

Argument Mining: Was Ist Das?

Simon WELLS^{a,1},

^a*School of Computing, Edinburgh Napier University*

Abstract. Argument Mining has become an increasingly popular term over the last few years but it is unclear to what exactly the term refers. It definitely refers to an area of endeavour within argumentation theory and within computational argumentation and is likely to become an important research direction in the near future but it is not clear how we define what is and what is not argument mining so that we can avoid it becoming the latest buzz-phrase and being left diluted and devoid of meaning. In this paper we explore some definitions of argument mining and reinterpret some previous directions in Argumentation research. Our aim is to contribute towards a clear future distinction as to what counts and to prompt wider discussion about the directions in which this nascent research venture might head.

Keywords. Argument Mining, Argument Structure, (Automated) Argument Analysis

Introduction

Argument mining has become an increasingly popular term over the last few years, and with good reason. There are many many data sources that contain arguments and argument related information but which are not sufficiently amenable to current argument analysis techniques for those resources to be efficiently utilised. For example, since 2004 Google has been operating the Google Books project² which sought to digitise and make available 15 Million volumes within a decade. However, as of April 2013 the Google Books database actually encompassed more than 30 Million volumes. If we consider only the fraction of those books that are non-fiction and therefore whose authors are likely to be formulating some sort of argument within a given text, that is a huge volume of human knowledge, in many cases containing thoughtful and well reasoned arguments, that we cannot currently access and re-use in terms of that argumentative content. We cannot currently select a classic text, for example, Darwin's Origin of Species, and view an argument diagram displaying all the arguments contained therein. We cannot take that diagram and align it alongside the most common arguments of evolution deniers, or even alongside the arguments contained in current evolutionary biology papers which bolster the arguments of Darwin with modern genetic science. In short, we cannot easily find and use the vast majority of argument-containing textual resources that exist. The key goals of argument mining are to be able to take the output of human cogitation and endeavour, to find structure within it, to evaluate it, and to do new things with it. How we achieve that is currently an open and hugely interesting question but gatherings such as CMNA³

¹Corresponding Author: School of Computing, Edinburgh Napier University, Merchiston Campus, 10 Colinton Road, Edinburgh, EH10 5DT; E-mail: s.wells@napier.ac.uk

²<http://books.google.com/>

³<http://www.cmna.info>

and COMMA⁴, and most recently the ArgDiaP⁵, SICSA⁶ and ACL⁷ workshops, have been laying the groundwork for a computational exploration of the arguments contained in all of this recorded human knowledge. However, this only takes into account the static resources available on the web. The web has increasingly become a social venue, concerned with interaction between people and between people and machines which means that there are huge, and increasing, repositories of inter-personal communication and argumentation, which, suitably mined, could provide real insight into the stated beliefs and reasoning of people in relation to the large problems that are increasingly affecting our society.

In the remainder of this paper we intend to spur discussion on this research direction by summarising three perspectives on Argument Mining; in Section 1 we briefly discuss standard directions in Argument Mining, in Section 2 we compare Argument Mining to analogous pursuits in Data Science and Data Mining, and finally in Section 3 we sketch some new perspectives on Argument Mining that build upon social interaction and broaden the notion of what Argument Mining can consist of by reinterpreting the functionality of some existing social argumentation software. However, the unifying factor in these approaches is the goal of creating stand-alone, automated tools which, when supplied with text containing arguments will identify specified argument components and structures.

1. Argument mining *simpliciter*

In its simplest form Argument Mining exploits existing, and develops new, techniques from Machine Learning (ML) and Natural Language Processing (NLP); re-purposing and extending them to identify argument structures within text. Representative of these approaches are the DisLog language running on the <TextCoop> platform [8] for processing discourse, Topic Based Modelling is used by Lawrence *et al* [3] to perform automated proposition extraction from 19th Century philosophical texts, and Peldszus [5] gives a good overview of the effectiveness of current machine learning classifiers used to automatically segment texts in terms of their argumentative content from a purpose built corpus. We shall keep this Section necessarily brief and not exhaustively list all of the NLP and ML inspired approaches to argumentation mining, but point instead in the direction of the aforementioned ArgDiaP, SICSA, and ACL workshops and their breadth and depth of papers on Argument Mining.

2. Argument Mining By Analogy

One way to define argument mining might be through comparison to analogous research domains such as data science and data mining. One could thus suggest that Argument mining is to arguments as Data Science and Data Mining are to data. A key goal of Data Science is the generalisable extraction of knowledge from data, similarly a key goal in

⁴<http://http://www.comma-conf.org/>

⁵<https://sites.google.com/site/argdiapen/>

⁶<http://www.arg-tech.org/index.php/sicsa-workshop-on-argument-mining-2014/>

⁷<http://www.aclweb.org/anthology/W/W14/#2100>

Data Mining is the discovery of patterns in large datasets. There is therefore a natural alignment between the, domain adjusted, goals of Argument Mining and Data Science and Data Mining. In Argument Mining one of our goals is to build the tools and techniques that enable us to discover and extract arguments from data. Similarly we should not wish to confine ourselves to small data sets but to discover arguments, and patterns of argumentation within large datasets. More generally, both Data Science and Data Mining can be conceived as those fields whose goals are to answer questions about data, but sometimes they also provide the tools that, given the data, enable us to work out what the questions should be and how they should be posed. So a lesson that might be learnt from this comparison is that Argument Mining can be not just about getting argument structure from data, but also about transforming that data into task-appropriate forms and discovering new questions that can be posed with respect to the data which would not otherwise have been asked. In Data Science, a range of cross and multi-disciplinary tools, techniques and work-flows have been developed. Sometimes these lead to new or task-adapted ways to work with data under new or non-traditional circumstances; witness the proliferation of so-called “No-SQL” data stores during the past decade. These have given us many useful new tools for capturing, storing, and processing data with respect to a wider range of things that we might want to do with it. For example, the kind of data-store and work-flow that might be used to work with streams of data, in real time, may be very different from those that are used to explore large stores of static historical data. Similarly Argument Mining is developing new tools that help to deal with the large-scale discovery, extraction, and re-use of argument-oriented data. This is giving rise to new storage and interchange formats and techniques and will impose evolutionary pressure upon the developmental directions of these tools. A case in point is the Argument Interchange Format (AIF) [1] which was originally developed as a way to exchange argument data between distinct argument tools, which at the time were developing their own individual formats for representing arguments. Whilst many of these formats have continued to be developed in order to satisfy their own specialist requirements, AIF has become the *de facto* format for sharing arguments between systems. The AIF has, since its inception, been pulled in various directions as researchers in different sub-fields of argumentation attempt to extend it to account for their particular interests, for example, AIF+ attempted to extend the AIF to support dialogue. The AIF will become increasingly important as a means to share and reuse the outputs of Argument Mining processes. This in turn suggests an increased pressure for improved tooling for working with, storing, and reusing increasingly large AIF data-sets. From this we could conclude not only that tool building for Argument Mining is important, but also that building tools for sharing the mined argument data is just as important.

3. Social Dimensions of Argument Mining

In the previous Section we recognised that Data Science is focussed not just on large static datasets but also on dynamic data. This has parallels to the ways in which people interact online and suggests directions for Argument Mining that build upon the ways that people interact to either add increased structure to existing resources or to generate new resources that are inherently better structured, either allowing us to immediately answer questions about their argumentative content, what we could call shallow mining,

or making the resources more amenable to the “deep mining” techniques that work on unstructured data as outlined in Section 1. Proceeding by example, we can define two contexts in which social interaction plays an important role in the Argument Mining process, in the first we extend the traditional argument analysis task to encompass multiple participants, and in the second we identify certain forms of online interaction which can produce argument resources as a side-effect of otherwise straightforward multi-party communication.

Example 1 In this form of Social Argument Mining, multiple analysts process a resource; analysing, cleaning, fixing, interpreting, evaluating, and reconstructing messy real-world data which happens to contain arguments in order to produce what we could term first-class argument resources, for example, AIF documents. A prime example of this social dimension of Argument Mining is the Argument Analysis Wall⁸, constructed by the Arg-tech group at the University of Dundee, and it’s associated work-flow in which multiple participants collaborate to produce analysed arguments. The work-flow takes transcripts from the BBC Moral Maze discussion program as input, and these are manually segmented, by a human analyst, into basic argumentation units which appear as unlinked nodes on the wall. From here multiple analysts link the nodes together according to the arguments structure that the analysts perceive that the original Moral Maze interlocutors intended, following the principle of charity proposed by Gilre [2]. In this case undifferentiated data enters the work-flow at one end, similar to the tools outlined in 1 and analysed, structured arguments exit the work-flow, so this is a form of Argument Mining. What makes it Social Argument Mining is the interaction between multiple analysts during the process of the work-flow, analysts who, additionally, may disagree and admit multiple different interpretations of the input data.

Example 2 In this form of Social Argument Mining, arguments resources are emitted from the process as a by-product of social interaction between multiple communicating parties. The basic premise of this approach is that the protocol for the interaction, the rules by which the parties interact, can admit an argument structure isomorphism. That is when particular sequences of interactions occur then arguments can be either explicitly or implicitly inferred from that sequence. This is the basis of the AIF+ extensions [7] which incorporate argument and dialogue within an AIF document, linking arguments as product and argumentation as process, or Argument1 and Argument2 in the terminology of [4]. Of course, in the most basic form this approach means that argument mining tools, like those outlined in Section 1 must also be developed to recognise dialogical characteristics as well as argument structure. However alternative approaches are available that enable some aspects of dialogue to be made explicit and these approaches rely on unifying dialogue games tools with user interaction. Dialogue games [12,10] are an approach to working with argumentative dialogue in which the interaction is portrayed as a kind of multi-player game in which the players make moves by saying things and the kinds of moves that they can make equate to different performative speech acts [9]. The MAgtALO system [6] used dialogue games to restrict and regulate what a person could say whilst they interacted with an intelligent agent. From the pattern of interaction, for example, a “<statement>,<challenge><defense>” sequence, the argument “Statement because Defense” could be inferred. These arguments were then stored and reused in

⁸<http://www.arg-tech.org/index.php/projects/argument-analysis-wall/>

subsequent interaction between people and the MAgtALO agents. The key point though was that with the addition of a small interaction element, selection of how the speaker intended the move to be interpreted, argument structure could be identified and stored even though that was not the core goal of the system. A similar approach is taken in the Argument Blogging system [11] which used simple dialogue game moves to capture how participants were responding to each other. In both systems the main goal was to support online argumentation and to improve the quality of said argumentation, but a side effect of this social interaction was the elicitation of new structured and analysed argument resources which could be reused, exactly what Argument Mining seeks to do.

4. Conclusions

In this paper we have outlined some approaches to Argument Mining in order to avoid the unnecessary dilution of the term as it gains popularity and to outline some of the directions in which this nascent field is heading. Our first direction looked at the range of approaches that are currently employed. Our second direction drew parallels with Data Science and Data Mining as analogies to Argumentation Theory and Argument Mining. Finally our third approach was to explore some slightly broader ground in which social dimensions of engaging in argument can be considered as a form of argument mining. As examples of this Social Argument Mining we re-interpreted the role of three existing argumentation systems, namely, the Argument Analysis Wall, MAgtALO, and Argument Blogging. By writing this paper it is the authors intention to stimulate wider debate on this hot topic.

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