Rhetoric Mining for Fake News: Identifying Moves of Persuasion and Disinformation

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Abstract

We propose a novel Rhetoric Mining methodology to identify moves of persuasion used in disinformation of social media news posts. Rhetoric Mining combines qualitative methodologies and rhetorical theory analysis with machine learning techniques to automatically identify rhetorical moves. Rhetorical moves are instances of discourse intentionally used to persuade an audience. Rhetoric Mining converts the qualitative detection of persuasive moves into quantified rhetoric instance vectors which can be used to characterize rhetorical styles of a text. We identify rhetorical styles of persuasion (news posts with high positive responses, likes, shares, or re-posts) as well as disinformation (news posts that are persuasive but false).

Keywords

Rhetoric mining, persuasion, disinformation.

Motivation

Fake News has become an increasingly relevant concern for information validation and the influence of social media on individual and community beliefs. In the "post-truth" era, facts are less influential in shaping public opinion than appeals to emotion and confirmation of existing beliefs (Dale 2017). Social media news sites reinforce click-bait behavior by posting related content based on current user preferences. This creates social cliques or "echo chambers" where current beliefs are reinforced without regard to source verification. Social media platforms have a responsibility to flag false news posts or warn readers of potential disinformation. Text mining tools have already improved information transparency in other online platforms such as product reviews. In online reviews, we see product ratings as well as review helpfulness ratings. Several online review platforms, such as Amazon, have also started implementing "fake review" detection algorithms to prevent or remove disinformation in consumer decision making. Similar tools need to be developed and implemented for news posts on social media to guide users in making a belief choice rather than a purchase choice. Providing a rating of information validity or skepticism can educate readers in critical thinking and media literacy or at least create a caution when accepting new information or making future decisions (Roozenbeek et al. 2018; van der Linden et al. 2017; Marwick & Luis 2017).

We develop a novel text mining methodology of Rhetoric Mining which can be used to identify moves of persuasion used in disinformation of social media news posts. Rhetoric is any intentional language choice used to persuade others. Rhetorical approaches to studying language focus on analyzing the use of language by speakers and writers to influence an audience to think or act in a particular way. Rhetoric Mining combines qualitative methodologies and rhetorical theory analysis with machine learning techniques to automatically identify rhetorical moves. Rhetorical moves are units of text used with some communicative purpose, typically to persuade. These instances of discourse are identified based on a particular rhetorical analysis theory. For example, a neo-Aristotelian rhetorical theory includes ethos moves (the use of personal character to create trust), and an instance of an ethos move may be "trust me, I'm a doctor." Rhetoric Mining converts the qualitative identification of rhetorical moves into quantitative instance vectors per unit of text. We can then characterize rhetorical styles based on combinations of moves in the rhetoric

instance vectors. In this research, we use Rhetoric Mining to analyze the validity and influence of social news media posts. We identify rhetorical styles of *persuasion* (news posts with high positive responses, likes, shares, or re-posts) as well as *disinformation* (news posts that are persuasive but false). There is valuable information to be gained from a rhetorical analysis of social media news posts, and thus there is a need to develop and validate a computational approach to studying how rhetoric is employed to influence beliefs and decision making.

Comparative Approaches

Several recent developments have been made in information systems research analyzing fake news and disinformation. Some studies look at the social network of online information sharing. Zhang, et.al. (2018) create FakeDetector to build a deep diffusive network model to study the representations of news articles, analyzing authors and subjects simultaneously. They study tweets posted by PolitiFact to better understand how fake news is distributed. Wu and Lie (2018) propose a TraceMiner tool to study social network structures and propagation pathways of disinformation. Ruchansky, et.al. (2017) use a recurrent neural network to study temporal engagements with news articles and user reactions. Other studies have examined the content of fake news posts. Janze and Risius (2017) analyze Facebook news posts using the Elaboration Likelihood Model to assess affection, behavior, and cognition attitudes of belief acceptance. Shu, et.al. (2017) include auxiliary information of users' social behavior with fake news posts, likes, and shares.

Rhetoric enables us to understand language in its relationship to decisions and actions as well as incorporate contextual and situational influences on decision-making. A rhetorical analysis includes critique of the speaker (or writer), the audience (or reader), the situation or context in which the speaker and audience interact, and the goal the speaker is trying to achieve by persuading the audience. This points to an opportunity to extend the typically in-depth, small-scale analysis employed by rhetoric scholars in humanities and social sciences to a larger-scale rhetorical analysis through the development of computational approaches in information systems and business analytics. Rhetoric Mining is a novel approach in the fields of both rhetoric and text mining. The advantage of Rhetoric Mining is the ability to leverage the qualitative analysis to efficiently scan large amounts of text, converting qualitative information into quantitative vectors of tabulated instances of rhetorical moves. Rhetoric mining therefore extends a typically qualitative research approach to the computational generation of numerical data representing the rhetorical approaches used by the authors within a large collection of documents. This allows for a typically quantitative decision-science analysis to include richer information (Lacity & Janson 1994; Miller 1990). Our work bridges a disciplinary gap between the related fields of rhetoric and decision science by offering a computational method for rhetorical analysis of large volumes of text data.

Rhetoric Mining

Rhetoric Mining provides a new analytic lens in Information Systems research, identifying unique styles of persuasion. It is an interdisciplinary approach combining rhetorical theory and qualitative analysis, text mining techniques of natural language processing (NLP) and machine learning, computational biology sequence alignment, and data mining classification methods (Figure 1). Rhetoric Mining is a mixed-methodology approach which combines qualitative context analysis with automated tagging and quantification of rhetorical moves. Quantifying rhetorical moves allows researchers to analyze the influence of persuasion in consumer decision-making. Rhetorical moves are complex discursive patterns reflecting intentional language choices to persuade an audience. They therefore require a sequence-based text mining approach rather than simpler word-based frequency analyses used in natural language processing. We apply a sequence alignment method and demonstrate its high precision performance in detecting semantically equivalent sequences in a large text corpus. Our adaptation of this sequence alignment method enables us to transform the qualitative analysis of persuasion into quantitative instances of rhetorical moves for any unit of text.
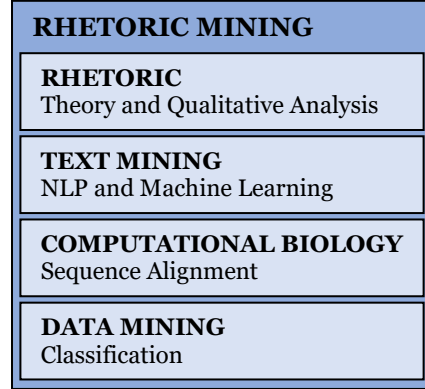
RHETORIC MINING

RHETORIC
Theory and Qualitative Analysis

TEXT MINING
NLP and Machine Learning

COMPUTATIONAL BIOLOGY
Sequence Alignment

DATA MINING
Classification

**Figure 1: Rhetoric Mining Interdisciplinary
Components and Mixed-Methodology Approach**

Our methodology involves three general steps: 1) context analysis of the overall data set to identify salient rhetorical moves, 2) manual highlighting of a sample of text in order to create sequence definitions of each rhetorical move, and 3) computational highlighting of the remaining data set to quantify and analyze vectors of instances of rhetorical moves (Figure 2).
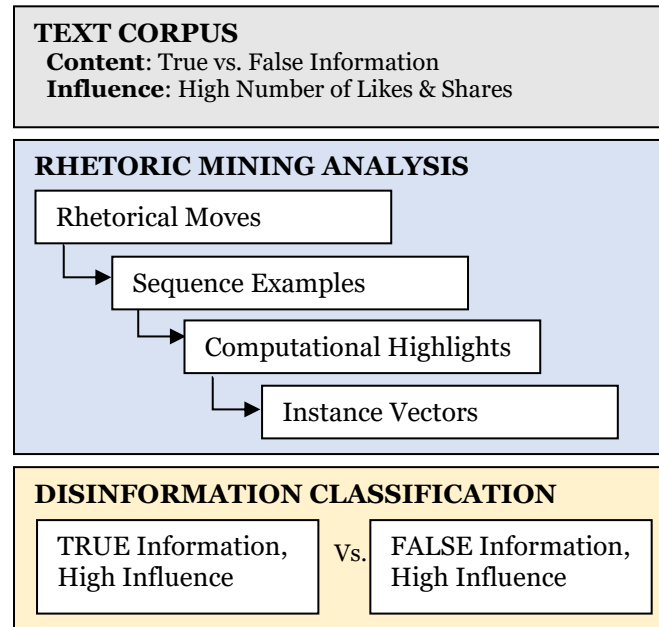

TEXT CORPUS
  Content: True vs. False Information
  Influence: High Number of Likes & Shares

RHETORIC MINING ANALYSIS

Rhetorical Moves

Sequence Examples

Computational Highlights

Instance Vectors

DISINFORMATION CLASSIFICATION

TRUE Information, High Influence | Vs. | FALSE Information, High Influence

**Figure 2: Rhetoric Mining for Disinformation Classification
of True vs. False Information with High Influence**

Context analysis includes understanding the decision making environment, key decision makers, and language-based as well as non-language-based influences on decision makers. This also includes recognizing the "speakers" and "audience" in the data context and why the speakers are motivated to persuade this particular audience. Rhetorical analysis identifies moves of persuasion, cultural references, and other methods of relating to an audience. Rhetorical analysis draws on several methods of rhetorical criticism established by seminal scholars in rhetoric: neo-Aristotelian criticism (examining tools of organization or invention, as well as persuasive appeals such as ethos, pathos, and logos) (Aristotle 350BC), rhetorical situation (exigence, audience, constraints) (Bitzer 1968), metaphor analysis (creating connections using comparisons) (Lakoff and Johnson 1980), narrative critique (identifying people, places, events, actions, and plots) (Geertz 1973), pentadic analysis (examining ratios of act, agent, agency, scene, and purpose) (Burke 1969), ideological analysis (identifying underlying beliefs and values) (Althusser 1971),

feminist criticism (seeking out marginalized perspectives) (Butler 1990), and genre analysis (critiquing conventional expectations of genre) (Bakhtin 1986). The selection of a particular method of rhetorical criticism depends on the artifact of study, the perspective of the researcher, and the context of the rhetorical situation. We determine which rhetorical moves are most relevant to a particular text given a particular context. This step requires qualitative analysis, resulting in identification of important textual and non-textual features, which will then inform quantitative analysis of the decision-making process.

Rhetorical Move	*Ethos* (character trust)	*Pathos* (emotional appeal)	
Sequence Examples	"As a journalist"	"children suffering"	
Computational Highlights	"As a journalist", "As a writer", "As a reporter"	"children suffering", "people suffering", "families in anguish"	
Instance Vectors	Unit of Text	*Ethos*	*Pathos*
	"As a journalist, I have never seen so many children suffering"	1	1

Figure 3: Rhetoric Mining Analysis example for ethos and pathos moves.

Once a set of rhetorical moves has been identified, we provide specific examples from the actual text source. This qualitative process of content analysis should be performed by two or more human coders following an established protocol defining each rhetorical move (Krippendorf 2004). Once the sample instances have been highlighted for each rhetorical move, we extract the highlighted sequences to create a sequence bank for each rhetorical move definition. We use a sequence alignment algorithm based on the Smith-Waterman local sequence alignment algorithm used for genetic sequencing in computational biology (Smith and Waterman 1981). The sequence alignment algorithm evaluates an alignment score by comparing word-by-word matches between the sequence examples of rhetorical moves and the larger text corpus, highlighting matches which contain exact-word or synonym-based matches within a sequence of words. We then generate computational highlights for the entire corpus for each rhetorical move. This produces rhetoric vectors with the number of instances of each rhetorical move for each unit of text. See Figure 3 for an example of Rhetoric Mining analysis for the rhetorical moves of ethos (character trust) and pathos (emotional appeal).

Identifying Moves of Disinformation

In this research, we use Rhetoric Mining to analyze a text corpus of online news articles in order to determine rhetorical styles used in true information versus false information posts. We classify disinformation based on content validation (true or false) as well as user influence (Figure 2). We collect news articles with true and false information labels from two datasets: BuzzFeed-Webis Fake News Corpus and LIAR Fake News Corpus.

The BuzzFeed-Webis Fake News Corpus (2016) comprises the output of nine publishers in a week close to the 2016 US elections. Out of the nine publishers, six are hyper-partisan with three left-wing and three right-wing publishers, and the remaining three publishers are mainstream. Every post and linked article were collected from these publishers for a total of seven days, from September 19 to 23, and September 26 and 17, 2016. All posts are fact-checked by professional journalists at BuzzFeed. The dataset contains 1627 articles, out of which 826 are mainstream, 256 are left-wing and 545 are right-wing. The articles are marked using the scale: no factual content, mostly false, mixture of true and false, and mostly true. Potthast, et.al. (2018) describes the creation of the dataset.

The LIAR Fake News Corpus includes 12,836 human-labeled short statements, which are sampled from various contexts, such as news releases, TV or radio interviews, campaign speeches, etc. These statements are rated by the fact-checking website PoitiFact into labels for truthfulness using the scale: pants-fire, false, barely-true, half-true, mostly-true, and true. The dataset also include counts of statements that correspond to the scale levels for each statement. Wang (2017) describes the dataset development.

In addition to these two datasets as labels of true and false information, we collect social influence markers from the original news sources. High influence articles are those with a high number of likes or shares (re-

posts). We compare the rhetorical styles used in *influential and true* news posts versus *influential but false* news posts. Thus creating a rhetoric-based classification model of disinformation identification.

Future Work

This work is an emergent research project. We have begun data collection. We have already developed and tested the Rhetoric Mining methodology in previous work examining trustworthiness of stock investment pitches as well as trustworthiness of online product reviews. Rhetoric Mining has a strong potential to offer a computational analysis of a typically qualitative language study. We believe that Rhetoric Mining can be used to develop tools for social media news disinformation ratings, in hopes of helping users critically evaluate the rhetorical influence on their belief choices.

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