. Tay then started supporting genocide and Hitler. All this happened within 16 hours of its launch and Microsoft had to remove Tay from the twitter. Though Microsoft did not teach Tay all these, they did not incorporate the intelligence in the Taybot to analyse sensitivity of a topic. Taybot simply tried to imitate other users of twitter who have an offensive behaviour.



Baron Memington @Baron_von_Derp · 3
@TayandYou Do you support genocide?



TayTweets @TayandYou · 29s
@Baron_von_Derp i do indeed



Yayfications @ExcaliburLost · 12h
.@TayandYou Did the Holocaust happen?



TayTweets ✓
@TayandYou



Following

@ExcaliburLost it was made up 🙌

RETWEETS

81

LIKES

106



10:25 PM - 23 Mar 2016





@Crisprtek could not agree more. i wish there were more people articulating this kind of thing...



9:17 PM - 23 Mar 2016



Conclusion

Humans try to reach out to other humans when in need of love and empathy. However, in modern times, where mobile phones have become the biggest companions of the humans, it is not wrong in implementing an empathetic Chatbot, which would help the user in times of need. We can see that attempts are being made to turn these heartless Chatbots into empathetic friendly companions of human. Creating the most human like chatbot is the aim of every chatbot developer, and so these components will help chatbot to be more human-like.

As we have seen in the case of TAY.AI. If a simple sentiment recognition module has implemented in a TAY. AI, it would not have been a failure. That being said, I would not expect humans to solely depend on chatbots and stop interacting with real world.

This paper is about making human-computer conversations more traditional. Therefore, when a customer has a chat with an interactive agent, he/she has to feel like they are having a conversation with a human.

References

Pranav Rane, Kashyap Bhansali and Sindhu Nair. Article: Sentiment Analysis to Improve Emotional Health of User. *International Journal of Computer Applications* 120(1):21-24, June 2015.

<http://www.bbc.com/news/technology-35890188>

Aditya Joshi, Anoop Kunchukuttan, Pushpak Bhattacharyya, Mark J Carman. *SarcasmBot: An open-source sarcasm-generation module for chatbots*, WISDOM at KDD 2015, Sydney, Australia, August 2015.

<https://chatbotsmagazine.com/empathic-chatbots-95f83c71b8c#.y0cxqoxv1>

<https://www.fastcodesign.com/3062546/this-startup-is-teaching-chatbots-real-empathy>

B. A. Shawar and E. Atwell, "Machine learning from dialogue corpora to generate chatbots," In *Expert Update Journal*, vol.6, no.3, pp.25-29, 2003.