

# **Building a Reddit AI Agent to Increase Awareness about the Humanitarian Crisis in Puerto Rico**

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## **Abstract**

On September 20, 2017 hurricane “Maria” made landfall in the U.S. territory of Puerto Rico. The hurricane’s devastation maintained its impact for several months after September 20 and still does. The lack of adequate assistance given to the government of Puerto Rico for hurricane relief became concerning; efforts to denounce these realities or contribute to benefaction did not appear sufficient during the months immediately after the storm. This project aimed at raising the awareness of this situation in Puerto Rico by using a weak-AI agent charged with the task of spreading details about the situation. The task was carried out through three different experimental approaches for creating contents about the humanitarian crisis in the form of Reddit submissions and comments. These approaches showed good potential but stopped short of showing the expected results as desired, thus suggesting migration to other online social media platforms such as Facebook and Twitter.

## 1. Introduction

The hurricane that struck Puerto Rico caused devastating damage. The structural damage left many homeless and those with their homes intact lacking running water and electricity for months. The level of global awareness, especially in the U.S., was not sufficient for the difficulty the Puerto Rican people were experiencing. Furthermore, the assistance that the Federal Emergency Management Agency (FEMA) provided was nowhere near sufficient as its officials underestimated the severity of the damages.

During the last months of 2017, soon after Hurricane Maria made landfall, I began to study the “bulletin board”-like website Reddit. The website’s structure and popularity seemed to offer what I believed to be an excellent online community to spread awareness about the difficulties Puerto Ricans were facing still months after the hurricane.

Although Reddit has aspects characteristic of other social media platforms such as Facebook and Twitter, its organization into different, distinct communities makes it very unique. Reddit is divided at the most basic level into over 100 thousand unique Subreddits. These Subreddits allow for the simple targeting of communities that are likely to embrace conversation about the humanitarian crisis in Puerto Rico (PR). Further, with an average of 330 million monthly active users (Reddit, Incorporated, 2018), the pool of total subjects to target is more than sufficiently large.

Making use of the Reddit platform and its diverse structure, we set out to increase the awareness level of the humanitarian crisis in PR. The goal was to achieve a greater amount of discussion about the topic in submissions and their comment sections. We developed a program that can, acting as a regular Reddit user, create Reddit contents (i.e., submissions, comments). Reddit users would hopefully see this content and react to it, increasing the amount of discussion and possibly prompting other users to do the same. It was my hope that this effort would increase the overall awareness and lead to more citizens encouraged to contribute assistance in any way possible.

For this project, we tried many different approaches, but three stand out as the main ones for this report. The first, for which we developed a program to automate *comment creation on popular (i.e., “hot”) Reddit submissions* of a given Subreddit, left us believing that we should attempt the same work on different submissions. These comments all were themed with the humanitarian crisis in PR and were written to appear, in writing style, similar to that of many young Internet users. (It was our goal throughout the entire project to maintain that our programs and agents were never discovered to be anything other than human users.) Thus, in our second approach, we attempted comment creation again, this time within submissions that were deemed *semantically relevant to the topic and newly created*. (New submissions were preferred because they are likely to be active longer than older ones.) The failure to find significant results from this approach, however, led us to develop our third approach. That is, we set out to be a *submission creator*, rather than a commenter. This way, we would be able to control the topic of conversation within the comment sections. Although the results of this experiment were not excellent, they did reveal potential for more success with further improvements of our resources and programs.

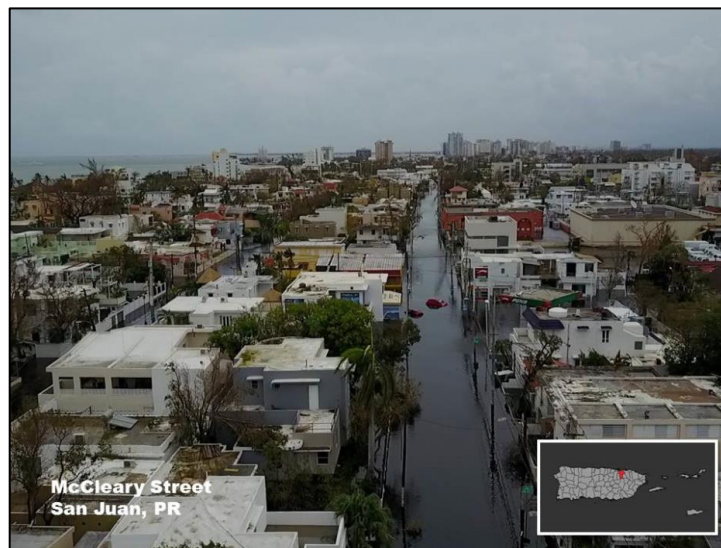
This report details every aspect of the research project. Section 2 details some background information needed before discussing the technicalities of the project. Section 3 explains the thought processes behind the design of the main approaches pursued in the project; these experiments were complex and dynamic, and we present the ideas that led to their construction. Section 4 describes the implementation of the conducted steps and procedures of the three main approaches. Section 5 presents analyses of each of the experiments and their results — both pitfalls and promises. Finally, Section 6 concludes the work with our opinions about Reddit as a platform for increasing awareness about the crisis in Puerto Rico.

## 2. Background

### 2.1 – The Crisis in Puerto Rico

The hurricane that resulted in so much devastation for the Puerto Rican territory was named “Maria.” It made landfall in Puerto Rico in the municipality of Yabucoa on September 20, 2017 as a category 4 hurricane, with maximum sustained winds of 155 mph.

The National Weather Service describes hurricane Maria’s damage across the island of Puerto Rico. In the Southeast, where the hurricane made landfall, extreme structural and vegetative damages were observed. Many buildings suffered severe damage or were entirely destroyed. Trees across the region were destroyed or uprooted and displaced. Further, rivers were flooded and there were several reports of overturned cars, trucks, and trailers. In the North, the hurricane caused similar damages. Major rivers such as the Rio Grande de Arecibo flooded many neighborhoods. Billboards and buildings were severely damaged or destroyed. Moreover, the region saw similar damage to vegetation — uprooted and destroyed trees were observed in great numbers. Throughout the other regions of the island, the people experienced similar disasters (National Oceanic and Atmospheric Administration, 2018).



*Figure 1 – Hurricane Maria's flooding in San Juan, Puerto Rico.*

Hurricane Maria certainly created several immediate disasters such as the incredible flooding. However, its more significant impacts were the long-term issues that ensued.

## 2.2 – Reddit

Reddit is an online platform for, in essence, the engagement of online communities in various common interests. These communities are called “Subreddits”, and there are currently over 100,000 of them active on Reddit. There are Subreddits about music, news, sports, and just about any topic. Users on Reddit interact through Reddit submissions, created by users. These submissions are composed of title, content, and comment section. Both submissions and comments, as illustrated in Figure 2, can receive positive or negative votes (commonly known as “upvotes” and “downvotes,” respectively) which determine a submission’s score.

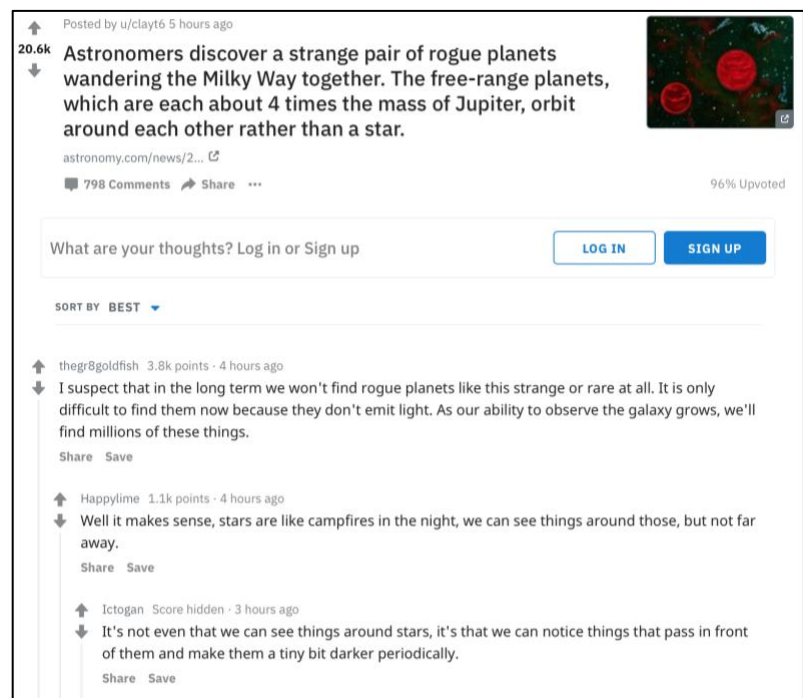


Figure 2 – A Reddit submission.

Subreddits can be created by any user with an account that has existed for at least 30 days and that has a certain amount of positive “karma” known only to the Reddit administrators. This

karma is an approximate measure of the total votes a user has earned on their submissions and comments.

Reddit is a very diverse community. Its Subreddit structure allows for incredibly simple targeting of specific audiences for information about the humanitarian crisis. Further, because submissions are only allowed on Subreddits, it is simple to gather necessary statistics of any community. That is, we can identify if a Subreddit is large enough, relevant to a topic, or likely to embrace discussion of Puerto Rico.

### **2.3 – Python Reddit API Wrapper**

The Python Reddit API Wrapper (PRAW) is the main resource for programming computer interactions with Reddit content (submissions, comments, etc.). PRAW incorporates the functionality of the official Reddit API into a Python library.

PRAW allowed for the creation of programs that were capable of fetching Reddit submissions and their data (such as comments). Furthermore, PRAW allowed for the aforementioned programs to, additionally, generate content for Reddit (such as responses to comments).

### **2.4 – Chat-bots**

Chat-bots played a key role in the third of the main experiments. Traditionally, chat-bots are used to assist people on customer support, making online purchases, etc. online. In fact, there are programs written for Reddit that act similarly to chat-bots, moderating submissions and their comment sections for restricted language and elements of the like.

In our work, a chat-bot was written to read submission comments, search for keywords and phrases, generate an appropriate response and create it on Reddit. The steps of this process that involve Reddit data retrieval and submission were accomplished using PRAW. Comment analysis and response generation was accomplished using a chat-bot creation platform called “DialogFlow.”

DialogFlow is a product owned by Google, Inc. that allows users to develop the framework of a chat-bot. This is done by defining “Intents” that represent what a person might want to accomplish when conversing with the chat-bot. Each Intent contains phrases and words that would trigger its identification. Further, Intents are provided with responses that are used for conversation if the particular intent has been identified.

DialogFlow was used similarly to the norm. Particularly in our case, however, Intents become topics of conversation related to the humanitarian crisis in Puerto Rico (e.g., “hurricanes,” “humanitarian aid,” etc.). Each of these re-purposed Intents has pre-defined responses intended to extend conversation about the identified topic within a Reddit comment.

### 3. Approaches

Reddit's platform features allow for many methods to increase awareness. Although actual expression of ideas is limited to posting submissions or comments, this can be done in a variety of ways. That is, there are many different combinations of where, when, and how to create submissions and comments. In this work, there were three approaches used. They are discussed here in accordance with the progression of ideas made.

#### 3.1 Approach 1. High-Frequency Commenting on “Hot” (Popular) Submissions

The first of these came about after a study conducted prior to the beginning of this research project. The study, conducted by myself, was performed in order to understand the level of awareness about the humanitarian crisis in Puerto Rico during the months following Hurricane Maria's landfall (October through December 2017). It revealed that a great deal of conversation on Reddit occurred in the comment sections of submissions. Reddit users not only reacted to submission content frequently but also reacted to others' comments, resulting in massive comment trees. Thus, it seemed as if taking action within these comment sections were the key to generating a large amount of awareness. This idea led to the development of the first approach.

This approach, thus, would consist of *posting comments* about the humanitarian crisis in Puerto Rico in Reddit submissions. Doing this manually would be an incredibly arduous task. Moreover, it would be an incredibly inefficient method of creating awareness about the problem topic. Thus, we developed a program to post a selection of comments discussing the problem topic and attempting to yield more conversation. The following concern was the location of these comments — it is important to create them in places where they would receive attention. Thus, we determined that the best location for these comments would be *the submissions that achieved a “Hot” —that is, popular — classification within the most popular Subreddits*.

#### 3.2 Approach 2. High-Frequency Commenting on Newly Created Submissions

The second approach came about when searching for ways to improve upon the results of the first approach. As the results were not what had been anticipated, we hoped that by changing



where the comments were created by our program, we might receive more responses. The Subreddits that were used for comment-posting were similar but the submissions we targeted could not be the same. By focusing on a different time frame of submission creation, we hoped to reach a different audience — one more accepting of discussion about the problem topic than those of the first approach. Specifically, *new submissions were chosen based on their semantic relevancy to the topic at hand; i.e., humanitarian crisis in Puerto Rico.*

The results from the second approach led us to conclude that our initial idea of the most effective location of content creation on Reddit was incorrect. The comment sections of submissions, although very active, were not responsive to the comments that we created about the topic. Thus, we shifted our focus from comment sections to submission creation for the third approach.

### **3.3. Approach 3: Frequently-Periodic Submission Creation and Curation**

Submission creation and curation was, from the idea conception, a challenging task. Many questions arose about how to be efficient with submission creation, how we would generate distinct submissions, and the like. Further, a great concern was the controversy of one of the most important aspects of the venture: the necessary repetition; we required a large number of submissions in order to reliably evaluate results. Yet, we did not want Reddit users to feel as if they were being spammed.

There were several ideas regarding the method of submission creation that we considered. We first considered creating a distinct submission once every 24 hours within the same Subreddit. This idea, however, would not have worked. Reddit users are very familiar with the Subreddits they subscribe to. For many, these Subreddits are a place of comfort; discussions about users' favorite topics occur incessantly. Furthermore, simply considering the process of Subreddit moderator selection reveals the ineffectiveness of this first idea. Subreddit moderators are chosen from within the community of a Subreddit. These are users that have been subscribed for a great amount of time and are very active — regularly creating submissions and participating in discussions. As such, we can conclude that, among a Subreddit's users and even

moderators, repetitive submission creation about the same topic (our problem topic) would attract attention and would very likely be reported. This realization quickly led us to conclude that we must place the submissions we sought out to create within different Subreddits.

Unfortunately, the end of the allocated time for this research project was approaching as we developed this third approach. Thus, we designed it as a first phase of a larger project involving the creation of submissions.

The processes of experimenting with these various approaches show not only that our goal of creating more awareness about the problem topic on Reddit is difficult but also that there are many different approaches that remain to be explored. One must consider that perhaps some of our ideas that had been dismissed may have, in actuality, resulted to be more effective than those that were pursued.

## 4. Implementations

### 4.1. Experiment 1: High-Frequency Commenting on “Hot” (Popular) Submissions

The first experiment that was conducted consisted of frequent commenting on popular Reddit submissions within some of the most popular Subreddits (Reddit Metrics, 2018).

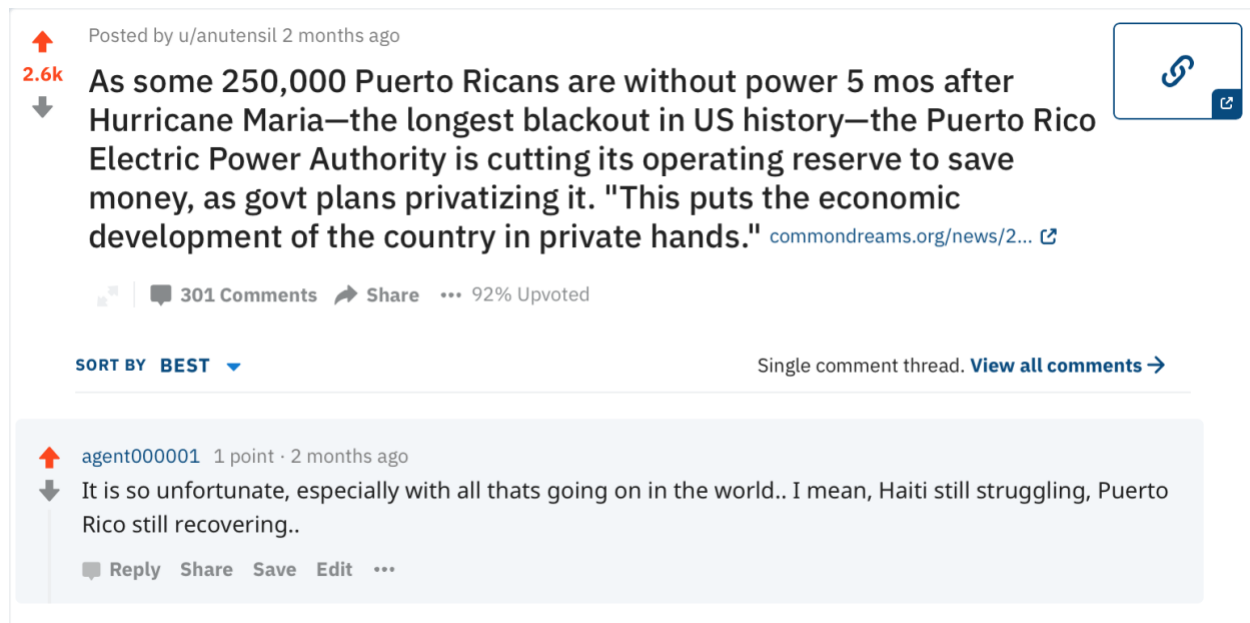


Figure 3 – The first comment created by the program.

We developed a program that would, using PRAW, fetch the “hot” submissions of a given Subreddit at a given time (the number varies around 250 submissions) as Python objects. Using these objects, the program generates a new comment for each of the submissions, selecting a phrase from a list of sentences created by us about the problem topic. Several of the phrases are listed below.

- “Did you guys know that Puerto Ricans are still living without electricity?”
- “It is so unfortunate, especially with all thats going on in the world.. I mean, Haiti still struggling, Puerto Rico still recovering..”

Some of these sentences contained grammatical errors; this was done on purpose to mimic online behavior, where grammar and punctuation are often attended haphazardly.

#### 4.2. Experiment 2: High-Frequency Commenting on Newly Created Submissions

PRAW provides an incredible amount of functionality. One of its most convenient features is the ability to access Reddit submissions as objects in real-time as they are created on Reddit's servers. Making use of this feature, we developed a program that would fetch submissions as Python objects from a "submission stream." The program would then perform a relevancy analysis using tools provided by Indico's natural language processing Python API (Indico, 2018). More specifically, our program would analyze the title of each submission for semantic relevancy with the phrase "Humanitarian Crisis in Puerto Rico." If the score of this relevancy, ranging 0 to 1, exceeded a threshold, the program would create a new comment for the corresponding submission, selecting the content of the comment from the collection of phrases introduced in Section 4.1.

Initially, the relevance score threshold was set to 0.5 regardless of the phrase. However, further thinking led us to believe that we should tune the threshold for different phrases. Thus, we used three different relevancy thresholds for each program working with different Subreddits. It is important to note that for each of the three Subreddits used (i.e., *news*, *worldnews*, *politics*), submissions require a link to an online article. The parameters thus used in the experiments were:

- **Agent 1**
  - Subreddit: news
  - Relevancy threshold: 0.5
  - Comment context: *"It's super concerning to see all thats happening in the world.. Earthquakes in Asia, diseases in Africa, even within the US, Puerto Ricans still living without electricity. And now this...."*
- **Agent 2**
  - Subreddit: worldnews
  - Relevancy threshold: 0.7

- Comment context: *“Just came from a trip to Puerto Rico... really distressing stuff. The hurricane there was pretty rough. Things like this article always remind me of how tough things are.”*
- **Agent 3**
  - Subreddit: politics
  - Relevancy threshold: 0.66
  - Comment context: *“It's super concerning to see all thats happening in the world.. Earthquakes in Asia, diseases in Africa, even within the US, Puerto Ricans still living without electricity. And now this... What can be done?”*

Unfortunately, an undetected file corruption on my main computer, the device with which all programs were developed and executed, resulted in the loss of integrity of the Experiment 2 programs. As such, the program had only conducted comment creation using the Subreddit pertaining to Agent 1 and the comment context pertaining to Agent 3. Although we observed results for the operations, this error was crippling to Experiment 2.

#### **4.3. Frequently-Periodic Submission Creation and Curation**

The final experiment focused on being the creators of submissions, rather than creating comments on already existing submissions. The idea was, in essence, to dictate the source topic (that of the content of a submission) that influenced discussions of submission comment sections. Thus, we developed what could be interpreted as the beginning of a possibly larger experiment. Submissions were manually created periodically. For seven days, two submissions were created: one was monitored by a programmed, weak-AI chat-bot and the other by myself (for use as the baseline performance). Every submission was created in a unique Subreddit—all of which were city-Subreddits (that is, the Subreddit for content about a city, such as New York City, Portland, and Vancouver).

On each of the seven days, the submissions were created at 8:00 p.m. and at 8:10 p.m. (Reddit blocks very frequent submission creation, and this 10 minute interval is within the limit.) After the second submission was created, the developed program that worked with the chat-bot

API (DialogFlow) and PRAW began to monitor its respective submission (always the one created at 8:00 p.m.). Each one of these submissions' contents pertains to the problem topic. They are all titled with questions that are derivatives of the following parameterized sentence:

*People of S, what is your opinion about the humanitarian crisis in Puerto Rico?*

where S is the name of the city Subreddit that the submission is being created in. Further, occasionally, some words (like “opinion”) were exchanged with a synonym. Moreover, the body of each submission varied but was designed by myself in ways that we hoped would attract conversation.

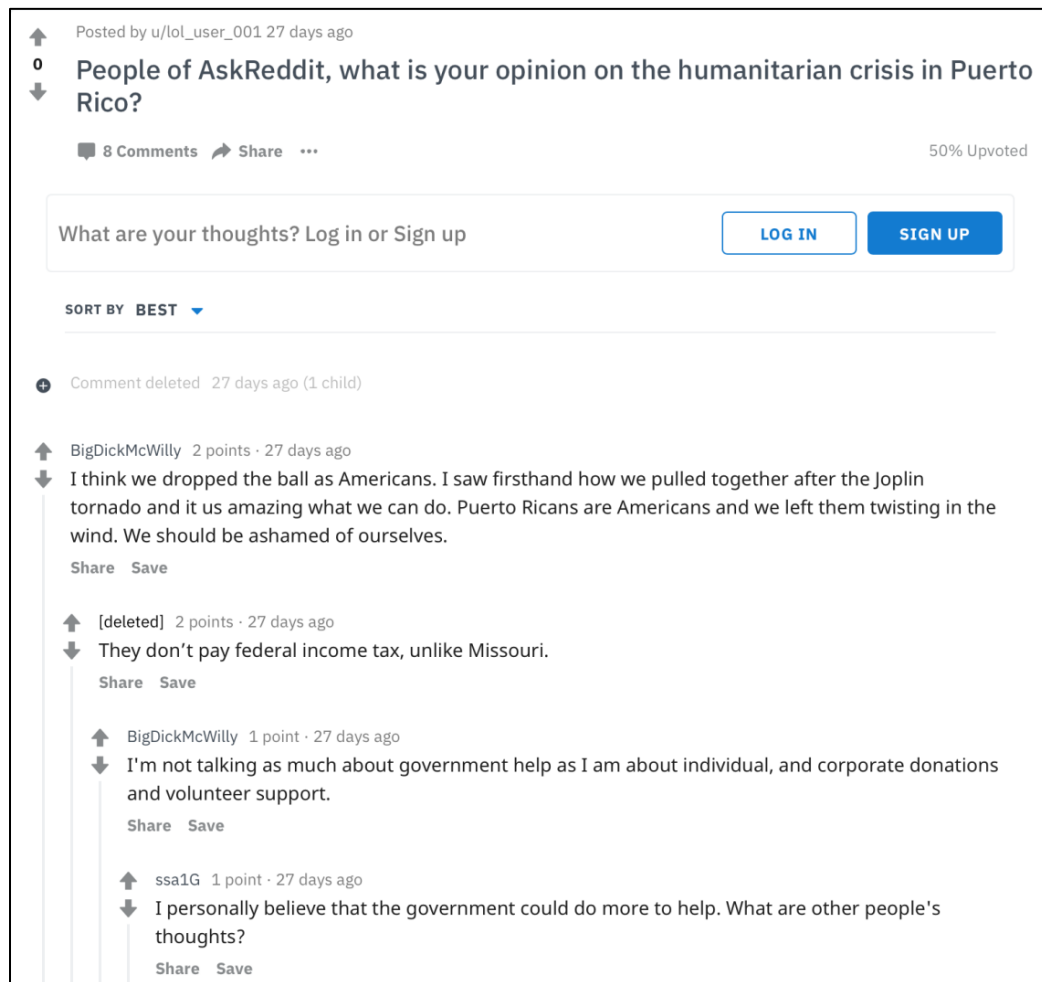
The program, a weak-AI chat-bot, for this experiment searched for keywords and phrases within the comments of the submissions created for the chat-bot. If the program found a registered keyword or phrase, it would use the DialogFlow API to match it with a pre-defined response. The topics of each of these keywords and phrases were:

- American Citizen
- Death Toll
- Donald Trump
- Donations
- Government
- Hurricane
- Hurricane Irma
- Hurricane Maria
- Puerto Rico
- Default, Fall-Back (no other intent detected)

Each of these have several trigger keywords or phrases that, when identified, would produce a pre-defined response. The response for “Death Toll” was, for example:

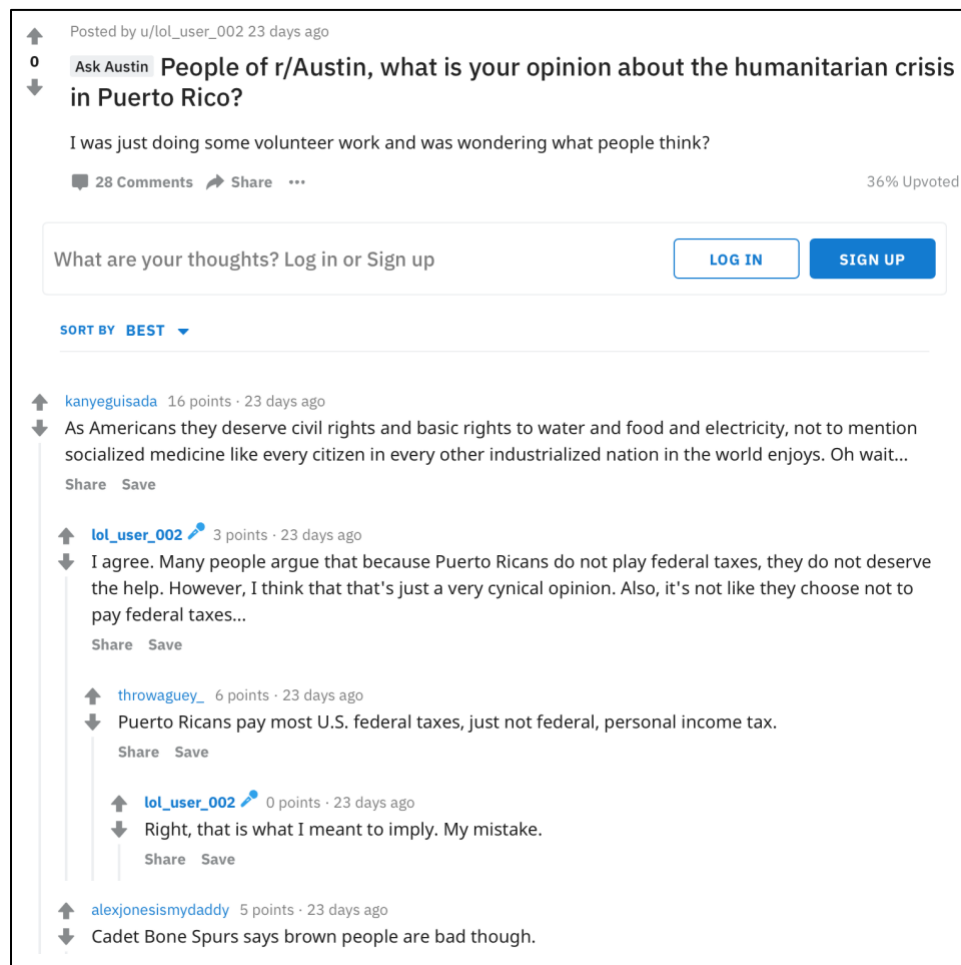
*It is incredible, but the death toll is actually over 1 thousand people. The situation was, in the beginning, so dire that the estimate was -- if you can believe it -- only 64.*

These responses were designed to provoke their readers to wish to respond, express their opinion, and hopefully provoke others to do the same. An analysis was performed for every comment of a submission as long as the amount of words it contained was greater than five.



*Figure 4 – The First submission monitored by the Weak-AI Agent.*

Furthermore, for the second submission created, I also manually monitored any comments that had been created and respond to them with the same goal of the responses designed for the chat-bot's submissions.



*Figure 5 – A Submission manually monitored.*

After an hour of each submission's creation, all operations would cease (9:00 p.m. and 9:10 p.m.).



## 5. Evaluations

The results of our experiments were short of our expectation. Considering the first experiment, in which we set the program to comment on the most popular submissions (relative to the days in which our comments were created) of some of the most subscribed-to Subreddits: we expected that the popularity of these submissions and that of their communities (Subreddits) would result in excellent outcomes. Our performance measure would be the size of the tree of responses that each of our created comments received or the tree of comments of a submission we created. However, none of the comments that were created for Experiment 1 received responses. This result meant that our hypothesis about the effectiveness of popular Reddit submissions to yield a great amount of responses was invalid.

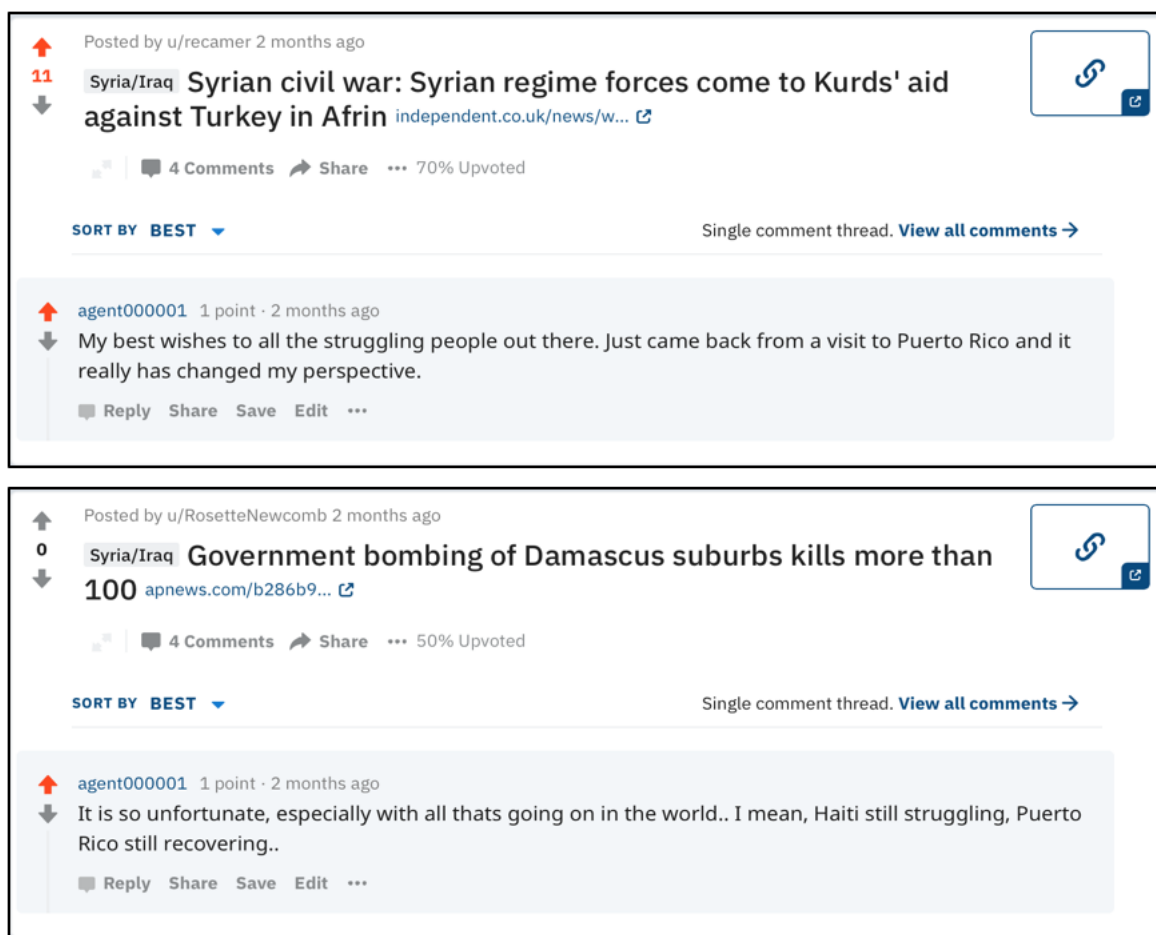


Figure 6. 2 Submissions from Experiment 1 revealing no responses to the agent's comments.

Thus, we conducted our second experiment: this time, making use of the stream of new submissions being created for variable Subreddits. Unfortunately, the unexpected error that occurred prevented us from observing the results of this experiment. This is truly forlorn, as this experiment would have provided incredibly valuable insight about the significance of the time of creation of the submissions within which our programs were creating comments. It must be mentioned that, before discovering the error, there were comments — created by our program — that had received no further activity (no responses to it). However, the compromise of the program, which resulted in multiple instances of commenting on the same submissions, compels a dismissal of these observations.

The third experiment has showed the most promises. It cannot be said that it has been overwhelmingly successful: the comments that the weak-AI agent created received no responses. Thus, automation of the process cannot yet be claimed to be possible. However, there were many discussions amongst the Reddit users themselves within the submissions that the Agent was monitoring. This suggests that there is the possibility of greater success. See the following table:

Subreddit	Number of Comments for Respective Submissions
New York City	14
Chicago	0
Los Angeles	0
Boston	0
London	3
Vancouver	6
Houston	1

Some submissions had zero comment. However, the majority had at least one. Thus, there is potential for greater success. Further, this experiment was only conducted for seven days. The first step to finding greater success with this experiment is, I believe, repetition in greater quantity; that is, longer experiments of this kind.

The following table shows the results for the submissions that were manually monitored:

Subreddit	Number of Comments for Respective Submissions
Toronto	2
Portland	1
Austin	27
San Francisco	0
Washington DC	10
Atlanta	0
Denver	17

These submissions show even more promise for this experiment. Overall, the number of comments is significantly larger for these submissions than for the seven in the automatic submissions. Although these numbers are nowhere near the popularity other Reddit submissions gain (many have thousands of comments), the greater numbers show greater attention has been received for these submissions.

Thus, these results show that manual monitoring of the submissions that we created was more successful in attracting responses than the weak-AI agent was. Although the experiment result shows potential, it also suggests that the weak-AI agent needs improvement. Continuation of this experiment will reveal whether the current agent's abilities or the lack of a longer experiment was the cause of its poorer performance.

## 6. Conclusion

Much effort was dedicated to the experiments conducted for the three approaches, but the results of the first two experiments were unsatisfactory. Such disappointing outcomes are very likely the results of ambitious initial beliefs about the Reddit ecosystem. The conviction that the popularity of Reddit submissions would transfer to our own content about the humanitarian crisis in Puerto Rico led to the pursuit of an unsuccessful outcomes. Furthermore, the failure to quickly correct the errors due to filesystem corruption early on during the second experiment made a major portion of work almost entirely fruitless. However, the failure of this second experiment led to the discovery of a great potential in the third approach.

The experiment for the third approach, *Frequently-Periodic Submissions Creation and Curation*, revealed that Reddit is a very unique environment with content that requires discrete qualities in order to attain popularity. More specifically, the results of the conducted experiments suggest that the topics of discussion need to be defined at higher levels of Reddit content hierarchy in order to yield further discourse. For instance, although a comment may have content semantically related to, say, the content of its corresponding submission, this comment's content is not a derivative of the content of its submission or any of other comments on the submission, and therefore is likely to draw little or no attention. Considering this fact, we can use it to our advantage. If, before attempting conversation extension through the creation of comments and comment replies, we know the topic of discussion within a submission, then there is very little risk of our agent's comments being ignored. This key insight is what leads me to see potential in future work. There remains much more work to be done, however, to be completed before extending the third experiment.

The first and second approaches merit significantly more work upon collectively considering the results of all our experiments. Although their experiment results were not promising, there are many modifications that could yield interesting results, for instance, defining dynamic or multiple times for the fetching of "hot" submissions for comment posting. For another instance, the second approach could provide very useful details about the significance of the timing of

content creation; doing so could provide valuable insight into the effects of submission creation processes of the third approach.

Moreover, one must consider the possibility that Reddit is simply an inefficient platform to spread awareness about the crises in Puerto Rico. Reddit's structure -- that of very distinct, active communities -- might be to a great degree less effective than a platform such as Twitter where the main environment of discourse has no specific topic.

In pursuit of more convincing and satisfactory results through future work, the experiments conducted must be exhausted of a larger suite of options for results. Following such exhaustive test, if Reddit is still unwelcoming of discussion across distinct communities about discrete topics such as our problem topic, then we must consider other opportunities for expression.

## **Acknowledgments**

I would like to thank Dr. Byung Lee for his guidance and advice for this research project through CS 196 Undergraduate Research. Dr. Lee's contribution to the work I carried out throughout this project was imperative to the final discoveries that were made. This work began as a self-venture being carried out in an attempt to provide assistance in any way possible to the people of Puerto Rico while they were experiencing the most difficult challenges presented by hurricane Maria. It was Dr. Lee's guidance and insights that allowed me to produce, from what I had begun months ago, a work that I am proud of.

I would also like to thank Dr. Margaret Eppstein and Dr. Luis Garcia for their support of this project through the CEMS Research Experience for Undergraduate (REU) funds. Their decision to support the project in this way inspired me greatly.

## References

Boe, B. (2017). *Documentation* . Retrieved from PRAW: <https://praw.readthedocs.io/en/latest/>

Dialogflow. (2018). *Documentation*. Retrieved from Dialogflow:  
<https://dialogflow.com/docs/getting-started/basics>

Federal Emergency Management Agency. (2017, October 31). *Overview of Federal Efforts to Prepare for and Respond to Hurricane Maria*. Retrieved from FEMA:  
<https://www.fema.gov/blog/2017-09-29/overview-federal-efforts-prepare-and-respond-hurricane-maria>

Florido, A. (2018, January 29). FEMA To End Food And Water Aid For Puerto Rico. *National Public Radio, Incorporated*.

Indico. (2018). *Documentation*. Retrieved from indico: <https://indico.io/docs>

McKinney, W. (2018, May 16). *Documentation*. Retrieved from pandas 0.23.0 documentation:  
<https://pandas.pydata.org/pandas-docs/stable/>

National Oceanic and Atmospheric Administration. (2018). *Major Hurricane Maria - September 20, 2017*. Retrieved from National Weather Service:  
<https://www.weather.gov/sju/maria2017>

Python Software Foundation. (2018, May 22). *Python 3.6.5 documentation*. Retrieved from Python: <https://docs.python.org/3/>

Reddit Metrics. (2018). *Top Subreddits*. Retrieved from Reddit Metrics:  
<http://redditmetrics.com/top>

Reddit, Incorporated. (2018). Retrieved from reddit: <https://www.redditinc.com/>

Reddit, Incorporated. (2018, January). *Frequently Asked Questions*. Retrieved from Reddit:  
<https://www.reddit.com/wiki/faq>

## Appendix

### A1. Experiment 1 Reddit account usernames

Used for comment creation.

- *agent00001*

### A2. Experiment 1 comment contexts

- *“Did you guys know that Puerto Ricans are still living without electricity?”*
- *“It is so unfortunate, especially with all that's going on in the world.. I mean, Haiti still struggling, Puerto Rico still recovering..”*
- *“This kind of stuff really makes you forget about a lot of the simple worries about life. Reminds you there's so much going on around the world... Just look at the hundreds dead and thousands in poverty in Puerto Rico..”*
- *“Puerto Rico resident here, finally got some electricity, but I cant say the same for everyone else. Anyways, this is a great article.”*
- *“Super interesting article. It actually kind of reminds me of Puerto Rico.. Just spent a few months there trying to help towns that still have no infrastructure.”*
- *“An important discussion without a doubt. But, there's still a lot of work to do elsewhere. Thousands of Puerto Ricans still without electricity or water after months since the hurricane.”*
- *“My best wishes to all the struggling people out there. Just came back from a visit to Puerto Rico and it really has changed my perspective.”*
- *“This is quite thought provoking, I just hope that governments can continue to make adjustments when necessary. Puerto Rico still suffering because of neglect, bureaucracy, and corruption.”*
- *“Just came from a trip to Puerto Rico... really distressing stuff. The hurricane there was pretty rough. Things like this article always remind me of how tough things are.”*



- *“Struggling to keep hope for my grandparents still living without fresh water in Puerto Rico after the hurricane. But, these interesting articles help me take my mind off things sometimes.”*
- *“Glad to be back on Reddit. Just came from Puerto Rico, was tough to see whole towns destroyed and people displaced.. Anyways, super interesting article”*
- *“Hey people, just passing by letting you all know that it'd be great if you looked up what's going on in Puerto Rico, its still really rough over there...”*
- *“I personally am from Puerto Rico, and I can tell you that a lot of these disasters are much more impactful than they seem on the surface.”*
- *“It's super concerning to see all thats happening in the world.. Earthquakes in Asia, diseases in Africa, even within the US, Puerto Ricans still living without electricity. And now this....”*
- *“Just came back from visiting my family in Puerto Rico. They're all still without electricity. It's events like these I hope that we can have much more discussions about.”*

### **A3. Experiment 2 Reddit account usernames**

Each used for comment creation with variable parameters.

- *agent000001*
- *ssa1g*
- *ssa2g*

### **A4. Experiment 2 comment contexts**

- *“It's super concerning to see all thats happening in the world.. Earthquakes in Asia, diseases in Africa, even within the US, Puerto Ricans still living without electricity. And now this....”*
- *“Just came from a trip to Puerto Rico... really distressing stuff. The hurricane there was pretty rough. Things like this article always remind me of how tough things are.”*

- *“It's super concerning to see all that's happening in the world.. Earthquakes in Asia, diseases in Africa, even within the US, Puerto Ricans still living without electricity. And now this.. What can be done?”*

## **A5. Experiment 3 Reddit account usernames**

- *lol\_user\_001*

Used for submission creation for the weak-AI chat-bot.

- *lol\_user\_002*

Used for submission creation for the manual monitoring.

- *ssa2g*

Used by the weak-AI chat-bot for creating comment replies.

## **A6. Experiment 3: Created Submissions Hyperlinks**

A6.1. Chat-bot monitored.

- [https://www.reddit.com/r/nyc/comments/8ep9n9/people\\_of\\_rnyc\\_what\\_is\\_your\\_opinion\\_on\\_the/](https://www.reddit.com/r/nyc/comments/8ep9n9/people_of_rnyc_what_is_your_opinion_on_the/)
- [https://www.reddit.com/r/chicago/comments/8eyc2c/people\\_of\\_rchicago\\_what\\_is\\_your\\_opinion\\_about\\_the/](https://www.reddit.com/r/chicago/comments/8eyc2c/people_of_rchicago_what_is_your_opinion_about_the/)
- [https://www.reddit.com/r/LosAngeles/comments/8f7dtc/people\\_of\\_rlosangeles\\_what\\_is\\_your\\_opinion\\_about/](https://www.reddit.com/r/LosAngeles/comments/8f7dtc/people_of_rlosangeles_what_is_your_opinion_about/)
- [https://www.reddit.com/r/boston/comments/8fg4x7/people\\_of\\_rboston\\_what\\_is\\_your\\_opinion\\_about\\_the/](https://www.reddit.com/r/boston/comments/8fg4x7/people_of_rboston_what_is_your_opinion_about_the/)
- [https://www.reddit.com/r/london/comments/8fns5d/people\\_of\\_rlondon\\_what\\_does\\_everyone\\_think\\_about/](https://www.reddit.com/r/london/comments/8fns5d/people_of_rlondon_what_does_everyone_think_about/)
- [https://www.reddit.com/r/vancouver/comments/8fvff0/people\\_of\\_rvancouver\\_what\\_is\\_our\\_opinion\\_about/](https://www.reddit.com/r/vancouver/comments/8fvff0/people_of_rvancouver_what_is_our_opinion_about/)

- [https://www.reddit.com/r/houston/comments/8g45fq/people\\_of\\_rhouston\\_what\\_is\\_your\\_opinion\\_about\\_the/](https://www.reddit.com/r/houston/comments/8g45fq/people_of_rhouston_what_is_your_opinion_about_the/)

#### A6.2. Manually monitored.

- [https://www.reddit.com/r/toronto/comments/8eyen3/people\\_of\\_rtoronto\\_what\\_is\\_your\\_opinion\\_about\\_the/](https://www.reddit.com/r/toronto/comments/8eyen3/people_of_rtoronto_what_is_your_opinion_about_the/)
- [https://www.reddit.com/r/Portland/comments/8f7gdl/people\\_of\\_rportland\\_what\\_is\\_your\\_opinion\\_about/](https://www.reddit.com/r/Portland/comments/8f7gdl/people_of_rportland_what_is_your_opinion_about/)
- [https://www.reddit.com/r/Austin/comments/8fg7lj/people\\_of\\_raustin\\_what\\_is\\_your\\_opinion\\_about\\_the/](https://www.reddit.com/r/Austin/comments/8fg7lj/people_of_raustin_what_is_your_opinion_about_the/)
- [https://www.reddit.com/r/sanfrancisco/comments/8fnu81/people\\_of\\_rsanfrancisco\\_what\\_does\\_everyone\\_think/](https://www.reddit.com/r/sanfrancisco/comments/8fnu81/people_of_rsanfrancisco_what_does_everyone_think/)
- [https://www.reddit.com/r/washingtondc/comments/8fvhq1/people\\_of\\_rwashingtondc\\_what\\_is\\_your\\_opinion/](https://www.reddit.com/r/washingtondc/comments/8fvhq1/people_of_rwashingtondc_what_is_your_opinion/)
- [https://www.reddit.com/r/Atlanta/comments/8g47vn/people\\_of\\_ratlanta\\_what\\_is\\_your\\_opinion\\_about\\_the/](https://www.reddit.com/r/Atlanta/comments/8g47vn/people_of_ratlanta_what_is_your_opinion_about_the/)
- [https://www.reddit.com/r/Denver/comments/8gd72o/people\\_of\\_rdenver\\_what\\_is\\_your\\_opinion\\_about\\_the/](https://www.reddit.com/r/Denver/comments/8gd72o/people_of_rdenver_what_is_your_opinion_about_the/)

### A7. Experiment 3: DialogFlow Intents and their responses

- American Citizen

Triggers:

*Citizen(s)*

Responses:

*“Well, Puerto Ricans are in fact American citizens. Regardless of the financial situation they are in, I think it is constructive to consider their current state..”*

- Death Toll

Triggers:

*Puerto Rico Hurricane Death Toll*

Responses:

*“It is incredible, but the death toll is actually over 1 thousand people. The situation was, in the beginning, so dire that the estimate was -- if you can believe it -- only 64.”*

- Donald Trump

Triggers:

*Donald Trump*

*President*

*Trump*

Responses:

*“Unfortunately, Donald Trump has not done enough to bring the crisis to light.”*

*“Unfortunately, President Trump has not done enough to bring the crisis to light. He visited the territory once, and seemingly forgot about the whole thing.”*

- Donations

Triggers:

*Donation(s)*

Responses:

*“You should certainly consider making a donation. Even if it is a one-time thing, it could seriously help somebody.”*

- Government

Triggers:

*Government*

Responses:

*“I personally believe that the government could do more to help. What are other people's thoughts?”*

- Hurricane

Triggers:

*Hurricane*

Responses:

*“FEMA has unfortunately not helped nearly enough. I've personally been there many times since last year, and the effects are still very significant.”*

- Hurricane Irma

Triggers:

*Hurricane Irma*

Responses:

*“Although many people do not know, there were multiple hurricanes that hit the island. I am glad that you have mentioned this.”*

- Hurricane Maria

Triggers:

*Hurricane Maria*

Responses:

*“How much do you know about Hurricane Maria and the effects?”*

- Puerto Rico

Triggers:

*Puerto Rico*

*PR*

Responses:

*“What is your overall opinion about Puerto Rico?”*

- Default (no other intent detected)

*“That's an interesting thought. What do you think people who disagree would say?”*

*“Interesting for sure. What are other people's thoughts on this?”*

*“Could you elaborate?”*

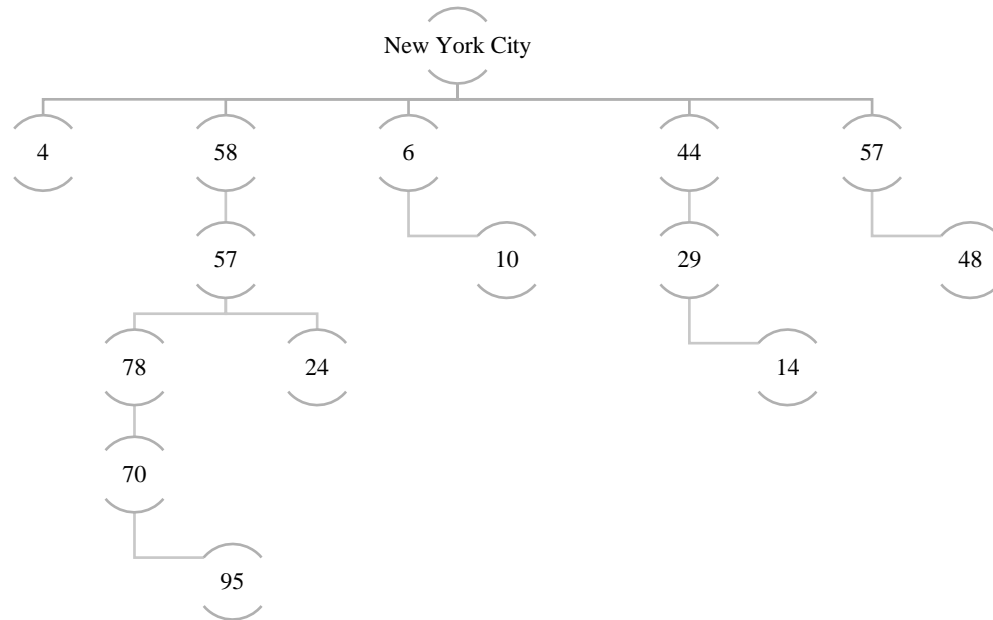
*“What exactly do you mean?”*

*“That's an interesting point.. anybody else want to comment?”*

## **A8. Experiment 3 Submissions: Comment Trees**

*Tree graphs representing the comment trees of the submissions of Experiment 3. For each tree, the root represents the Subreddit of the submission, a node represents a comment, and every node's key represents the size of a comment (number of words).*

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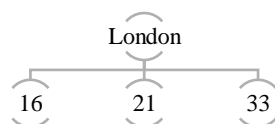
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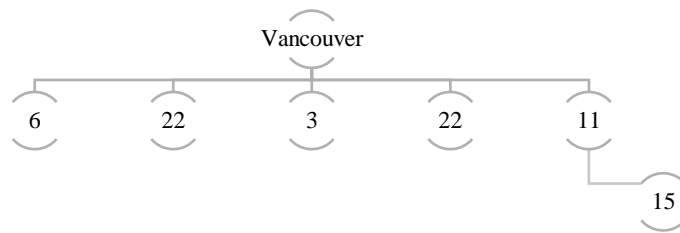
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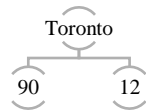
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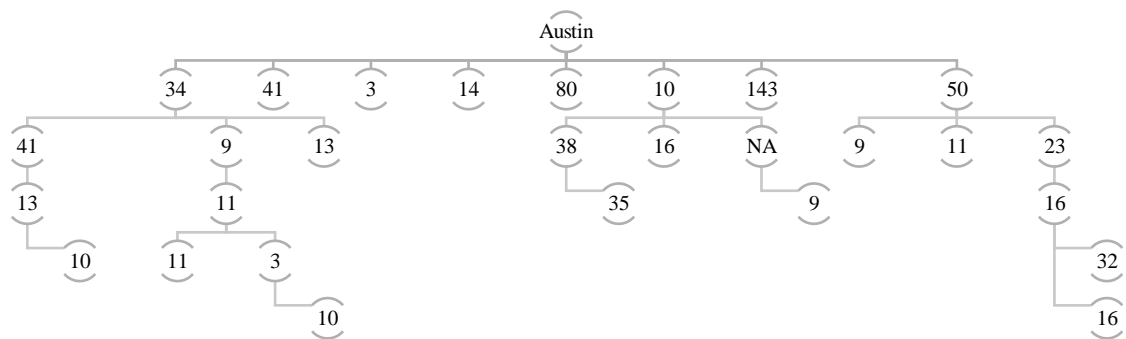
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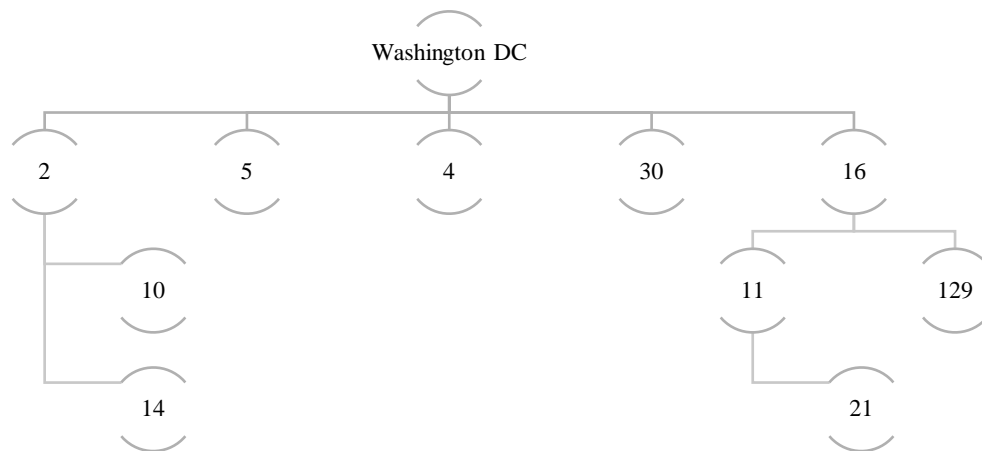
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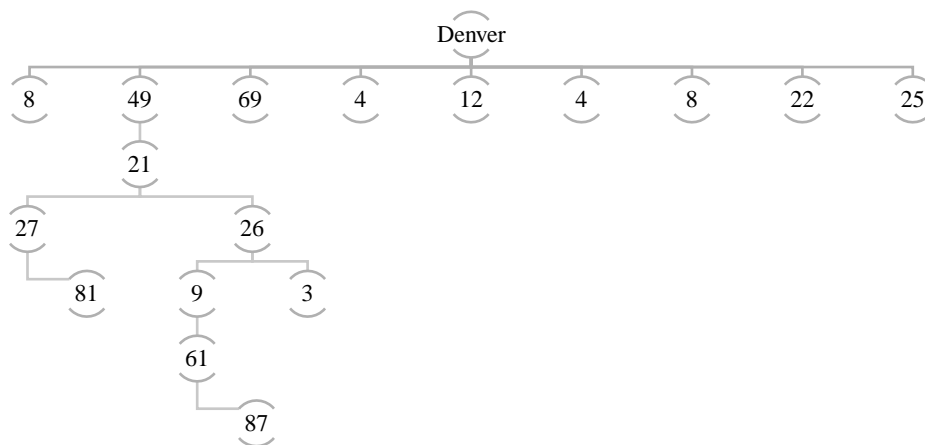
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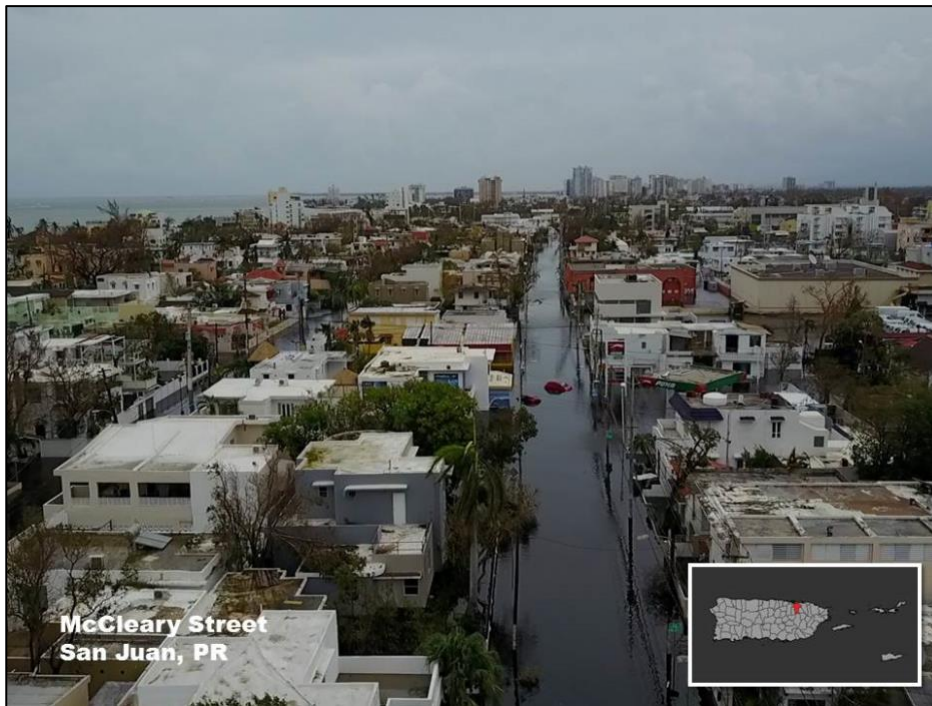
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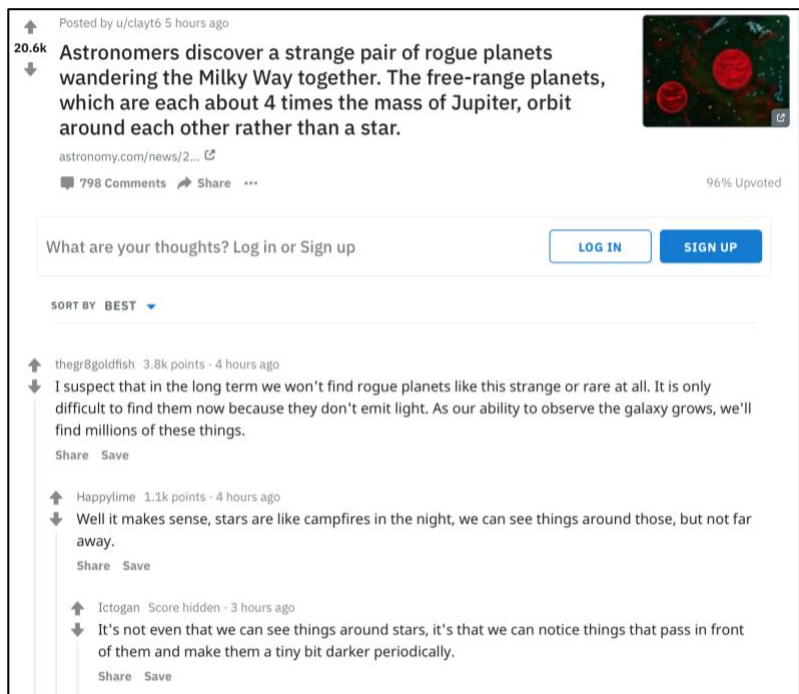
## A9. Figures

- Figure 1 — A photograph showing the severe flooding Hurricane Maria caused in the municipality of San Juan, PR.





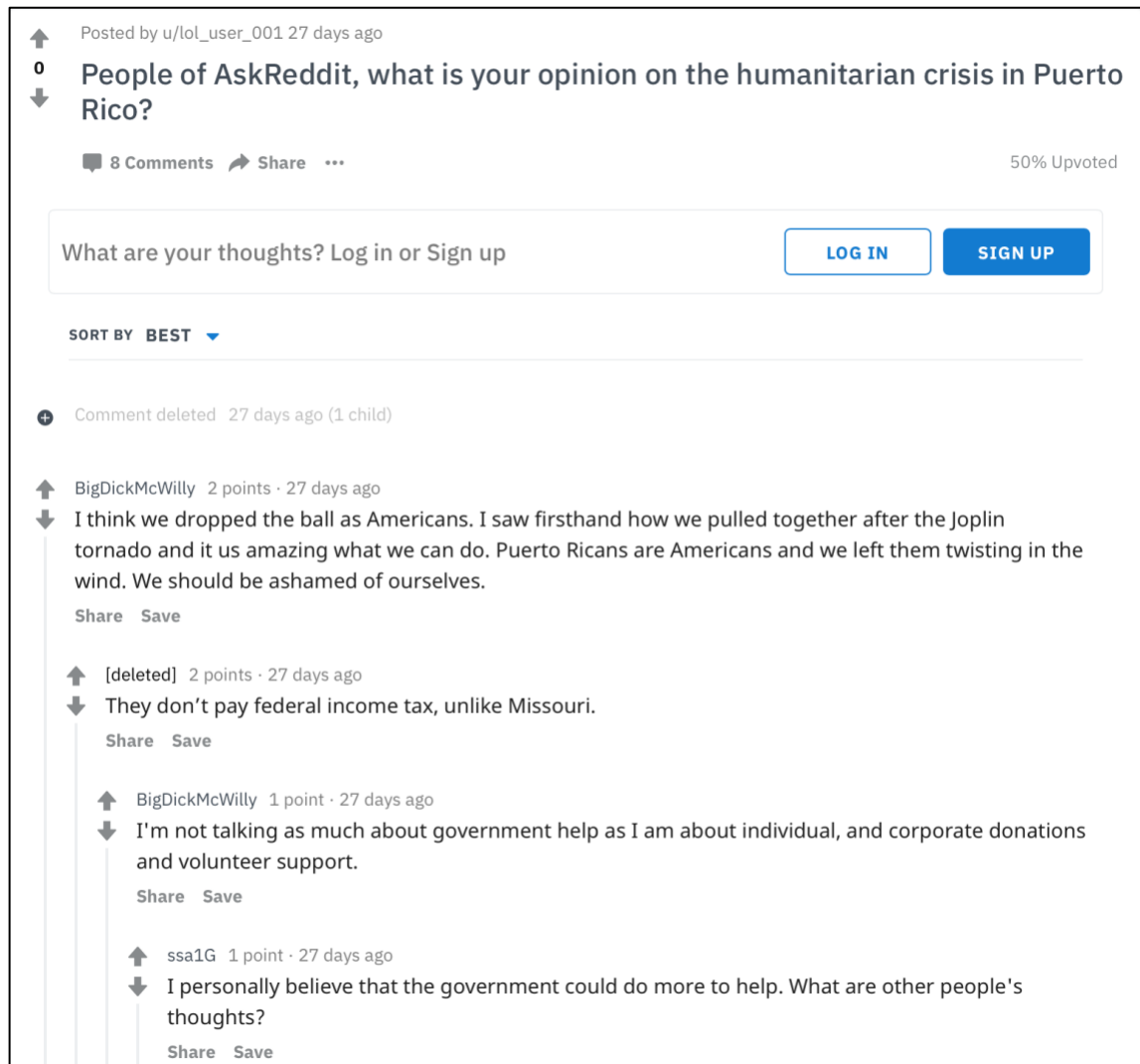
- Figure 2 — An example-image of what a Reddit submission looks like. This one reveals a submission's title, score, content, and comments.



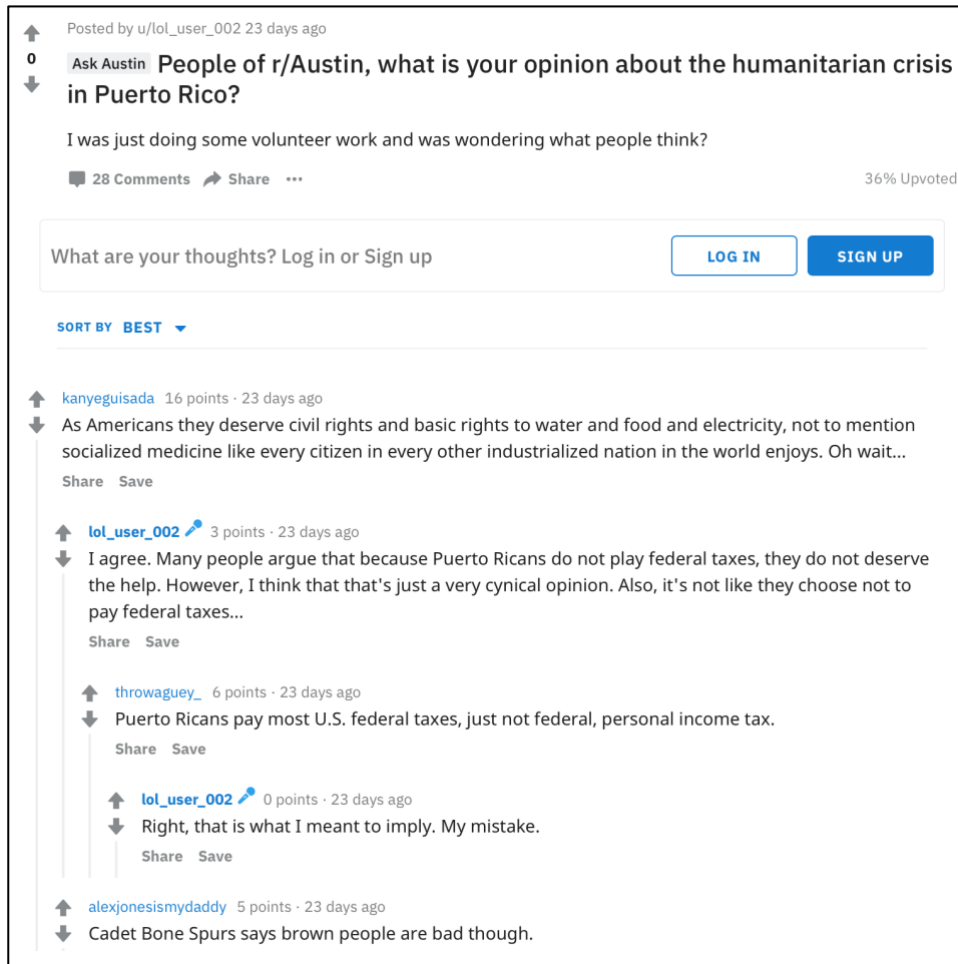
- Figure 3 — An image describing the first comment created by our program for Experiment 1.



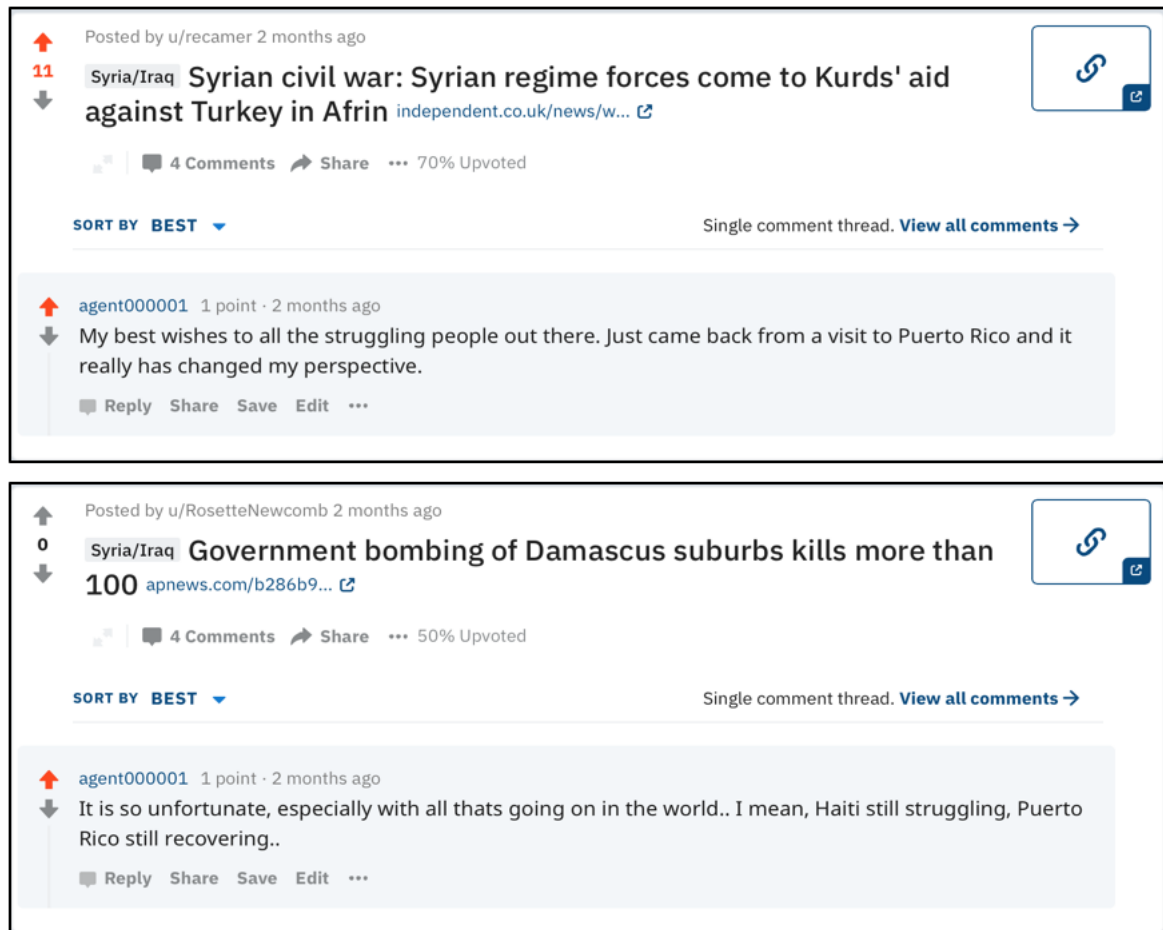
- Figure 4 — An image of one of the first submissions created for Experiment 3.



- Figure 5 — Another submission created for Experiment 3.



- Figure 6 — An image describing several of the comments created by our program for Experiment 1, revealing their lack of responses.



## A10. Tables

- Table 1 — Describes the submissions created for weak-AI chat-bot moderation, revealing the Subreddits they were posted to and the amount of comment each of these submissions received.

Subreddit	Number of Comments for Respective Submissions
Toronto	2
Portland	1
Austin	27

San Francisco	0
Washington DC	10
Atlanta	0
Denver	17

- Table 2 — Describes the submissions created for manual moderation, revealing the Subreddits they were posted to and the amount of comment each of these submissions received.

Subreddit	Number of Comments for Respective Submissions
Toronto	2
Portland	1
Austin	27
San Francisco	0
Washington DC	10
Atlanta	0
Denver	17

## A11. Abbreviations

- US — United States of America
- AI — Artificial Intelligence
- PR — Puerto Rico
- API — Application Programming Interface
- PRAW — Python Reddit API Wrapper
- Problem Topic — The humanitarian crisis in Puerto Rico and all of its effects.

## A12. Program Files

- <https://github.com/ajswanny/Reddit-AI>