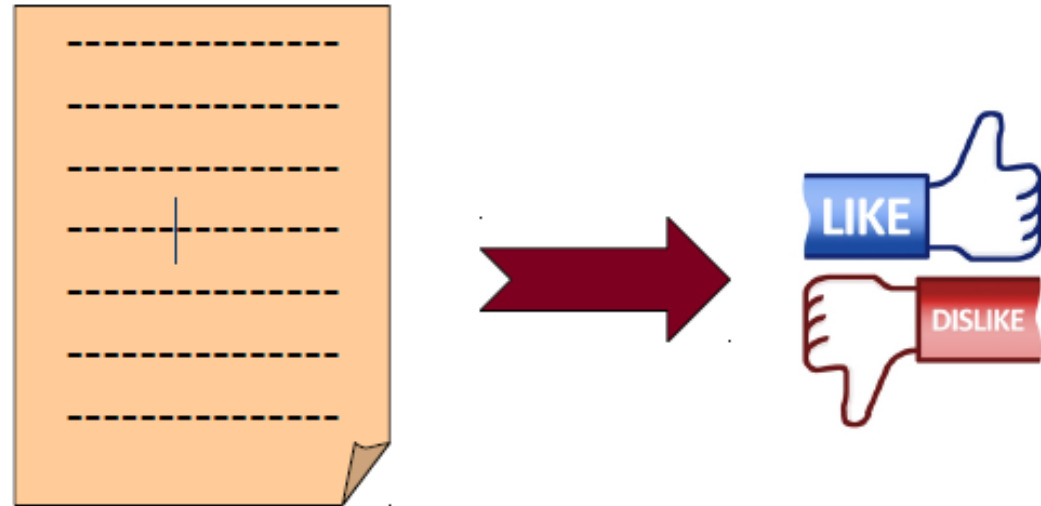# Natural Language Processing

Lecture 20: Sentiment Analysis

Amirkabir University of Technology

Dr Momtazi

Sentiment Analysis

Outline

- **Applications**

- Task

- Machine Learning Approach

- Rule-based Approach

- Aspect-based Sentiment Analysis

Hotel Reviews

Hotel Reviews

Hotel Reviews

Product Reviews

★★★★½ (4,810)
4.3 out of 5 stars

5 star		3,120
4 star		884
3 star		293
2 star		159
1 star		354

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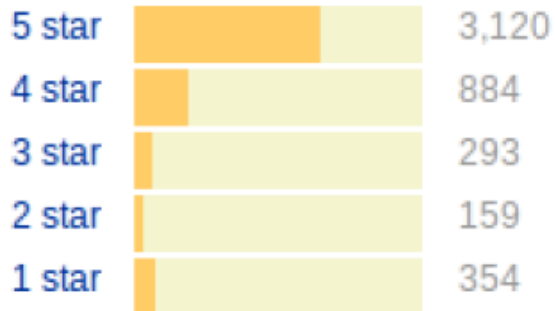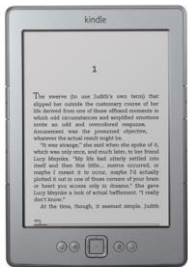
Picture Quality

Ease of Use

Size

Weight

Color

Zoom

Social Media

Event Analysis and Prediction

- Analyzing the side effects of events in different communities

- Predicting the election results

- Predicting the Stock exchange

- …

Outline

- Applications

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Sentiment Analysis Levels

Text

Sentiment Analysis Levels
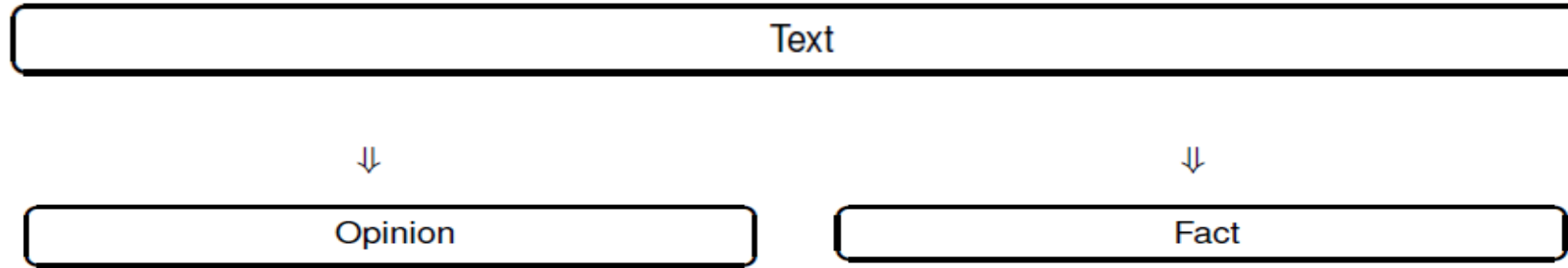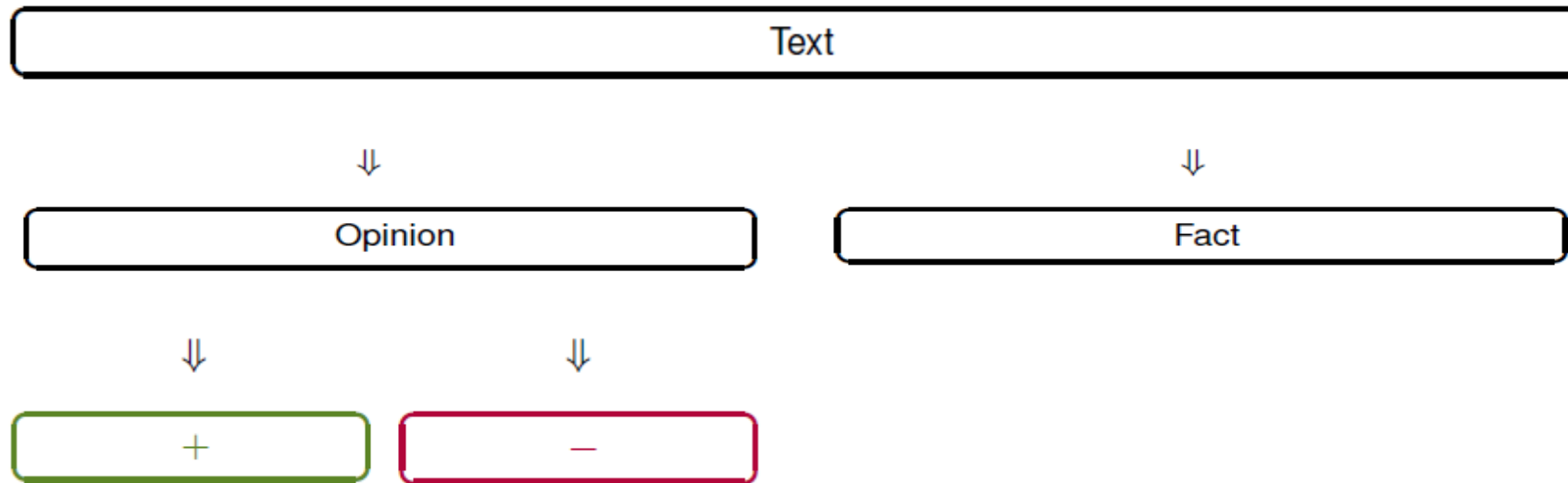
Sentiment Analysis Levels

Sentiment Analysis Levels

Sentiment Analysis Levels
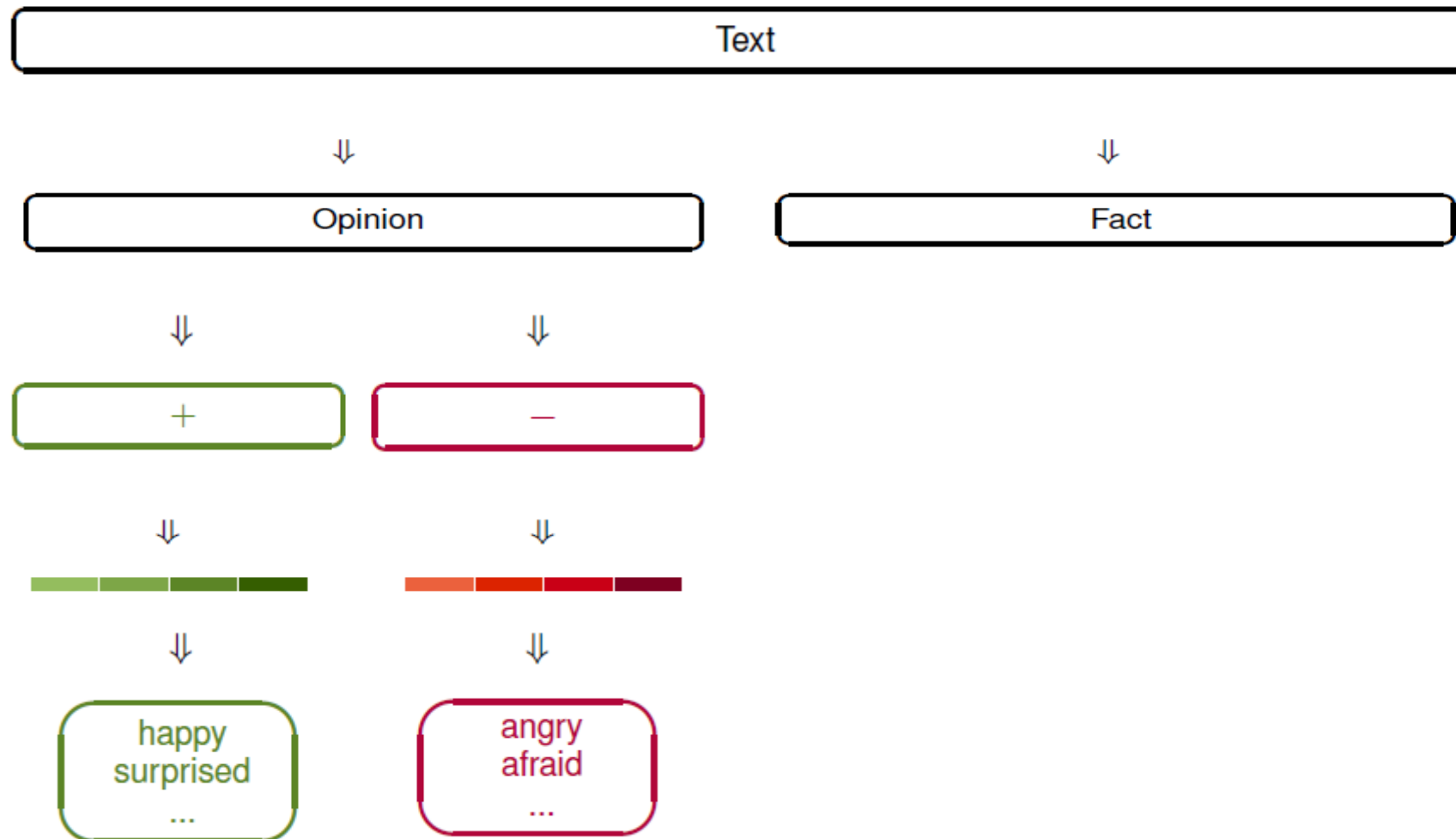
Sentiment Analysis Tasks

- Opinion holder detection

- Opinion target detection

- Aspect detection

Sentiment Analysis Tasks

- Opinion holder detection

- Opinion target detection

- Aspect detection

Students like Wikipedia because it is easy to use and it sounds authoritative.

op holder   target

Sentiment Analysis Tasks

- Opinion holder detection

- Opinion target detection

- Aspect detection

Students like Wikipedia because it is easy to use and it sounds authoritative.
op holder   *target*

I had a nice stay in this hotel and the rooms were very clean.
aspect

The restaurant has an amazing view but the staffs are unfriendly.
aspect   *aspect*

Mixed opinions

Other Names

- Opinion mining

- Opinion extraction

- Sentiment mining

- Subjectivity detection

- Subjectivity analysis

Sentiment Analysis Approaches

- Machine learning methods

  $\implies$ classification

- Rule-based methods

  $\implies$ dictionary oriented

Outline

- Applications

- Task

- **Machine Learning Approach**
  - **Conventional Machine Learning Algorithms**
  - Deep Learning

- Rule-based Approach

- Aspect-based Sentiment Analysis

Sentiment Classification

- Using any kinds of supervised classifiers
  - K Nearest Neighbor
  - Support Vector Machines
  - Naïve Bayes
  - Maximum Entropy
  - Logistic Regression
  - …

Features

- Word

Features

- Word
  - All words or adjectives?
  - All words works better than adjectives only

Features

- Word
  - All words or adjectives?

    All words works better than adjectives only
  - Word occurrence or frequency?

    Word occurrence is more useful than frequency
    - Using binary value for words
    - Replace all word counts higher than 0 in each text by 1

Features

- Negation
  - Negation words change the text polarity
    - Adding prefix NOT_ to every word between negation and next punctuation

Features

- Negation
  - Negation words change the text polarity
    - Adding prefix NOT_ to every word between negation and next punctuation

"*I did not like the restaurant location, but the food ...*"

I   did   not |NOT-like   NOT-the   NOT-restaurant   NOT-location   but   the   food ...

Features

- Other emotions

Features

- Other emotions
  - Considering emoticons as additional features
    - :)
    - :(

Fine-grained Analysis

- Dealing with finer classes of sentiment

  -3,-2,-1,+1,+2,+3

- Approaches
  - Using multiclass classifier (6 classes in this case)
  - Using two level classifier
    - First level: polarity classifier (positive or negative)
    - Second level: strength classifier (1 or 2 or 3)

Outline

- Applications

- Task

- **Machine Learning Approach**
  - ◦ Conventional Machine Learning Algorithms
  - ◦ **Deep Learning**

- Rule-based Approach

- Aspect-based Sentiment Analysis

CNN
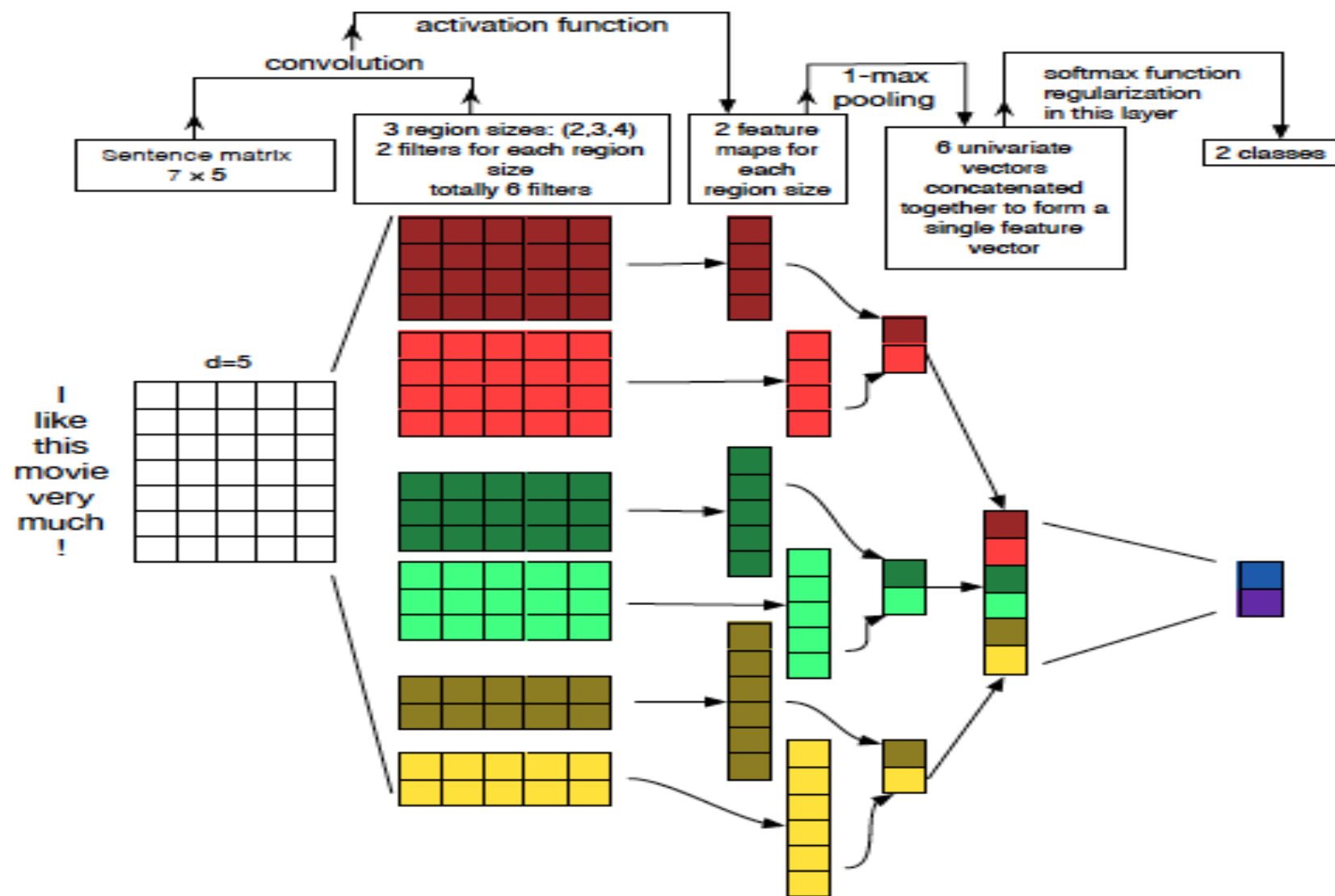
Outline

- **Applications**

- Task

- Machine Learning Approach

- **Rule-based Approach**

- Aspect-based Sentiment Analysis

Rule-based Approach

- Looking for opinionated words in each text

- Classifying the text based on the number of positive and negative words

- Considering different rules for classification
  - Fine-grained dictionary
  - Negation words
  - Booster words
  - Idioms
  - Emoticons
  - Mixed opinions
  - Linguistic features of the language

Rule-based Approach

- Fine-grained Dictionary

"It was a *good* song." 👍

"The song was *excellent*." 👍👍👍

Rule-based Approach

- Negation Words

"The song was good." 👍

"The song was *not* good." 👎

Rule-based Approach

- Booster Words

"The song was interesting."

"The song was *very* interesting."

"The song was *somewhat* interesting."

Rule-based Approach

- Idioms

"shock horror"

Rule-based Approach

- Mixed Opinions

"The song was *good*, but I think its title was *strange*."

Rule-based Approach

- Linguistic Features
  - The position of negation or boosting words differ from one language to another

"I do not love the song."

Opining Dictionary

- English
  - Subjectivity Clues (2005)
  - SentiSpin (2005)
  - SentiWordNet (2006)
  - Polarity Enhancement (2009)
  - SentiStrength (2010)

Machine Learning with Opinion Dictionary

- Using opinion words as a feature in the algorithms

- Ignoring other words in the text

Adjectives alone do not work well,

but opinion words are the best features to be used

Outline

- Applications

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- Machine Learning Approach

- Rule-based Approach
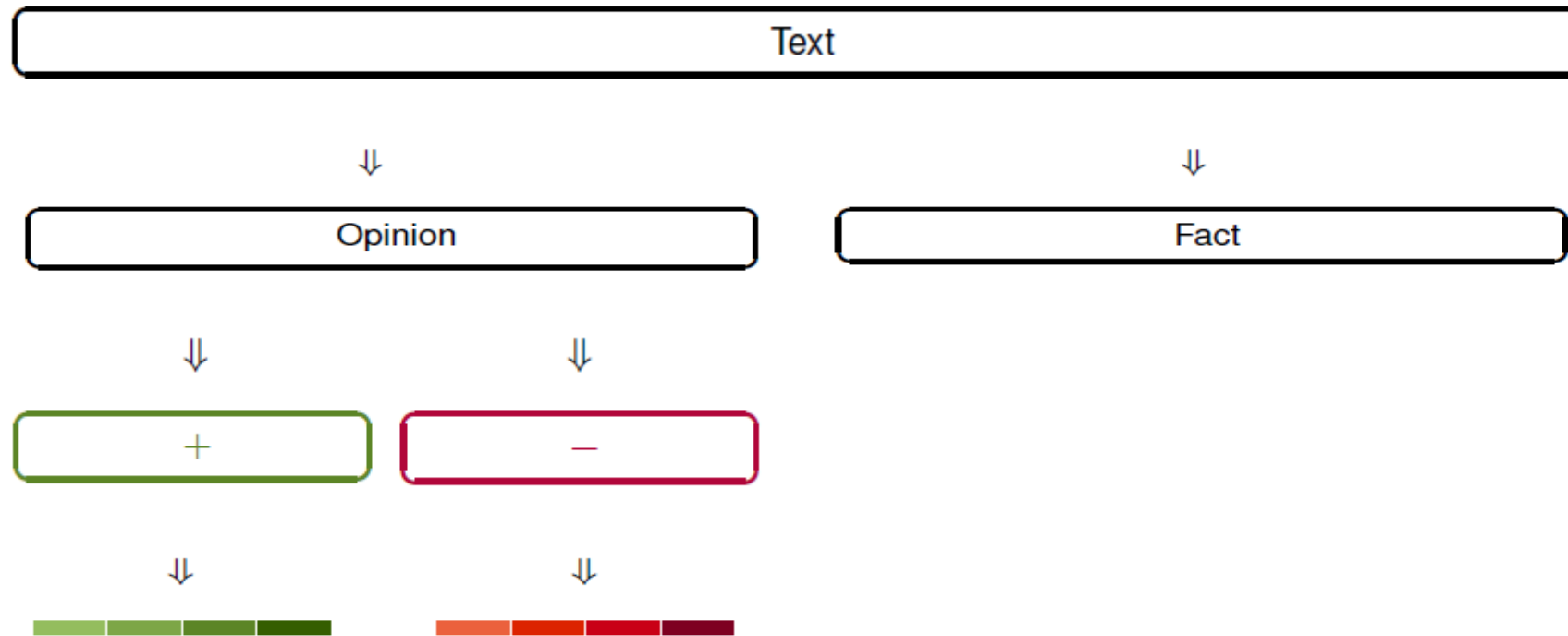
- **Aspect-based Sentiment Analysis**

Modeling Aspect-based Sentiments

Multi-label classification

> "The So called laptop Runs to Slow and I hate it! Do not buy it! It is the worst laptop ever."

LAPTOP : OPERATION-PERFORMANCE, negative
LAPTOP : GENERAL, negative

> "The restaurant was expensive, but the menu was great."

RESTAURANT : PRICE, negative
RESTAURANT : FOOD, positive

Modeling Aspect-based Sentiments

Sequence labeling with IO or IOB schema

> "Chow fun was dry. I was very disappointed with this restaurant."
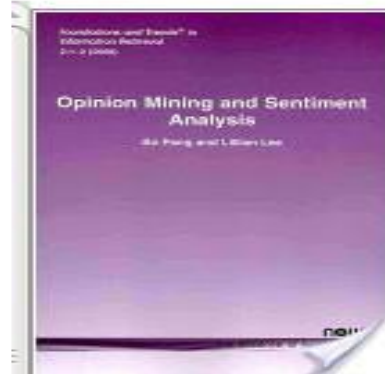
{RESTAURANT:
FOOD, "Chowfun", negative, from="0"to="8"}
{RESTAURANT:
GENERAL, "restaurant", negative, from="52"to="62"}

Further Reading

Opinion Mining and Sentiment Analysis

Bo Pang, Lillian Lee

Now Publishers Inc, 2008 - Computers - 137 pages

★☆☆☆☆

1 Review

G+1 [1]

An important part of our information-gathering behavio
availability and popularity of opinion-rich resources su
challenges arise as people can, and do, actively use i
The sudden eruption of activity in the area of opinion n

More »

Sentiment Analysis and Opinion Mining

Bing Liu

Morgan & Claypool Publishers, Ordibehesht 12, 1391 AP - Computers - 167 pages

★★★★★

1 Review

G+1 [0]

Sentiment analysis and opinion mining is the field of study that analyzes people's o
emotions from written language. It is one of the most active research areas in natura
studied in data mining, Web mining, and text mining. In fact, this research has sprea

Further Reading

- Speech and Language Processing (3rd ed. draft)
  - Chapter 4 & 25