Computational Modelling of Word Sense Sentiment

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Outline

Introduction

- Traditional Data Mining
  Text Mining: topic/fact (sports, finance, politics, science,etc..)
- Opinion Mining
  Opinion/Attitude: thumb-up (positive) or thumb-down (negative)
- Examples
  Movie/product reviews
  Social event/policy survey

Motivation

Potential Application:

- Automatic summarization of reviews
- Opinion Extraction
- Detection of hostile messages
- ...

Task

- Aim
  Predict the semantic orientation of word senses

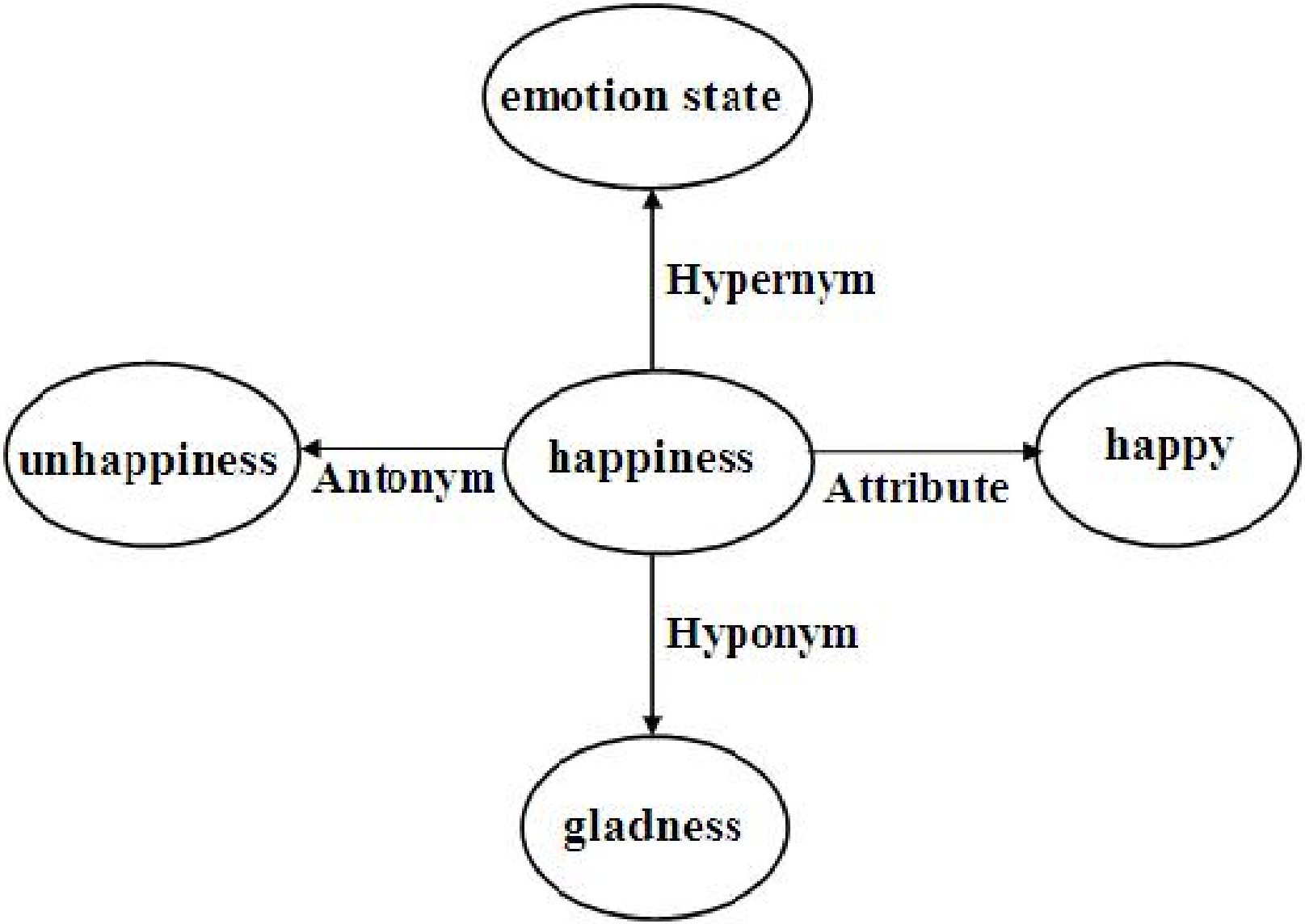
- Task Description
- Input
  A collection of word sense: $ws_1, ws_2, ws_3 \ldots ws_n$
- Output
  The semantic orientation of the corresponding word senses: $SO(ws_1), SO(ws_2), SO(ws_3) \ldots SO(ws_n)$

WordNet

- A large lexical database of English[1, 2]
- Synsets: Synonym Set
  - definition of the words
  - each synset corresponds to a distinct concept
- Relations

  Synonym, antonym, similar-to, attribute, hypernym, hyponym...

Example


emotion state
Hypernym
unhappiness
Antonym
happiness
Attribute
happy
Hyponym
gladness

Semantic Orientation

- Subjectivity
  Subjective(S), Objective(O), Both(B)

  Opinion, emotion, evaluation, speculation etc...[3]
- Connotation

  Polarity: positive(S:P/O:P), negative (S:N/O:N) and no connotation (O:O),varied(S:V)
- Current Work

  Start from subjectivity categorization

  S (S:P, S:N and S:V)

  O (O:P, O:N and O:O)

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word	polarity
pig	objective
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"One word only corresponds to one polarity"

Terms

- Semantic orientation of word senses
  Example:[1, 2]
  (1)hog, pig, grunter, squealer, Sus scrofa – (domestic swine)(objective)
  (2)slob, sloven, pig, slovenly person – (a coarse obnoxious person)(negative)
  (3)positive – (characterized by or displaying affirmation or acceptance or certainty etc.; "a positive attitude")(positive)
  (4)positive – (greater than zero; "positive numbers")(objective)

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  "One word may have several different word senses, which may correspond to different semantic orientations"

Proposed Algorithms

- Basic idea

  Semi-supervised learning(SSL)[4, 5, 6] with constraints[7, 8]
- Intuition
  - A small number of labeled data
  - A large number of unlabeled data
- Constraints

Constraints

- WordNet synset relations[1, 9]

  Synonym, antonym, direct hyponym...etc

- Morphological information

  Prefix: happy-unhappy, convenient-inconvenient...etc

  Suffix: happy-happiness...etc

Algorithm Framework

1. Train a classifier on labeled data only
2. Apply the classifier to unlabeled data, assign probabilistic values
3. Incorporate the constraints information to reweigh the probabilistic value
4. Update the parameters of the classifier
5. Go back to step 2 until convergence

Alternative Proposal

Monosemous words (=word senses)

- Characteristics
  (1)infrequent word
  (2)each word corresponds to only one sense
  (3)single polarity
- Strategy
  (1)compute co-occurrence frequency with subjective paradigm words [10]
  (2)Threshold setting for polarity filtering

Completed Work

Annotation Study

- Micro-WNOp corpus[11]
  3 groups, 1105 WordNet synsets
- Agreement statistic
  agreement $\geq$ 83%
- Kappa statistic
  kappa$\geq$ 76%

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- Conclusion—"a well-defined task"

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Baseline Measurement

- Majority category: 62.5%
- Rule-based Method: 67.7%
- Classification[12, 13] without feature reduction: 64.5%
- Classification with feature reduction
  - Word Frequency threshold: 63.4%
  - SVD(Singular Value Decomposition): 69.1%

Future Work

- Implementation
  - Semi-supervised learning with constraints
  - Semantic orientation detection of monosemous synsets
- Exploration of potential evaluation methodology
- Embedding sentiment information of word senses in other opinion mining tasks.

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Any questions?