University of Applied Sciences and Arts Northwestern Switzerland
School of Applied Psychology

Swiss Alliance for Data-Intensive Services

Triangulated Sentiment Analysis of Tweets

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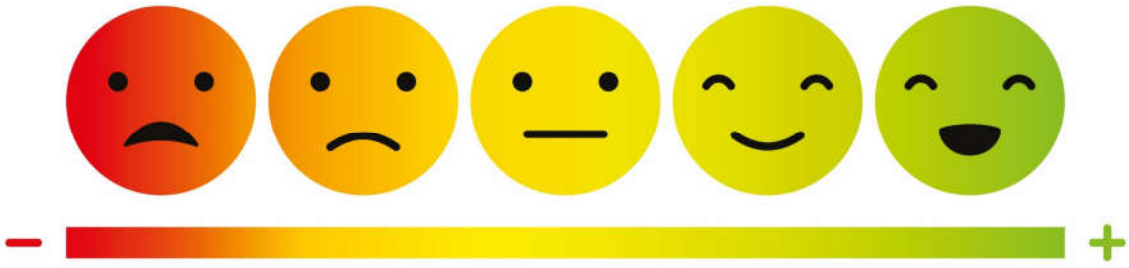

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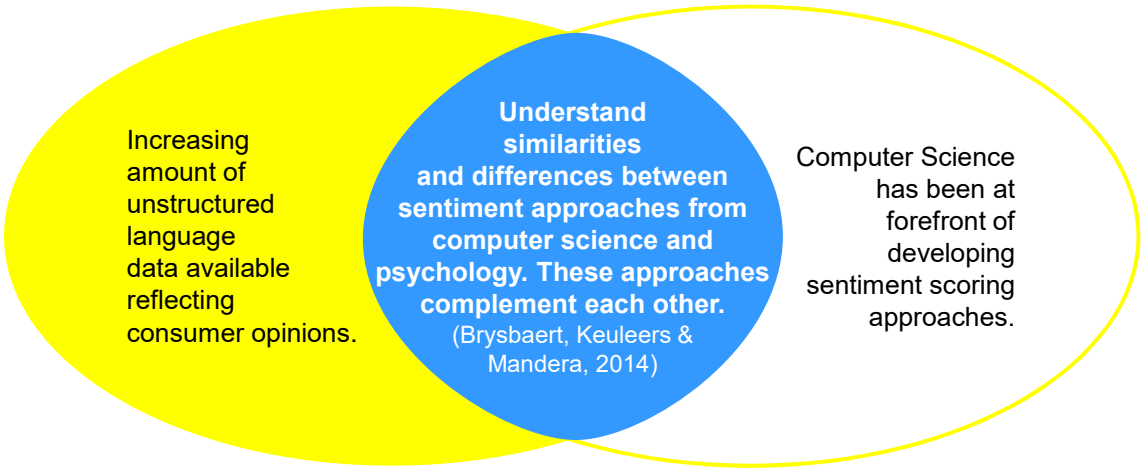
Agenda

- Research Motivation
- Overview of Lexical, Machine Learning, and Psycholinguistic Sentiment Approaches
- Dataset
- Sentiment Analysis with Lexical, Machine Learning, and Psycholinguistic Approaches
- Results
- The Nuances of Psycholinguistics: Sentiment Intensity
- Outlook

Research Motivation: Data Abundance and Lack of Interdisciplinary Approach



Computer Science Approaches: Lexical and Machine Learning

Lexical Method

Data Dictionaries (Lexicons)

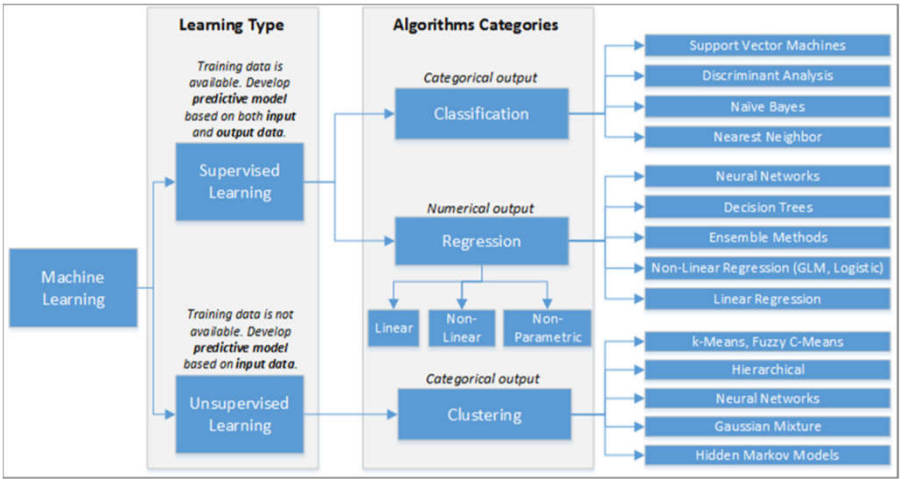
↓

Word Comparisons

↓

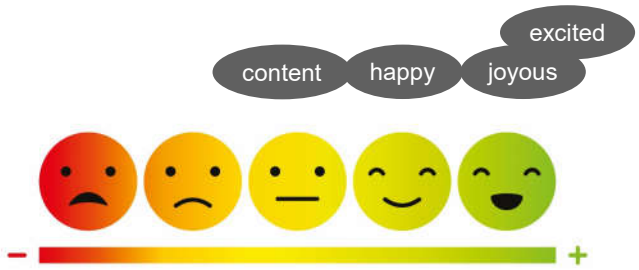
Sentiment Scores

Several Machine Learning Methods



Psychological Approach: Psycholinguistics

- Psycholinguistics is concerned with language comprehension and the relationship between language and psychological processes. (Miller, 1965; Rubenstein & Aborn, 1960)
- Views sentiment a continuum and differentiates between different positive emotions, e.g. *how positive.*
- Emotional experiences are multidimensional. (Warriner, et al., 2013)



Sentiment Positivity

Comparing and Contrasting the Different Approaches

Lexical	Machine Learning	Psycholinguistics
Unigram	Bigram	Unigram
1 or >1 Lexicon(s)	1 or >1 Lexicon(s) Training data	1 Dictionary database (lexicon)

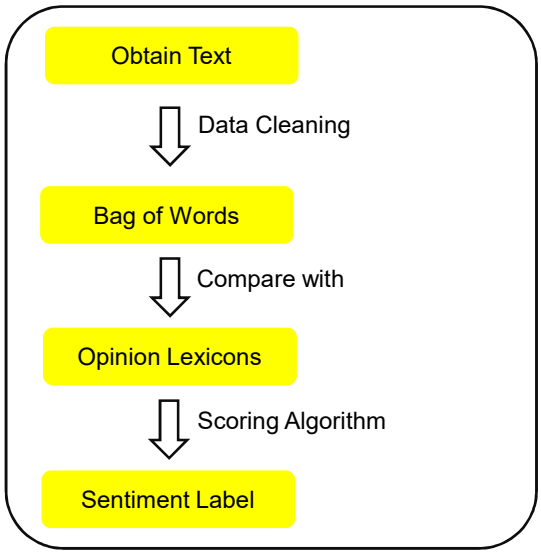
Ensuing Propositions

- Lexical and Psycholinguistics approaches are similar due to unigram.
- Lexical and Machine Learning approaches are similar due to the same initial dictionary database.
- Lexical and Machine Learning approaches are similar due to calculus similarity: the number of negative word occurrences are subtracted from the number of positive word occurrences.

The Dataset and Research Context: Service Outage

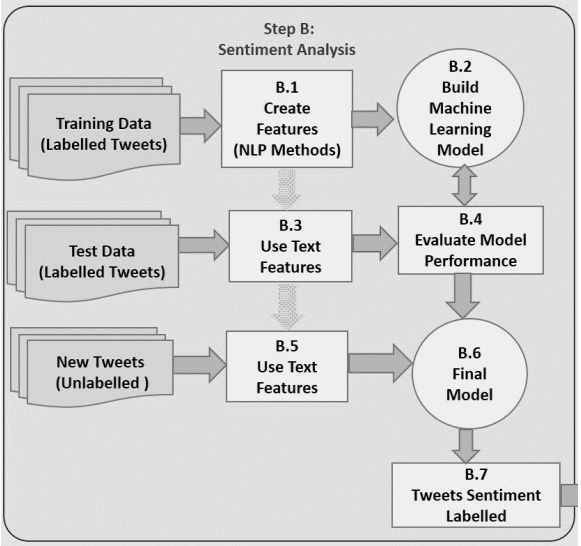
- Skype outage on 21st September 2015.
- Data collection with Twitter streaming API and twitter4j API Java package.
  - Real-time collection of 1% - 40% of sent tweets.
- Use of keywords, '#skypedown' and 'skypedown' in the tweet text.
- Collection of approximately 10,000 tweets.

Sentiment Scoring: Lexical Approach



- Remove stop words from text.
- Extract unigrams (single words).
- Obtain sentiment scores per words from Bing-Liu lexicon.
- Classify tweets into positive, negative, and neutral categories.

Sentiment Scoring: Machine Learning Approach



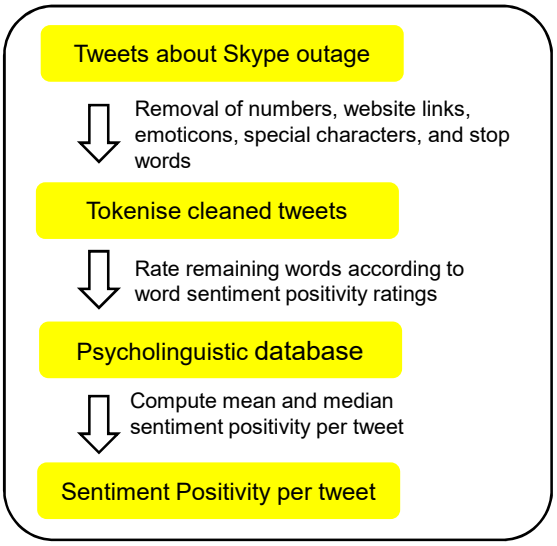
- Divide into training dataset (labelled) and test dataset.
- Train machine learning model (Logistic Regression).
- Check performance – cross validation.
- Run model on unseen data.
- Repeat.

Sentiment Scoring: Psycholinguistic Approach

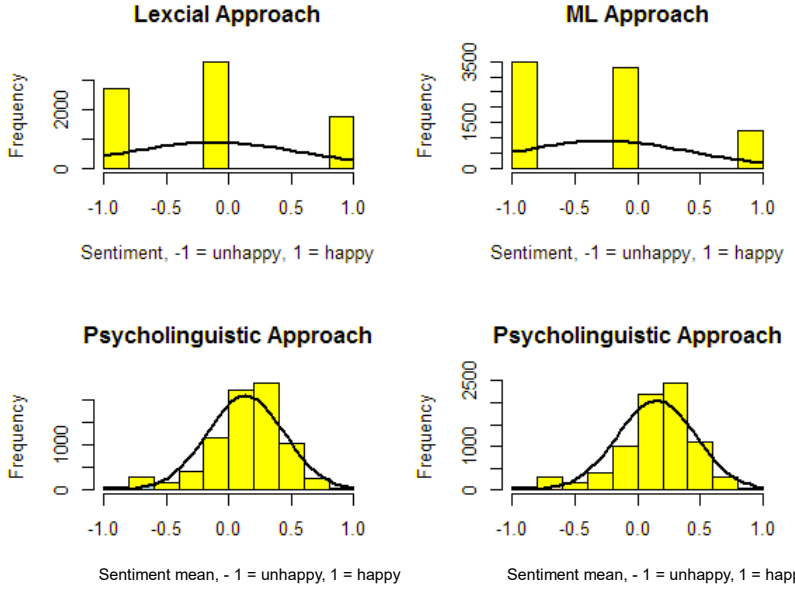
- Sentiment positivity ratings for 13,915 word lemmas. (Warriner et al. 2013)
- Each word has been rated at least by 18 individuals.
- 1 2 3 4 5 6 7 8 9

  1 = completely unhappy, annoyed, unsatisfied, melancholic, or despaired

  9 = completely happy, pleased, satisfied, or contented
- Database has been recently used in the consumer behaviour discipline.
  (Ren & Nickerson 2014; Hildebrand et al. 2017)



Results: Visual Comparison

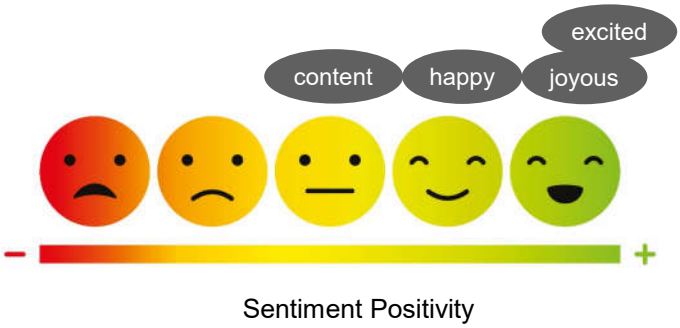


Results: Statistical Comparison with Kendall's *tau*

	Lexical	Machine Learning	Psycholinguistic Mean	Psycholinguistic Median
Lexical	-	.473***	.466***	.403***
Machine Learning		-	.295***	.244***
Psycholinguistic Mean			-	.847***
Psycholinguistic Mean				-

- Lexical and psycholinguistics dictionary databases (lexicon) seem to be somewhat similar.
- Approaches seem to start deviating from each other with the learning algorithm.
- Similarities or differences cannot be explained in terms of data cleaning processes or differing stop words.
  - Same data cleaning process and same stop word list for all three approaches.

The Nuances of Psycholinguistics: How to Obtain More Customer Insight



- Emotional experiences are multidimensional:
  (Warriner, et al., 2013)
  - Sentiment positivity: language valence

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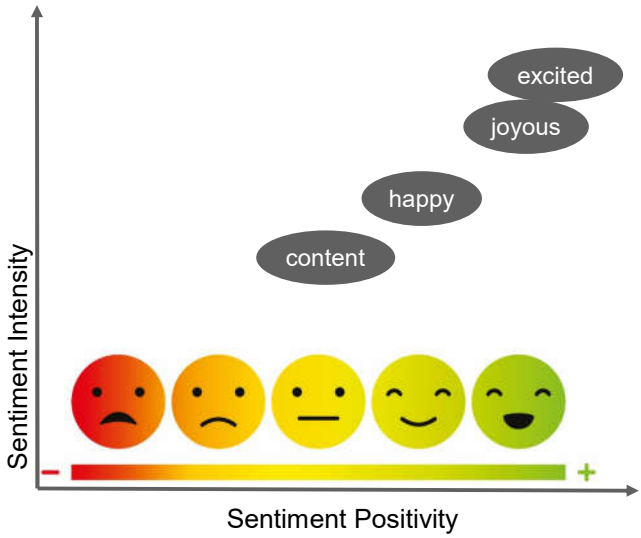
The Nuances of Psycholinguistics: How to Obtain More Customer Insight



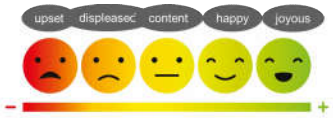
- Emotional experiences are multidimensional:
  (Warriner, et al., 2013)
  - Sentiment positivity: language valence
  - Sentiment intensity: language arousal

1 = completely relaxed, calm, sluggish, dull, sleepy, or unaroused.

9 = completely stimulated, excited, frenzied, jittery, wide-awake, or aroused.

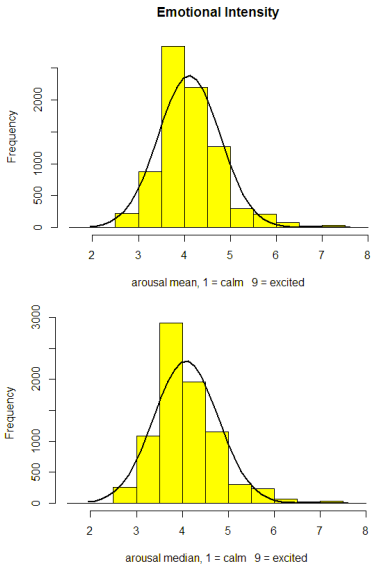
The Nuances of Psycholinguistics: Use in Customer Relationship Management (CRM)

- **Customer Delight** (Oliver, Rust & Varki, 1997): '*delighted*' customers are more satisfied and loyal than '*content*' customers.
- '*Delight*' is a stronger positive emotion than '*content*' → strong emotions more powerfully influence customer satisfaction than weakly experienced emotions.
- The Lexical and Machine Learning approaches poorly reflect these nuances because:
  - The words '*delighted*' and '*content*' are treated as equally positive.
  - According to the computation method of the Lexical and Machine Learning approaches, these sentences would have an equal sentiment:
    "It was a joyous event, but I was displeased about the weather".
    "It was a joyous event, but I was upset about the weather".



Psycholinguistic approach addresses this lack of detail for CRM with nuanced sentiment positivity and sentiment intensity scores.

The Nuances of Psycholinguistics: Sentiment Intensity in CRM



- Despite service failure, Skype customers were not strongly upset.

  → Maybe only very unhappy customers were strongly upset?

- Selection of tweets in the sample whose sentiment was three standard deviations above or below the mean.
- Correlation of sentiment positivity and sentiment intensity:
  - With increasing sentiment positivity, unhappy and happy customers use slightly calmer language (*tau* = - .115, z = -15.453, p <.001; *tau* = - .143, z = -5.185, p <.001).
  - Negligible difference in sentiment intensity between very unhappy and very happy customers.

Outlook

- Monitor customer sentiment positivity and intensity in written or spoken language to assess the impact of:
  - Service recovery actions.
  - Customer inconveniences, i.e. delayed or wrong delivery, on customer satisfaction.
- Better understand when your customer gets frustrated with self-service technology and wants a member of staff: Very negative and emotionally intense language → high levels of frustration.
- Monitor the performance of complaint handling or call centres by analysing customer language.
- Reduce market research and customer insight cost.

- More from Psycholinguistics: Language abstractness.
  - Measure similarities between brands.
  - Measure brand or product knowledge of individual customer groups.

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Thank you!

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