Dependency Forest for Sentiment Analysis

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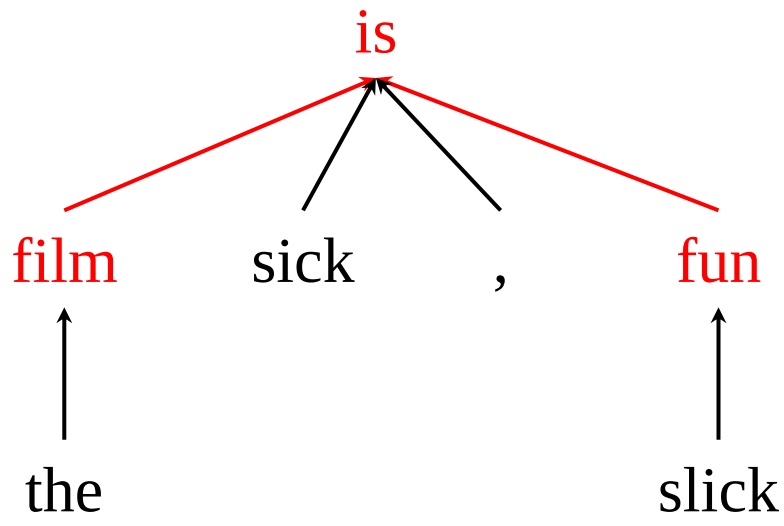
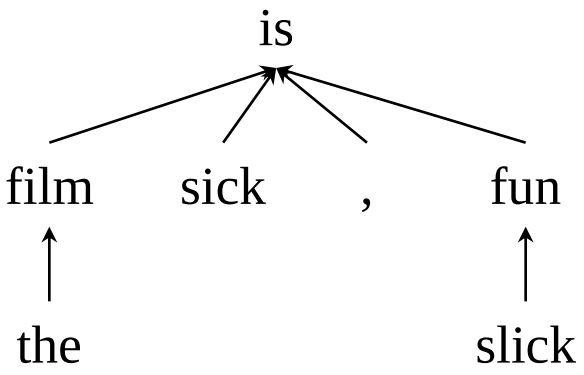
Dependency Grammars in SA

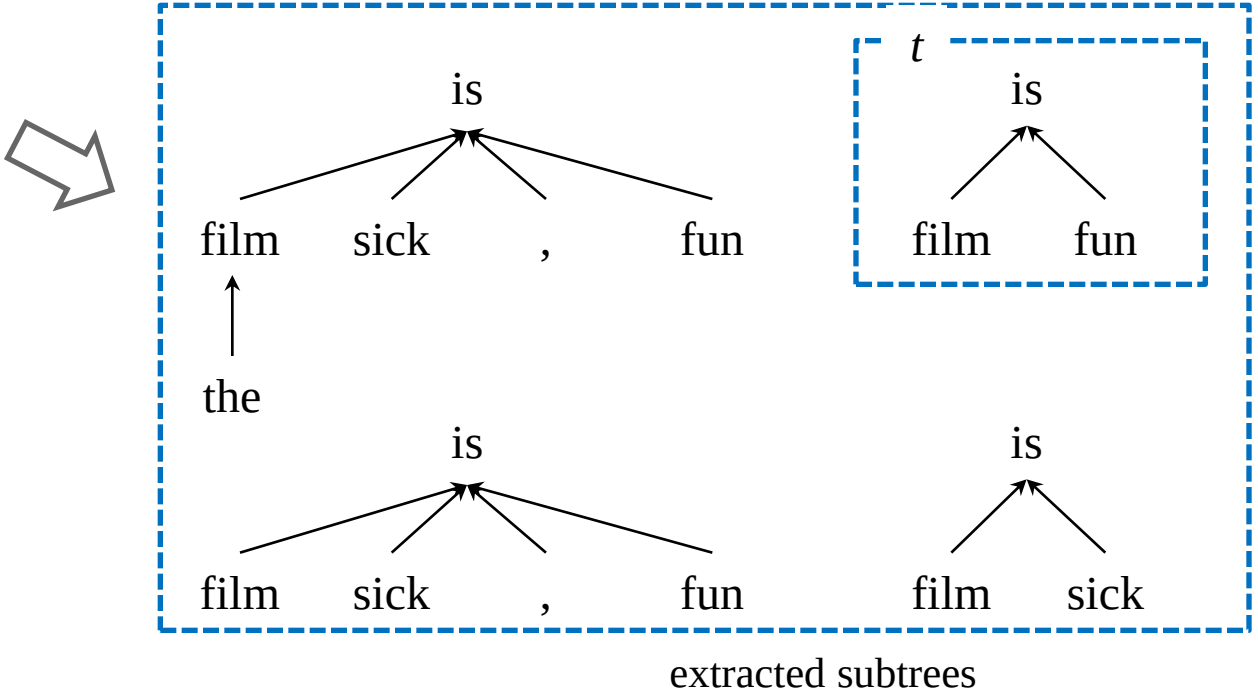


(Matsumoto et al., 2005; Joshi et al., 2009; Liu et al., 2009)

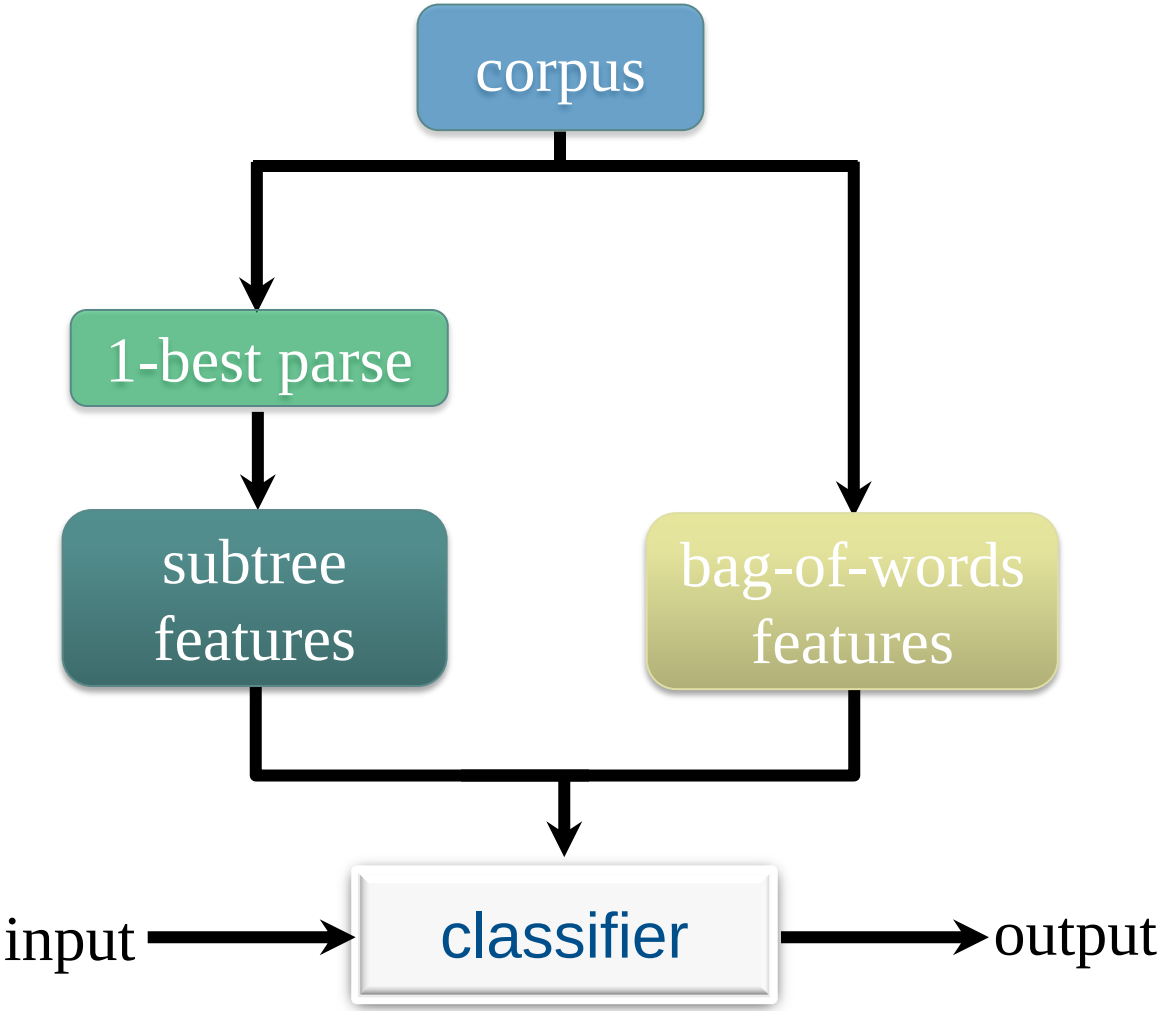
Tree-based Features Extraction

(Matsumoto et al., 2005)

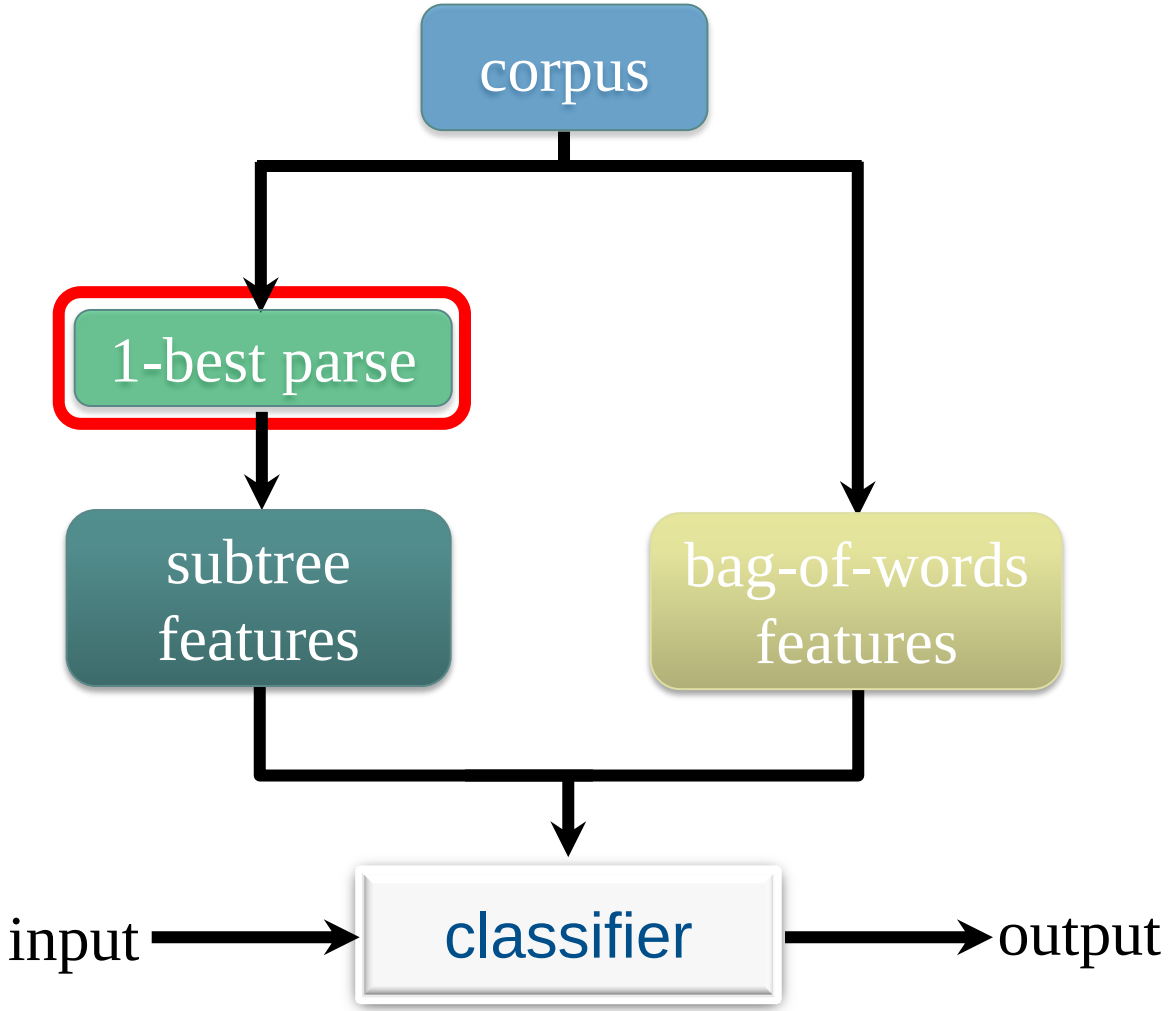




Pipeline


corpus
1-best parse
subtree features
bag-of-words features
input
classifier
output

Pipeline


corpus
1-best parse
subtree features
bag-of-words features
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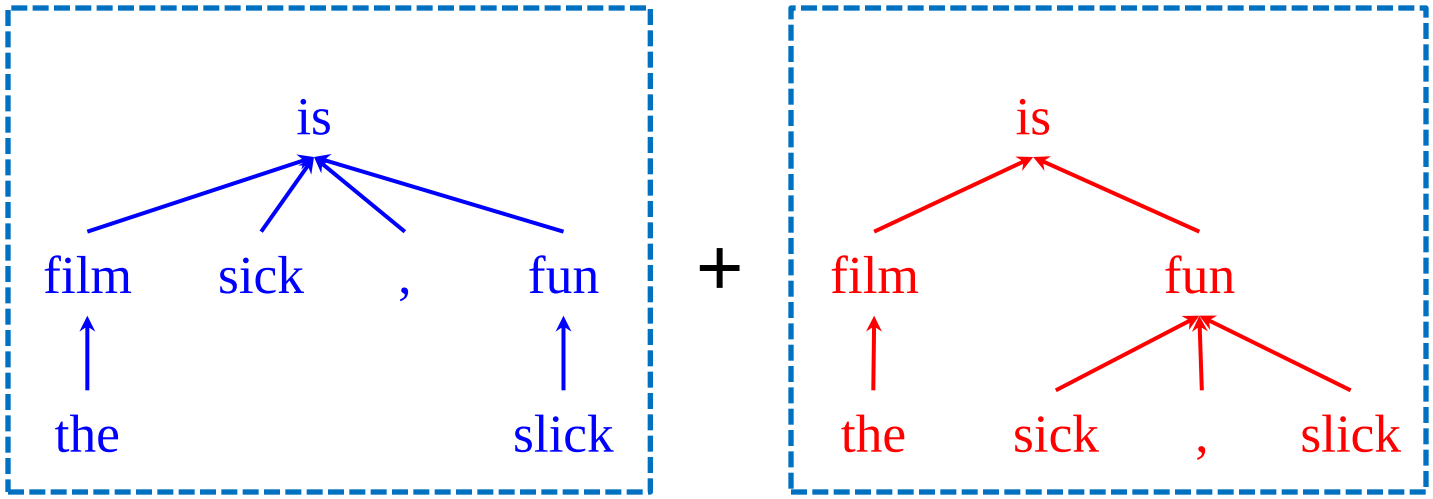
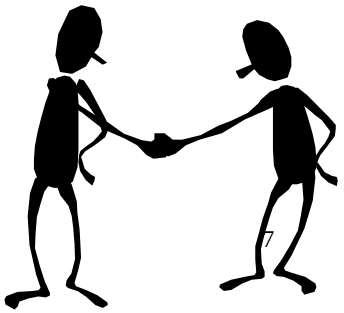
Challenges

- Tree-based approach faces the major challenges:
  - vulnerable to parsing error

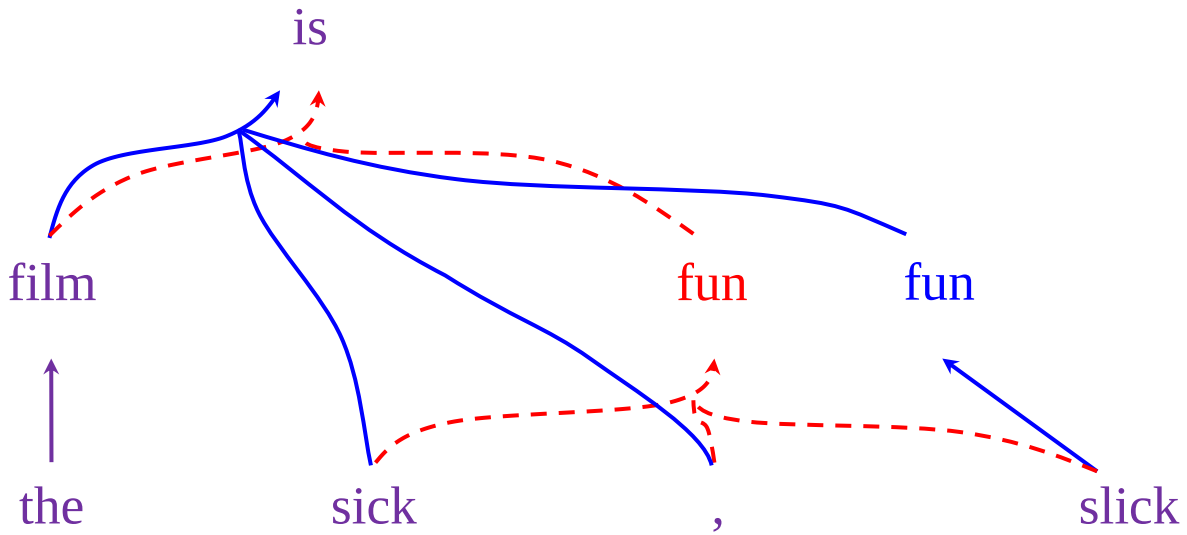
Solution

- Dependency forest provides an elegant solution to this problem (Tu et al, 2010)

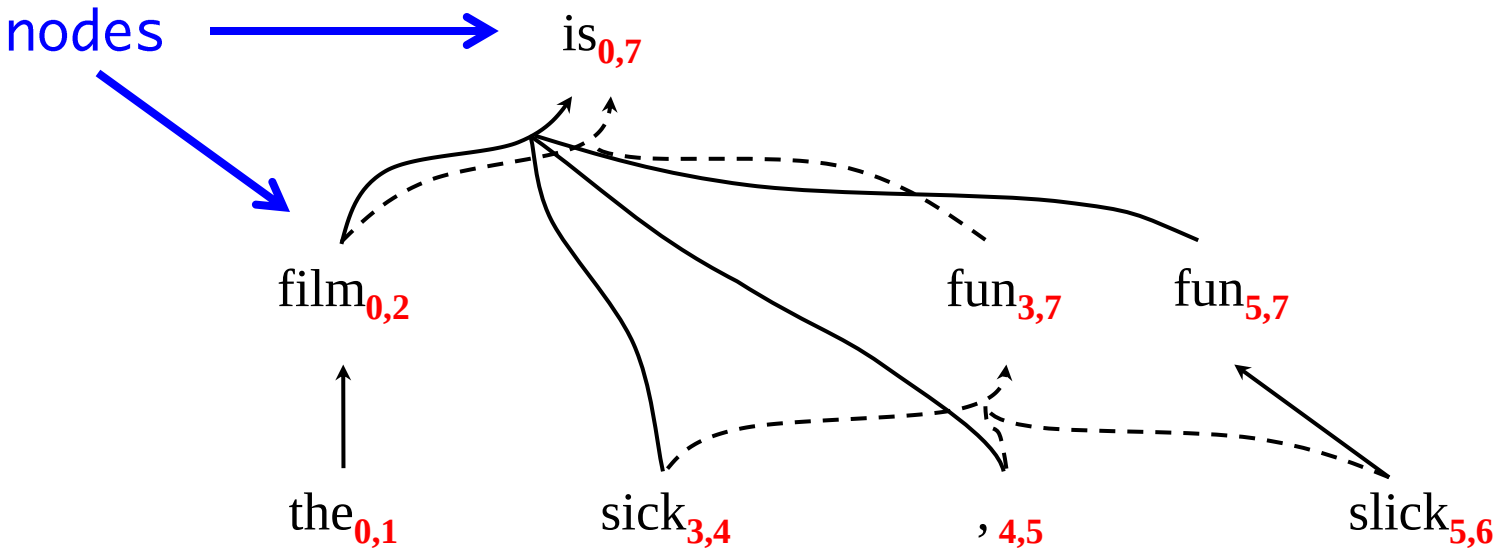




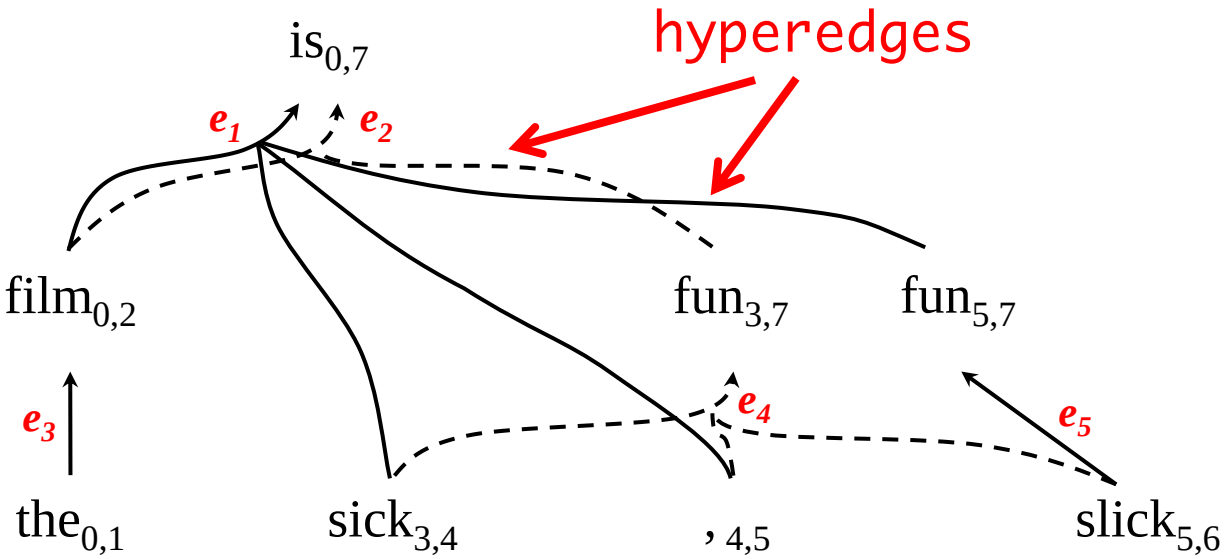
Dependency Forest



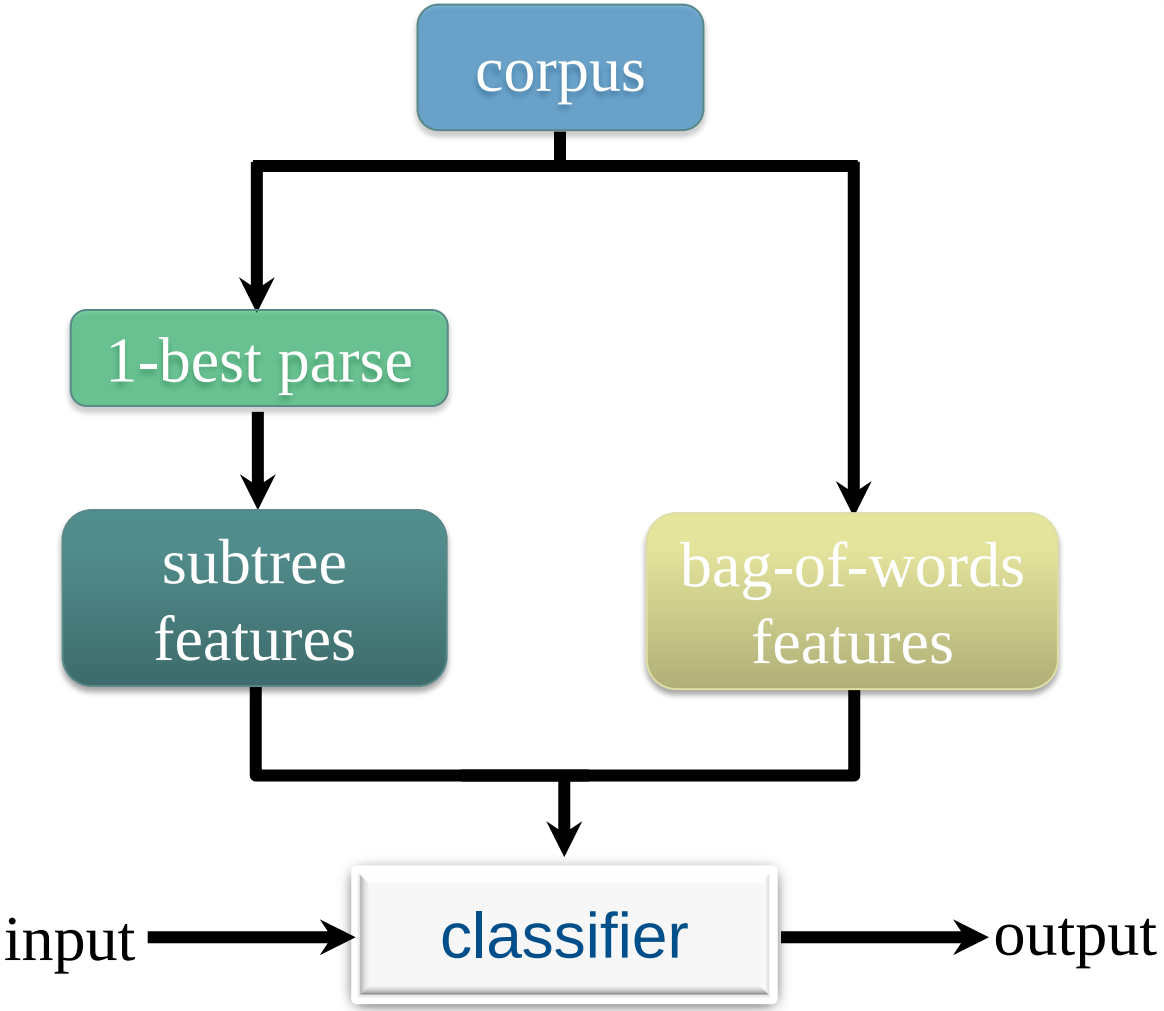
Dependency Forest



Dependency Forest

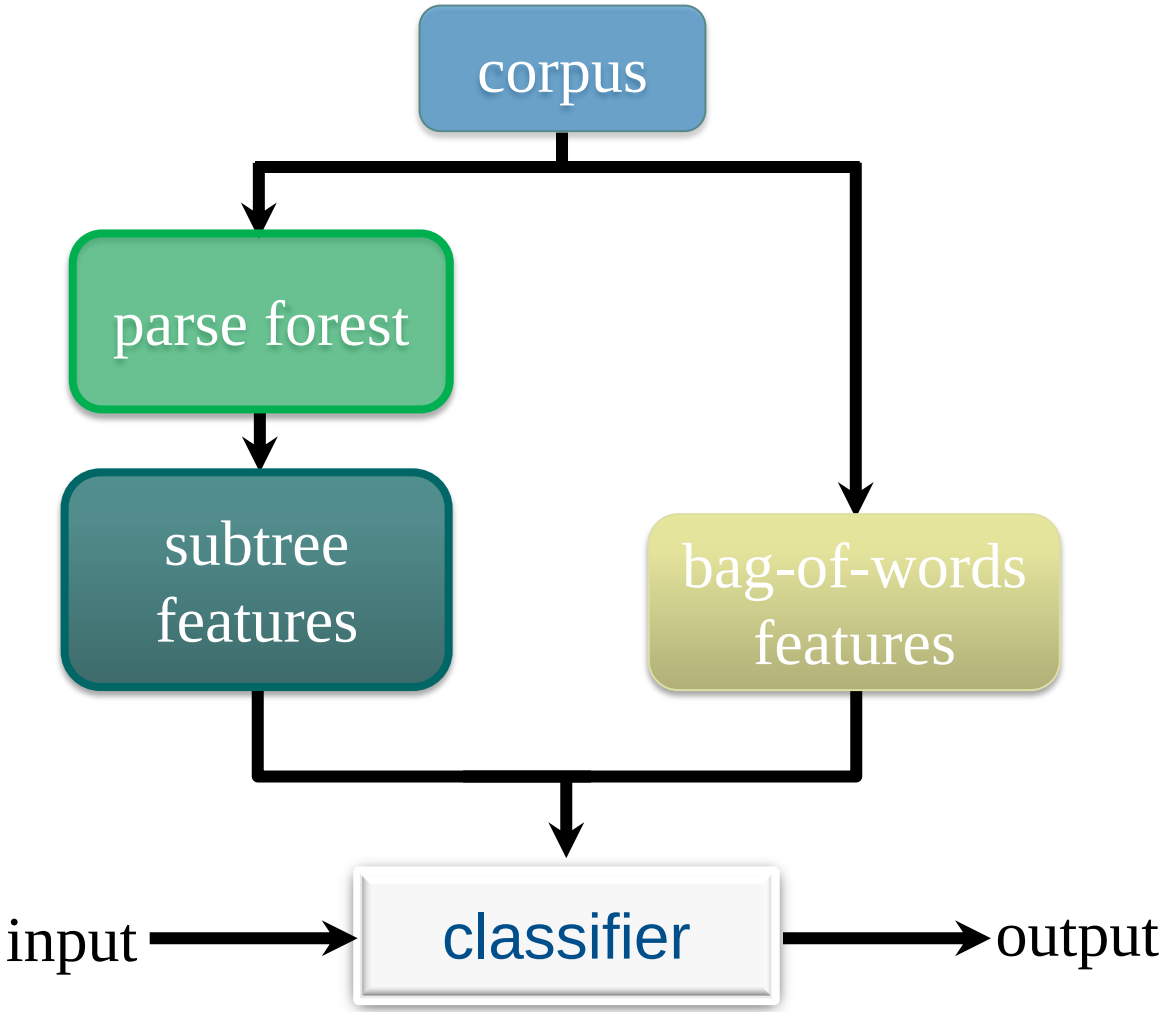


Pipeline



tree-based

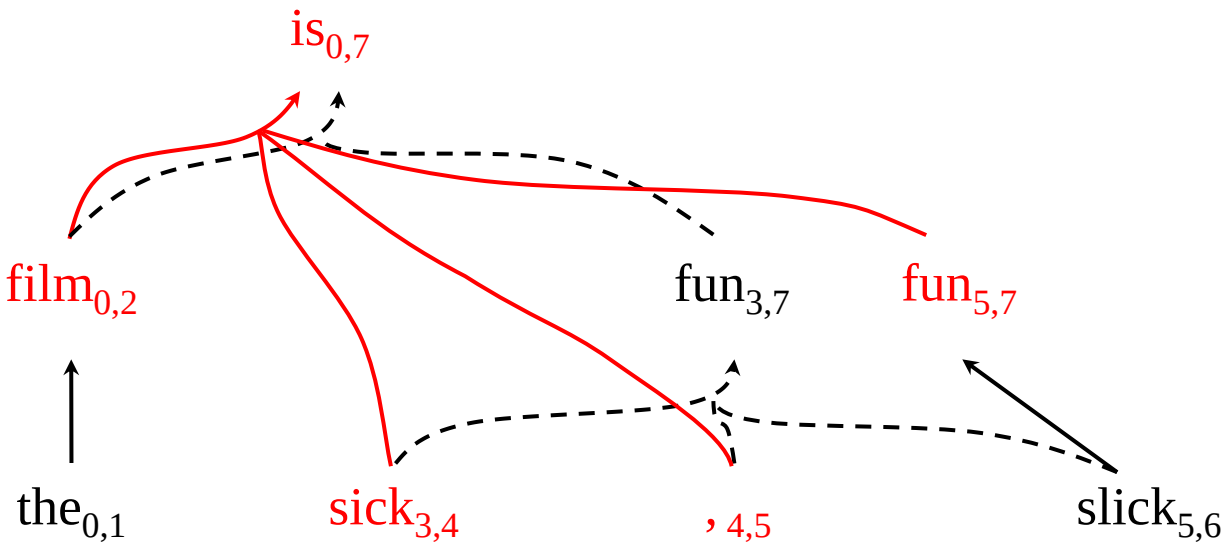
Pipeline



forest-based

Forest-based Feature Extraction

bottom-up style



Forest-based Feature Extraction

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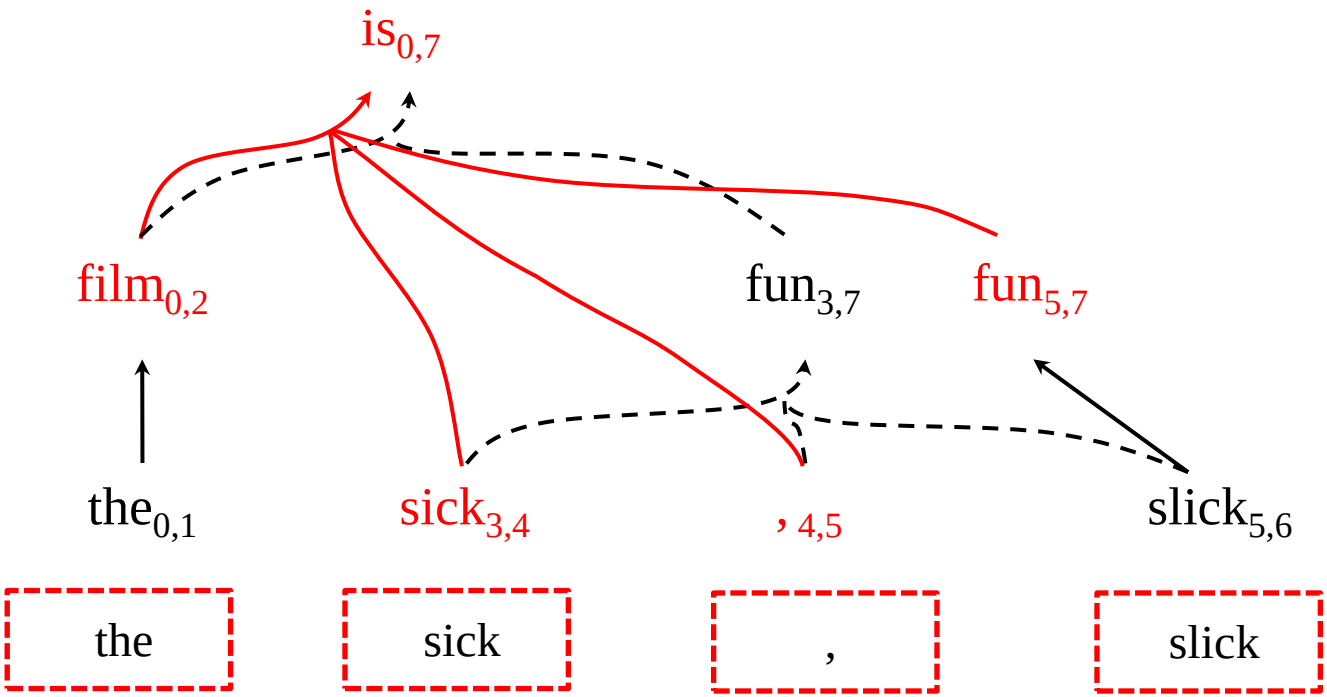

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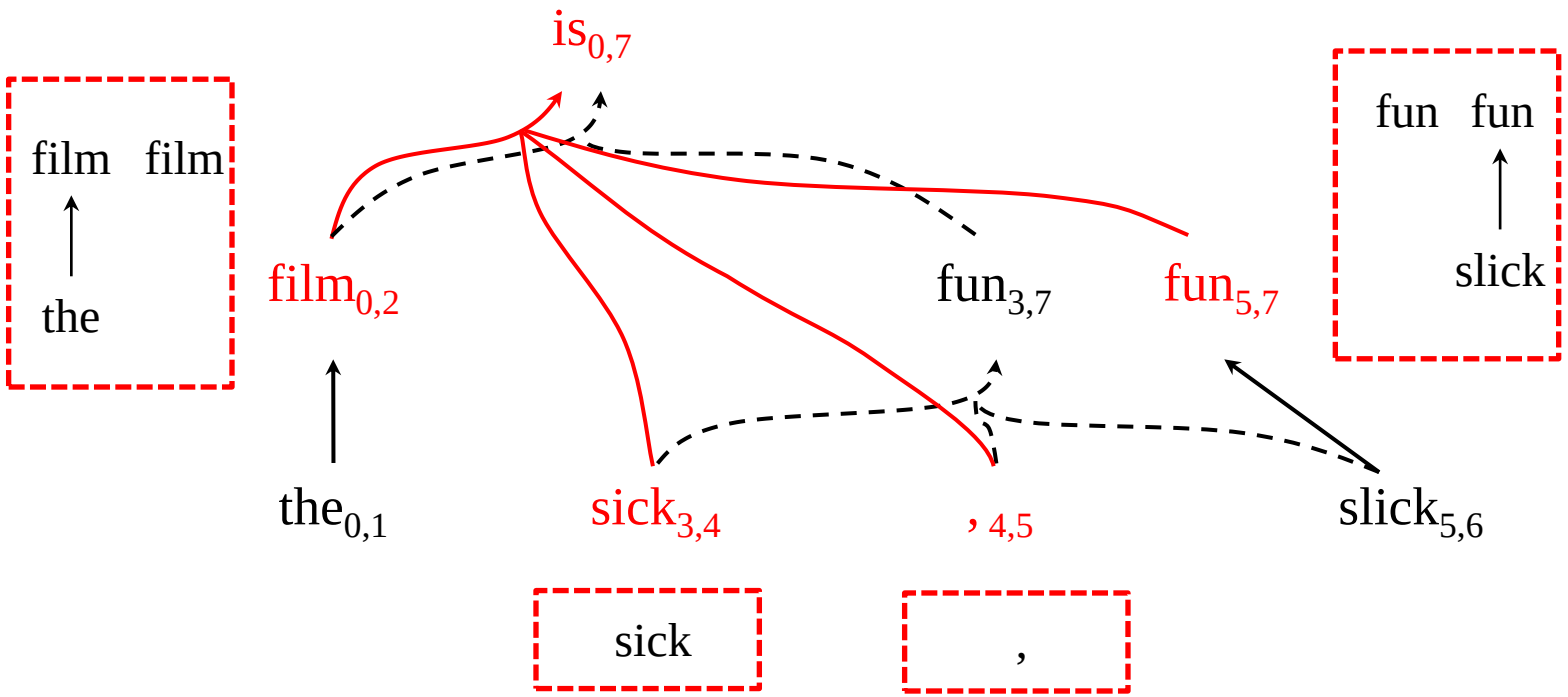
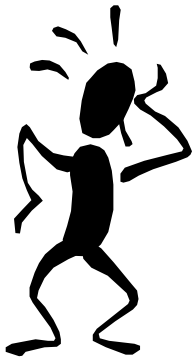
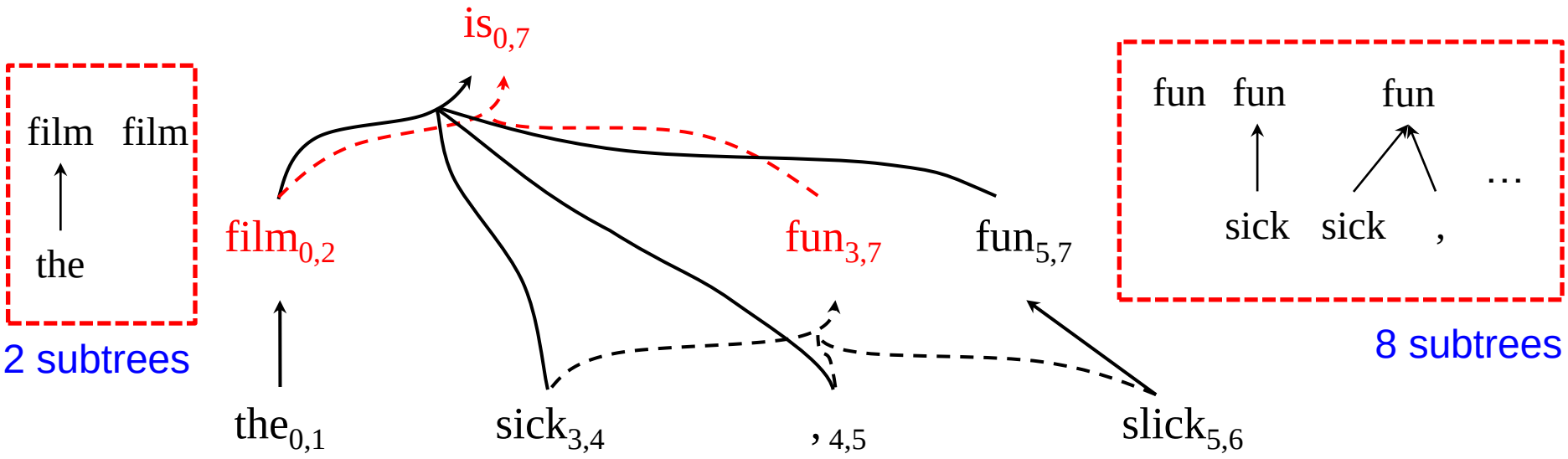


Difficulty in Finding Subtrees

too many choices



Forest-based Feature Extraction



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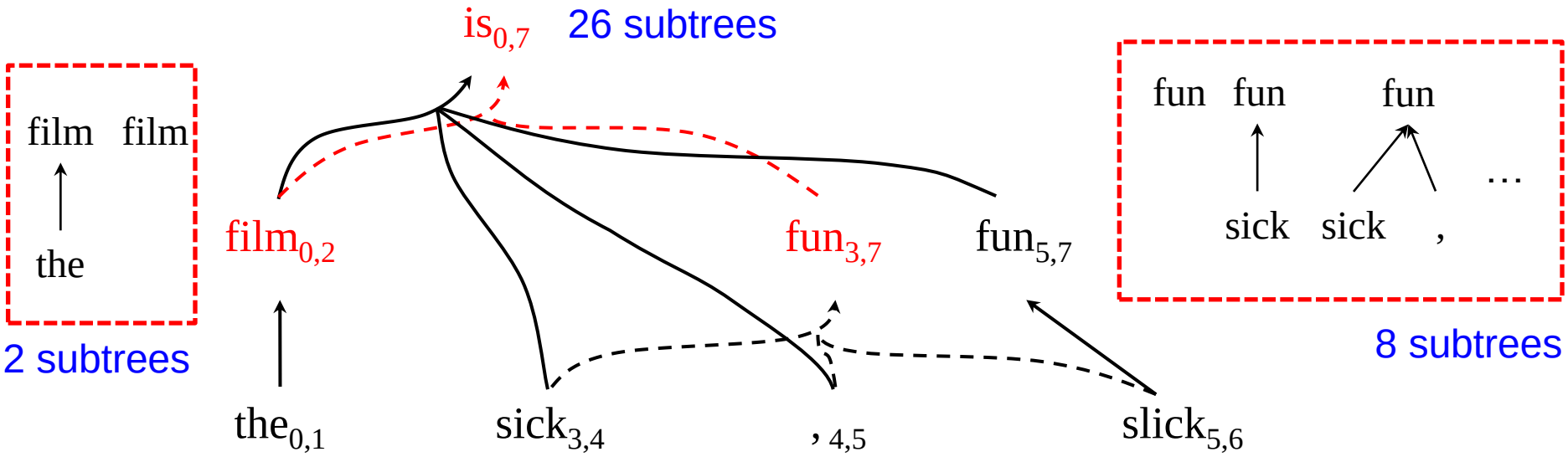

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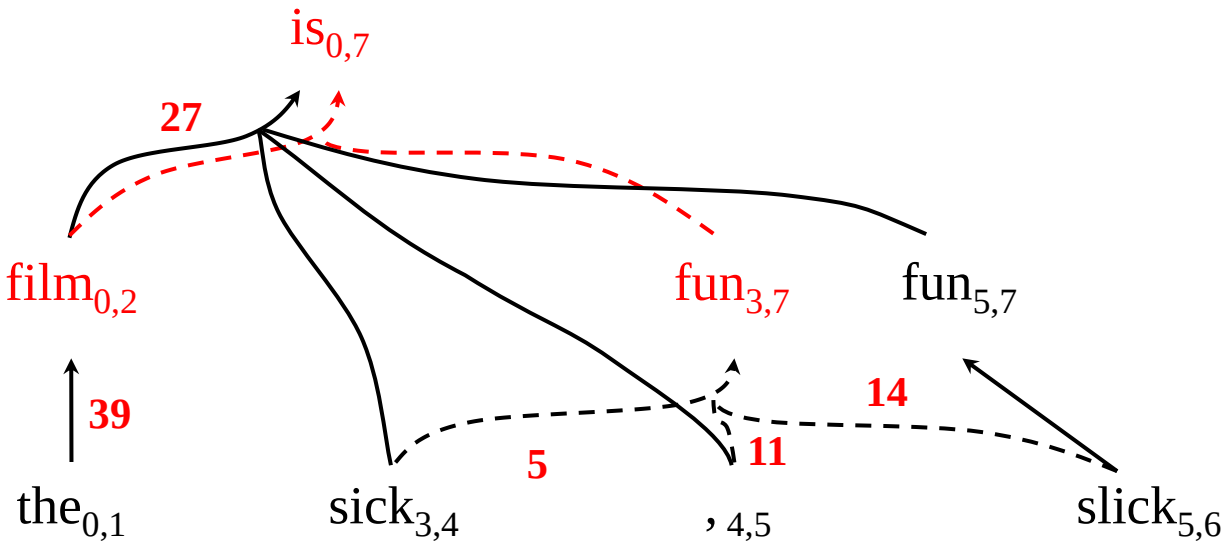
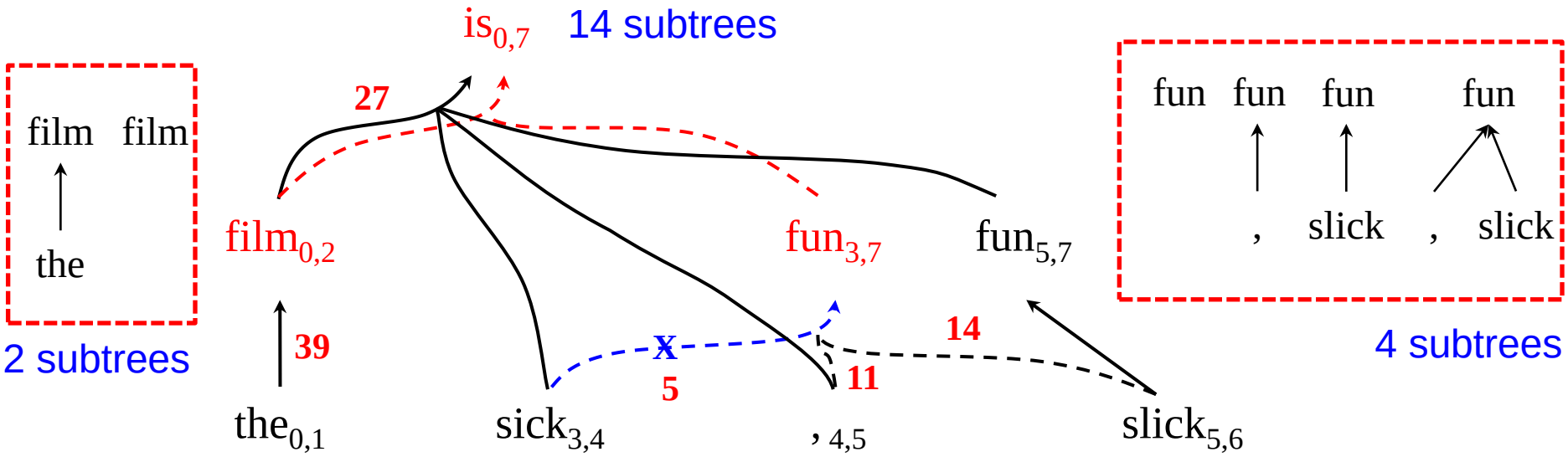


gathering the occurrences of edges

Forest-based Feature Extraction



gathering the occurrences of edges

Experiments

Setup

- Movie Review Corpus (Pang et al., 2004)
  - 1000 positive documents and 1000 negative documents
- Unigrams:
  - appear at least 4 times
- Tree-based Subtrees:
  - appear in at least 10 distinct sentences
- Forest-based Subtrees:
  - appear in at least 10 distinct sentences
  - the fractional count should be not lower than 0.01 (Tu et al., 2010)

Results

Features	Number	Accuracy	Time
Unigram	17,704	86.2	–
Subtree$_{1-best}$	12,282	74.2	0.33
Unigram + Subtree$_{1-best}$	29,986	90.3†	–
Subtree$_{100-best}$	24,006	81.9	35.47
Unigram + Subtree$_{100-best}$	41,710	90.2†	–
Subtree$_{forest}$	18,968	81.2	6.93
Unigram + Subtree$_{forest}$	36,674	**91.6**‡	–
Pang et al. [18]	–	87.1	–
Ng et al. [17]	–	90.5	–
Yessenalina et al. [23]	–	91.8	–

Forest VS Bag-of-words

Features	Number	Accuracy	Time
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Forest VS 1-best tree

Features	Number	Accuracy	Time
Unigram	17,704	86.2	–
Subtree$_{1-best}$	12,282	74.2	0.33
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Ng et al. [17]	–	90.5	–
Yessenalina et al. [23]	–	91.8	–

Forest VS *k*-best trees

Features	Number	Accuracy	Time
Unigram	17,704	86.2	–
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Unigram + Subtree$_{1-best}$	29,986	90.3†	–
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Ng et al. [17]	–	90.5	–
Yessenalina et al. [23]	–	91.8	–

Forest VS State-of-the-art

Features	Number	Accuracy	Time
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Conclusion and Future Work

- dependency forest provides an elegant solution to the problem of *parsing error propagation*
- very simple idea, but works very well in practice
  - 5.4 points in accuracy better than bag-of-words
  - 1.3 points in accuracy better than 1-best trees

Forest offers more alternatives.

Thank you!

Thanks to the anonymous reviewers.