On opinion summarization with textual entailment recognition

(and how I got here..)

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Outline

- Previous work
  - Sentiment Analysis
- Phd topic – Opinion Summarization with Textual Entailment Recognition
  - Textual entailment
- Current ongoing work

Sentiment Analysis – ABSA task

Task: SemEval 2014 – Task4 Aspect-Based Sentiment Analysis
→ Determine sentiments or opinions on different aspects of entities (fine-grained SA)

– Aspect term and aspect term polarity detection
– Aspect category and aspect category polarity detection
• Polarity = {positive, negative, neutral, conflict}
• Categories = {food, service, price, ambience, anecdotes}

Example: Restaurant review:
"Their pizza was great, yet the lasagna that my friend had was awful."

Aspect terms: pizza, lasagna
Aspect term polarity: pizza – positive, lasagna – negative
Aspect category: food
Aspect category polarity: food – conflict

XRCE: Hybrid classification for Aspect-Based Sentiment Analysis, Brun C., Popa D. N. & Roux C. In Proceedings of the 8th International Workshop on Semantic Evaluation (SemEval 2014), p. 838–842, Dublin, Ireland:Association for Computational Linguistics and Dublin City University.

Sentiment Analysis – ABSA method

Existing opinion detection system:

•Based on a robust dependency parser (Xerox Incremental Parser - XIP)

•Additional component extracting sentiments relations (Brun, 2012): Polar lexicon (1265 negative words, 1082 positive words)

Term detection

Goal: sentence → aspect terms

Method: Domain lexicon + hand-crafted rules to detect multiword terms

Term polarity detection

Goal: aspect term → aspect term polarity

Method: Additional sentiment extraction rules

Category detection

Goal: sentence → aspect categories

Method: logistic regression, bag-of-words (lemma forms + adjusted term freq)

Category polarity detection

Goal: 1 sentence, 1 category → aspect category polarity

Method: SVM, 5 models, bag-of-words, polarities

Sentiment Analysis – ABSA results

Data:
Training corpus: 3044 sentences annotated for all subtasks:
3699 aspect term occurrences, 3714 aspect categories occurrences
Test corpus : 800 sentences annotated for all subtasks:
1134 aspect term occurrences, 1025 aspect category occurrences

Phase A : Term & Category Detection

	Method	Prec.	Recall	F-Meas	Rank
Terms	Baseline	0.63	0.37	0.47	2
	XRCE	0.86	0.82	0.84	
Categories	Baseline	0.64	0.48	0.55	3
	XRCE	0.83	0.81	0.82	

Phase B: Term and Category Polarity Detection

	Method	Accuracy	Rank
Term Polarity	Baseline	0.58	4
	XRCE	0.78	
Categ. Polarity	Baseline	0.59	3
	XRCE	0.78	

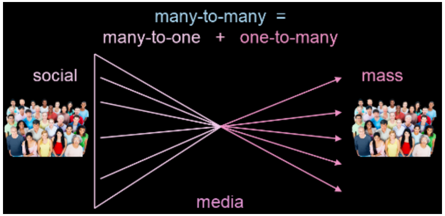
Label	F-measure	# of examples
Conflict	0.23	52
Negative	0.70	222
Positive	0.87	657
Neutral	0.48	94

Phd outline and goals

Goal: Investigate methods for producing abstract summaries* of opinionated statements

→ **range** and **quantitative distribution** of opinions

Motivation: * to * communication



A 3-steps approach:

Starting from a large collection of text statements expressing opinions on the same topic

1. Choose candidate statements
2. Estimate the ***pattern of agreement*** between opinions and statements
3. Select the statements to be included in the summary

*Summary = List of statements with % of opinions that agree to each statement

Phd focus

Pattern of agreement

→ Predict whether / to what extent a person who wrote an opinion would agree to a given statement

- Develop models of textual entailment

Particular focus and preference towards distributional semantics vector-space models.

- Train on labelled agreement-prediction data

Identify agreement/disagreement in linked social media posts → supervised learning setting (refinement on top of the unsupervised methods)

Phd focus - example

"Universal health care systems have lower long-term health costs as they encourage patients to seek preventative care"

"Public insurance is less costly than private insurance to the overall economy"

"Public insurance will help protect the uninsured from economic calamity"

Public healthcare is less expensive

Textual entailment

Textual entailment (TE) - directional relation between text fragments: T - the entailing "Text", and H - the entailed "Hypothesis"

T entails H if, typically, a human reading T would infer that H is most likely true.

A man inspects the uniform of a figure in some East Asian country.	**contradiction** C C C C C	The man is sleeping
An older and younger man smiling.	**neutral** N N E N N	Two men are smiling and laughing at the cats playing on the floor.
A black race car starts up in front of a crowd of people.	**contradiction** C C C C C	A man is driving down a lonely road.
A soccer game with multiple males playing.	**entailment** E E E E E	Some men are playing a sport.
A smiling costumed woman is holding an umbrella.	**neutral** N N E C N	A happy woman in a fairy costume holds an umbrella.

Textual entailment

Challenge: Variability of semantic expression; *-to-* mapping between language expressions and meanings.

Usefulness: NLP applications: QA, IE, (multi-document) summarization, MT

Attempts: Pascal RTE challenges (2006 →)

Methods: pattern-based models, distributional models

State-of-the-art: 84% (2014)

Textual entailment

Lexical entailment

- Different types of lexical semantic relationships

Hypernymy: X is a type of Y. *example: dog/animal*

Co-hyponymy: X and Y share the same hypernym. *example: dog/cat*

Meronymy: X is a part of Y. *example: paws/dog*

How to distinguish between them?

Textual entailment

→ Extensive use of lexical resources (WordNet, FrameNet)

→ Asymmetric measures

→ Distributional Semantic Models (vector-space models)

→ Distributional Inclusion Hypothesis

If u is semantically narrower term than v, then a significant number of salient distributional features of u is included in the feature vector of v as well.

$$WeedsPrec(u,v) = \frac{\sum_{f \in F_u \cap F_v} w_u(f)}{\sum_{f \in F_u} w_u(f)}$$

$$cosWeeds(u,v) = \sqrt{WeedsPrec(u,v) * \cos(u,v)}$$

$F(x)$ = set of distributional features of a term x

$w_x(f)$ = weight of feature f for x

→ Operations on word2vec/ GloVe embeddings

! Entailment vector space !

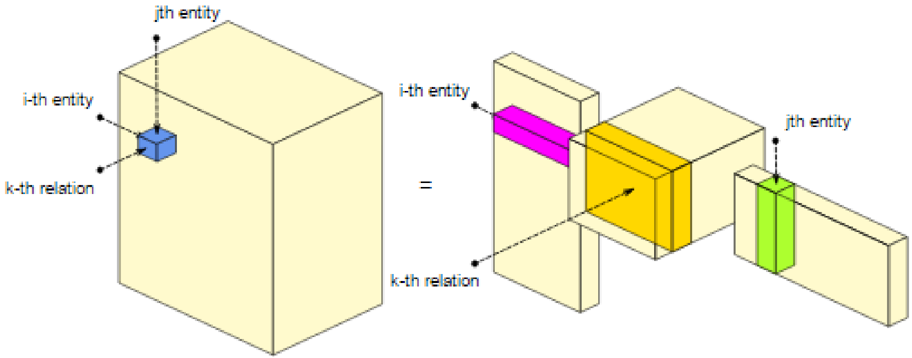
Ongoing work

Factorization Model - RESCAL

X = adjacency tensor representing a multigraph of sentences

X≈R× A × A, or equivalently in elementwise notation

$$x_{ijk} \approx a_i^T R_k a_j$$



Thank you!

More on Phd outline and goals

1. Choose a set of candidate statements

- **List the candidate statements** before seeing the opinions
- **Use the input opinions** as candidate statements
- **Apply paraphrasing** models to **extend** the set of **opinions** with simpler versions
- **Apply lexical entailment** to **substitute** terms in the set of input opinions

2. Estimate the pattern of agreement between opinions and statements

3. Select the subset of statements to be included in the summary

- Data = opinions, cluster labels = summary statements