Machine learning for argumentation mining

Quick overview

TECHNISCHE UNIVERSITÄT DARMSTADT

2nd Workshop on Argumentation Mining
NAACL2015, Denver, Colorado

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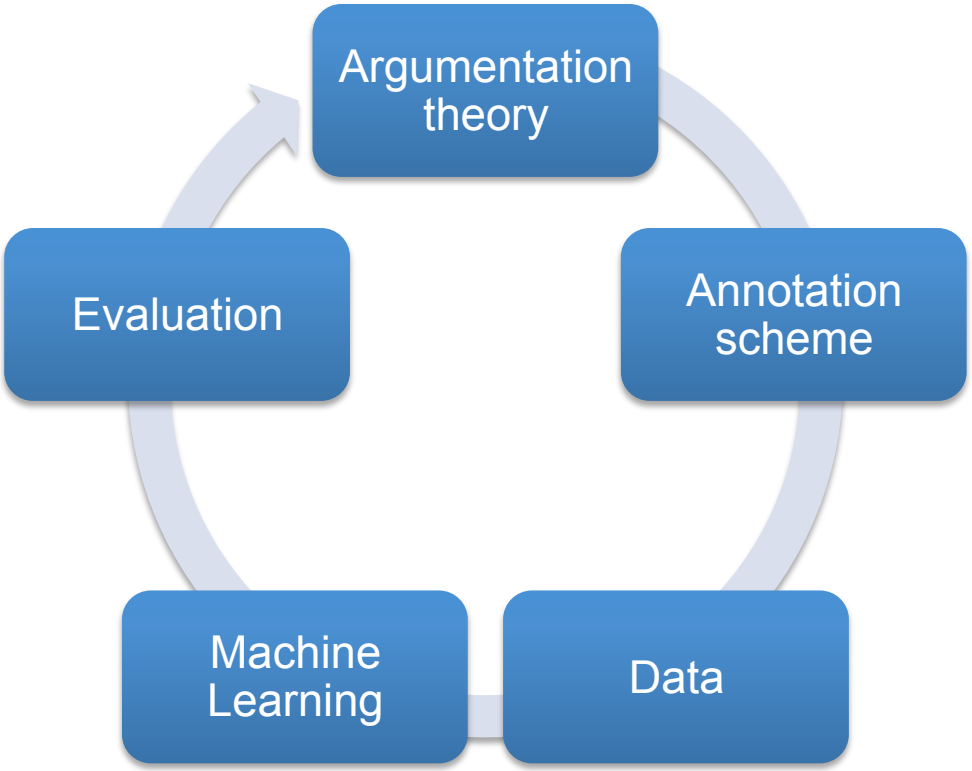
It's all about…

- …the argumentation
  - Theory
  - Model
  - Annotation scheme
  - Task
- …and also...
  - Data
  - Evaluation



Argumentation models

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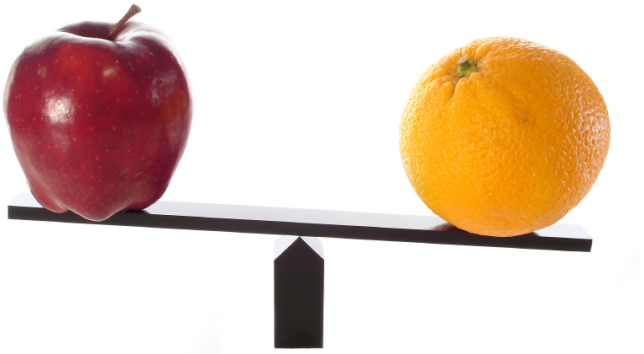
- Micro-level
  - Walton's schemes
    - Prototypical patterns
  - Toulmin's model
    - Various components
  - Components and relations
    - Claims, premises and support, attack
- And lots of arbitrary decisions
  - What are the single units?
  - What NOT to annotate?
  - Rich structure versus flat annotations?
- Macro-level
  - Dung's abstract framework
    - Graph-based dialogical model
  - Pragma-dialectical theory
    - Has anyone actually used it?



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Datasets

Source	Arg. Model	Domain	Size	IAA
Newman and Marshall (1991)	Toulmin (1958)	legal domain (People vs. Carney, U.S. Supreme Court)	qualitative	N/A
Bal and Dizier (2010)	proprietary	socio-political newspaper editorials	56 documents	Cohen's κ (0.80)
Feng and Hirst (2011)	Walton, Reed, and Macagno (2008) (top 5 schemes)	legal domain (AracuariaDB corpus, 61% subset annotated with Walton scheme)	$\approx$ 400 arguments	not reported claimed to be small
Biran and Rambow (2011)	proprietary	Wikipedia Talk pages, blogs	309 + 118	Cohen's κ (0.69)
Georgila et al. (2011)	proprietary	general discussions (negotiations between florists)	21 dialogs	Krippendorff's α (0.37-0.56)
Mochales and Moens (2011)	Claim-Premise based on Freeman (1991)	legal domain (AracuariaDB corpus, European Human Rights Council)	641 documents w/ 641 arguments (AracuariaDB) 67 documents w/ 257 arguments (EHRC)	not reported
Walton (2012)	Walton, Reed, and Macagno (2008) (14 schemes)	political argumentation	256 arguments	not reported
Rosenthal and McKeown (2012)	opinionated claim, sentence level	blog posts, Wikipedia discussions	4000 sentences	Cohen's κ (0.50-0.57)
Conrad, Wiebe, and Hwa (2012)	proprietary (spans of arguing subjectivity)	editorials and blog post about Obama Care	84 documents	Cohen's κ (0.68) on 10 documents
Schneider and Wyner (2012)	proprietary, argumentation schemes	camera reviews	N/A (proposal/position paper)	N/A
Schneider, Davis, and Wyner (2012)	Dung (1995) + Walton, Reed, and Macagno (2008)	unspecified social media	N/A (proposal/position paper)	N/A
Villalba and Saint-Dizier (2012)	proprietary, RST	hotel reviews, hi-fi products, political campaign	50 documents	not reported
Peldszus and Stede (2013a)	Freeman (1991) + RST	Potsdam Commentary Corpus	N/A (proposal/position paper)	N/A
Florou et al. (2013)	none	public policy making	69 argumentative segments / 322 non-argumentative segments	not reported
Peldszus and Stede (2013b)	based on Freeman (1991)	not reported, artificial documents created for the study	23 short documents	Fleiss' κ multiple results
Sergeant (2013)	N/A	Car Review Corpus (CRC)	N/A (proposal/position paper)	N/A
Wachsmuth et al. (2014)	none	hotel reviews	2100 reviews	Fleiss' κ (0.67)
Llewellyn et al. (2014)	proprietary, no argumentation theory	Riot Twitter Corpus	7729 tweets	only percentage agreement reported
Stab and Gurevych (2014a)	Claim-Premise based on Freeman (1991)	student essays	90 documents	Kripp. α_U (0.72) Kripp. α (0.81)
Aharoni et al. (2014)	proprietary (claims, evidence)	Wikipedia	104 documents	Cohen's κ (0.40)
Park and Cardie (2014)	proprietary (argument propositions)	policy making (passenger rights and consumer protection)	1047 documents	Cohen's κ (0.73)
Goudas et al. (2014)	proprietary (premises)	social media	204 documents	not reported
Faulkner (2014)	none ("supporting argument")	student essays	8176 sentences	Cohen's κ (0.70)

Walton schemes family

- Mochales and Moens, 2011
  - Tasks
    - (1) Binary classification of all the propositions of the text as argumentative or non- argumentative - sentences on the *AraucariaDB* corpus (Reed and Rowe 2004), (2) classification as premise or conclusion
  - Classifier
    - multinomial Naive Bayes, MaxEnt, SVM
  - Features
    - N-grams, POS features, all word pairs, length, punctuation, key word, parse tree depth, context
  - Results
    - 0.73-0.80 accuracy (1), 0.74 (conclusion), 0.68 (premise) F1 (2)

Mochales, R., & Moens, M.-F. (2011). Argumentation mining. Artificial Intelligence and Law, 19(1), 1–22. doi:10.1007/s10506-010-9104-x

Walton schemes family

- Feng and Hirst, 2011
  - Task
    - Assign argument into one of five most common argumentation schemes (AraucariaDB)
  - Classifier
    - C4.5 decision tree
  - Features
    - Location, lenght, scheme-specific features (punctuation, keywords, words from General Inquirer, dependency parser output)
  - Results
    - Various experiments (0.60-0.90 accuracies)

Feng, V. W., & Hirst, G. (2011). Classifying Arguments by Scheme. In Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics (pp. 987–996). Portland, Oregon: Association for Computational Linguistics.

Walton schemes family

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- Rooney, Wang, and Browne (2012)
  - Task
    - Whether a sentence belongs to an argumentative element or not using the same corpus
  - Classifier
    - Convolution kernel methods (SVM w/ normalized factored kernel)
  - Results
    - 0.65 accuracy

Rooney, N., Wang, H., & Browne, F. (2012). Applying Kernel Methods to Argumentation Mining. In Proceedings of the Twenty-Fifth International Florida Artificial Intelligence Research Society Conference Applying (pp. 272–275). Association for the Advancement of Artificial Intelligence.

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Claim-premise family

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- Stab and Gurevych (2014)
  - Task
    - (1) Classify sentences to four categories (none, major claim, claim, premise), (2) Find relation between sentences (support, attack)
  - Classifier
    - SVM
  - Features
    - Structural, lexical, (n-grams, verbs, etc.), parse tree-based, dependency production rules
  - Results
    - 0.72 macro-F1 both for (1) and (2)

Stab, C., & Gurevych, I. (2014). Annotating Argument Components and Relations in Persuasive Essays. In Proceedings of COLING 2014, the 25th International Conference on Computational Linguistics: Technical Papers (pp. 1501–1510). Dublin, Ireland: Dublin City University and Association for Computational Linguistics.

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Claim-premise family

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- Biran and Rambow (2011)
  - Task
    - Identifiy justifications for subjective claims in blog threads and Wikipedia talk pages
  - Classifier
    - naive Bayes
  - Features
    - Lengths, BOW, indicators extracted from RST, word pairs (context)
  - Results
    - 0.46 and 0.50 F1 score

Biran, O., & Rambow, O. (2011). Identifying Justifications in Written Dialogs By Classifying Text As Argumentative. International Journal of Semantic Computing, 05(04), 363–381. doi:10.1142/S1793351X11001328

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Claim-premise family

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- Rosenthal and McKeown (2012)
  - Task
    - Determine whether sentence is a claim in blogs and Wikipedia talks
  - Classifier
    - MaxEnt
  - Features
    - N-grams, POS, sentiment, emoticons
  - Results
    - Around 0.70 accuracy (several experimental setups)

Rosenthal, S., & McKeown, K. (2012). Detecting Opinionated Claims in Online Discussions. In 2012 IEEE Sixth International Conference on Semantic Computing (pp. 30–37). IEEE. doi:10.1109/ICSC.2012.59

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Claim-premise family

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- Park and Cardie (2014)
  - Task
    - Classify propositions in user comments into three classes (verifiable *experiential, verifiable non-experiential,* and *unverifiable)*
  - Classifier
    - Linear SVM
  - Features
    - N-grams, SBAR tags, POS counts, Sentiment clue counts, Speech event counts, Tense and Person counts
  - Restuls
    - 0.69 macro F1 score

Park, J., & Cardie, C. (2014). Identifying Appropriate Support for Propositions in Online User Comments. In Proceedings of the First Workshop on Argumentation Mining (pp. 29–38). Baltimore, Maryland USA: Association for Computational Linguistics.

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Claim-premise family

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- Goudas et al. (2014)
  - Task
    - (1) Classify argumentative/non-argumentative sentences
    - (2) Identifiy *premises* in Greek social media texts using BIO encoding
  - Classifier
    - (1) MaxEnt, (2) Conditional Random Fields
  - Features
    - Positions, punctuation, cue words, n-grams, POS-grams, entities in context, ratio of n-gram lang. models
  - Results
    - 0.77 macro F1 (1), 0.42 macro F1 (2)

Goudas, T., Louizos, C., Petasis, G., & Karkaletsis, V. (2014). Argument extraction from news, blogs, and social media. In A. Likas, K. Blekas, & D. Kalles (Eds.), Artificial Intelligence: Methods and Applications (pp. 287–299). Springer International Publishing.

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And others

- Dialogical argumentation (Cabrio and Villata, 2012)
- Toulmin's model (Habernal et al., 2014)
- Stance recognition (Hasan and Ng, 2013)

Cabrio, E., & Villata, S. (2012). Natural Language Arguments- A Combined Approach. In L. De Raedt (Ed.), Proceedings of European Conference on Artificial Intelligence ECAI 2012 (Vol. 242, pp. 205–210). IOS Press.

Habernal, I., Eckle-Kohler, J., & Gurevych, I. (2014). Argumentation Mining on the Web from Information Seeking Perspective. In E. Cabrio, S. Villata, & A. Wyner (Eds.), Proceedings of the Workshop on Frontiers and Connections between Argumentation Theory and Natural Language Processing (pp. 26–39). Bertinoro, Italy: CEUR-WS.

Hasan, K. S., & Ng, V. (2013). Stance Classification of Ideological Debates - Data , Models , Features , and Constraints. In Proceedings of the Sixth International Joint Conference on Natural Language Processing (pp. 1348–1356). Association for Computational Linguistics.

Conclusions and outlook

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- Supervised machine learning
- Features
  - N-grams, POS, syntax
  - From external resources
    - Discourse markers
    - Task-tailored lists of words
    - Sentiment-related lexicons
- What's next?
  - Semi-supervised?
  - Embeddings?

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