Argument and Counter-argument Generation: a Critical Survey

Wang Xiaoou, Cabrio Elena & Villata Serena

Université Côte d'Azur, CNRS, Inria, I3S, France

Motivations

Argument Generation (AG) refers to **the generation of arguments in natural language**. To the best of our knowledge, no survey has been published on Argument and Counter-argument Generation (AG and CAG). The existing resources are:

- A brief chapter in [1] summarizing several relevant works up **to 2018**;
- A survey on the role of **knowledge** in AM, argument assessment, argument reasoning and AG [2].

In the meantime, a huge variety of methods have been explored in AG, under various names such as argument construction, argument retrieval, argument synthesis and argument summarizatio. AG has now numerous **socially beneficial** applications such as:

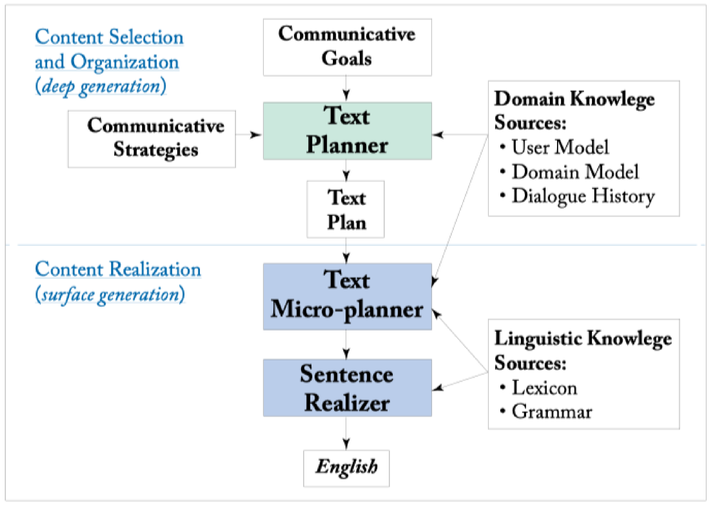
- Legal decision making [3];
- Collective decision making [4];
- Counter Narrative Generation to fight online hate speech [5].
- Writing assistance [6].

Our survey aims to

- Illustrate the **historical landscape** of developments in AG and CAG research;
- Provide a detailed outline of the **main results** and especially, **various tasks and subtasks** in AG and CAG;
- Synthesize **the key datasets**;
- Discuss **the main issues and some open challenges** in AG and CAG.

Architecture of typical data to text generation systems [7]

Deep Generation phase selecting knowledge chunks based on the comparison of a User Model and a Domain Model, followed by **Content Realization phase** requiring specific grammatical knowledge of the target language such as verbal inflections and logical connectors.



A new chapter

Around the beginning of the 2010s, a shift took place in AG:

- **Debating systems** started to emerge (Project Debater, IBM[a])
- **Natural Language Generation** started to be used in AG.

Generation of argument components

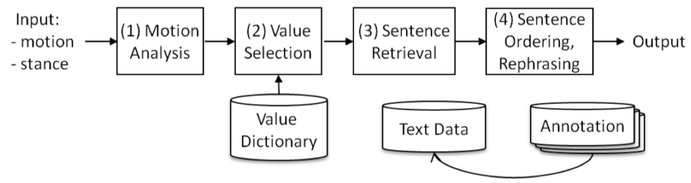
Claim Generation: CG is different from **Claim Retrieval**. Its input is often a debate topic (Internet censorship) and a typical output is an assertion with a clear stance (Internet censorship is a violation of free speech). Bilu and Slonim [8] showed that a predicate on a certain topic can be applied to other topics. Gretz et al. [9] showed the potential of GPT-2 in CG. Alshomary et al. [10] **Encode users' beliefs** into CG by leveraging bag-of-words representations of users' stances on various topics;

Contrastive Claim Generation: Negation has an important role in argumentation. However, explicit negation is not always possible. Hidey and McKeown [11] used a seq2seq model to encode the original claim with an attention mechanism and compared a sequence of **words** or a sequence of **edits** as decoder input to implement negation. They found that the sequence of edits representation was more effective. The task of *Bias Flipping* [12] (i.e., switch the left or right bias of an article) is similar to CCG.

Conclusion Generation: Conclusion Generation is sometimes necessary because **conclusions often remain implicit**. **Premise Target Identification** [13] identifies the target in a premise. Based on this task, Alshomary et al. [14] initiated the task of **Conclusion Target Inference** identifying the final target in a conclusion. An explicit conclusion is generated once the target is identified. Finally, **Enthymeme Reconstruction** clarifies how a conclusion is inferred from the given premises.

Generation of full arguments

Sato et al. [15] presented the **first end-to-end rule-based** retrieval system to generate arguments: at least **4 distinct components** need maintenance; The value dictionary containing talking points (economy, health, etc.) is **hand-made**.



Some studies propose to use a neural summarization approach which formulates the summary by stating **the main claim and the supporting reason**. This task is called **Argument Snippet Generation (ASG)** [16].

In terms of CAG, Hua and Wang [17] proceeded in two steps by using a seq2seq neural network: evidence retrieval and text generation. Especially, the decoding phase has a **distinct talking points generation step**.

Alshomary et al. [18] proposed to attack an argument by challenging the validity of one of its premises

[a] https://www.research.ibm.com/artificial-intelligence/project-debater/.

Datasets in AG and CAG classified by subareas

Task	Datasets	Source	Size
CG	[24]	Crowd annotation	30k arguments, 71 topics
	[48]	Wikipedia articles	2.3k claims, 58 topics
Belief-based CG	[1]	debate.org	51k claims, 27k topics
CCG	[26]	Reddit	1,083,520 pairs of contrastive claims
Bias Flipping	[18]	Biased headlines from allsides.com	6458 claim-like headlines
CG or PTI	[7]	Wikipedia articles	2,394 claims, 55 topics
CTI	[61]	idebate.org	2,259 arguments, 676 topics
ER	[25]	Comments section of the New York Times	2k arguments with two enthymemes of which one is correct
	[8]	Extended from a collection of five sentence stories	7,2k argument-hypothesis pairs
ASG	[2]	args.me	83 arguments along with two-sentence snippets
AG and CAG	[59]	Written by experts based on pools of ADUs representing pros and cons	130 logos-oriented and 130 pathos-oriented arguments, 10 topics
	[28]	Change My View (CMV) channel of Reddit	26,525 arguments, 305,475 counter-arguments
	[4]	CMV	111.9k triples of argument, weak premise and counter-argument

Conclusions and perspectives

Studies on AG and and CAG are clearly on the rise, with multiple subareas and research directions.

Four lines of research are particularly promising:

- Integration of **users' beliefs and preferences** in AG;
- Development of intelligent argument **dialogue systems**;
- Design of **novel evaluation metrics** concerning the quality of automatically generated arguments;
- Integration of **fact-checking** into AG to produce consistent, verified and sound arguments.

The main objective of AG and CAG is to generate coherent and understandable (counter-)arguments based on a given input, which still remains the biggest challenge to be resolved.

Main references

[1] Manfred Stede and Jodi Schneider. "Argumentation Mining". In: *Synthesis Lectures on Human Language Technologies* 11.2 (2018), pp. 1–191.

[2] Anne Lauscher et al. "Scientia Potentia Est—On the Role of Knowledge in Computational Argumentation". In: *Transactions of the Association for Computational Linguistics* 10 (Dec. 2022), pp. 1392–1422. ISSN: 2307-387X. DOI: 10.1162/tacl_a_00525. (Visited on 01/17/2023).