Simulating the Effect of Automated Accounts in a Social Media Environment

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Goals

- Design and implement a way to simulate automated ‘bot’ accounts to inflate traffic to information posted by human controlled social media accounts
- Analyze the data to determine what scale is required to ‘influence’ real users
- Provide insights into how these ‘bots’ may impact the spread of (mis)information

Related Works

- Related work has been done to attempt to quantify ‘influence’ of a user
- Work to map the spread of a certain message across a social platform
- Attempts to correlate data gathered from APIs, relate follower counts to retweets, etc.
- Determine typical behavior of automated accounts in a real environment and simplify for simulation

Research Gathered

- Data shows that 1-2% of new views will generate a retweet
  - Much higher rate for people who follow already or for accounts that have a higher ‘influence’
- Suggests new views can be randomly drawn from Exponential Distribution
- Influence of a user is a combination of follower numbers, retweet rate, and total traffic
  - Implies that accounts with lower followers can achieve high influence by having higher retweet rate

Approach

- Object oriented approach
- Discrete Event
  - Only 1 event - the generation of new tweet at each time step
- Each account is an object that has a associated number of ‘automated bots’ which are used to inflate traffic to the account
- Views are randomly generated for each account based on exponential distribution
  - function of follower number and normally distributed ‘tweet quality’
- Generate random number of new followers, from Binomial test of new views

The Basic Model

- Each account has an initial ‘influence level’
- This level increases when a new follower is gained - if the follower itself has a relatively higher influence level, it will increase by more
- This influence level will have a ‘multiplier’ effect on the number of expected views per tweet
- Created this model to simplify generation of views, retweets, and new followers, as research and related works did not provide any concrete or well established ways to model this behavior

Assumptions/Limitations

- Our model assumes ‘growth only’ Twitter environment where no account can ever lose followers
- Random generation of Impressions does not follow from known distribution
    - We did not find any data that would provide a way to generate random views
- Does not fully model a fully connected environment
    - True structure is a Directed Graph, our simulation only models only the ‘first layer’ deep

Definitions for Simulation

- Average Tweet Quality - The quality of an Account's Tweets on average
- Average Engagement Rate - The rate at which the Account's Tweets will generate engagements
- Tweet Probability - The probability that an Account will generate a Tweet event during a specific time step
- Impressions - The number of views a Tweet receives from followers and random searches
    - Impressions = Followers * Tweet Quality * Popularity Multiplier
- Popularity Multiplier - A factor that simulates the inflation of generated Impressions per Tweet per Account due to non-follower searches
- Engagements - The number of interactions a Tweet receives
    - Engagements = Impressions * Engagement Rate
- Engagement Rate - The rate at which an Account's Impressions for a given Tweet generate Engagements

Assumptions for Simulation Parameters

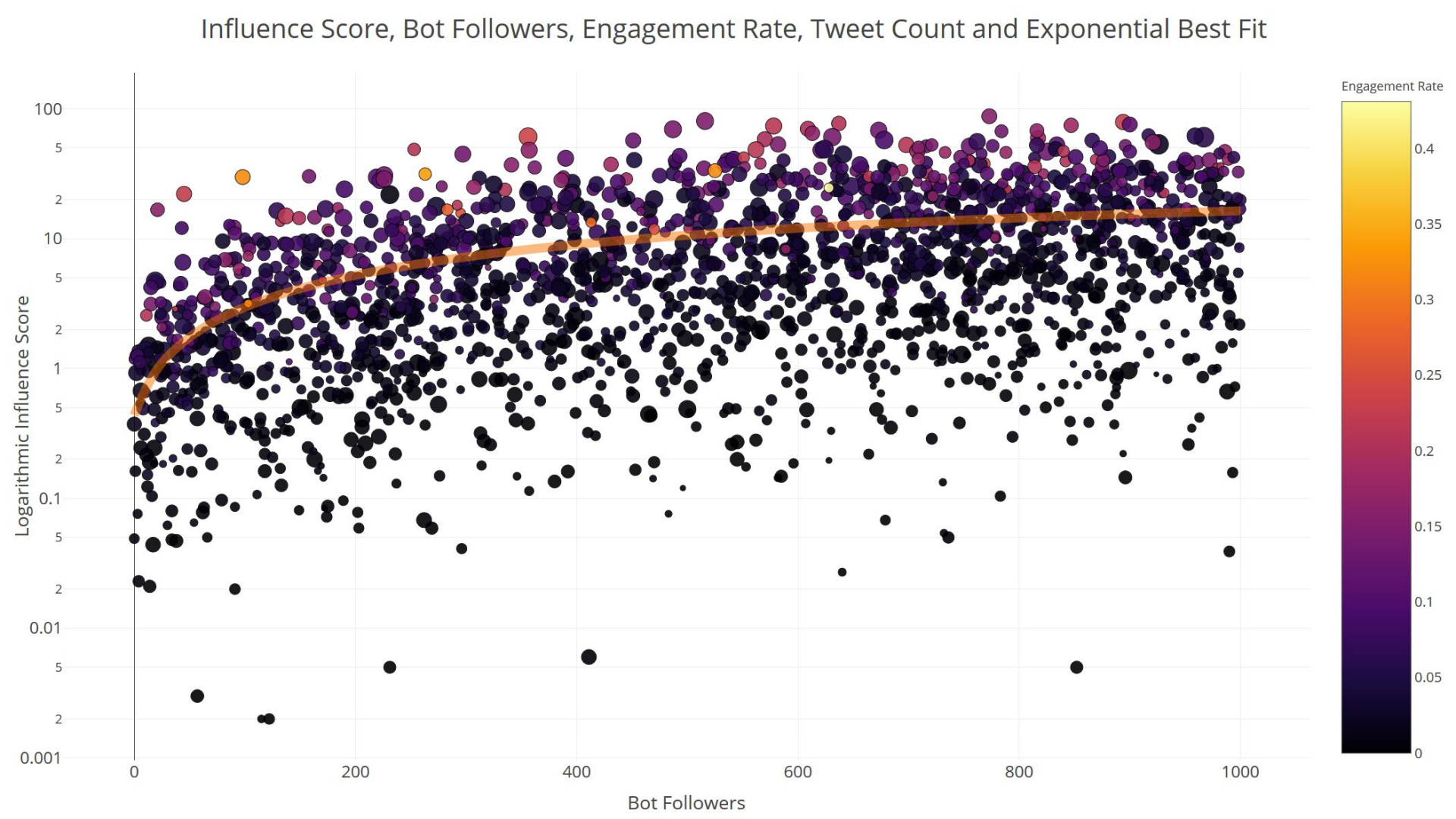
- Account is represented by the following variables:
  - Average Tweet Quality - Best Guess
    - Normally distributed - Mean = 0.5, Standard Deviation = 0.1
  - Average Engagement Rate - Researched Based
    - Exponentially distributed - Mean = 0.05
  - Tweet Probability - Best Guess
    - Normally distributed - Mean = 0.5, Standard Deviation = 0.1
  - Popularity Multiplier - Best Guess
    - Initially constant - 1.01
  - Human Follower Count - Best Guess
    - Normally distributed - Mean = 100, Standard Deviation = 10
  - Bot Follower Count - Introduced Variable of Interest
    - Uniformly distributed - Range = [0,1000]

Assumptions for Simulation Parameters Cont.

- Global environment parameters are defined as:
  - New Follower Probability
    - Constant - 0.005
  - Retweet Probability
    - Constant - 0.01

Results

- 200 simulations were performed, generating 2,000 distinct accounts and 10,000,000 unique Tweets
- Data shows a surprising trend is present


Influence Score, Bot Followers, Engagement Rate, Tweet Count and Exponential Best Fit
Logarithmic Influence Score
100
5
2
10
5
2
1
5
2
0.1
5
2
0.01
5
2
0.001
0
200
400
600
800
1000
Bot Followers
Engagement Rate
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0

Future Expansion

- Add a real time tracking, allow for message frequency to impact the rate of new view generation as research shows this can have a fair amount of impact on results
- Evaluate data from social media or other similar interactions that may help to model new views and how to determine the conversion of traffic into followers that will help the information to spread
- Expand the model to include all accounts in the simulation
- Allows for negative growth of each account