

Doubling DOP*

A comparison of Double-DOP and DOP*

Benno Kruit Sara Veldhoen

Supervised by:

Andreas van Cranenburg Khalil Sima'an

University of Amsterdam (UvA)

Project AI, January 2014

Outline

Data Oriented Parsing

Introduction to DOP

Bias and Consistency

Double-DOP and DOP*: a comparison

Introduction to Double-DOP and DOP*

Comparison

Experiments

Results

Analyzing grammars

Parsing Performance

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

Outline

Data Oriented Parsing

Introduction to DOP

Bias and Consistency

Double-DOP and DOP*: a comparison

Introduction to Double-DOP and DOP*

Comparison

Experiments

Results

Analyzing grammars

Parsing Performance

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

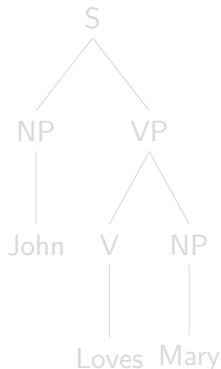
Summary

Parsing

- ▶ input: sentence

John Loves Mary

- ▶ output: constituent tree



Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*
Comparison
Experiments

Results

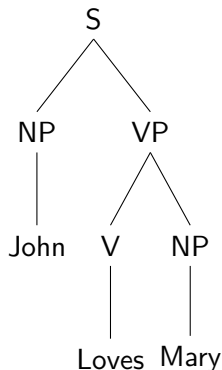
Analyzing grammars
Parsing Performance

Summary

- ▶ input: sentence

John Loves Mary

- ▶ output: constituent tree



Data Oriented Parsing

Introduction to DOP

Bias and Consistency

Double-DOP and DOP* : a comparison

Introduction to Double-DOP and DOP*

Results

Summary

A grammar describes:

- ▶ how trees can be built
 - ▶ CFG's - elementary rules
 - ▶ TSG's - larger units: *fragments*
- ▶ how likely constructions are: *probabilistic* grammars
 - ▶ PCFG's - independence
 - ▶ PTSG's - derivations

Grammar: CFG rules

$S \rightarrow NP VP$

$VP \rightarrow V NP$

$NP \rightarrow John$

$NP \rightarrow Mary$

$V \rightarrow loves$

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

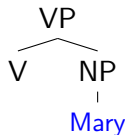
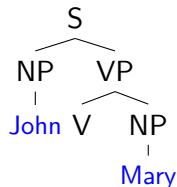
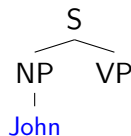
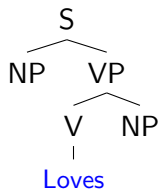
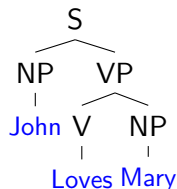
Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

Grammar: Tree fragments



Etc...
Exponentially many

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

Outline

Data Oriented Parsing

Introduction to DOP

Bias and Consistency

Double-DOP and DOP*: a comparison

Introduction to Double-DOP and DOP*

Comparison

Experiments

Results

Analyzing grammars

Parsing Performance

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

Consistency

- ▶ Assumption
 - ▶ Language is an infinite parse tree distribution
 - ▶ Treebank is a finite sample
- ▶ *Estimate* the true distribution
- ▶ Expected estimation should improve when the treebank grows → expected *loss* should decline
- ▶ **Consistency**: Expected loss becomes 0 when the sample size approaches ∞

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

- ▶ Assumption
 - ▶ An estimator should approach *any* distribution
 - ▶ Even finite distributions!
- ▶ If there's a distribution that doesn't match its expected estimate, the estimator is **biased**.
- ▶ What about unseen data?
- ▶ Bias is **good**

Outline

Data Oriented Parsing

Introduction to DOP

Bias and Consistency

Double-DOP and DOP*: a comparison

Introduction to Double-DOP and DOP*

Comparison

Experiments

Results

Analyzing grammars

Parsing Performance

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

Double-DOP

- ▶ Extraction: Maximal Overlap
- ▶ Estimation: relative frequency
- ▶ Coverage: PCFG rules

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*
Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

- ▶ Held-out estimation - *HC* and *EC*
- ▶ Extraction: Shortest derivations
- ▶ Estimation: relative frequency *in shortest derivations*
- ▶ Coverage: smoothing PCFG rules with probability p_{unkn}

Outline

Data Oriented Parsing

Introduction to DOP

Bias and Consistency

Double-DOP and DOP*: a comparison

Introduction to Double-DOP and DOP*

Comparison

Experiments

Results

Analyzing grammars

Parsing Performance

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

Comparison

- ▶ Shortest derivations or Maximal overlap
- ▶ Held-out estimation or one vs. the rest

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

Outline

Data Oriented Parsing

Introduction to DOP

Bias and Consistency

Double-DOP and DOP*: a comparison

Introduction to Double-DOP and DOP*

Comparison

Experiments

Results

Analyzing grammars

Parsing Performance

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

Outline

Data Oriented Parsing

Introduction to DOP

Bias and Consistency

Double-DOP and DOP*: a comparison

Introduction to Double-DOP and DOP*

Comparison

Experiments

Results

Analyzing grammars

Parsing Performance

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

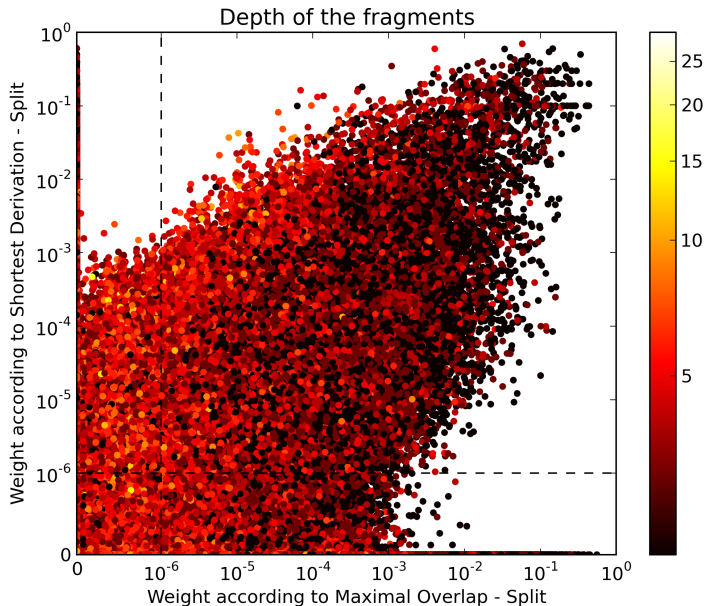
Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

Maximal overlap \leftrightarrow shortest derivation



Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*
Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

Split \leftrightarrow one vs. the rest

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

Outline

Data Oriented Parsing

Introduction to DOP

Bias and Consistency

Double-DOP and DOP*: a comparison

Introduction to Double-DOP and DOP*

Comparison

Experiments

Results

Analyzing grammars

Parsing Performance

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

F1 scores

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary

Summary

- ▶ So **shortest derivations** are not as useful as they seem
- ▶ And a **split** moves weight to large fragments
- ▶ **Performance** is not related to **consistency**
- ▶ Outlook
 - ▶ Why not?
 - ▶ Is it just grammar size?

Doubling DOP*

Kruit, Veldhoen

Data Oriented
Parsing

Introduction to DOP
Bias and Consistency

Double-DOP and
DOP*: a
comparison

Introduction to
Double-DOP and
DOP*

Comparison
Experiments

Results

Analyzing grammars
Parsing Performance

Summary