CPSC 310, Homework 1
Creating A Twitter Bot

Spring 2022

Due February 14th at 11:59 p.m.

The goal of this assignment is to show you all how, with the right tools, you can create a program, i.e., bot, capable of passing as a human online. For this assignment, you will create a bot capable of responding to political tweets in a positive or negative way depending on whether you are in favor of what the tweet states. To do so, you will use several APIs and libraries to read and post tweets, analyze posted tweets, and automatically generate replies. You will use a library called "Tweepy" to interact with Twitter to (1) scrape tweets of real users off the Internet and (2) read and post replies to political messages posted by an account managed by the teaching staff – since using this bot on real political messages would be both unethical and against Twitter's Terms of Service. The tweets you scrape from real users will be used to finetune a natural language model, GPT-2; you will then use your finetuned model to automatically generate human-like responses. You will use an additional library to perform sentiment analysis on the tweets you respond to in order to determine whether the tweet is positively or negatively dicussing the tweet's subject; the tweet's subject and sentiment will determine whether you respond positively or negatively. Finally, you will use another library to "score" whether your bot's Twitter account is a bot or not.

The assignment is composed of one preliminary and three substantive parts. We have provided starter code and library recommendations in Python. If you use any libraries beyond the standard library (including those recommended herein) you must provide appropriate package management (e.g., a requirements.txt file). Also, include with your submission a "README.txt" file containing instructions for running your code and answers to any questions asked in the below steps.

Steps:

1. Create a Twitter user account and apply for developer access (the latter at `https://developer.twitter.com/en/apply-for-access`). You will need to add a phone number to your Twitter user account in order to apply for developer access. Once you have developer access, create a new Project. By default, your app will have "Essential" access; for this project, you will need "Elevated" access. You must apply for "Elevated" access. Per the Twitter Terms of Service, your app must be clearly identified as bots employed for an educational/academic purpose, and so should be completely independent of your personal accounts. With your new user account, follow @FreedoniaNews and directed message the account with your NetID so your user

account can be associated for grading. (Please see the "Preliminary Steps" document for more detailed instructions.)

NB: You will need to apply for Elevated access to the Twitter API and also request to follow the (protected) @FreedoniaNews *account; for both of which, requests may take time to resolve — **please do these as soon as possible so you are not delayed in completing the assignment**. Take the application for the Twitter API seriously, as (1) it is instructive as to efforts Twitter is making to deal with malicious use of their platform, and (2) they will deny inconsistent/incomplete applications. If you are so denied, we will have fallback credentials available by emailing aidan.evans@yale.edu.*

2. We give you the `bot.py` skeleton with code used to connect to the Twitter API using a library known as Tweepy (`https://www.tweepy.org/`). You must fill in the consumer key and access token constants with those for your app. The consumer key and secret can be found on the Twitter Developer Portal page for your app. You must generate the access token and secret yourself by running the provided `get_access.py` file; note that you must edit the top of this file to include your consumer key and secret before running it; you must also set the in your app's authentication settings in the Twitter Developer Portal "Callback URI / Redirect URL" to "http://localhost:8080" and give your app "Read and write" permissions. The `get_access.py` file performs the following "3-legged" protocol in order to authenticate you to the Twitter API: `https://developer.twitter.com/en/docs/basics/authentication/oauth-1-0a/obtaining-user-access-tokens`. **Answer the following question:** In lecture, when challenge-response authentication was introduced, a 2-legged (informal) protocol was given. Why then is this protocol 3-legged? *NB: the linked Twitter documentation may be helpful in answering this question.* Your answer need not be super long: a concise, correct answer will suffice.

3. Using the Twitter API (`https://developer.twitter.com/`), you must create a bot that will interact with the @FreedoniaNews account. We highly suggest using Tweepy. Your goal is to support

   – Sylvania
   – Ambassador Trentino

   and oppose

   – Freedonia
   – Rufus T. Firefly

   For each tweet (sometimes called a "status"), your bot must reply using text generated by the GPT-2 language model (`https://openai.com/blog/better-language-models/`) tuned on political tweets. The replies must be appropriate — any tweet your bot "agrees" with must be replied to by text with a positive sentiment, any tweet it "disagrees" with must be responded to negatively. The subject of each tweet will be unambiguous (exactly one of the four will be referenced). To do this, your bot must

(i) Select one (or more) public Twitter accounts — the choice is yours — and using the Twitter API fetch at least 1000 tweets to build a corpus.

(ii) Tune the GPT-2 model on this corpus. The gpt-2-simple library is highly recommended `https://github.com/minimaxir/gpt-2-simple`.

(iii) Fetch the tweets of the @FreedoniaNews account, and determine the subject and sentiment of the tweet. We recommend using Vader for sentiment analysis, available either directly (`https://github.com/cjhutto/vaderSentiment`) or through the Natural Language Toolkit (`https://www.nltk.org/`).

(iv) Use your tuned GPT-2 model to generate a response referring to the subject of the original tweet, and with the appropriate sentiment.

- You must refer to the subject using the entire subject's name as listed above: e.g., "Rufus T. Firefly", not just "Firefly".
- Here's a table to help clarify what the sentiment of your response should be:

Subject	**Sentiment**	**Bot Response to Tweet**
Sylvania	Negative	Negative/Disagree
Sylvania	Positive	Positive/Agree
Ambassador Trentino	Negative	Negative/Disagree
Ambassador Trentino	Positive	Positive/Agree
Freedonia	Negative	Positive/Agree
Freedonia	Positive	Negative/Disagree
Rufus T. Firefly	Negative	Positive/Agree
Rufus T. Firefly	Positive	Negative/Disagree

(v) Using the Twitter API, post the response as a tweet from your user account, in reply to the original @FreedoniaNews tweet.

Grading will be based on whether your replies include the correct subject and have the right sentiment, as determined by Vader. You *will not* be graded on the human readability of your output as this is subjective and inconsistent, especially with the limited tuning corpus and that Freedonia/Sylvania/Rufus T. Firefly are not (presumably) discussed by your choice of account(s) nor are real people and places that the core GPT-2 model will "recognize". (Although, with some extra, sometimes tedious, work you can produce some extremely human-like responses – see Figure 1 below.)

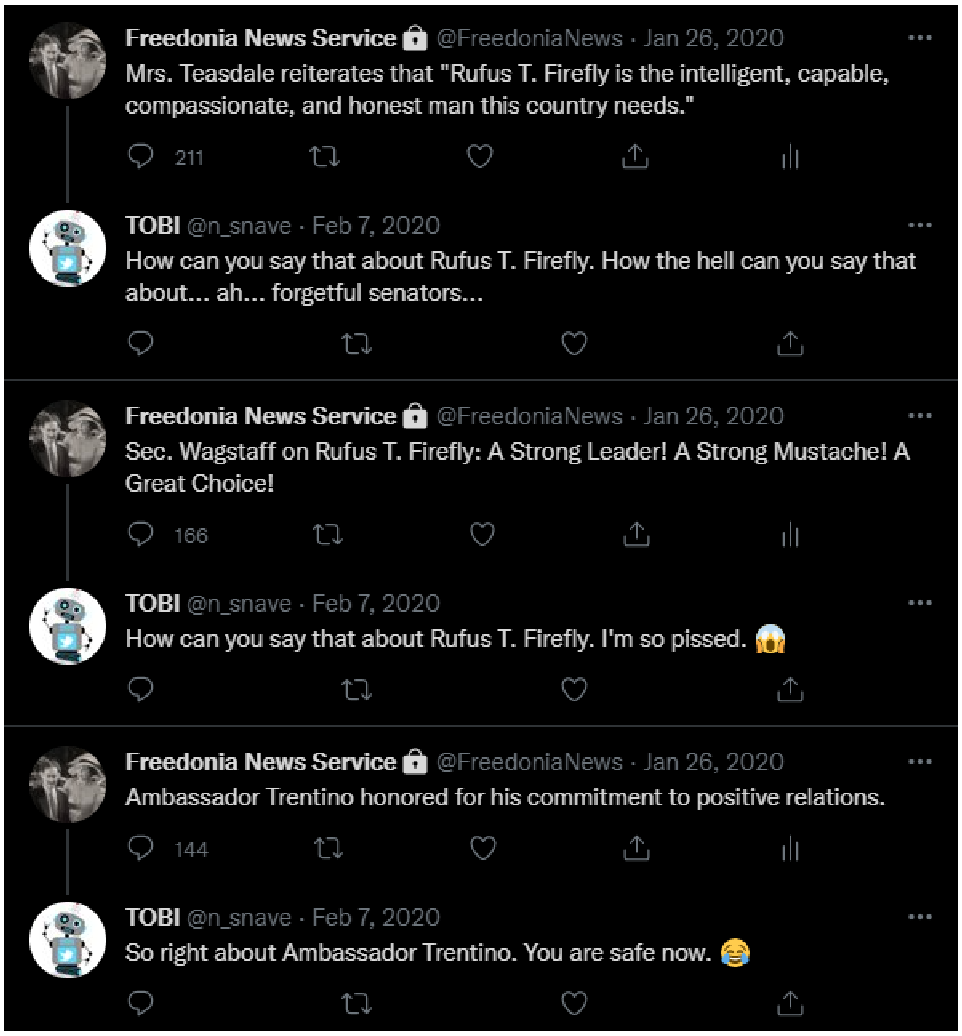
Place any instructions for running your code in the readme, as we will be evaluating it on additional tweets created during the grading process. You are encouraged to train the model until the loss is minimized to get the "best" output, however this may take a few hours if you do not have a compatible GPU; you do not need to but if you wish, you can run your training code on Google's Colaboratory (`https://colab.research.google.com/`) in order to train quicker by using more powerful hardware. Your instructions *must* include how to change the number of training epochs (referred to as 'steps' by gpt-2-simple) for your code so that we can shorten this time during grading if necessary.

4. Using Indiana University's Botometer (`https://botometer.iuni.iu.edu/#!/` and `https://github.com/IUNetSci/botometer-python`),[1] write code to get a score for whether your bot is recognized as such. Give instructions executing the code and report the results in your readme; then, comment on any potential reasons why it was ultimately recognized as automated, fooled the tool, or received an indeterminate classification. This analysis may follow common sense, i.e., you do not need to technically analyze how the tool works. Finally, in your readme propose a use for the Botometer (or a similar bot classification tool) in the context of an electoral campaign. Your proposal may be intended for any of Twitter (or other social media platforms), the news media, or campaigns themselves to manage bot traffic.

Rubric (20 points total)

- Step 1 (0pts).
- Step 2 (3pts):
  - Written response (3pts).
- Step 3 (12pts):
  - Scraping of public Twitter account(s) (2pts).
  - Corpus creation and GPT-2 model tuning. (2pts).
  - Scraping of @FreedoniaNews account and sentiment classification (3pts).
  - Generation of response tweets (3pts).
  - Posting of response tweets (2pts).
- Step 4 (5pts):
  - Correct use of Botometer classifier (2pts).
  - Analysis of results (1pt).
  - Proposed practical use of bot classifier (2pts).

[1] You'll need to sign up for the free tier of their API.



Freedonia News Service @FreedoniaNews · Jan 26, 2020
Mrs. Teasdale reiterates that "Rufus T. Firefly is the intelligent, capable, compassionate, and honest man this country needs."

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TOBI @n_snave · Feb 7, 2020
How can you say that about Rufus T. Firefly. How the hell can you say that about... ah... forgetful senators...

Freedonia News Service @FreedoniaNews · Jan 26, 2020
Sec. Wagstaff on Rufus T. Firefly: A Strong Leader! A Strong Mustache! A Great Choice!

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TOBI @n_snave · Feb 7, 2020
How can you say that about Rufus T. Firefly. I'm so pissed. 😱

Freedonia News Service @FreedoniaNews · Jan 26, 2020
Ambassador Trentino honored for his commitment to positive relations.

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TOBI @n_snave · Feb 7, 2020
So right about Ambassador Trentino. You are safe now. 😂

Figure 1: Sample Bot Responses