Give me More Feedback: Annotating Argument Persuasiveness and Related Attributes in Student Essays

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Automated Essay Scoring

- Current work's focus: **holistic** scoring, summarizing quality with one number
  - provides limited feedback to students
- A few attempts to address this problem by scoring a particular dimension of essay quality, such as coherence, technical errors, relevance to prompt, etc.
- Little work on scoring **argument persuasiveness** despite its being one of the most important dimensions of persuasive essay quality
  - Exception: Persing & Ng (2015)
  - Problems with P&N's persuasiveness-scored essay corpus
    - Only the "overall' argument was scored
    - The resulting score does not explain why the argument is (un)persuasive
      - Provides limited feedback to students on how to improve arguments

Goal

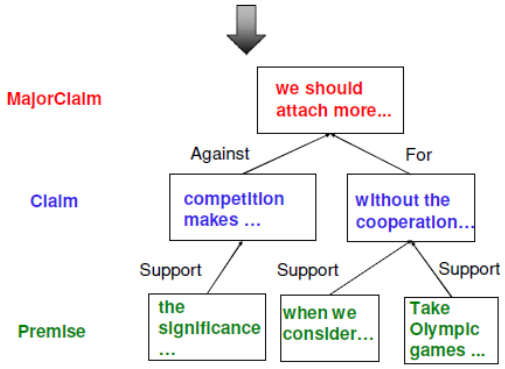
- Annotate a corpus of persuasive student essays that addresses the problems of P&N's corpus via designing annotation schemes and scoring rubrics
  - Score **each** argument's persuasiveness
  - Annotate the **attributes** of an argument that can impact its persuasiveness

Corpus

- 102 essays randomly chosen from the Argument Annotated Essays corpus
  - Each essay was annotated by Stab & Gurevych with an argument tree

Prompt: Should students be taught to compete or to cooperate?

… **we should attach more importance to cooperation during primary education.** First of all, …On the other hand, **the significance of competition is that**… Hence… **competition makes the society more effective**. However, **when we consider about the question that how to win the game**… **Take Olympic games for instance**… **Therefore without the cooperation there would be no victory of competition.**



Annotation

- **Definition:** for the purposes of our work, an argument is composed of a node in an argument tree and all of its children, if any
  - a non-leaf node can be interpreted as a conclusion supported/attacked by its children, which can be interpreted as evidences for the conclusion
  - a leaf node can be interpreted as an unsupported conclusion
- **Goal:** annotate each argument with its persuasiveness and a set of predefined attributes that could impact an argument's persuasiveness

Attribute	Possible Values	Applicability	Description
Persuasiveness	1-6	MC,C,P	How persuasive the argument is
Specificity	1-5	MC,C,P	How specific the statement is
Eloquence	1-5	MC,C,P	How well the idea is presented
Evidence	1-6	MC,C,P	How well the supporting statements support their parent
Logos/Ethos/Pathos	Yes,No	MC,C	Whether the argument uses the respective persusive strategy
Relevance	1-6	C,P	Relevance to the parent statement
ClaimType	Value,Fact ,Policy	C	The category of what is claimed
PremiseType		P	The type of premise
Strength	1-6	P	How well a single statement contributes to persuasiveness

Annotation Procedure

- Two human annotators who were both native speakers of English were first familiarized with the rubrics and definitions and then trained on five essays
- 30 essays were doubly annotated for computing inter-annotator agreement
- Each of the remaining essays was annotated by one of the annotators
- Score/Class distributions by component type:

Specificity	1	2	3	4	5
MC	0	73	72	32	8
C	80	259	155	59	14
P	64	134	238	173	98

Evidence	1	2	3	4	5	6
MC	3	62	57	33	16	14
C	246	115	85	80	35	6
P	614	28	12	26	15	12

Eloquence	1	2	3	4	5
MC	3	19	116	42	5
C	23	106	320	102	16
P	24	97	383	154	49

Persuasiveness	1	2	3	4	5	6
MC	3	62	60	28	17	15
C	82	278	84	74	39	10
P	8	112	145	249	123	70

ClaimType	Fact	Value	Policy
C	368	145	54

Relevance	1	2	3	4	5	6
C	1	33	58	132	97	246
P	5	45	59	145	147	306

PremiseType	Real example	Invented instance	Analogy	Testimony	Statistics	Definition	Common knowledge	warrant
P	93	53	2	4	15	3	493	44

Logos	Yes	No
MC	181	4
C	304	263

Pathos	Yes	No
MC	67	118
C	59	508

Ethos	Yes	No
MC	16	169
C	9	558

- Inter-annotator agreement (Krippendorff's alpha):

Attribute	MC	C	P
Persuasiveness	.739	.701	.552
Specificity	.560	.530	.690
Eloquence	.590	.580	.557
Evidence	.755	.878	.928
Relevance		.678	.555
Strength			.549
Logos	1	.842	
Pathos	.654	.637	
Ethos	1	1	
ClaimType		.589	
PremiseType			.553

- Persuasiveness agreement exhibits a downward trend as the component type narrows
- Evidence agreement exhibits an upward trends as the component type narrows
- Eloquence has one of the lowest agreement
- Specificity has low agreement in claims and major claims
- Relevance agreement for premises is one of the lowest

Analysis of Annotations

- To understand whether the attributes are useful for predicting persuasiveness, we compute the Pearson's Correlation Coefficient (PC) between Persuasiveness and each attribute along with the corresponding p-value
- Among the correlations that are significant at the $p < .05$ level, Persuasiveness is positively correlated with Specificity, Evidence, Eloquence, and Strength.
- Support in the form of statistics and examples is positively correlated with Persuasiveness
- Logos and invented_instance have significant correlations with Persuasiveness, but the correlation is weak

Attribute	PC	p-value
Specificity	.5680	0
Relevance	-.0435	.163
Eloquence	.4723	0
Evidence	.2658	0
Strength	.9456	0
Logos	-.1618	0
Ethos	-.0616	.1666
Pathos	-.0835	.0605
CType:Fact	.0901	.1072
CType:Value	-.0858	.1251
CType:Policy	-.0212	.7046
PType:real_example	.2414	0
PType:invented_instance	.0829	.0276
PType:analogy	.0300	.4261
PType:testimony	.0269	.4746
PType:statistics	.1515	0
PType:definition	.0278	.4608
PType:common_knowledge	-.2948	0
PType:warrant	.0198	.6009

- **Oracle experiment**: to understand how well these attributes, when used together, can explain persuasiveness, we train 3 linear SVM regressors, one for each component type, to score an arguments persuasiveness using gold attribute's as features
- Five-fold cross validation results (in terms of PC and ME (mean absolute error) show that they largely can

	MC	C	P	Avg
PC	.9688	.9400	.9494	.9495
ME	.0710	.1486	.0954	.1061