Surveytree

Automatic Generation of Survey Structures for NLP and AI topics

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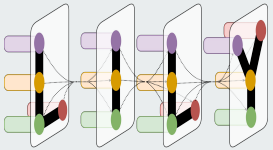
Yale



Why is structure important?

Structure increases readability

Consider:

(1) Definition, Task, Evaluation, Results

(2) Results, Task, Definition, Evaluation

Current systems

- **Domain-specific templates** by clustering (Sauper and Barzilay, 2009)
- **HMM** of topic ordering (Jha et al., 2015)

Surveys cover many subtopics

Each with their own subtopics

Eg. Automatic Summarization

-> Evaluation

-> ROUGE

-> BLEU

-> DUC Quality Questions

Approach

Convert document to tree

Nodes are section headings with subheadings as children

Extract features from heading

Adaptation of tf-idf

- tf: ancestor headings taken into account
- idf: word frequencies from ACL Anthology

Combine trees into single tree

Nodes merged recursively if similar

Other nodes are simply added

Dataset

Five topics considered

- Linear Algebra
- Statistics and Probability
- Sentiment Analysis
- Automatic Summarization
- Dependency Parsing

4 - 6 input documents from AAN each

Document Frequencies:

Calculated from papers in ACL Anthology

Evaluation & Results

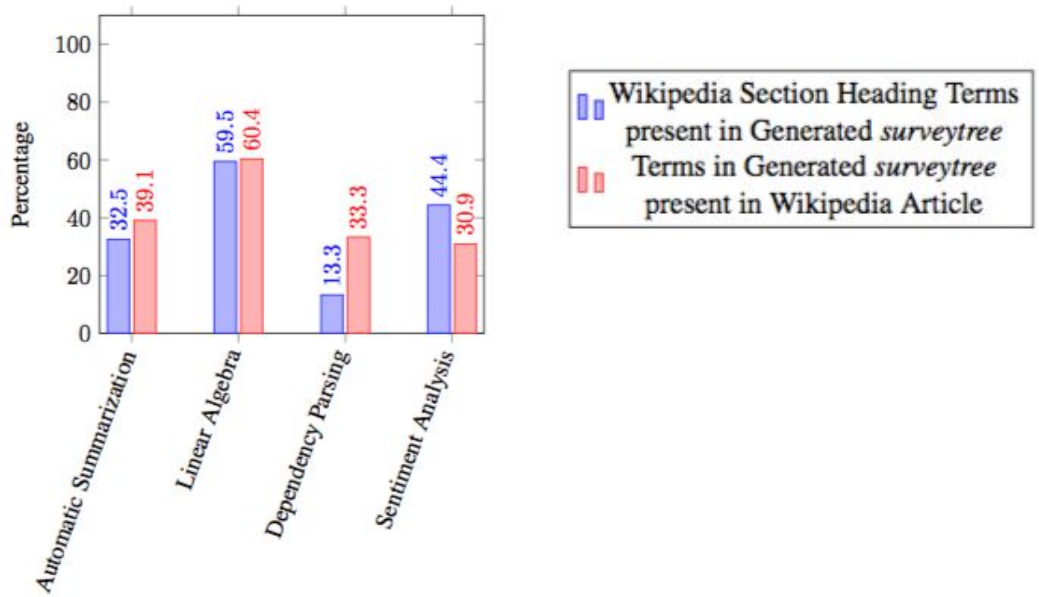
(1) Wikipedia Term Coverage

(2) Human Evaluation of Node Merges

(3) Tree Properties

(4) Inspection of Output

Wikipedia Term Coverage



Human Evaluations of Node Merges

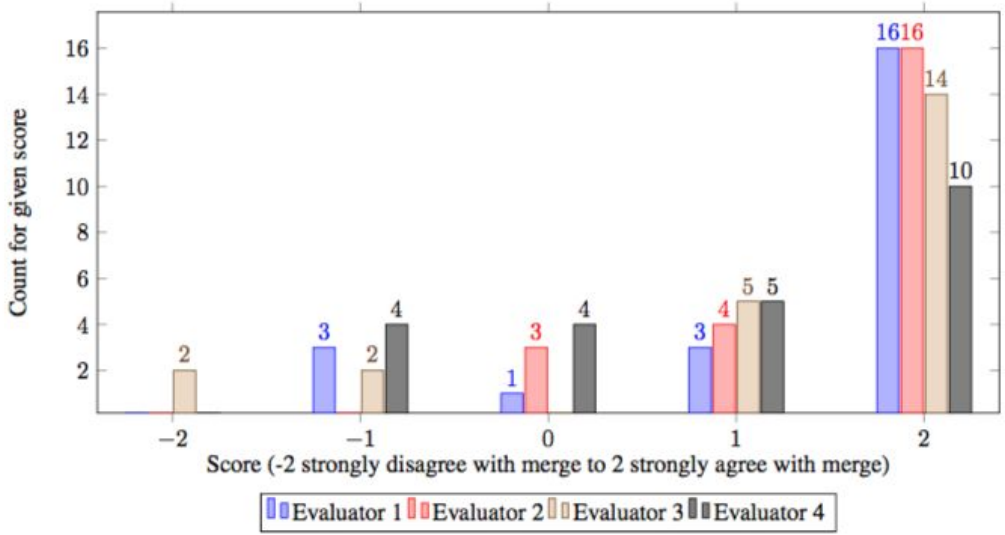


Figure 3: Evaluation of Heading Merges for Automatic Summarization

Human Evaluations of Node Merges

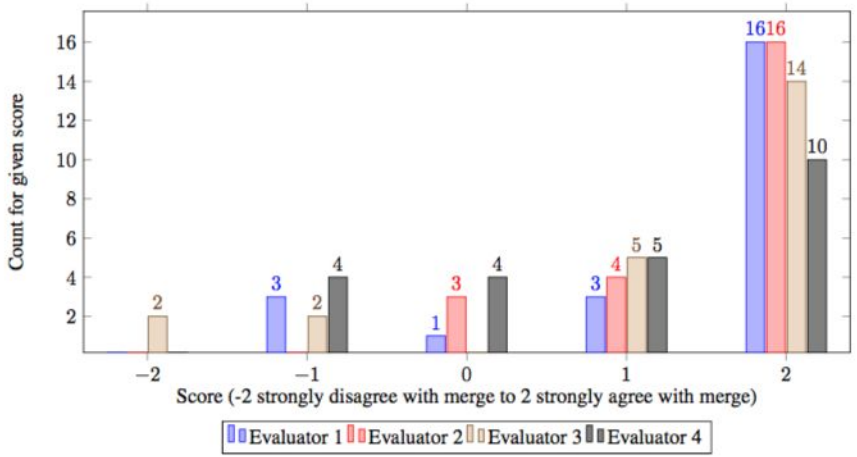


Figure 3: Evaluation of Heading Merges for Automatic Summarization

Topic	Krippendorff's α
Automatic Summarization	0.73
Linear Algebra	0.54
Statistics & Probability	0.48
Dependency Parsing	0.38
Sentiment Analysis	0.39

Table 2: Inter-Evaluator Agreement

Thanks Alex, Michi, and Ryan!

Human Evaluations of Node Merges

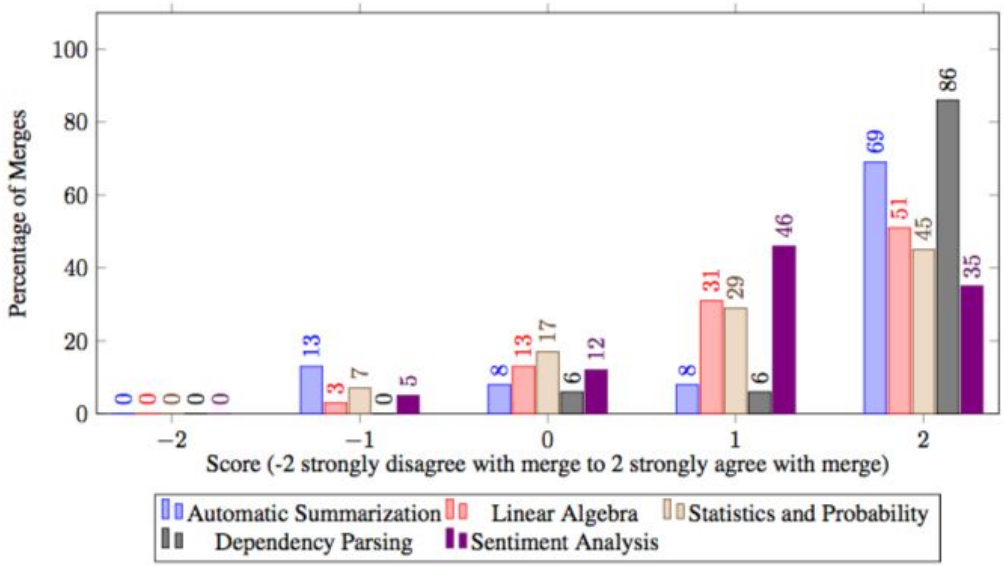


Figure 2: Mean Merging Agreement Score Distributions for each topic

Tree Properties

	surveytree	*dt* 1	*dt* 2	*dt* 3	*dt* 4	*dt* 5	sum	mean
# Nodes	123	90	73	56	51	28	298	59.6
# Nodes in *surveytree*	123	90	41	49	41	18	239	47.8
Max Depth	4	3	2	2	2	2	N/A	2.2
Mean Depth	2.8	2.7	2.0	0.8	2.0	2.0	N/A	1.9
Max # Children	19	11	12	25	8	13	N/A	13.8
Mean # Children	3.9	3.6	6.5	3.2	5.6	5.4	N/A	4.9

Table 3: Tree Structure Properties for Linear Algebra

Selections from Generated Survey Trees

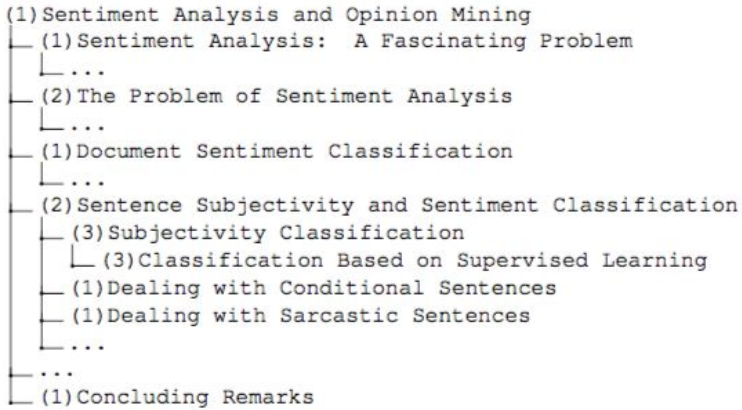


Figure 4: Selection of nodes from the generated *surveytree* of Sentiment Analysis

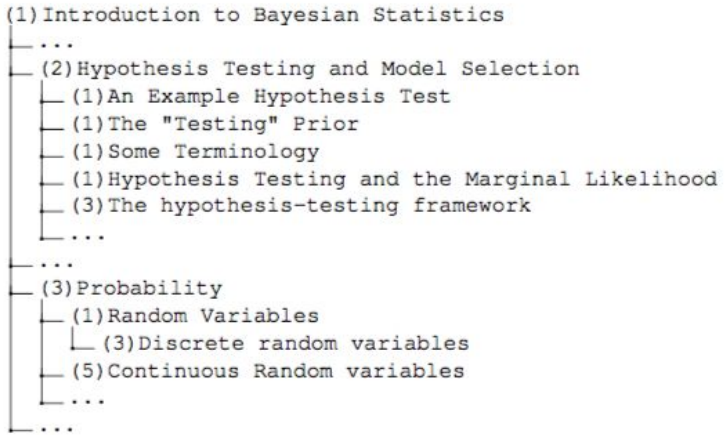


Figure 5: Selection of nodes from the generated *surveytree* of Statistics and Probability

Conclusion & Future Work

- This approach has potential
- Heading comparison works fairly well
- Also has a lot of room to improve
- Explore possibility of using vector magnitudes
- We need more reliably parsed input documents