Parser Showdown at the Wall Street Corral

Jonathan K. Kummerfeld†, David Hall†, James R. Curran‡, and Dan Klein†

UC Berkeley† and U Sydney‡
Parser F-Score

Dunlop et. al. (2011)
Petrov and Klein (2007)
Bikel (2004)
Henderson (2003)
Klein and Manning (2003) Factored
Klein and Manning (2003) Unlexicalized
Charniak (2000)
Collins (1997)

F-Score on WSJ 23
Parser F-Score

- Dunlop et. al. (2011) 88.5
- Petrov and Klein (2007) 90.06
- Bikel (2004) 88.16
- Henderson (2003) 89.42
- Klein and Manning (2003) Factored 86.42
- Klein and Manning (2003) Unlexicalized 85.78
- Charniak (2000) 89.71
- Collins (1997) 87.62

F-Score on WSJ 23
Parser F-Score

<table>
<thead>
<tr>
<th>Method</th>
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<tbody>
<tr>
<td>Charniak with Reranking and Self-Training</td>
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Parser F-Score

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Surface vs Underlying Errors
named the chief executive officer of Google in 1999
Surface vs Underlying Errors

VP
  VBN
  S
  NP
    NP
      named
      chief executive officer
    PP
      IN
      NP
        NNP
        Google
      PP
        in 1999

of Google in 1999
Surface vs Underlying Errors

named chief executive officer of Google in 1999
Surface vs Underlying Errors

VP
  S
  NP
    VBN
    named
    chief executive officer
    of
    Google
  PP
  in 1999
Surface vs Underlying Errors

VP
VBN
S
IN
NP
IN
NP
NP
NPP
PP

named chief executive officer of Google in 1999
Surface vs Underlying Errors

- **VBN**
  - **S**
    - **NP**
      - **IN**
        - **NP**
          - **NNP**
            - **in 1999**
        - **NP**
          - **chief executive officer**
    - **NP**
      - **of**
        - **Google**
      - **named**
Surface vs Underlying Errors

chief executive officer named Google of in 1999
Surface Errors: Extra S, NP, PP, NP
Missing S, NP, PP

Surface vs Underlying Errors

In the example, the surface tree on the left shows "chief executive officer named Google of in 1999" as having surface errors such as extra S, NP, PP, NP and missing S, NP, PP. The right side of the tree shows the underlying structure, which correctly represents the sentence structure without the surface errors.
Surface vs Underlying Errors

Surface Errors:
- Extra S, NP, PP, NP
- Missing S, NP, PP

Underlying Error:
- PP Attachment

Example:

- Surface: chief executive officer named Google of in 1999
- Underlying: chief executive officer of Google in 1999

The diagram shows the surface and underlying structures, highlighting the errors.
Surface vs Underlying Errors

A 16% drop for Google and Apple’s 10% decline
A 16% drop for Google and Apple’s 10% decline
A 16% drop for Google and Apple’s 10% decline.
A 16% drop for Google and Apple’s 10% decline
Surface vs Underlying Errors

A 16% drop for Google and Apple’s 10% decline
A 16% drop for Google and Apple's 10% decline.
Surface vs Underlying Errors

Surface Errors: Extra PP, NP
Missing NP, PP

A 16% drop for Google and Apple’s 10% decline

A 16% drop for Google

and Apple’s 10% decline
Surface vs Underlying Errors

**Surface Errors:** Extra PP, NP
Missing NP, PP

**Underlying Error:** Coordination

A 16% drop for Google and Apple’s 10% decline
Surface vs Underlying Errors

The first thing that caught my eye that was encouraging
The first thing that was encouraging that my eye caught was encouraging.
The first thing that was encouraging was that my eye caught.
The first thing that was encouraging
The first thing that was encouraging that my eye caught was that.
The first thing that was encouraging
Surface vs Underlying Errors

Surface Errors: Extra SBAR, S, VP, NP
Missing SBAR, S, VP

The first thing that was encouraging

Extra SBAR, S, VP, NP
Missing SBAR, S, VP

The first thing that was encouraging
Surface Errors: Extra SBAR, S, VP, NP
Missing SBAR, S, VP

Underlying Error: Clause Attachment

Surface vs Underlying Errors

The first thing that was encouraging my eye caught that.
Surface vs Underlying Errors

got out of their positions at any cost Monday morning
Surface vs Underlying Errors

```
VP
  |-----------------
  |                 
  |                 
|                 |
VB  | ADVP        | PP                  | NP
  | get          | out of their positions | at any cost | Monday morning
```

- get out of their positions at any cost Monday morning
Surface vs Underlying Errors

- **VP**
  - **VB**
  - **ADVP**
    - **get**
    - **out of their positions**
  - **PP**
    - **at any cost**
  - **NP**
    - **Monday morning**
get out of their positions at any cost Monday morning
Surface vs Underlying Errors

get out of their positions at any cost Monday morning

get out of their positions at any cost Monday morning
Surface vs Underlying Errors

Surface Errors:  Extra ADVP
               Missing PP

Tree diagram showing the structure of sentences with different types of errors.
Surface vs Underlying Errors

Surface Errors: Extra ADVP
Missing PP

Underlying Error: Different Label

Diagram showing the structure of sentences with surface errors and underlying errors, highlighting the differences in ADVP and PP.
Underlying Errors

PP Attachment
Clause Attachment
Different Label
Modifier Attachment
NP Attachment
Coordination
Single Word Phrases
Unary
NP Internal Structure
Other
Underlying Errors

PP Attachment
Clause Attachment
Different Label
Modifier Attachment
NP Attachment
Coordination
Single Word Phrases
Unary
NP Internal Structure
Other
Error Identification
Error Identification

- VBN: named
- NP: chief executive officer
- IN: of
- NP: Google
- PP: in 1999

- S: Google of chief executive officer named in 1999
Error Identification

Tree Transformations

List of Transformation Steps
Error Identification

Tree Transformations

List of Transformation Steps

Categorise

List of Errors

chief executive officer named Google of in 1999

chief executive officer named Google of in 1999
Error Identification

List of Transformation Steps

List of Errors
Tree Transformations
Tree Transformations

Create Node
Tree Transformations

Create Node
Tree Transformations

Delete Node

Adjective Phrase: reported higher earnings

NP: earnings

ADJP: reported

RBR: higher

CD: reported
Tree Transformations

Delete Node

Delete Node

NP

ADJP

RBR
higher

CD
reported

NNS
earnings

NP

RBR
higher

CD
reported

NNS
earnings
Tree Transformations

Move Node
Tree Transformations

Move Node

[Diagram of tree transformations]
Tree Transformations

Create Node

Delete Node

Move Node
Tree Transformations

Create Node

Delete Node
Tree Transformations

- Create Node
- Delete Node
- Move Node
I ate pizza with a bright blue fork.
I ate pizza with a bright blue fork.
I ate pizza with a bright blue fork.
I ate pizza with a bright blue fork.
I ate pizza with a bright blue fork.
I ate pizza with a bright blue fork.
Templates
named chief executive officer of Google in 1999
named chief executive officer of Google in 1999
named chief executive officer of Google in 1999
named chief executive officer of Google in 1999
named chief executive officer of Google in 1999

Extra bracket
named chief executive officer of Google in 1999

- Extra bracket
- Set of extra brackets ending at the same point
named chief executive officer of Google in 1999
named chief executive officer of Google in 1999

- Extra bracket
- Set of extra brackets ending at the same point
- Set of missing brackets that cross the extra bracket
named chief executive officer of Google in 1999

- Extra bracket
- Set of extra brackets ending at the same point
- Set of missing brackets that cross the extra bracket
- No other bracket errors present
named chief executive officer of Google in 1999

- Extra bracket
- Set of extra brackets ending at the same point
- Set of missing brackets that cross the extra bracket
- No other bracket errors present

Attachment too low, move bracket up
Error Identification

List of Transformation Steps

Categorise

List of Errors

Tree Transformations

chief executive officer named Google of in 1999

chief executive officer named Google of in 1999
Error Identification

Tree Transformations

List of Transformation Steps

Categorise

List of Errors
Categorise
Categorise

Transformation: Move PP, delete NP

Before transformation:
- named
- chief executive officer
- of
- Google
- in 1999

After transformation:
- named
- chief executive officer
- of
- Google
- in 1999
Transformation: Move PP, delete NP

Underlying Error: PP Attachment
A 16% drop for Google and Apple’s 10% decline.
A 16% drop for Google and Apple’s 10% decline
Transformation: Move CC, move NP, delete NP, create NP

Underlying Error: Coordination

A 16% drop for Google and Apple’s 10% decline
The first thing that was encouraging was...
The first thing that was encouraging that my eye caught was the first thing that was encouraging that my eye caught.
Transformation: Move SBAR, delete NP

Underlying Error: Clause Attachment
get out of their positions at any cost Monday morning
Categorise

Transformation: Delete ADVP, create PP

get out of their positions at any cost Monday morning

get out of their positions at any cost Monday morning
Different Label

Transformation: Delete ADVP, create PP

Underlying Error: Different Label
Related Work
Related Work

Intrinsic Evaluation

- Collins (2003) — Studied surface errors for a single parser
- Hara et al. (2007), Yu et al. (2011) — Manually analysed underlying errors
Intrinsic Evaluation
- Collins (2003) — Studied surface errors for a single parser
- Hara et al. (2007), Yu et al. (2011) — Manually analysed underlying errors

Dependencies
- McDonald and Nivre (2007) — Investigated the impact of various factors
- Nivre et al. (2010) — Designed data to test specific types of constructions
## WSJ Top Errors

<table>
<thead>
<tr>
<th>Parser</th>
<th>F-score</th>
<th>PP Attach</th>
<th>Clause Attach</th>
<th>Diff Label</th>
<th>Co-ord</th>
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<tbody>
<tr>
<td>Charniak++</td>
<td>92.07</td>
<td></td>
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<td></td>
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</table>

- **Min errors:** 0.60, 0.38, 0.31, 0.23
- **Max errors:** 1.12, 0.61, 0.51, 0.40

**WSJ Top Errors**
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- PP Attach: 0.60
- Clause Attach: 0.38
- Diff Label: 0.31
- Co-ord: 0.23

**Max errors:**
- PP Attach: 1.12
- Clause Attach: 0.61
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Min errors:  
Max errors:
## Reranking

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Min errors: 
Max errors:
## Reranking

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Min errors: 
Max errors: 

Oracle 50 97.18
Charniak++ 50 92.07
Charniak++ 1 91.02
### Reranking

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<td>0.26</td>
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Out of Domain
## Out of Domain

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<th>Corpus</th>
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<th>Clause Attach</th>
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Thank you!