What to Do with an Airport? Mining Arguments in the German Online Participation Project Tempelhofer Feld

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ONLINE-PARTIZIPATION

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Outline

What is the Tempelhofer Feld?

- Former airport *Berlin-Tempelhof (THF)*, air traffic was ceased in 2008
- 300 hectare area that is mostly open space, used for recreation (inline skating, kite surfing, ...)

What is Online Participation?

- Involvement of citizens in relevant political or administrative decisions
- Cities offer their citizens an internet-based way to participate in drafting ideas for urban planning or in local political issues
- Examples:
  - Lörrach: sustainable urban development
  - Darmstadt and Bonn: gather proposals in participatory budgetings
  - Berlin: Tempelhofer Feld

Tempelhofer Feld + Online Participation

- Official online plattform[1] that includes citiziens in the planning of the area's future
- *ThF law* entered into force in 2014: structural changes are limited, for instance the construction of new buildings on the field is prohibited
- The project aims to collect ideas that improve the field for visitors while adhering to the ThF law.
- Official submission phase for proposals from November 2014 until the end of March 2015

[1] `https://tempelhofer-feld.berlin.de`

Tempelhofer Feld + Online Participation

- Forum-like plattform with proposals and comments
- Until July 2015, users proposed 340 ideas and wrote ≈1400 comments.
- ≈7000 sentences in the whole plattform
- Comments vary in length: on average 3.5 sentences

Desired System Output

- Assume that you have thousands of text comments
- An automatic extraction approach should answer three questions:
  1. What are suggestions that politicians can decide upon?
  2. What are reasons for/against the realization of these suggestions?
  3. How many citiziens express a pro/contra stance towards these suggestions?

Argumentation Model

- We tried to apply existing argumentation models, namely Toulmin and the claim-premise scheme.
- We quickly realized that
  - we have discourse between different users
  - attacks on logical conclusions are rather rare
  - users frequently express their wishes
  - users participate by providing reasons for and against other suggestions
  - suggestions cannot be classified as true or false
  - suggestions can be accepted without additional support

Argumentation Model

- We decided to modify the claim-premise family and its modification for persuasive essays from Stab and Gurevych 2014[2] to a three-part model in online participation processes: (i) major positions, (ii) claims, and (iii) premises
- **major positions**:
  - are options for actions or decisions that occur in the discussion (e.g., "*We should build a playground with a sandbox.*" or "*The opening hours of the museum must be at least two hours longer.*").
  - are most often someone's vision of something new or of a policy change.
  - In our practical view, major positions are unique suggestions from citizens that politicians can decide on.

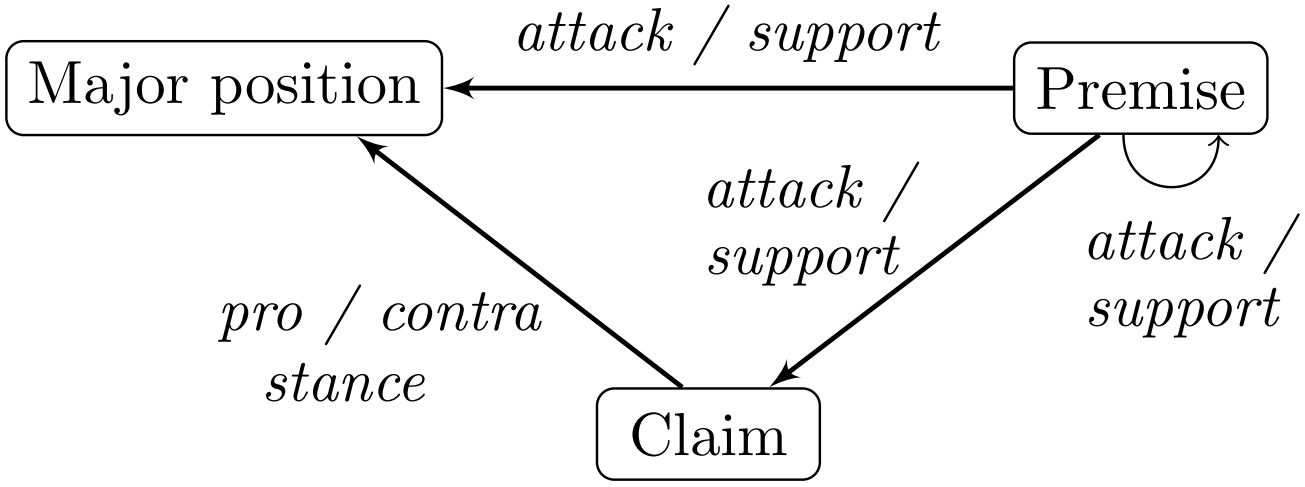
[2]Christian Stab and Iryna Gurevych. 2014. Annotating Argument Components and Relations in Persuasive Essays. COLING

Argumentation Model

- **claims**:
  - are pro or contra stances towards a major position (e.g. "*Yes, we should definitely do that!*")
- **premises**:
  - are defined as reasons that attack or support a major position, a claim or another premise
  - are used to make an argumentation comprehensible for others, by reasoning why a suggestion or a decision should be realized or why it should be avoided (e.g. "*This would allow us to save money.*")

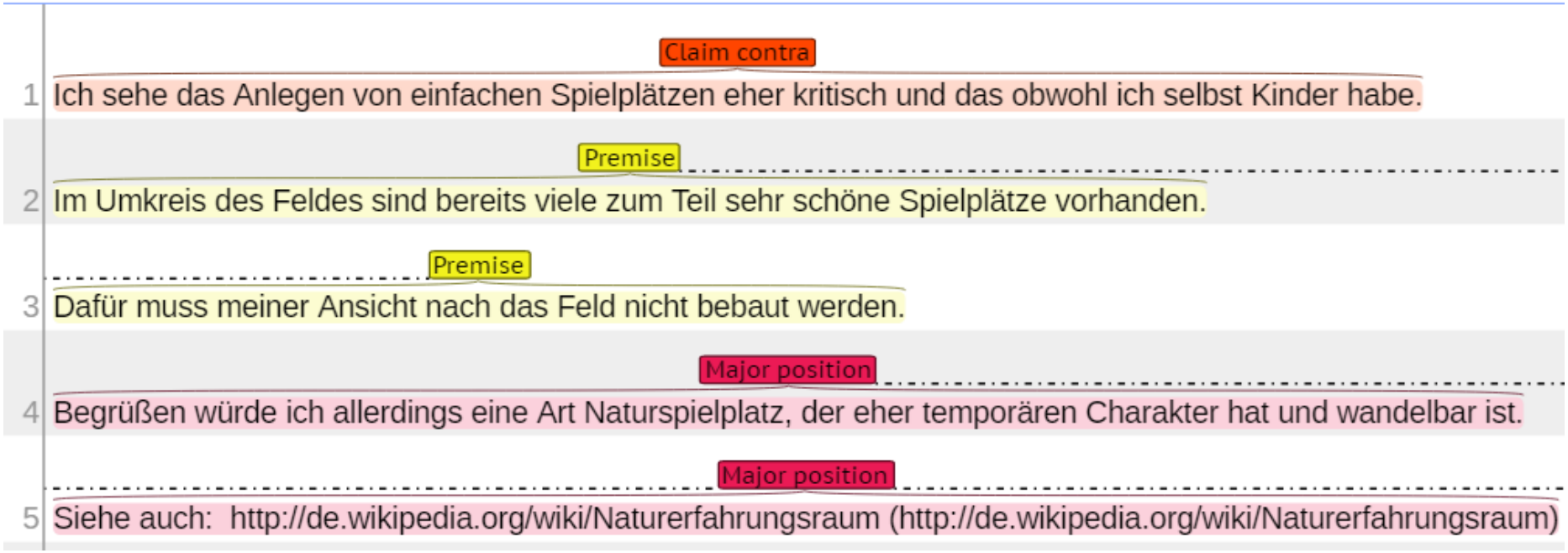
Argumentation Model

- Relations between the argument components



Annotation

- We used three annotators to annotate a subset of the online participation project.
- The annotators used *freely assignable spans*. Multiple annotations per sentence were possible.
- The dataset was annotated in the *brat rapid annotation tool*:



Inter-Annotator Agreement

- Before annotating our dataset, we took a subset (8 proposals and 74 comments, comprising 261 sentences and 4.1k tokens) to measure the IAA among the three annotators.
- We use *DKPro Agreement* to report our inter-annotator agreement values
  - Krippendorff's unitized alpha α_u
  - token-based observed agreement $A_{o,t}$
  - token-based Fleiss' kappa κ_t

  for the following three scenarios

  (i) joint measures over all categories
  (ii) category-specific values
  (iii) argumentative vs. non-argumentative units

Inter-Annotator Agreement

	$A_{o,t}$	κ_t	α_u
all	76.4	62.6	**78.0**
major positions	89.3	71.9	79.8
claims pro	96.3	66.1	59.0
claims contra	95.6	52.3	57.2
premises	80.9	61.5	80.1
AU / non-AU	90.7	49.1	**92.4**

- Reliable agreement between our three annotators:
  - $\alpha_u = 0.924$ for argumentative versus non-argumentative spans
  - $\alpha_u = 0.78$ for the joint measure for all categories

Statistics of the annotated corpus

- 72 proposals
- 575 comments
- $\approx$2400 sentences
- 88% of the tokens belong to argumentative spans
- 3.6% of the sentences were annotated with more than one argument component

Classification

- Preprocessing:
  - *OpenNLP*: Sentence splitting and tokenization
  - *Mate Tools*: POS-tagging and dependeny parsing
- Classification tasks:
  - **Subtask A**: Classify sentences as argumentative or non-argumentative
  - **Subtask B**: Classify argument components in argumentative sentences with exactly one annotated argument component
- Training/Test data: 80% training set, 20 % test data
  - **Subtask A**: ≈2000 sentences for training
  - **Subtask B**: ≈1600 sentences for training

Features

All features are sentence-based:

- n-Grams
  - Unigrams
  - Bigrams
- Grammatical features:
  - L_2-normalized POS-Tag distribution
  - L_2-normalized dependency distribution
- Structural features:
  - token count
  - comma count / token count
  - dot count / token count
  - last-token of a sentence as a one-hot encoding (‘.’, ‘!’, ‘?’, ‘OTHER’)
  - number of links

Classification

- We evaluated three classifiers:
  - SVM with an RBF kernel
  - Random forest
  - k-nearest neighbor
- Gridsearch with 10-fold cross validation on the training set
- Evaluation metric: macro-averaged F_1
- We evaluated different feature combinations and report their results:

Results

Feature Set	AU / non-AU			Argument Components		
	SVM	RF	k-NN	SVM	RF	k-NN
Unigram	65.99	68.13	61.00	64.40	59.41	40.30
Unigram,lowercased	66.69	64.53	62.26	65.32	53.35	38.25
Bigram	41.79	50.48	16.25	46.62	50.42	11.51
Grammatical	55.88	52.24	48.52	59.54	47.89	46.81
U + G	**69.77**	58.39	64.87	**68.50**	57.13	35.90
U + G + Structural	67.50	61.14	54.07	65.99	59.46	47.27

Table: Macro-averaged F_1 scores for the two classification problems: (i) classifying sentences as argumentative and non-argumentative, (ii) classifying sentences as major positions, claims, and premises.

Results

- The best results for both subtasks were achieved by an SVM and *unigrams + grammatical features*.
- Confusion matrix for the best approach of subtask B:

Actual \ Predicted	MP	C	P	$\sum$
MP	63	4	43	110
C	9	48	12	69
P	27	20	172	219
$\sum$	99	72	227	398

- The classification of premises works well.
- Major positions are often misclassified as premises.

Conclusion

- New corpus for German argumentation mining (will be released shortly)
- Argumentation model for online participation
- Inter-annotator agreement study
- Two classification tasks:
  - We evaluated different feature combinations and multiple classifiers.
  - The best results of 69.77% in subtask A and 68.5% in subtask B were both achieved by a support vector machine.

Future Work

- Additional features to further increase our classification results
- Automatically detect tokens that form a group, based on the content. For this, we could use the token-based BIO scheme, which divides tokens into beginning (B), inner (I), and other (O) tokens of an argument component
- Identify more freely available corpora for online participation to which we can apply our model for a comparative study

Thanks for listening!

References

- Google Maps: Bilder (c) 2018 Google, Kartendaten (c) 2018 GeoBasis-De/BKG ((c)2009), Google