Arc-Hybrid Non-Projective Dependency Parsing with a Static-Dynamic Oracle

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Outline

1. **System**
   - Arc-Hybrid
   - Dynamic Oracles
   - Reordering
   - A Static-Dynamic Oracle
   - Parsing using BiLSTMs

2. **Experiments**

3. **Conclusion and Future Work**
Outline

1 System
   - Arc-Hybrid
   - Dynamic Oracles
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   - Parsing using BiLSTMs

2 Experiments

3 Conclusion and Future Work
Transition-Based Parsing with Arc-Hybrid

Configuration:

STACK

Drive your

BUFFER

friend home root

Transitions:

Kuhlmann et al. (2011)
Transition-Based Parsing with Arc-Hybrid

Configuration:

STACK

Drive your

BUFFER

friend home root

Transitions:

LEFT–ARC

Kuhlmann et al. (2011)
Transition-Based Parsing with Arc-Hybrid

Configuration:

STACK

Drive your

BUFFER

friend home root

Transitions:

LEFT-ARC

Kuhlmann et al. (2011)
Transition-Based Parsing with Arc-Hybrid

Configuration:

STACK

BUFFER

Drive your

friend home root

Transitions:

LEFT-ARC

Kuhlmann et al. (2011)
Transition-Based Parsing with Arc-Hybrid

Configuration:

STACK

Drive your

BUFFER

friend home root

Transitions:

LEFT−ARC

RIGHT−ARC

Kuhlmann et al. (2011)
Transition-Based Parsing with Arc-Hybrid

Configuration:

STACK

Drive your

BUFFER

friend home root

Transitions:

LEFT−ARC

RIGHT−ARC

Kuhlmann et al. (2011)
Transition-Based Parsing with Arc-Hybrid

Configuration:

STACK

Drive your

BUFFER

friend home root

Transitions:

LEFT-ARC

RIGHT-ARC

Kuhlmann et al. (2011)
Transition-Based Parsing with Arc-Hybrid

Configuration:

STACK

BUFFER

Drive your friend home root

Transitions:

LEFT-ARC

RIGHT-ARC

SHIFT

Kuhlmann et al. (2011)
Transition-Based Parsing with Arc-Hybrid

Configuration:

STACK

Drive  your

BUFFER

friend  home  root

Transitions:

LEFT−ARC

RIGHT−ARC

SHIFT

Kuhlmann et al. (2011)
Static Oracle for Arc-Hybrid

Drive your friend home **root**
Drive your friend home **root**

[Drive your friend home **root**]
Static Oracle for Arc-Hybrid

SHIFT

Drive your friend home **root**

[ Drive ]  [ your friend home **root** ]
Static Oracle for Arc-Hybrid

SHIFT

Drive your friend home **root**

[ Drive your ]  [ friend home **root** ]
Static Oracle for Arc-Hybrid

LEFT-ARC

[ Drive ]

[ friend home **root** ]
Static Oracle for Arc-Hybrid

SHIFT

[ Drive friend] [home **root**]

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Non-Projective Parsing with a Static-Dynamic Oracle
Static Oracle for Arc-Hybrid

RIGHT-ARC

Drive → your → friend → home → **root**

[Drive] [home **root**]
Static Oracle for Arc-Hybrid

SHIFT

Drive your friend home **root**

[ Drive home] [**root**]
Static Oracle for Arc-Hybrid

RIGHT-ARC

Drive your friend home **root**

[ Drive ]

[ **root** ]
Static Oracle for Arc-Hybrid

LEFT-ARC

Drive your friend home **root**

[ ] [**root**]
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Dynamic Oracle for Arc-Hybrid

Goldberg and Nivre (2013)

[ Drive your ]  [ friend home **root** ]
Dynamic Oracle for Arc-Hybrid

RIGHT-ARC

Drive your friend home **root**

Goldberg and Nivre (2013)
Dynamic Oracle for Arc-Hybrid

RIGHT-ARC

Drive your friend home **root**

Goldberg and Nivre (2013)
Dynamic Oracle for Arc-Hybrid

RIGHT-ARC

[Drive] [friend home **root**]

Goldberg and Nivre (2013)
Dynamic Oracle for Arc-Hybrid

SHIFT

Drive your friend home **root**

[ Drive your ] [ friend home **root** ]

Goldberg and Nivre (2013)
Dynamic Oracle for Arc-Hybrid

SHIFT

Drive  your  friend  home  **root**

[ Drive your friend ]  [ home **root** ]

Goldberg and Nivre (2013)
Dynamic Oracle for Arc-Hybrid

Goldberg and Nivre (2013)
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Arc-Hybrid Parsing with Reordering

Configuration:

STACK  BUFFER

Drive  your  friend  home  root

Transitions:

LEFT-ARC

RIGHT-ARC

SHIFT

Nivre (2009)
Arc-Hybrid Parsing with Reordering

Configuration:

STACK

BUFFER

Drive    your

friend    home    root

Transitions:

LEFT−ARC

RIGHT−ARC

SHIFT

SWAP

Nivre (2009)
Arc-Hybrid Parsing with Reordering

Configuration:

STACK

BUFFER

Drive your friend home root

Transitions:

LEFT-ARC

RIGHT-ARC

SHIFT

SWAP

Nivre (2009)
Arc-Hybrid Parsing with Reordering

Thanks Carlos Gomez-Rodriguez for the example!
Arc-Hyrid Parsing with Reordering

found  best  example  ever
Arc-Hybrid Parsing with Reordering

found  best  example  ever
1       2         4        3
Arc-Hybrid Parsing with Reordering

SHIFT

[ ] [ found_1 best_2 example_4 ever_3 ]
Arc-Hybrid Parsing with Reordering

SHIFT

[ found<sub>1</sub> ]  [ best<sub>2</sub> example<sub>4</sub> ever<sub>3</sub> ]
Arc-Hyrid Parsing with Reordering

SHIFT

[ found₁ best₂ ] [ example₄ ever₃ ]
Arc-Hyrid Parsing with Reordering

SHIFT

[ found \textsubscript{1} best \textsubscript{2} example \textsubscript{4} ] [ ever \textsubscript{3} ]
Arc-Hyrid Parsing with Reordering

SHIFT

found
best
example
ever

[ found_1 best_2 example_4 ] [ ever_3 ]
SWAP

[ found\textsubscript{1} best\textsubscript{2} ] [ ever\textsubscript{3} example\textsubscript{4} ]
Arc-Hyrid Parsing with Reordering

SHIFT

[ found₁, best₂, ever₃ ]  [ example₄ ]
Arc-Hybrid Parsing with Reordering

RIGHT-ARC

[ found_1 best_2 ] [ example_4 ]
Arc-Hyrid Parsing with Reordering

LEFT-ARC

found \[1\] best \[2\] example \[4\] ever \[3\]

[ found\textsubscript{1} ] [ example\textsubscript{4} ]
Arc-Hybrid Parsing with Reordering

SHIFT

[ found\textsubscript{1} example\textsubscript{4} ] [ ]
Arc-Hybrid Parsing with Reordering

RIGHT-ARC

found 1
best 2
example 4
ever 3

[ found_1 ] [ ]
Outline

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A Static-Dynamic Oracle

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Non-Projective Parsing with a Static-Dynamic Oracle
A Static-Dynamic Oracle

RIGHT-ARC

[ found_1 ]  [ example_4 ever_3 ]
A Static-Dynamic Oracle

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Non-Projective Parsing with a Static-Dynamic Oracle

RIGHT-ARC

[ found₁ ]  [ example₄ ever₃ ]
A Static-Dynamic Oracle

LEFT-ARC

[ found_1 ] [ example_4 ever_3 ]
A Static-Dynamic Oracle

LEFT-ARC

found \hspace{0.5cm} best \hspace{0.5cm} example \hspace{0.5cm} ever

\hspace{0.5cm} 1 \hspace{0.5cm} 2 \hspace{0.5cm} 4 \hspace{0.5cm} 3

[ found_1 ] \hspace{0.5cm} [ example_4 \hspace{0.5cm} ever_3 ]
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Transition-Based Parsing using BiLSTMs

Configuration:

STACK

BUFFER

the brown fox

jumped root

Configuration:

STACK

BUFFER

the brown fox

jumped root

Scoring:

(score(LEFT−ARC), score(RIGHT−ARC), score(SHIFT), score(SWAP))

Kiperwasser and Goldberg (2016); de Lhoneux et al. (2017)
Xthe
Transition-Based Parsing using BiLSTMs

Xthe

e(the) pe(the)
Transition-Based Parsing using BiLSTMs

Xthe

e(the)  pe(the)

concat

Cf Cf Cf
Cb Cb Cb
h et
pe(the) e(the)

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Transition-Based Parsing using BiLSTMs

\[ X_{\text{the}} \quad X_{\text{brown}} \quad X_{\text{fox}} \quad X_{\text{jumped}} \quad X_{\text{root}} \]
Transition-Based Parsing using BiLSTMs

Vthe
concat
LSTM\textsuperscript{b}
LSTM\textsuperscript{f}
X_{the}

Vbrown
concat
LSTM\textsuperscript{b}
LSTM\textsuperscript{f}
X_{brown}

Vfox
concat
LSTM\textsuperscript{b}
LSTM\textsuperscript{f}
X_{fox}

Vjumped
concat
LSTM\textsuperscript{b}
LSTM\textsuperscript{f}
X_{jumped}

Vroot
concat
LSTM\textsuperscript{b}
LSTM\textsuperscript{f}
X_{root}
Transition-Based Parsing using BiLSTMs

Diagram showing the architecture of LSTM networks for parsing a sentence: "The fox jumped root brown."
Transition-Based Parsing using BiLSTMs

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Non-Projective Parsing with a Static-Dynamic Oracle
Transition-Based Parsing using BiLSTMs

\[
\text{(score(LEFT-ARC), score(RIGHT-ARC), score(SHIFT), score(SWAP))}
\]

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Experiments
Experiments

![Bar chart showing non-projective percentages for different languages.]

- English: 0.5
- Arabic: 0.3
- Portuguese: 1.3
- Basque: 5.0
- Ancient-Greek: 9.8
Experiments

![Bar Chart](chart.png)

The chart illustrates the non-projective percentage for different languages. The x-axis represents the languages: English, Arabic, Portuguese, Basque, and Ancient-Greek. The y-axis represents the non-projective percentage. The chart shows that Ancient-Greek has the highest non-projective percentage at 63.2%, followed by Basque at 33.7%, Portuguese at 18.4%, Arabic at 8.2%, and English at 0.3%.
Experiments

- Static (baseline)
- Static-Dynamic (this work)
- Pseudo-Projective
- Projective (baseline)
Experiments

- Static (baseline)
- Static-Dynamic (this work)
  - Pseudo-Projective
  - Projective (baseline)
Experiments

- Static (baseline)
- Static-Dynamic (this work)
- Pseudo-Projective
- Projective (baseline)
Experiments

- Static (baseline)
- Static-Dynamic (this work)
- Pseudo-Projective
- Projective (baseline)
Experiments

![Bar chart showing labeled attachment error for different languages. The x-axis represents languages: English, Arabic, Portuguese, Basque, Ancient-Greek. The y-axis represents labeled attachment error. The chart compares two methods: Stat and Static-Dynamic.]
Experiments

The graph shows labeled attachment error for different languages and parsing methods. The languages are English, Arabic, Portuguese, Basque, and Ancient-Greek. The methods compared are Stat, Static-Dynamic, and Pproj. The error rates vary across languages, with Ancient-Greek showing the highest error rate for all methods.
Experiments

![Graph showing labeled attachment error for different languages and parsing models. The x-axis represents languages: English, Arabic, Portuguese, Basque, Ancient-Greek. The y-axis represents labeled attachment error. The models compared are Stat, Static-Dynamic, Pproj, and Proj. The error is lowest for Stat and highest for Proj, with variations for each language.](image)
Conclusion

We integrated a swap transition into arc-hybrid

Our system benefits from error exploration

Future Work

Proper hyperparameter tuning

A fully dynamic oracle?
Conclusion

We integrated a swap transition into arc-hybrid.

We defined an oracle that is partially dynamic for this system.

Our system benefits from error exploration.

Future Work

Proper hyperparameter tuning

A fully dynamic oracle?
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Conclusion

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References


