

Analysis on new Avenues in Opinion mining and Sentiment Analysis

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Abstract— The main goal of this New Avenues in Opinion mining and Sentiment Analysis is to extracting, classifying, understanding and accessing the opinions expressed in various online news sources social media comments, and other user-generated content. Here opinion mining refers to computational techniques for analysing the opinions that are extracted from various sources. Current opinion research focuses on business and e-commerce, such as product reviews and movie ratings.

Researchers developed a framework for analysis in their major stages such as stakeholder analysis, topical analysis, sentiment analysis and stock modeling. During the stakeholder analysis stage, they identified the stakeholder groups participating in Web forum discussions. The sentiment analysis stage consists of assessing the feelings expressed by the Web forum participants in their treatments. Lastly, in the stock modeling stage, they test the relationships between various attributes of Web forum discussions and the firm's stock behaviour.

Keywords— Opinion mining , Sentiment Analysis , Lexical affinity, Statistical methods and Concept-based approaches,etc.

1. INTRODUCTION

1.1 Opinion Mining

Opinion mining is a process for tracking the mood of the public about a certain product, for example, by building a system to examine the conversations happening around it. Opinion mining is a type of natural language processing for tracking the mood of the public about a particular product, which is also called Sentiment analysis, involves building a system to collect and categorize opinions about a product. Automated opinion mining often uses machine learning, a type of artificial intelligence (AI), to mine text for sentiment [14].Opinion mining is used to automate the process of identifying opinion whether it is a positive or negative view. Majority of previous works on this field uses natural language programming techniques to identify the sentiment [3].

1.2 Sentiment Analysis

Sentiment analysis is often used in opinion mining to identify sentiment, affect, subjectivity, and other emotional states in online text. For example, they might seek to answer these such questions:

- What was the opinions of young US voters toward the Democratic and Republican presidential candidates during the most recent election?
- Since September 11, how do the international Jihadi forums introduce radical ideology and incite young members?

- What are the opinions and comments of investors, employees, and activists toward Wal-Mart in light of its cost-reduction efforts and global business practices?
- What was the most successful McDonald's promotional campaign conducted recently in China, and why did it succeed? Which McDonald's product is most preferred by young students in China and why?

Much advanced research in this area has recently focused on several critical areas. Researchers have also been able to classify text segments based on sentiment, affect, and subjectivity by analyzing positive or negative sentiment expressed in sentences, the degree of violence expressed in forum messages, and so on.

Expressing opinions on a particular product or service is very easy with the advancement of online communication technologies. Opinions and sentiments are expressed freely in electronic forums, blog or the most famous would be social networking Websites such as Twitter or Facebook. These opinions are referred to by other customers before any transaction takes place. Therefore, it is important for the provider of a product or service to capture and analyze opinions or sentiments that are expressed online. The feedbacks from customers can help an organization to improve the quality of its product and service. From this, a provider can also spark ideas towards new product or service.

Opinion mining or sentiment analysis refers to activities that automatically identify a sentiment (such as a positive or negative sentiment) from a group of words such as a sentence or a document. Since 2001, this field has gained popularity among researchers due to the advancement of Internet technology and the advancement of machine learning techniques in information retrieval [1]. Prior to that, most works in sentiment analysis were done using methods that are embodied in natural language processing (NLP). Even though NLP techniques produce good result, it cannot be applied to online reviews due to the occurrence of noisy texts. Incorrect spelling, incorrect language structure, use of slang and the mixing of languages that cause difficulty in constructing correct sentence structure [2].

2. BRIEF LITERATURE SURVEY

The main sources of information were friends and specialized magazine or websites. Now, the "social web" provides new tools to efficiently create and share ideas with everyone connected to the World Wide Web. Forums, blogs, social networks, and content-sharing services help people share useful information [1]. This information is unstructured, because it's produced for human consumption, it's not something that's "machine process able." Capturing public opinion about social events, political movements, company strategies, marketing campaigns, and product preferences is garnering increasing interest from the scientific community (for the exciting open challenges), and from the business world (for the remarkable marketing fallouts and for possible financial market prediction)[2].

In New Avenues in Opinion Mining and Sentiment Analysis researchers concluded opinion was, resulting emerging fields of opinion mining and sentiment analysis commonly used interchangeably to denote the same field of study, opinion mining and sentiment analysis actually focus on polarity detection and emotion recognition, respectively. Because the identification of sentiment is often exploited for detecting polarity, however, the two fields are usually combined under the same umbrella or even used as synonyms. Both fields use data mining and natural language processing (NLP) techniques to discover, retrieve, and distil information and opinions from the World Wide Web's vast textual information.[3]

Mining opinions and sentiments from natural language is challenging, because it requires a deep understanding of the explicit and implicit, regular and irregular, and syntactical and semantic language rules. Sentiment analysis researchers struggle with NLP's unresolved problems: co reference resolution, negation handling, anaphora resolution, named-entity recognition, and word-sense disambiguation. Opinion mining is a very restricted NLP problem, because the system only needs to understand the positive or negative sentiments of each sentence and the target entities or topics. Therefore, sentiment analysis is an opportunity for NLP researchers to make tangible progress on all fronts of NLP, and potentially have a huge practical impact.

In Common Sentiment Analysis Tasks, opinion mining is polarity classification. Polarity classification occurs when a piece of text stating an opinion on a single issue is classified as one of two opposing sentiments. Reviews such as "thumbs up" versus "thumbs down," or "like" versus "dislike" are examples of polarity classification [3]. They strongly discussed that, sentiment analysis research is distinguishing itself as a separate field, falling between NLP and natural language understanding. Unlike standard syntactical NLP

tasks, such as summarization and auto categorization, opinion mining mainly focuses on semantic inferences and affective information associated with natural language, and doesn't require a deep understanding of text. They envision sentiment analysis research moving toward content-, concept-, and context-based analysis of natural language text, supported by time efficient parsing techniques suitable for big social data analysis[3]. Multimodal Sentiment Analysis reviews new sources of opinion mining and sentiment analysis abound. Webcams installed in Smartphone's, touchpad's, or other devices let users post opinions in an audio or audio-visual format rather than in text, many new areas might be useful in opinion mining, such as facial expression, body movement

Margaret Rouse posted in her article Opinion mining (sentiment mining) challenges: There are several challenges in opinion mining. The first is that a word that is considered to be positive in one situation may be considered negative in another situation. Take the word "long" for instance. If a customer said a laptop's battery life was long, that would be a positive opinion. If the customer said that the laptop's start-up time was long, however, that would be a negative opinion. These differences mean that an opinion system trained to gather opinions on one type of product or product feature may not perform very well on another [15]. A second challenge is that people don't always express opinions the same way. Most traditional text processing relies on the fact that small differences between two pieces of text don't change the meaning very much. In opinion mining, however, "the movie was great" is very different from "the movie was not great".

Norlela Samsudin, Mazidah Puteh and his colleagues reports the use of artificial immune system (AIS) technique in identifying Malaysian online movie reviews. Artificial immune system (AIS) refers to the reaction of an organism to infectious diseases by foreign substances known as pathogens or antigens. This opinion mining process uses three string similarity functions namely Cosine Similarity, Jaccard Coefficient and Sorensen Coefficient. In addition, AIS performance was compared with other traditional machine learning techniques, which are Support Vector Machine, Naïve Baiyes and k-Nearest Network. The result of the findings are analyzed and discussed [4].

Alexandra Balahur, Ralf Steinberger and their friends published an article Opinion Mining on Newspaper Quotations in which they present Opinion mining is the task of extracting from a set of documents opinions expressed by a source on a specified target. This article also presents a comparative study on the methods and resources that can be employed for mining opinions from quotations (reported speech) in newspaper articles. Opinion holders are more important in news articles because we often explicitly state the person or organization that holds a particular opinion. An opinion on a feature f (or object o) is a positive or negative view or appraisal on f (or o) from an opinion holder. Positive and negative are called opinion orientations [2].

Alexander Pak, Patrick Paroubek express their opinion on Twitter as a Corpus for Sentiment Analysis and Opinion Mining, Micro blogging today has become a very popular communication tool among Internet users. Therefore microblogging Web-sites are rich sources of data for opinion mining and sentiment analysis. They focus on using Twitter, the most popular microblogging platform, for the task of sentiment analysis in that they show how to automatically collect a corpus for sentiment analysis and opinion mining purposes. Twitter Sentiment Analysis can be cast as a classification problem where the task is to classify messages into two categories depending on whether they convey positive or negative feelings [9]. Twitter sentiment analysis is not an easy task because a tweet can contain a significant amount of information in very compressed form, and simultaneously carry positive and negative feelings.

Researchers from Opinion Miner: A Novel Machine Learning System for Web Opinion Mining and Extraction expressed their opinion. Merchants selling products on the Web often ask their customers to share their opinions and hands-on experiences on products they have purchased. Unfortunately, reading through all customer reviews is difficult, especially for popular items, the number of reviews can be up to hundreds or even thousands. This makes it difficult for a potential customer to read them to make an informed decision. The Opinion Miner system designed in this work aims to mine customer reviews of a product and extract high detailed product entities on which reviewers express their opinions. Opinion expressions classified as positive or negative .

3. MOTIVATION

As mentioned in the previous section, extensive work has already been conducted on opinion mining, at different levels of text and on different polarity scales. Applications include a variety of areas, depending on the source and final user of the extracted data – from monitoring the image of public figures to company reputation or trust, monitoring and analysing social media to detect potentially dangerous situations and what is done about them, or tracking opinion across time for market and financial studies.

Advent of Web 2.0 and social media content has stirred much excitement and created abundant opportunities for understanding the opinions of the general public and consumers toward social events, political movements, company strategies, marketing campaigns, and product preferences. Many new and exciting social, geo political, and business-related research questions can be answered by analyzing the thousands, even millions, of comments and responses expressed in various blogs (such as the blogosphere), forums (such as Yahoo Forums), social media and social network sites (including YouTube, Facebook, and Flickr), virtual worlds (such as Second Life), and tweets (Twitter). Reviews abound on the Web 2.0 consumer demands for review on electronics, hotels, etc. Automatic extraction of customer opinions can benefit both manufacturers and customer.

On recent years, The e-commerce sector is one of the most affected by the amount of data produced by customers, which increased dramatically during the phase known as Web 2.0. Customer's opinions represent a valuable unique type of information which should not be mistreated or ignored by the research community. From the customer perspective, considering others opinions before purchasing a product is a common behaviour long before the existence of Internet. In the era of the digital world, the difference is that a customer has access to thousands of opinions, which greatly improves decision making. Basically, customers want to find the best for the lowest price. In other words, they search for products that best fulfil their needs inside a price range that they are willing to pay.

It is important to emphasize that the benefit of analyzing other opinions, comes from their neutral nature, which are usually not linked to an organization or company. They represent the voice of ordinary consumers, and that differs greatly from ads (advertisements are biased and tend to favour the product, emphasizing the positives aspects and concealing the negatives ones). From the e-commerce perspective, receiving consumer's feedback can greatly improve its strategies in order to increase profits of the sector. For example, an online shop can place smart ads by measuring the level of satisfaction of consumers for a given product. For instance, if a product has a low level of satisfaction, a smart strategy would be placing a competitor. The actual search systems are focused on facts (e.g ranking mechanisms used by search engine). Therefore, one opinion from an object under discussion (OuD) is usually different from multiple opinions for the same OuD. The proposed framework will combine several techniques to extract valuable information out of natural language text (user-generated content), in order to provide enrichment of the experience of users by taking advantage of the available content in a more intelligent and organized way.

4. PROBLEM DEFINITION

Sentiment analysis is the computational study of people's opinions, appraisals, and emotions toward entities, events and their attributes. In the past few years, this field has attracted a great deal of attention from both the academia and industry due to many challenging research problems and a range of applications.

Opinions are important because whenever people and organizations need to make a decision, they want to hear others' opinions existed before the Web. In the past, when making a decision, individuals typically asked for opinions from friends and families. When an organization wanted to find opinions of the general public about its products and services, it conducted surveys and focus groups. People can now post reviews of products at merchant sites and express their views on almost anything in discussion forums and blogs, and at social network sites. Hence, individuals are no longer limited to asking friends and families because of the plethora of user-generated product reviews and opinions available on the Web.

In many cases, opinions are hidden in long forum posts and blogs, so it is difficult for a human reader to find relevant sites, extract related sentences with opinions, read them, summarize them, and organize them into usable formats. The research in the field started with sentiment and subjectivity classification, which treated the problem as a text classification problem.¹ Sentiment classification classifies whether an opinionated document (such as product reviews) or sentence expresses a positive or negative opinion.² Subjectivity classification determines whether a sentence is subjective or objective.³ Many real-life applications, however, require more detailed analysis because users often want to know the subject of opinions. For example, from a product review, users want to know which product features consumers have praised and criticized.

5. OBJECTIVE(S)

The Goals intended to be achieved according to Problem Statement, described in below section:

1. Opinion mining, a sub discipline within data mining and computational linguistics, refers to the computational techniques for extracting, classifying, understanding, and assessing the opinions expressed in various online news sources, social media comments, and other user-generated content.

2. Sentiment analysis is often used in opinion mining uses natural language programming (NLP) techniques to identify the sentiment to identify sentiment, affect, subjectivity, and other emotional states in online text.
3. Researchers have also been able to classify text segments based on sentiment, affect, and subjectivity by analyzing positive or negative sentiment expressed in sentences, the degree of violence expressed in forum messages, and so on.
4. Advanced and mature techniques have been developed especially for English, public opinions expressed by citizens in different parts of the world, new, scalable opinion mining and sentiment analysis resources and techniques need to be developed for various languages.
5. Current opinion mining research artificial immune system (AIS) technique has focused on business and e-commerce applications, such as product reviews and movie ratings.
6. captured the opinion-related body language expressed by Second Life participants (such as thumbs-up, thumbs-down, and applause) for opinion mining.
7. Polarity classifications occur when a piece of text stating an opinion on a single issue is classified as one of two opposing sentiments. Reviews such as “thumbs up” versus “thumbs down,” or “like” versus “dislike” are examples of polarity classification..
8. Agreement detection determines whether a pair of text documents should receive the same or different sentiment-related labels.
9. General textual analysis uses part of speech (POS) information (for example, nouns, adjectives, adverbs, and verbs, phrases) as a basic form of word-sense disambiguation.
10. Here tried for achieved From Heuristics to Discourse Structure, From Coarse- to Fine-Grained Analysis, Keyword spotting, Lexical affinity, Statistical methods and Concept-based approaches.

6. PROPOSED WORK

6.1 Methodology and Workflow

Following are the steps to extracting the opinions.

- Identify the objects.
- Feature extraction and synonym grouping.
- Opinion orientation determination.
- Integration.
- polarity classification
- Agreement detection
- keyword spotting
- Lexical affinity
- Statistical methods
- Concept-based techniques

6.1.1 Natural Language Processing

NLP to discover, retrieve, and distil information and opinions from the World Wide Web's vast textual information. Word Sense Disambiguation (WSD) is an intermediate task of Natural Language Processing. Use natural processing algorithm to find the positive and negative opinion, use data mining algorithm to extracting data from data base. Use of a Word Sense Disambiguation algorithm is done to determine the correct sense of the words in the opinion. Word-based Method Applied to Polarity Classification. It consists in

selecting the appropriate meaning of a word given the context in which it occurs. WSD algorithm for the finding the correct meaning of the sentence.

6.1.2 Module Description

Posting opinions:

In this module, they get the opinions from various people about business, e-commerce and products through online. The opinions may be of two types. Direct opinion and comparative opinion. Direct opinion is to post a comment about the components and attributes of products directly. Comparative opinion is to post a comment based on comparison of two or more products. The comments may be positive or negative.

Object identification:

In general, people can express opinions on any target entity like products, services, individuals, organizations, or events. In this project, the term object is used to denote the target entity that has been commented on. For each comment, we have to identify an object. Based on objects, we have to integrate and generate ratings for opinions.

The object is represented as "O". An opinionated document contains opinion on a set of objects as $\{o_1, o_2, o_3 \dots o_n\}$.

Feature extraction:

An object can have a set of components (or parts) and a set of attributes (or properties) which they collectively call the features of the object. For example, a cellular phone is an object. It has a set of components (such as battery and screen) and a set of attributes (such as voice quality and size), which are all called *features* (or *aspects*). An opinion can be expressed on any feature of the object and also on the object itself. With these concepts in mind, we can define an object model, a model of an opinionated text, and the mining objective, which are collectively called the *feature-based sentiment analysis model*. In the *object model*, an object "O" is represented with a finite set of features,

$$F \subseteq \{f_1, f_2, \dots, f_n\}$$

This includes the object itself as a special feature. Each feature $f_i \in F$ can be expressed by any one of a finite set of words or phrases

$$W_i \subseteq \{w_{i1}, w_{i2}, \dots, w_{im}\}$$

Which are the feature's *synonyms*.

Opinion-orientation determination:

The opinion holder is the person or organization that expresses the opinion. In the case of product reviews and blogs, opinion holders are usually the authors of the posts. An opinion on a feature f (or object o) is a positive or negative view or appraisal on f (or o) from an opinion holder. Positive and negative are called opinion orientations. From this opinion orientation we have to determine the type of opinion whether it is direct opinion or comparative opinion.

❖ **Direct opinion:**

A *direct opinion* is a quintuple $(o_j, f_{jk}, oo_{ijkl}, h_i, t_i)$,
where o_j is an object,

f_{jk} is a feature of the object o_j ,

oo_{ijkl} is the orientation of the opinion on feature f_{jk} of object o_j ,

h_i is the opinion holder, and

t_i is the time when the opinion is expressed by h_i .

The opinion orientation oo_{ijkl} can be positive, negative, or neutral.

❖ **Comparative opinion:**

A *comparative opinion* expresses a preference relation of two or more object based their shared features. A comparative opinion is usually conveyed using the comparative or superlative form of an adjective or adverb, such as "Coke tastes better than Pepsi."

Integration:

Integrating these tasks is also complicated because we need to match the five pieces of information in the quintuple. That is, the opinion oo_{ijkl} must be given by opinion holder h_i on feature f_{jk} of object o_j at time t_l . To make matters worse, a sentence might not explicitly mention some pieces of information, but they are implied using pronouns, language conventions, and context. Then generate ratings based on above tasks. Thus we can clearly see how holders view the different features of each product.

Polarity Classification:

The basic task of opinion mining is polarity classification. Polarity classification occurs when a piece of text stating an opinion on a single issue is classified as one of two opposing sentiments. Reviews such as “thumbs up” versus “thumbs down,” or “like” versus “dislike” are examples of polarity classification. Polarity classifications also identify pro and con expressions in online reviews and help make the product evaluations more credible.

Agreement detection:

Agreement detection is another form of binary sentiment classification. Agreement detection determines whether a pair of text documents should receive the same or different sentiment-related labels. After the system identifies the polarity classification, it might assign *degrees of positivity* to the polarity—that is, it might locate the opinion on a continuum between positive and negative.

Keyword spotting:

This approach classifies text by affect categories based on the presence of unambiguous affect words such as happy, sad, afraid, and bored. Keyword spotting relies on the presence of obvious affect words that are only surface features of the prose.

Lexical affinity:

Lexical affinity is slightly more sophisticated than keyword spotting. This approach not only detects obvious affect words, it also assigns arbitrary words a probable “affinity” to particular emotions.

Statistical methods:

This approach, which includes Bayesian inference and support vector machines, is popular for affect text classification. Researchers use statistical methods on projects such as Pang’s movie review classifier and many others. By feeding a machine-learning algorithm a large training corpus of affectively annotated texts, the system might not only learn the affective valence of affect keywords (as in the keyword spotting approach), but also take into account the valence of other arbitrary keywords (similar to lexical affinity), punctuation, and word co-occurrence frequencies.

Concept-based techniques:

These methods use Web ontologies or semantic networks to accomplish semantic text analysis. This helps the system grasp the conceptual and affective information associated with natural language opinions. By relying on large semantic knowledge bases, such approaches step away from blindly using keywords and word co-occurrence counts, and instead rely on the implicit meaning/features associated with natural language concepts. Superior to purely syntactical techniques, concept-based approaches can detect subtly expressed sentiments. Concept-based approaches can analyze multi-word expressions that don’t explicitly convey emotion, but are related to concepts that do.

6.1.3 Algorithm for WSD

$P(w)$ = Positive value of s in a lexical resource.

$N(w)$ = Negative value of s in a lexical resource.

Finally, the global positive and negative scores (S_p , S_n) are calculated as:

$$\begin{aligned} S_p &= \sum P(w) & w: P(w) > N(w) \\ S_n &= \sum N(w) & w: N(w) > P(w) \end{aligned}$$

If $S_p > S_n$ then the opinion is considered as positive. If $S_p < S_n$ the opinion is negative.
Finally, if $S_p = S_n$ the opinion is considered as neutral.

6.1.4 Artificial Immune System (AIS) Technique

AIS technique use in identifying Malaysian online movie reviews. This opinion mining process uses three string similarity functions namely Cosine Similarity, Jaccard Coefficient and Sorensen Coefficient. In addition, AIS performance was compared with other traditional machine learning techniques, which are Support Vector Machine, Naïve Baiyes and k-Nearest Network. In order to classify online reviews into corresponding positive and negative reviews, each review was considered as an artificial immune cell.

6.1.5 Feature Selection with Opinion Mining

Feature Selection based on Immune Network System (FSINS) which inspired from the Artificial Immune System (AIS) theory, technique was better than the traditional 'filter' typed feature selection techniques. Feature selection is an activity, which select relevant features based on a particular measurement. On the other hand, it is important to select a feature selection technique which reduces the number of features without reducing the performance of opinion mining. Several common feature selection techniques such as POS, Information Gain, Document Frequency and Chi Square were incorporated. There are three groups of feature selection techniques i.e. filter, wrapper and embedded.

In a filter category, a group of features is selected based on a particular mathematical equation and may be used with any classifier. Contrary to that, the features that are selected in the wrapper and the embedded techniques are bound to a particular classifier. The calculation which is used:

$$CPD(t) = \frac{|FP_i - FN_i|}{DF_i}$$

Where:

FP_i is the number of feature i in the positive class

FN_i is the number of feature i in the negative class

DF_i is the number of document where feature i exist.

6.2. Functional Block diagram

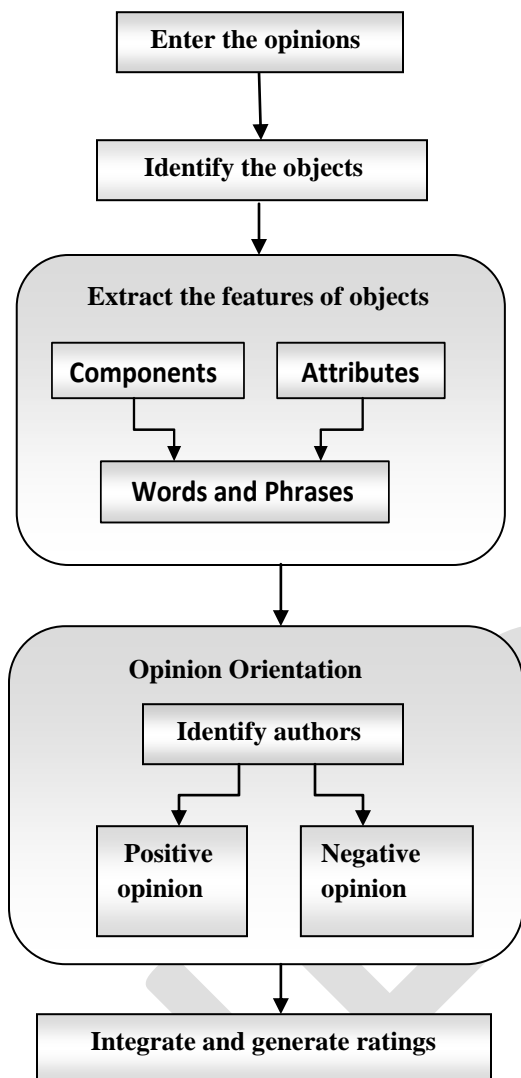


Figure 1. Functional block diagram of Natural Language Processing

7. CONCLUSION

The key is to fully understand the whole range of issues and pitfalls, cleverly manage them, and determine what portions can be done automatically and what portions need human assistance. Despite these difficulties and challenges, the field has made significant progress over the past few years. This is evident from the large number of start-up companies that provide opinion mining services.

Sentiment analysis research is distinguishing itself as a separate field, falling between NLP and natural language understanding. Opinion mining and sentiment analysis are inextricably bound to the affective sciences that attempt to understand human emotions., Word Sense Disambiguation (WSD) is an intermediate task of Natural Language Processing. Feature Selection based on Immune Network System (FSINS) which inspired from the Artificial Immune System (AIS) theory as opinion mining technique was investigated for movie rating review.

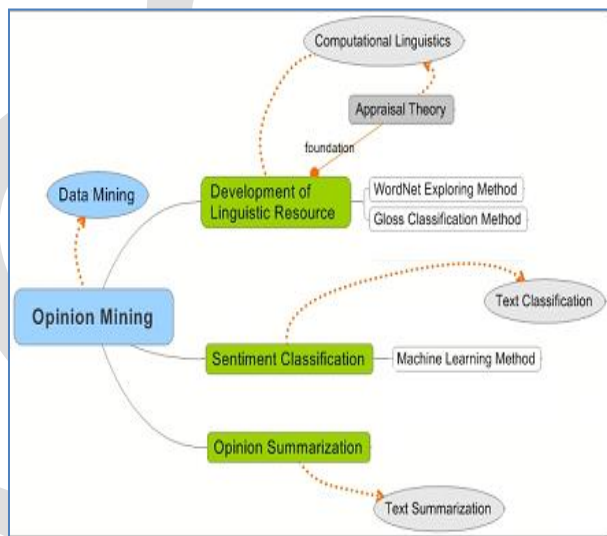


Figure 2. Tasks for opinion mining and its relationship with related areas

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