Capturing Bottom-Up Argumentation

Paolo TORRONI [a] Simone GABBRIELLINI [b]
[a] *DISI, University of Bologna, Italy*
[b] *GEMASS, University of Paris Sorbonne, France*

Abstract. How are social media changing the way we argue? Are they helping us make better arguments or do they silence debate, as it has been suggested by some? Are current computational models of argument adequate to capture the nature and dynamics of argumentation in social media? With these questions in mind, we discuss some recent proposals and identify challenges and impacts of an ambitious vision: making computational argumentation an enabling technology for new forms of collective intelligence.

Keywords. Natural argumentation, social networks, online debate, abstract argumentation frameworks, microdebates

Introduction

A recent report from Pew Research Center's Internet Project [10] identifies in Twitter six "conversational archetypes," i.e., different ways that crowds and conversations can take shape on the famous social media platform. According to the report, there are at least six distinctive structures of social media crowds which form depending on the subject being discussed, the information sources being cited, the social networks of the people talking about the subject, and the leaders of the conversation. Each has a different social structure and shape.

For example, *polarized discussions* feature two big and dense groups that have little connection between them. Polarized crowds on Twitter are not arguing. They are ignoring one another while pointing to different web resources and using different hashtags. Discussions in so-called *community clusters* instead are characterized by multiple smaller groups, which often form around a few hubs, each with its own audience, influencers, and sources of information. Community clusters conversations look like bazaars with multiple centers of activity. There we can see arguments: some information sources and subjects ignite multiple conversations, each cultivating its own audience and community. These can illustrate diverse angles on a subject based on its relevance to different audiences, revealing a diversity of opinion and perspective on a social media topic.

As there is no single way conversations take shape in social media, *there is no single way arguments take shape*, either. Nonetheless, one thing we could tell is that online arguments are mostly *informal*: their rational structure, if present, is not always spelled out and immediately visible. This is confirmed by many studies in the rapidly growing discipline of *argumentation mining*.

Understanding people's opinions in online debate forums is a challenging task because of the informal language use and the dynamic nature of online conversations [13].

Online user comments often contain arguments with inappropriate or missing justification [8]. Because of the complex challenges argumentation mining poses, most efforts are directed to capturing one well-defined aspect of argumentative discourse (support, rejection, causality, etc.) in one well-defined domain (user reviews, legal texts, instruction manuals, political discourse, etc.).

Describing the arguments that appear in social media certainly is key to argumentation mining. But the study of online arguments has attracted considerable interest even outside of argumentation mining, with a number of works that aim to improve online discussions. Leite & Martins' *social abstract argumentation* [7] is motivated by the vision of a "deeper, more serious social web" with the goal of "counteracting the growing trend of superfluous discussion by providing debates with formal, justifiable and yet subjective outcomes." De Liddo et al.'s *evidence hub* [3] aim to put "issues, ideas, and evidence at the center of a reflective community of practice," to "distil the most important issues, ideas and evidence from the noise by making clear why ideas and web resources may be worth further investigation." Many other online sense-making aids and collective intelligence deliberation platforms have been proposed in argumentative contexts (see [2] for a discussion). In the case of social abstract argumentation, the argument model is Dung's abstract framework augmented with weights. The evidence hub instead uses IBIS. Again, there is no single argument model (although Tuolmin's model, IBIS, and Dung's abstract framework, extended in various ways, seem to be among the most popular computational frameworks).

It is a fascinating and intellectually challenging domain. But what are the social impacts of this research? We have witnessed the potential of Internet and social media in accelerating political and social change at a massive scale. Many recent initiatives, including a number of EU-funded projects, aim to help *e-participation* with tools that make use of social media. Policy makers are looking at social media to get feedback from the citizens of an evermore connected society. Politicians and brands alike are more and more relying on *sentiment analysis* tools to support decision making, and on social simulations that take input form social media analytics.[1]

If these new horizons pave the way to new forms of participation, they also create new worries. According to another Pew report [6] "the Internet, it seems, is contributing to the polarization of America, as people surround themselves with people who think like them and hesitate to say anything different. Internet companies magnify the effect, by tweaking their algorithms to show us more content from people who are similar to us." Even worse, people are afraid of being kept under surveillance and manipulated by governments and companies. They are shocked by the scope of secret state spying on their private communications, especially in light of documentary evidence leaked to media outlets by former NSA contractor Edward Snowden. They are angered by the illegal, unconstitutional nature of NSA programs such as Echelon and Prism.[2] Privacy, trust, powers and hidden agendas are issues of growing concern.

So on one hand we have exciting intellectual challenges, and the perspective of unprecedented forms of emerging collective intelligence; on the other hand, we seem to have to live with the worrisome prospect of a dystopian future. The question is not how we can apply computational argumentation to online debates—we aren't short of ideas

[1] See for instance http://epolicy-project.eu

[2] http://www.globalresearch.ca/echelon-today-the-evolution-of-an-nsa-black-program/5342646

and potential applications—but rather, *how can we do that in meaningful, non intrusive, positive ways?*

This is of course an open issue. We do not have a solution. The main purpose of this paper is to foster a discussion on these topics. We contribute with an initial list of *desiderata*, and with a *proposal* for a computational model of online argument arising from recent research.

1. Desiderata for positive applications of computational argumentation to online debates

1. **Transparency**. Computational models and methods should be open-source and inspectable by all the stakeholders (especially by the participants in the debates where we are applying the technology). This does not mean, of course, that one should expect users to understand argumentation semantics and other technicalities, or worse, that one should "dumb down" the logic in an effort to use only concepts that are accessible to everyone. What we mean is instead that all the stakeholders will benefit if anyone who is competent can inspect the code, as it is the case with open source software.[3] One trusts an open source web browser not because one is able to understand its code, but because there is an open community behind who can access and understand the code, detect vulnerabilities, implement modifications, and so on.
2. **Simplicity**. Argument models should be simple enough to accommodate the sort of informal arguments that pervade online debate. Forcing a Tuolmin argument model on informal online arguments seems limiting. On the other hand, many discussions around given issues can be remarkably well summarised in terms of pros and cons. In fact, several online debate sites are structured in such a way: thus an IBIS-like model that identifies issues, positions, arguments, pro, con and decision may seem appropriate to capture this type of discussions. However, not all discussion can be reduced to IBIS, as the objective is not always to evaluate pros and cons and take a decision. Argument schemes are also limiting, since they define structures of arguments. It seems to us that a promising alternative is to do away with any attempt at structuring online informal arguments, and focus instead on the *relations* among arguments and on the *emphasis* given to parts of the framework composed by arguments and relations among them. To us, *weighted abstract argumentation frameworks* seem to be a good candidate model, as they are simple yet expressive enough to capture relations among arguments and emphasis (thanks to weights), and they can accommodate inconsistency.
3. **Openness**. The data used by the positive applications we envisage should be open. In this way, the same data could be used by different applications. Among the mainstream social media platforms we do find some where user content is public - Twitter is one of them. Openness is not to be confused with transparency (although there are clear links) since openness refers to data, not code. The idea of making data open and accessible was promoted by important initiatives such as Linked Open Data: a way of publishing structured data that allows metadata to

[3] See http://opensource.org/

be connected and enriched, so that different representations of the same content can be found, and links made between related resources.[4]

4. **Inclusion**. Applications should have a low entry threshold. There should be no need to explain technicalities, agree on complicated concepts and ontologies (what is a claim, what is a warrant, etc.), refer to reasoning frameworks, etc, because this would necessarily exclude potential users. The number of concepts involved, on the user end, should be kept to a minimum. Ideally, there should be some flexibility in interpreting such concepts.
5. **Awareness**. Users should always be allowed to remain in control. They should be able to decide at all times if and how their produced content is going to be used, and by whom. In particular, approaches that only work with a conscious user involvement are to be preferred. Tagging is an example of conscious user involvement in the production of metadata. For example, when a Facebook user tags a picture with his own name, he contributes to building metadata used in the organization and presentation of content to the other users, and he is aware of what he is doing (at least, nothing is done "behind the curtains"). If he does not wish other users to associate that picture to his name, he can leave the picture untagged. Tagging could be used in similar ways in online debates, as we will see below.
6. **Serendipity**. Tools should foster diversity and emergence. Online discussons are inherently bottom-up: topics are not superimposed, there are no formats and protocols to limit the discussion. New topics can emerge, opinions can emerge at some point in a discussion in an embryonal format and become more articulated later on. Positive applications should encourage serendipity and not impose limits on what can be said.
7. **Self-organization**. Debates should not be controlled; the interference of the debating application to the debate itself should be kept to a minimum. This may be a difficult point to digest for an argumentation community whose purpose has been, to a great extent, to set criteria for accepting or rejecting arguments. However, when we pose a query to a search engine, we obtain a ranking of web pages, not a selection of them. Similarly, argumentation semantics could be used to rank arguments, rather than accepting/rejecting them. Finally, and also in the interest of *scalabilty*, no expert intervention should ever be required (no "argumentation engineers" or "mapping experts" analysing a debate and putting the various pieces in place).
8. **Neutrality**: There are no winners and losers in an online debate (or not necessarily so!). Tools should treat all arguments equally, without discriminating by user, content, mode of communication etc. (à la *net neutrality*). Keeping "minority arguments" alive is also important.

2. Capturing bottom-up argumentation

Some proposals that go in this direction are *bottom-up argumentation* and *microdebates*.

The idea of *bottom-up argumentation*, a term coined by Toni & Torroni [11], is that of a grassroot approach to the problem of deploying computational argumentation in on-

[4] See http://lod-cloud.net/

line systems, where the argumentation frameworks are obtained bottom-up starting from the users' comments, opinions and user annotations, without top-down intervention of or interpretation by "argumentation engineers." Toni & Torroni propose users annotating opinions and comments in order to enable an automated translation of an online discussion into an assumption-based argumentation framework for determining computational validity. Topics emerge, bottom-up, during the underlying process, possibly serendipitously. Notice that in this framework, users are expected to distinguish between *comments* and *opinions*, and identify which comments *support* which opinions.

A further step towards capturing informal arguments in a computational framework with increased simplicity is made by Gabbriellini & Torroni with *microdebates* [5]. These are Twitter conversations that use some special tags (annotations) to identify *opinions* and *attack relations* among opinions. Microdebates also follow a bottom-up argumentation approach.

In a nutshell, microdebates consist in streams of tweets annotated with some special tags, to mark opinions and conflicts between opinions. In particular, the $$ tag (*double-cashtag*), as in $$redLooksGreat, is interpreted as (the label of) an opinion or argument *supported* by the author of the tweet, whereas the !$ tag (*bang-cashtag*), as in !$greenLooksGreat, is interpreted as (the label of) an opinion or argument *opposed* by the author of the tweet.

There is no special syntax for tweets belonging to a microdebate, other than the usual 140-character limit for a tweet, and space-free tags. However, tweets belonging to a microdebate should at least contain a discussion identifier (#hashtag), and an argument identifier (double-cashtag). There are no other restrictions on the number and type of tags a tweet can/should contain. Figure 1 gives an illustration.

When a user broadcasts a tweet containing a double-cashtag/bang-cashtag association, a link is set between the two tags and the corresponding opinions. If another user sends out another tweet with the same association, or recasts the same tweet, that link is reinforced.

The keywords identified by double-cashtags are labels for *abstract arguments*, while the presence of a double-cashtag and a bang-cashtag in the same tweet establishes an *attack* relation between the corresponding abstract arguments. The semantics given to the resulting network of arguments and links is expressed using Bistarelli and Santini's interpretation of weighted abstract argumentation frameworks (α-semantics) [1].

The concept is developed and prototyped for Twitter [12] but can be applied to online conversations in general. In fact *tagging* is now a widespread practice in most popular online social networks.

In essence, microdebates propose to enhance traditional threaded discussions, enabling authors to explicitly *mark* the arguments in their posts, and let arguments be expressed in several posts, possibly by several users, in a collaborative fashion, as opposed to mapping individual posts to arguments one-to-one. In this way, we make it possible for "older" arguments to attack "newer" arguments. This also allows posts to make explicit reference to the arguments they attack.

Attacks relations have weights attached, proportional to the number of times the attack is expressed. For example, if a message containing an attack is posted twice, that attack has weight 2. If a new different message is posted, containing the same attack, the attack's weight increases to 3. And so on.

Figure 1. A fragment of a Twitter stream, showing a sample microdebate. Twitter organises its entries top to bottom from newest to oldest.

The rationale behind this model is that an argument in an online discussion is a dynamic entity, which can be constructed by multiple hands. Once a label (double cashtag) is associated to a concept representing an embryonic argument, possibly as embryonic as a simple, sketchy claim, other comments can contribute to fleshing up and defining the concept. No structure is imposed to the argument, which can contain unstructured text or multimedia content. Applications can be deployed to collect all pieces of the argument based on the label, and visualise them in a suitable way. The Microdebates App for Android described in [12] for instance uses word clouds (see Figure 2). To this end, relations among arguments are important to define a *ranking* for presentation purposes. For example, α-preferred extensions can be computed and arguments ranked based on their acceptability state according to the value of α (or β if we use inconsistency budgets and β-semantics [4]).

The effort towards very simple conceptual model also carries some limitations. For example, the treatment of an argument node as black-box in an abstract argument network, and the weight of an attack is quantitatively derived without considering the quality of the attack as well. Moreover, since microdebates use abstract argumentation, they do not explicitly model support. This might be limiting. Further experimentation may help better understand the role of weights and give us better insights as to whether weighted abstract argumentation frameworks are sufficient for this kind of application, or if they are unable to represent key aspects.

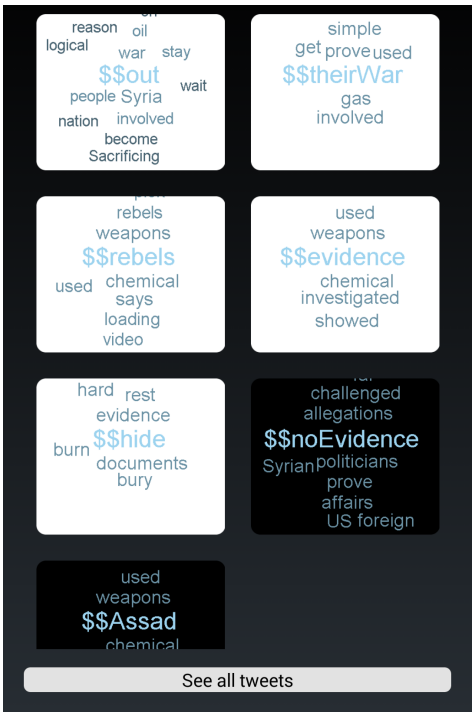

Figure 2. Microdebates App for Android argument visualization

3. Conclusion

The application of computational argumentation methods to online discussions poses new challenges. We advocate a need for *positive* applications, able to address the needs of contemporary world, taking into consideration the ethical issues and strong feelings that exist around crucial aspects of our online existence. Research in this area is still in its infancy, and there are more open questions than solutions. If successful, its impacts can be significant. We believe that the development of positive applications of computational argumentation to online debates would benefit from the definition of a reference framework where such issues are discussed. For example, there are interesting links with the recent effort to establish an open research and action community network in the context of the Collective Intelligence for the Common Good initiative.[5] There are also other interesting links with recent efforts at developing environments for "fair and reasonable" dialogues, such as technology-enhanced learning and human-computer interaction, where several authors proposed solutions based on argumentation theories and models such as informal logic and dialogue games [9,14,15].

One possibile direction for future work could be definition of a *manifesto*, by interested CMNA community members. Our contribution here lies in sparking the discussion, outlining a number of desiderata and discussing a concrete proposal that aims to meet them.

[5] See http://events.kmi.open.ac.uk/catalyst/

Acknowledgments

We thank the anonymous reviewers for useful comments.

References

[1] S. Bistarelli and F. Santini. A common computational framework for semiring-based argumentation systems. In H. Coelho, R. Studer, and M. Wooldridge, editors, *ECAI*, volume 215 of *FAIA*, pages 131–136. IOS, 2010.

[2] S. Buckingham Shum, A. De Liddo, and M. Klein. DCLA meet CIDA: Collective intelligence deliberation analytics. In *2nd International Workshop on Discourse-Centric Learning Analytics, LAK14: 4th International Conference on Learning Analytics & Knowledge*, 2014.

[3] A. De Liddo and S. Buckingham Shum. The evidence hub: Harnessing the collective intelligence of communities to build evidence-based knowledge. In *Workshop: Large Scale Ideation and Deliberation at 6th C&T*, Munich, 2013.

[4] P. E. Dunne, A. Hunter, P. McBurney, S. Parsons, and M. Wooldridge. Weighted argument systems: Basic definitions, algorithms, and complexity results. *Artif. Intell.*, 175(2):457–486, Feb. 2011.

[5] S. Gabbriellini and P. Torroni. Microdebates: Structuring debates without a structuring tool. *AI Communications*, in press.

[6] K. Hampton, L. Rainie, W. Lu, M. Dwyer, I. Shin, and K. Purcell. Social media and the 'spiral of silence'. Technical report, Pew Research Center, Washington, DC, 2014. Available at http://www.pewinternet.org/2014/08/26/social-media-and-the-spiral-of-silence/.

[7] J. Leite and J. Martins. Social abstract argumentation. In T. Walsh, editor, *IJCAI 2011, Proceedings of the 22nd International Joint Conference on Artificial Intelligence, Barcelona, Catalonia, Spain, July 16-22, 2011*, pages 2287–2292. IJCAI/AAAI, 2011.

[8] J. Park and C. Cardie. Identifying appropriate support for propositions in online user comments. In *Proceedings of the First Workshop on Argumentation Mining*, pages 29–38, Baltimore, Maryland, June 2014. Association for Computational Linguistics.

[9] A. Ravenscroft, S. McAlister, and M. Sagar. Digital dialogue games and interloc: A deep leaning design for collaborative argumentation on the web. In N. Pinkwart, editor, *Educational Technologies for Teaching Argumentation Skills*. Bentham Science E-Books, 2010.

[10] M. A. Smith, L. Rainie, I. Himelboim, and B. Shneiderman. Mapping Twitter topic networks: from polarised crowds to community clusters. Technical report, Pew Research Center, Washington, DC, 2014. Available at http://www.pewinternet.org/2014/02/20/mapping-twitter-topic-networks-from-polarized-crowds-to-community-clusters/.

[11] F. Toni and P. Torroni. Bottom-up argumentation. In S. Modgil, N. Oren, and F. Toni, editors, *TAFA 2011: Revised Selected Papers from the First International Workshop on Theory and Applications of Formal Argumentation*, volume 7132 of *Lecture Notes in Computer Science*, pages 249–262. Springer, 2012.

[12] N. Yaglikci and P. Torroni. Microdebates app for Android: A tool for participating in argumentative online debates using a handheld device. In *Proceedings of the 26th IEEE International Conference on Tools with Artificial Intelligence (ICTAI)*. IEEE Press, 2014.

[13] J. Yin, P. Thomas, N. Narang, and C. Paris. Unifying local and global agreement and disagreement classification in online debates. In *Proceedings of the 3rd Workshop in Computational Approaches to Subjectivity and Sentiment Analysis*, WASSA '12, pages 61–69, Stroudsburg, PA, USA, 2012. Association for Computational Linguistics.

[14] T. Yuan, D. Moore, C. Reed, A. Ravenscroft, and M. N. Informal logic dialogue games in human-computer dialogue. *Knowledge Engineering Review*, 26(2):159–174, 2011.

[15] T. Yuan and G. Zhong. Collaborative argumentation on the web-a dialogue game approach. In *IEEE 13th International Conference on Advanced Learning Technologies (ICALT)*, pages 161–165, Beijing, 2013.