Proposed Projects: SWP 2019/20

Prof. Dr. Anette Frank

Department of Computational Linguistics
Heidelberg University

frank@cl.uni-heidelberg.de

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Project 1:
Building Argument Knowledge Graphs (AKG) for Debating

1. Building AKGs from Large-scale Argumentation Datasets
2. Explainability: Classify Arguments with Explanations and Frames
3. Synthesis: Generating (Counter-)Arguments in Debates
What is argumentation and what is it good for?

**Deliberation:** considering pros and cons of controversial issues

Examples: Brexit, e-scooters, raise flight prices, serve meat in canteen

Argumentation: Tasks

- Argument Analysis: given a debate or argumentative text, identify Argumentative relations between Argumentative Units (AUs), e.g.
  - *topic – stance* (pro or con of AU given T)
  - *support vs. attack* between AUs

- Argument Synthesis: generating arguments Baff et al. (2019)
  - given a topic: generate pro or con arguments
  - given a premise, generate a counter-argument
  - using counter-considerations to reinforce your argument
### Framing

- Arguments are made from specific **perspectives** (or 'frames'): economic, social, ethical, health, legal, security, reputation, ...
  
  (cf. Ajjour et al. (2019a))

- E.g., two arguments on different topics, but sharing common frame:
  - **Arg1**: I support legalization of marijuana since it can be taxed for revenue gain. [Topic: Marijuana] [Frame: economic]
  - **Arg2**: Legalizing prostitution would increase government revenue. A tax on the fee charged by a prostitute, and the imposition of income tax on the earnings of prostitutes would generate revenue. [Topic: Prostitution] [Frame: economic]

- **Argue convincingly** by framing your arguments according to the perspectives of your audience!
A refuted counter-argument makes your argument stronger!

- **Counter-considerations:** taking possible objections into account
  
  A debater can reinforce her position by *raising potential objections* and *refuting them right away*. This needs to be explicitly marked.
  
  cf. Peldszus and Stede (2015b)
  
  - “Some people *think that X*. However, this ...”
  - “Even *though the project is expensive, we need to pursue it, because*...”

  Q: Are there *specific frames* that are often put in contrast?

  Q: How to *coherently combine and refute counter-arguments*?

  \[ \Rightarrow \] Learn patterns and factors from large argumentation data sets.
Hypotheses

1. Argumentation needs domain-specific knowledge
   - for Analysis and Synthesis
   - existing knowledge graphs are too general (ConceptNet)
     or not domain-specific (DBpedia) (Kobbe et al. (2019))
   - **Aim:** harvest argument-relevant knowledge from debating portals
   - **Aim:** employ harvested knowledge in Analysis and Synthesis

2. Classification of argument frames:
   - provides coarse-grained aspects for selection from knowledge graph
   - supports convincingness (audience-oriented)
   - helps ensure coherence (wrt. previous premises or counter-arguments)
   - ensure diversification

3. Argument Synthesis can be enhanced with generation and integration of *counter-considerations*
Knowledge Graph Construction (KGC)

Different techniques can be used for KGC

- Fan et al. (2019) use OpenIE to extract concept nodes and relations, and TF-IDF to collapse nodes (scientific literature)

Figure: Left: two documents mapped to a graph; Right: steps in graph construction: node merging and frequency-based edge weighting.

Alternatives

- AMR Parsing (Zhang et al., 2019) or DRT Parsing (Liu et al., 2019)
- Semantic Dependency Parsing (Dozat and Manning, 2018)
Both tasks can be approached using neural systems and knowledge graphs.

**Argument Framing = Multi-class text classification task**

Paul and Frank (2019):

Ranking and Selecting Multi-hop Knowledge Paths for better predicting Human Needs

- encode text (premises)
- extract knowledge subgraph connecting concepts from text and frames
- select relevant (shortest) paths using graph centrality measures

**Argumentative Relation Classification**

Kobbe et al. (2019), Paul et al. (2019):

Classify argumentative relations between AUs w/ NN & knowledge paths
Generate Arguments from Argument Knowledge Graph (Data2Text)

Based on your data for text-to-graph construction (KGC):

- Select relevant frames and knowledge sub-graphs given a topic
- Make your argument coherent and convincing (i.e., in context):
  - diversification: bring up further aspects (frames) given prior premises
  - select appropriate counter-arguments
  - raise and refute counter-considerations when debating
- Possible approach: Graph writer (Koncel-Kedziorski et al. (2019))

Encode graph and prior context (premises/topic) to generate arguments
Data sets

- Datasets extracted from debate portals (not necessarily discursive)
  - Ajjour et al. (2019a,b); Trautmann et al. (2019); Kobbe et al. (2019) (the latter two: in-house-access)
- Annotated essays or microtexts (discursive texts)
  - e.g., Peldszus and Stede (2015a,b)
1. **Knowledge Graph Construction**: Building Argumentation Knowledge Graphs (AKG) from Argumentation Datasets

2. **Explainability**: Classify Argumentative Relations with Frames and Knowledge-based Explanations

3. **Synthesis**: Using AKG for Generating Counter-Arguments in Debates

- variable scope: 1 + 2 or 1 + 3
- group size: 3-4 students
References Project 1


Project 2: Language Modeling makes Sense (LMMS) for FrameNet

1. With contextualized word embeddings (a.k.a. BERT) we are able to learn sense-specific word representations.

2. CWEs are able to perform **supervised and unsupervised** WordNet-based WSD at high performance levels.

3. Project aims:
   - apply LMMS to the FrameNet frame identification task, exploiting annotated data, frame and role definitions and frame-to-frame relations.
   - evaluate relative impact of training data, definitions and F2F relations.

Group size: 2-3 students
FrameNet-style semantic role labeling (SRL) differs from PropBank SRL: it assigns semantically interpretable roles and groups predicates into families of semantic frames.

This makes the framework attractive for many tasks, such as narrative text modeling or interpretation of images. (Silberer and Pinkal 2018)

In contrast to PropBank, FrameNet offers very detailed definitions of both frames and roles.

An important task in FrameNet SRL is frame identification: given a predicate in context, predict the appropriate frame (Hartmann et al. (2017); Botschen et al. (2018)).

This is essentially a word sense disambiguation (WSD) task.
Previously available word representations (Word2Vec, GloVe, etc.) conflate all meanings of a word in one single representation. It is therefore difficult to put WEs to use for WSD.

The new contextualized word representations (such as BERT, Devlin et al. (2019)) learn sense-specific word representations by conditioning on the context in which the word or predicate occurs.

It is now possible to induce sense-specific word representations from rich lexical resources, to perform supervised or unsupervised word sense disambiguation (e.g. LMMS for WordNet-based WSD (Loureiro & Jorge 2019))

The obtained performance increases are impressive!
Steps  (Loureiro and Jorge (2019))

1. **train**: create initial sense embedding by bootstrapping from annotated corpora.

2. **extend**: propagate supervised representations (sense embeddings) through WordNet

3. **embeddings (glosses)**: create sense embeddings based on WordNet’s glosses and lemmas (using bert-as-a-service)

4. **embeddings (lemmas)**: create sense embeddings from lemmas (synsets)

5. **concat**: concatenate and normalize

LMMS: Language Modeling Makes Sense:  https://github.com/danlou/LMMS
Project aims:

- Address the frame identification task (Hartmann et al. (2017); Botschen et al. (2018)) using LMMS on the basis of BERT.

- FrameNet provides
  - rich definitions of frames and their participating roles, and
  - frames are densely connected with frame-to-frame relations

- **Evaluate** the impact of BERT on the frame identification task, using (in isolation and diverse combinations):
  - supervised training data
  - propagation via frame-to-frame relations
  - frame definitions
  - role definitions

