FACULDADE DE ENGENHARIA DA UNIVERSIDADE DO PORTO

Detecting Opinionated Claims for Argumentation Mining

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DISSERTATION PLANNING

Mestrado Integrado em Engenharia Informática e Computação

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Abstract

Argumentation mining is the process of extracting structured argument data from raw natural text.

Opinion mining is the process of extracting and assessing the opinions expressed in various online news sources, social media comments, and other user-generated content.

Developments in natural language processing and machine learning as well as the potential in business and government intelligence applications turn the spotlight into these study fields.

One overlapping characteristic of these fields is that they deal with online user generated content that is highly subjective and unstructured and so difficult to transform into valuable information despite its potential.

We aim to design of a semi-supervised argumentation mining framework targeting opinion claim detection, using an approach coined opinion based argumentation mining.

With this approach we expect to enhance argumentation mining capabilities dealing with subjective language incorporating opinion mining features/techniques.

Because a data driven methodology is expected we provide a survey on the available *corpus* and provide some insights on the desirable capabilities of *corpus* for such task.

Summary

A extracção de argumentos é o processo de extração de dados de argumentação estruturados a partir de texto natural.

A extracção de opinião é o processo de extração e avaliação das opiniões expressas em várias fontes de notícias on-line, comentários de redes sociais e outros conteúdos gerados pelos usuários.

Desenvolvimentos em processamento de linguagem natural e aprendizagem de máquina, bem como o potencial em aplicações de inteligência de negócios e governo despertam o interesse nesses campos de estudo.

Uma característica desses campos é que eles lidam com conteúdo gerado por usuários on-line que é altamente subjetivo e não estruturado e por isso difícil de transformar em informação valiosa, apesar do seu potencial.

Nosso objetivo é projetar uma estrutura de extracção de argumentação semi-supervisionada visando a detecção de conclusões opinativas, usando uma abordagem baseada em opinião.

Com essa abordagem, esperamos melhorar as capacidades de extracção de argumentação lidando com linguagem subjetiva incorporando características / técnicas de extracção de opinião.

Como uma metodologia baseada em dados é esperada, fornecemos uma pesquisa sobre o *corpus* disponível e fornecemos algumas considerações sobre as capacidades desejáveis de um *corpus* para essa tarefa.

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" all knowledge leads to self-knowledge."

Bruce Lee

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Abbreviations

AM	Argumentation Mining
OM	Opinion mining
ML	Machine Learning
SVM	Support Vector Machine
CRF	Conditional Random Fields
WWW	World Wide Web
IR	Information Retrieval

Chapter 1

Introduction

Argumentation mining is a recent expanding field with ties to natural language processing, machine learning and argumentation theory.

It's main goal is to automatically extract arguments from generic textual corpora, in order to provide structured data for computational models of arguments and reasoning engines.[LT16]

Traditionally argumentation mining systems dealt with structured domains like legal cases, scientific articles, and students essays, however analyzing arguments from user generated content is recently gaining attention, and so new ways to deal with the added subjectivity and informal writing, characteristic of this domain, have been proposed.

This document will provide a broad state of the art in opinion based argumentation mining, and some preliminary design of a system aiming for opinion claim detection.

1.1 Context

Opinion mining, a sub-domain 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.

Opinionated claims are assertions in which an author expresses a subjective point of view showing some level of belief and perhaps an inherent sentiment charge.

Claims are also an important component of arguments. In a simplistic view an argument can be seen as a nested type of structure, either a graph or a tree, and is composed by one claim and a set of premises supporting the claim.

In online discussions, people usually back up their stance by arguing with each other. In this process, people make claims, exchange opinions and are sometimes compelled to provide justification, especially when their opinions validity is attacked.

They do so in order to persuade the others to adopt their point of view, sharing the same opinion. However the way people present their arguments is often vague, implicit, poorly worded and with a high presence of subjectivity.

But what is subjectivity? It can be seen as the linguistic expression of somebody's opinions, beliefs, sentiments and emotions.

In Appraisal theory these are called private states, a state that is not open to objective verification. [Wil08]

Current technologies in computational linguistics and machine learning allow argumentation mining to have the potential to provide massive qualitative analysis from such sources.

Argumentation mining can be seen as an extension of sentiment analysis as it could provide automatic analysis of subjectivity in language, whose main practical application is opinion mining. [BJK+14]

Opinion mining and sentiment analysis, sub domains of opinion retrieval which deals with computational treatment of opinions, sentiment, and subjectivity in text appeared as a direct response to the necessity of new systems that handle directly with opinions as first-class object.

1.2 Motivation and Objectives

While the goal of opinion mining is to understand what people think about something, the aim of argumentation mining is to understand why.

The motivation is to move beyond simple opinion mining and discover reasons underlying opinions.

Thus it is key not only to detect opinions but to detect if it constitutes a claim as in being part of an argument.

This document explores opinionated claim detection using semi-supervised machine learning techniques, in what can be called opinion based argumentation mining this is, exploring features and methods usually employed in sentiment analysis and subjectivity detection.

1.3 Document structure

Apart from the introductory chapter, this document has four more chapters.

In Chapter 2, it is described the state of the art in subjectivity analysis and in argumentation mining, particularly in online discussions. Is given special attention to opinion/claim detection and to the corpora available for the task.

Chapter 3, describes the proposed solution to this problem, including architecture, methods and features expected to be used.

To conclude, Chapter 4 provides some insights about the research so far and provides a planning for future work.

Chapter 2

State of the art

Section 2.1 provides a descriptive overview on subjectivity analysis challenges, applications and sub-tasks. Sub-section 2.1.1 focus on subjectivity detection and then some research on work done is provided at 2.1.2.

Section 2.2 supplies a broad overview on argumentation mining.

It starts by explaining in some detail how a typical AM system works and how the problem is formulated in a divide and conquer way generating several interconnected problems with different targets 2.2.1 .

After presenting the general AM sub tasks in 2.2.2 we will focus in more detail in the task where our motivation resides, claim detection at 2.2.3.

In section 2.3 the *corpora* used in some works will be described and presented with their main analytic information and annotation purpose.

2.1 Subjectivity Analysis

What others think has always been an important piece of information. Currently we, as individuals no longer are limited to source our friends and relatives for opinions, and companies don't need to only rely on consumer reports since people provide their opinions to the web.

But still, there are some challenges to fully benefit from these overwhelming amount of information.

Search engines are not prepared to search for opinions, it is hard to analyze many opinions and since different opinions might cover different aspects, systematization in terms of analysis is hard to do.

And also opinions can be biased or fake/spam, which also poses a problem.

This field has been growing and much work has been done as for one side due to NLP and ML technological advances, and for other due to the potential applications this field could unlock.

Businesses and organizations could benefit by having a better understanding on consumer view on their brand and products, and on competitors weaknesses, and individuals can have means of doing more informed decisions.

This complex task can be decomposed in several sub tasks:

- Determine Subjective-Objective polarity — classify as either objective or subjective.
- Determine Positive-Negative polarity — grade according to a seed that defines what is positive and negative (one could say that in a set seed defined by jubilant on the positive and depressed on the negative side, that happy would be closer to the positive pole)
- Determine holder, strength and target of the opinion — strength refers the degree of certain.

2.1.1 Subjectivity detection

2.1.2 Related work

[BCC07] trains CRF classifier to detect two kinds of expressions of opinion: Direct subjective expressions and expressive subjective elements. Direct subjective expressions (DSEs) are spans of text that explicitly express an attitude or opinion. Expressive subjective elements (DSEs) are spans of text that indicate a degree of subjectivity on the part of the speaker.

[MC11] and [MKN+16] find leverage for detecting subjectivity using clues external to text, audio and gestures in the first one, facial expression and eye movement in the second.

[ORC+15] deals with extracting patterns for both factual and feeling argumentation style using AutoSlog-TS, a weakly supervised pattern learner.

2.2 Argumentation mining

The aim of argumentation mining is the identification of arguments in a document and its structure.

So it is mandatory to define how an argument is composed, i.e what are its argument components, also called the argumentative elementary units and the type of relations between these components and between arguments.

This lifts the problem of defining:

1. what's the correct abstract structure of argumentation?
2. what are the elementary units of argumentation?
3. what are the relations that hold between arguments and between components?

[PM09] provide some formalization on this topic.

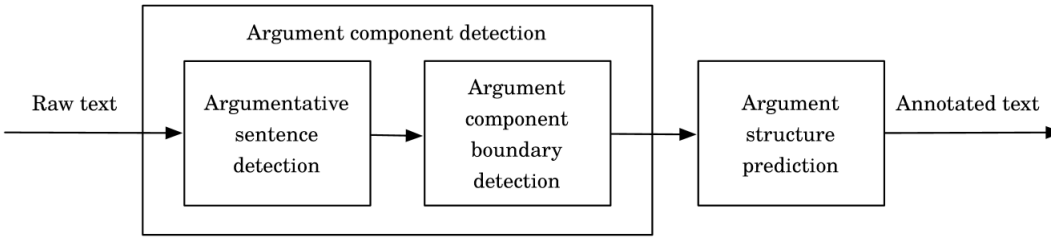


Figure 2.1: AM architecture

2.2.1 Formulation

At a high level, any AM system can be decomposed in a sequence of three particular tasks: argumentative sentence detection, argument component boundary detection and argument structure prediction[LT16].

2.2.1.1 Argumentative sentence detection

This step addresses the extraction of sentences in the input document that contain an argument or at least part of it, and can therefore be defined as argumentative.

This detection problem is usually set as a classification problem and several approaches in terms of classifiers are available (Naive Bayes, Support Vector Machines, Maximum entropy, Logistic regression, Decision Trees, Random Forests).

No matter the classifier chosen, the emphasis is usually put on the features that are selected for the purpose rather then the learning methods used.

The approach used here is mainly conditioned by the type of model used and the objective at hand.

The simplest approach is the use of a binary classifier trained to distinguish non-argumentative from argumentative and after that another classifier is used so that the type of the component is found. Other approaches use a multi-class classifier that detects and discriminates thought all classes taken into account in one step.

2.2.1.2 Boundary detection

This step aims to segment the components, determining the beginning and end of each component.

2.2.1.3 Structure prediction

This step aims at predicting links between arguments, or argument components, involving high-level knowledge representation and reasoning issues.

2.2.2 AM sub-tasks

AM is a new and broad topic that encompasses a variety of tasks.

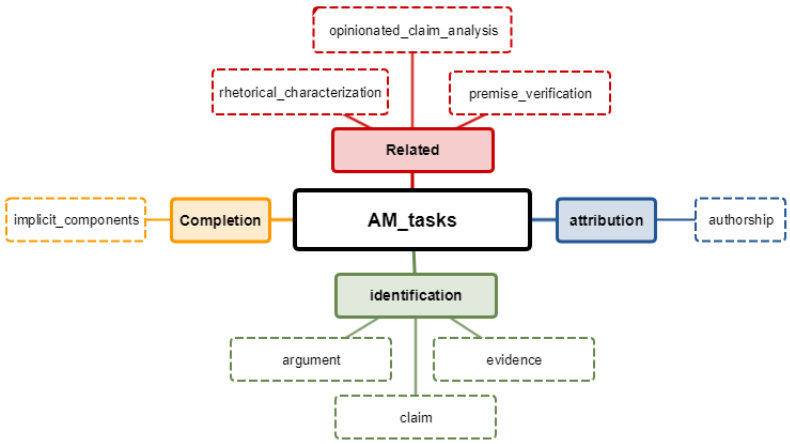


Figure 2.2: AM sub tasks

Generally the sub tasks are:

- detection — detection of arguments or any specific argument component;
- completion — prediction of implicit components;
- attribution — attributing authorship to arguments;

2.2.3 Detecting claims

A choice one has to do in any AM task is whether or how to apply contextual information. There is this trade of that in spite of improving an AM application in one context domain it loses scalability since those improvements don't extend to other domains.

[LBH+14] sets a clear distinction between context features and context-free features.

[LT15] deal with claim identification with the assumption that argumentative sentences are often characterized by common rhetorical structures that are domain independent. This approach represents sentences using constituency trees and is based on a SVM classifier that captures similarities between parse trees.

[RM12] targets opinionated claim detection in online discussions using sentiment analysis. The most relevant features are sentiment, committed belief and social media features.

2.2.4 AM in online discussions

There are many works in AM that focus on debate and discussions. Some debate platforms make users set their stance in the particular topic where they want to post, and doing that they provide some annotation value [HG15] [BŠ15].

2.3 Available *corpora*

For the process of detecting opinionated claims we highlight the need for three desirable capabilities:

- a balance between sentences with and without argumentative value;
- claim identification
- annotation for the presence of subjectivity at sentence or sub-sentence level.

It seems that among the publicly available *corpora* there is not one annotated *corpus* that overlaps these three capabilities.

However there are alternatives that have some potential, we will present some *corpora* used in opinion mining and argument mining. One of them (we refer to it as OPCLAIM) is specially interesting since it is a custom made corpus for opinionated claim detection.

- **Multi perspective question answering (MPQA)** — contains news articles from a wide variety of news sources manually annotated for opinions and other private states (i.e., beliefs, emotions, sentiments, speculations, etc.).
- **Internet Argument corpus (IAC)** — for research in political debate on internet forums. Subsets of the data have been annotated for topic, stance, agreement, sarcasm, and nastiness among others;
- **IBM Debating Technologies (IDT)** — labeled claims and evidence on several topics. It is also labeled for stance and includes term-relatedness values thousands of terms.
- **COMARG** — ComArg is a dataset of online user comments manually annotated with comment-argument pairs[BS14];
- **OPCLAIM** — Dataset used in opinionated claim detection in online discussions

Table 2.1: labeling purpose

	claim	argumentative	subjectivity	opinion	stance	evidence
MPQA			x	x		
IAC	x	x			x	x
IDT	x	x			x	x
COMARG		x			x	
OPCLAIM	x	x		x		

2.4 Summary

This chapter only contains a small and superficial research on the work done tackling this tasks. A lot more work needs to be done in understanding all these different approaches and selecting the best experiments to compare our work with. On relation to the *corpus* introduced here, experiments are needed to understand at full their potential and how can we benefit from their value on the pursue of our goal.

Chapter 3

Design

The key goal here is the automatic detection of opinionated claims, assertions in which the author expresses his personal belief on a particular topic and with a argumentative intention.

One key issue is that people don't switch their discourse between factual/subjective propositions, they mix it up. So even that our problem is a detection/classification problem, the system will only be of any use if it is able to select only the relevant spans of text, the ones that actually present an opinion.

Another key issue is that our task is to identify opinions in a claim, so it is expected that the presence of an opinion coincides with the presence of argumentative elements, supporting both the presence of opinion and argumentative intent.

3.1 Pipeline

1. **Subjectivity detection** — tag sub spans of text as objective/subjective;
2. **Argumentative detection** — determine which spans of text are argumentative;
3. **Claim detection** — detect claim from the intersection of spans with high subjective and argumentative value;

3.2 Methods

Two classifiers will be used, first we will create a model for detecting subjectivity and opinions, then we will create a model for detecting argumentative sentences and claims. We make two assumptions: that a sentence with high levels of subjectivity might present an opinion, and that a sentence with high presence of argumentative features and an opinion might present an opinionated claim.

Chapter 4

Conclusions and Future Work

Section 4.1 provides final considerations on the work done for this dissertation planning report.

The provisional task assignment that compose the dissertation that this planning report refers to is enumerated as well as the predicted work plan for accomplishing those tasks in section 4.2 .

4.1 Discussion

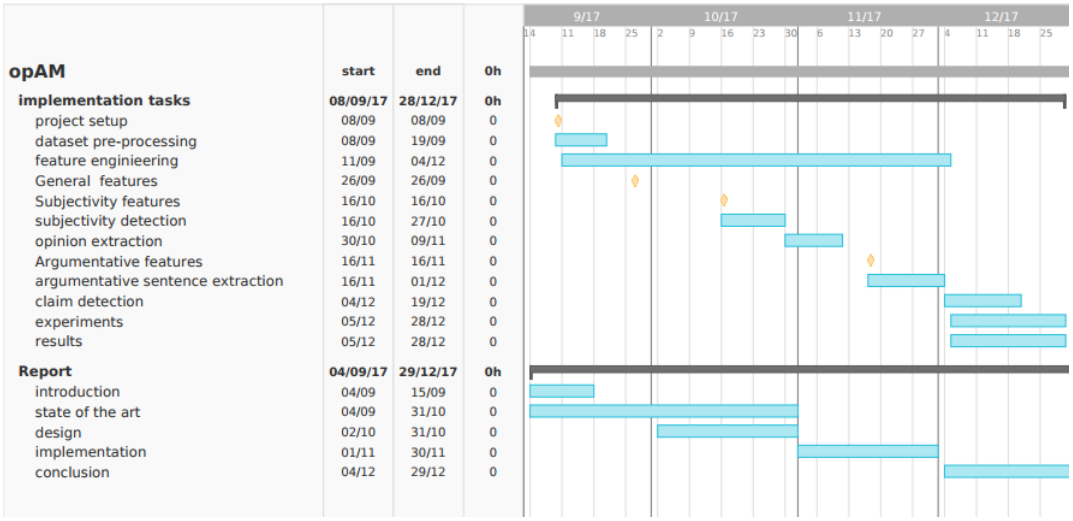
This report gave us the opportunity to have a better understanding on the task at hand, on what has been done in the research field, and have a inception phase on the design to implement. The research done so far is only superficial and preliminary but will help to consolidate knowledge on the topic in the near future.

4.2 Future Work

1. Study of state-of-the-art related to opinion mining, sentiment analysis, subjectivity detection and argumentation mining;
2. Detailed study of techniques that are commonly used in text mining and methods/tools commonly used in opinion-based argumentation mining;
3. Analysis of the *corpus* that will be used;
4. Implementation of features that are relevant for the task at hand and construction of one or more classifiers to perform the task automatically;
5. Detailed analysis of the results obtained from the classifiers and study of the most relevant features;
6. Evaluation of the obtained model(s) and results;

7. Design of a visualization tool for the obtained results;

8. Writing the master thesis report and a scientific article with the obtained results.



opAM	start	end	0h
implementation tasks	**08/09/17**	**28/12/17**	**0h**
project setup	08/09	08/09	0
dataset pre-processing	08/09	19/09	0
feature enginieering	11/09	04/12	0
General features	26/09	26/09	0
Subjectivity features	16/10	16/10	0
subjectivity detection	16/10	27/10	0
opinion extraction	30/10	09/11	0
Argumentative features	16/11	16/11	0
argumentative sentence extraction	16/11	01/12	0
claim detection	04/12	19/12	0
experiments	05/12	28/12	0
results	05/12	28/12	0
Report	**04/09/17**	**29/12/17**	**0h**
introduction	04/09	15/09	0
state of the art	04/09	31/10	0
design	02/10	31/10	0
implementation	01/11	30/11	0
conclusion	04/12	29/12	0

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