Annotation Scheme for Aggregated Argumentation in Online Educational Forums

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Abstract

We present an ongoing work of collecting small-group online discussions written in Hebrew. Discussants deal with contentious topics, while complying with educational ground rules. Our growing repository comprises 152 discussions containing over 3k turns. We propose an annotation procedure for turning such unstructured data into structured argument data in three stages: (i) segmenting to discourse and e-talk units, (ii) classifying e-talk units, and (iii) identifying and classifying relations between e-talk units. We applied the scheme to a sample. The results indicate the feasibility of the scheme as well as the abundance of natural argumentation and the intensity of interaction in the data.

Keywords

Argument Mining, Natural Argumentation, Knowledge Graph, Online Educational Forums

1. Introduction

Argument mining is the automatic process of turning unstructured text in natural language into structured argument data by extracting arguments and identifying argument relations [1]. Corpora for argument mining are mostly held in English and center around debates (e.g., [2, 3]), legal documents (e.g., [4]), and opinionated essays (e.g., [5, 6]). In an ongoing work we are collecting unique written discussions gathered from educational online forums held in Hebrew. Contra the abovementioned examples, this corpus demonstrates highly unstructured text emerging from intense interaction in small groups, where discussants are instructed to comply with certain ground rules in order to reach a shared stance. We present a growing repository, an initial annotation scheme for transforming discussions into structured knowledge graphs, and primary results.

2. Collection Method and Repository of Educational Discussions

The repository comprises written discussions carried out in small groups. The discussions take place in higher education courses where participation is compulsory. Discussions are collected using three computer-supported collaborative learning text-based dialogue platforms

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involving threaded discussions - DIALLS [7], Hot Discussions Platform (HDP) [8], Dialogym [9] - and Google Docs. Discussants are presented with a controversial question that is meant to stimulate a contentious discussion among the participants (Table 1). The students are instructed to comply with ground rules accustomed for educational dialogues, such as expressing reasoned viewpoints, respecting others' ideas, challenging ideas, or building on others' ideas. So far, the repository contains over 3k turns from 152 discussions (Table 2).

3. Rationale and Theoretical Background for Annotation Scheme

The annotation scheme should enable the conversion of each discussion into an argumentative knowledge graph representing the aggregated argumentation. To capture the aggregated argumentation in *written* discussions on *controversial* issues within *educational* settings, we integrate a purely argumentative theory [10] with a pragma-dialectical one [11]. For example, while the notion of 'claim' stems from the former, the distinction between 'claim' and 'non-rhetorical question' is important under the latter. We also refer to schemes employed in argument mining. Specifically, Stab and Gurevych [5] identify three subtasks in the literature of argument mining: component identification, component classification, and structure identification. Similarly, Visser et al. [12]'s guidelines for annotation include four stages: segments, transitions, illocutionary connections, and inferences. We attempt to adapt these schemes applied to written essays or election debates, to the case of our data.

4. The Annotation Protocol

The annotation protocol consists of three consecutive stages and is demonstrated in Table 1.

I. *Segmentation*: (i) Segmenting each turn into **Discourse Units (DUs)** - syntactic sentence(s) interrelated via deictic pronouns (e.g., *then*, *their*), certain connectors (e.g., *and*, *but*, *for example*, *on the other hand*), or special configurations (e.g., a question immediately followed by an answer provided by the same author). (ii) Segmenting each DU into **e-Talk Units (eTUs)** - semantically distinct stand-alone units.

II. *Classification of eTUs.* Classifying eTUs into types: **Claim** - an eTU expressing an opinion/position, an argument, (dis)agreement with previous eTUs, or a rhetorical question, or **Question** - an eTU expressing a non-rhetorical question marked by an interrogative expression/construction, or **Unclassified** - neither of the above;

III. *Intra- and Inter-Turn Relations between eTU Pairs*: (i) Identification of semantically-related pairs of eTUs; (ii) Classification of those relations into types: **Support** - an eTU supports another eTU via repetition, justification, explanation, providing evidence, providing examples, or **Opposition** - an eTU negates/opposes another eTU via providing contradicting evidence, rebutting, casting doubt, challenging, or **Elaboration** - an eTU adding information concerning another eTU via expansion, description, specification, conditioning.

Table 1
Annotation: An Example (Translated)

Discussion Topic
In the shadow of the COVID-19 pandemic raging in Israel and around the world, the vaccination process against the virus began last week. There are already voices calling for mandatory vaccination for COVID-19 and even suggesting that unvaccinated people be denied entry to public places (e.g., students into schools). Discuss whether the state can oblige citizens to get the vaccine.

Turn	Author	DU	eTU	eTU Type	Content
1	Anna	1	1-1	claim	I think that the state should definitely oblige citizens to get vaccinated,
			1-2	claim	this can be done using law and enforcement or simply by imposing sanctions against those who refuse to get vaccinated.
			1-3	claim	These sanctions can include entry to public places, inability to fly, etc.
2	Avi	2	2-1	claim	The state has no right to oblige its citizens to get vaccinated, especially when they have not yet explained to the public about the vaccine.
		3	3-1	claim	People don't trust the government after everything we've been through
			3-2	claim	so it doesn't make sense that they require citizens to get vaccinated without even explaining how they produced this vaccine.

Intra-Turn Relations:
eTU1-2 →eTU1-1: elaboration
eTU1-3 →eTU1-2: elaboration
eTU3-1 → eTU2-1: support
eTU3-1 →eTU3-2: support
eTU3-2 →eTU2-1: support
Inter-Turn Relations:
eTU2-1 →eTU1-1: opposition

Table 2
Volume of Repository and Sample of Collected Discussions

	Discussions*	Turns	Topics	Domains	Non-Unique Participants
Repository	152	3000**	22	3	834
Sample	8	277	3***	1	75

* Discussions were collected from four platforms: DIALLS (5.3%), HDP (59.2%), Dialogym (10.5%), Google Docs (25%)
**Estimation based on 82 discussions ***Domains: civic issues (40.1%), education (49.3%), and history (10.5%)

Table 3
Segmentation (Stage 1) and Classification of eTUs (Stage 2)

DUs	eTUs		
	Claims	Questions	Unclassified
799	1278 (97%)	26 (2%)	13 (1%)
	1317 (100%)		

Table 4
Intra- and Inter-Turn Relations of eTU Pairs (Stage 3)

Identified Pairs of Related eTUs*	Support	Opposition	Elaboration
507 (100%)	187 (37%)	111 (22%)	209 (41%)

*Based on both intra- and inter-turn relations in four discussions (totaling 118 turns, 360 DUs, and 494 eTUs)

5. Sample Results

To check the feasibility of the annotation and determine the properties of our data, two expert linguists (the first and third authors) *manually* applied the scheme to a sample (Table 2). The results show that the scheme is feasible in all three stages. Table 3 shows that turns, DUs, and eTUs are indeed three distinct structures. Moreover, 99% of the eTUs are classified as either claims or questions, thus attesting to the argumentative quality of the educational discussions. Table 4 shows that all three relation types play a major role in the discussions, and the large number of relations illustrates the intensity of the interaction in the discussions at hand.

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