Recursive Structure
Application: Sentiment Analysis

Word Sequence

Recurrent Structure
Special case of recursive structure

Recursive Structure
How to stack function $f$ is already determined
Recursive Model

not very good

syntactic structure

How to do it is out of the scope

word sequence:

not very good
Recursive Model

By composing the two meanings, what should the meaning be.

Dimension of word vector = |Z|
Input: 2 X |Z|, output: |Z|

Meaning of “very good”

V(“not”) → not
V(“very”) → very
V(“good”) → good

syntactic structure
not very good
Recursive Model

\[ V(w_A \ w_B) \neq V(w_A) + V(w_B) \]

“not”: neutral

“good”: positive

“not good”: negative

Meaning of “very good”

\[ V(\text{“very good”}) \]

syntactic structure

not  very  good

\[ V(\text{“not”}) \]

\[ V(\text{“very”}) \]

\[ V(\text{“good”}) \]
Recursive Model

\[ V(w_A w_B) \neq V(w_A) + V(w_B) \]

“棒”: positive

“好棒”: positive

“好棒棒”: negative

Meaning of “very good”

\[ V(\text{“very good”}) \]

not very good

syntactic structure

\[ f \]

network

V(“not”) \rightarrow not

V(“very”) \rightarrow very

V(“good”) \rightarrow good
Recursive Model

Meaning of “very good”

V(“very good”)
Recursive Model

Meaning of “very good”

: “emphasize” another input

V(“very”) → very

V(“not”) → not

V(“good”) → good

syntactic structure

not  very  good
Train both ...

5 classes

( --, -, 0, +, ++ )

V("not very good")
Recursive Neural Tensor Network

\[ W = \sigma(\text{Little interaction between } a \text{ and } b) \]

\[ x^T + \sum_{i,j} W_{ij} x_i x_j \]
Experiments

5-class sentiment classification ( --, -, 0, +, ++ )

Demo: http://nlp.stanford.edu:8080/sentiment/rntnDemo.html
Experiments

Matrix-Vector Recursive Network

Inherent meaning: how it changes the others

\[ f = \sigma(W) = \sigma(W_M) = \]

Zero? \( a \) Informative? \( b \) Identity? \( B \)

\[ A = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \]

not good
Tree LSTM

**Typical LSTM**

Tree LSTM
More Applications

- Sentence relatedness