What's Going on in Neural Constituency Parsers? An Analysis

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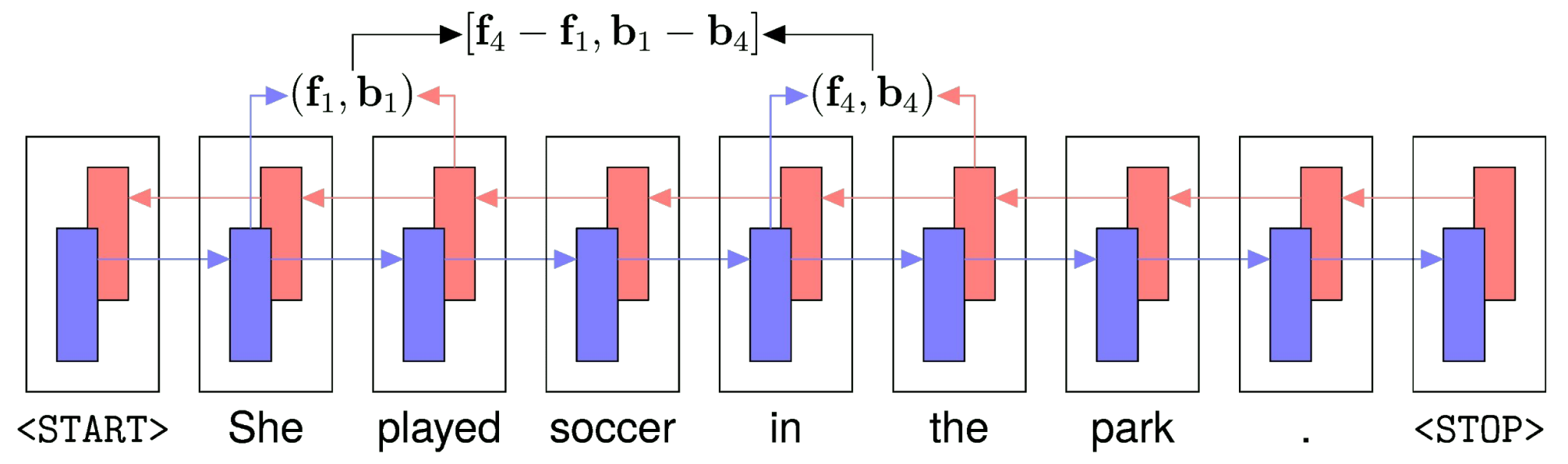
Why don't we need a grammar?

Adjacent tree labels are redundant with LSTM features

If we can predict surrounding tree labels from our LSTM representation of the input, then this information doesn't need to be provided explicitly by grammar production rules

We find that for **92.3%** of spans, the label of the span's parent can be predicted from the neural representation of the span



Do we need tree constraints?

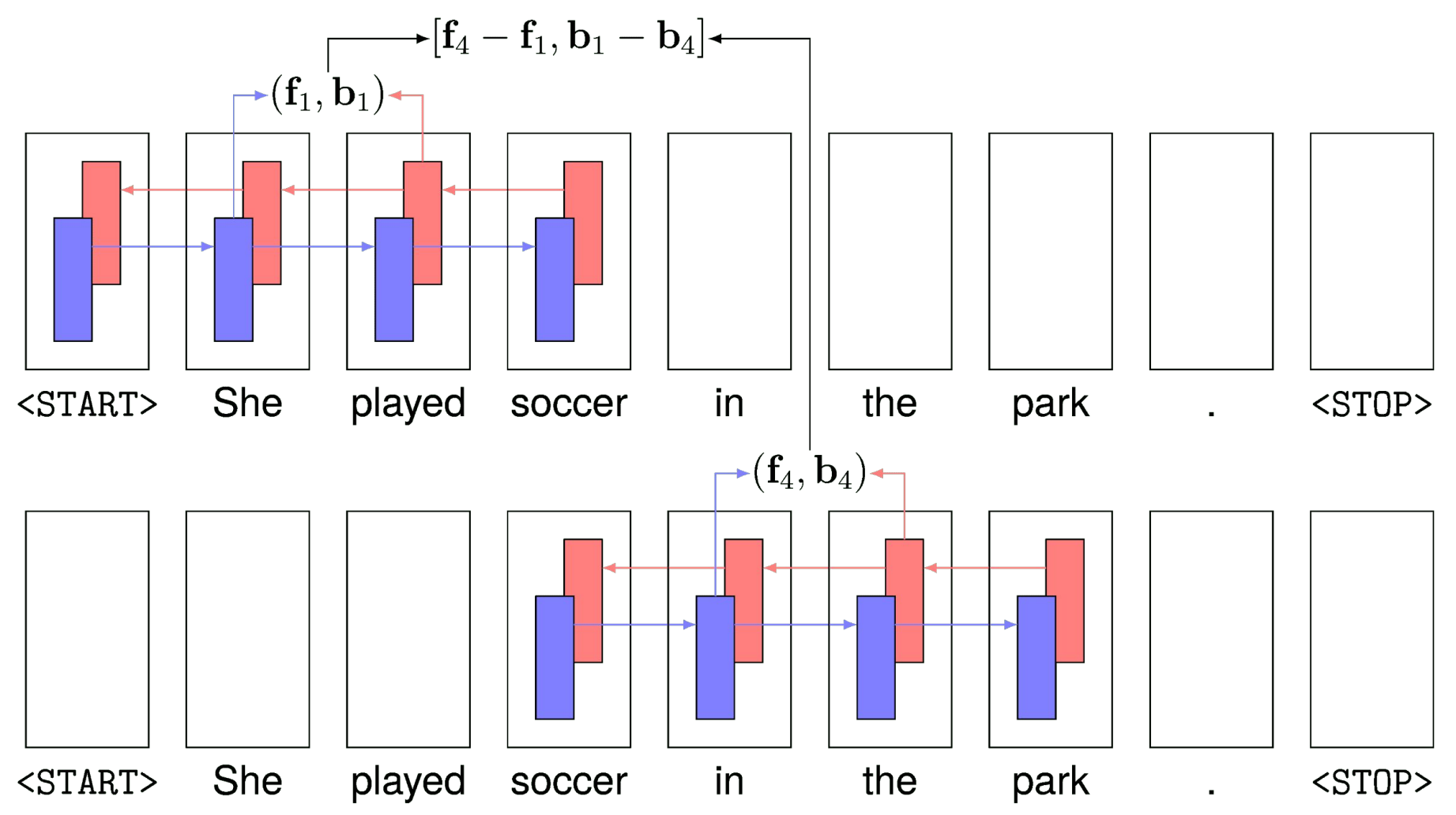
Not for F1

Many neural parsers no longer model output correlations with grammar rules, but still use output correlations from tree constraints

Predicting span brackets independently gives **nearly identical performance** on PTB development set F1 and produces valid trees for **94.5%** of sentences

Is distant context important?

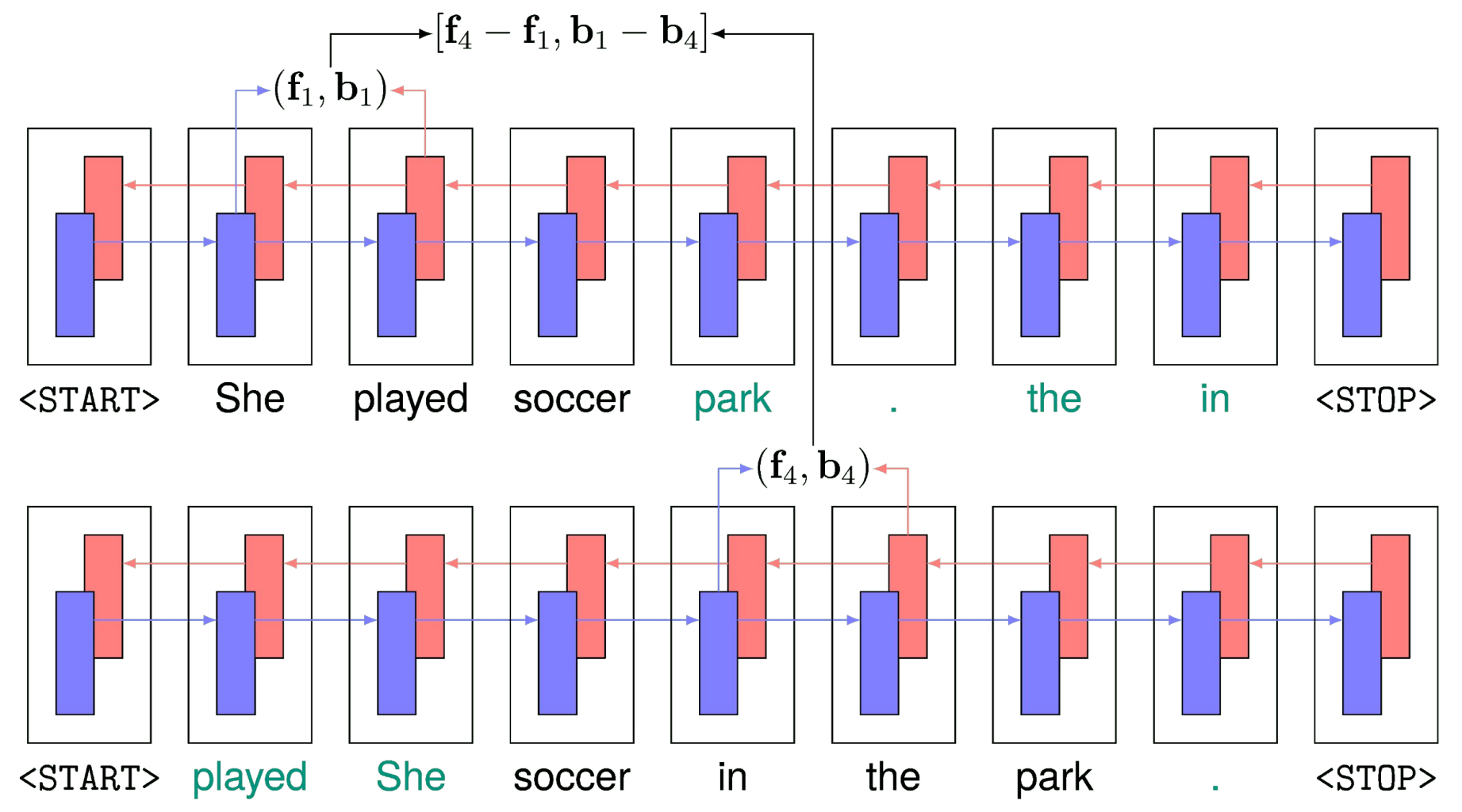
Yes!



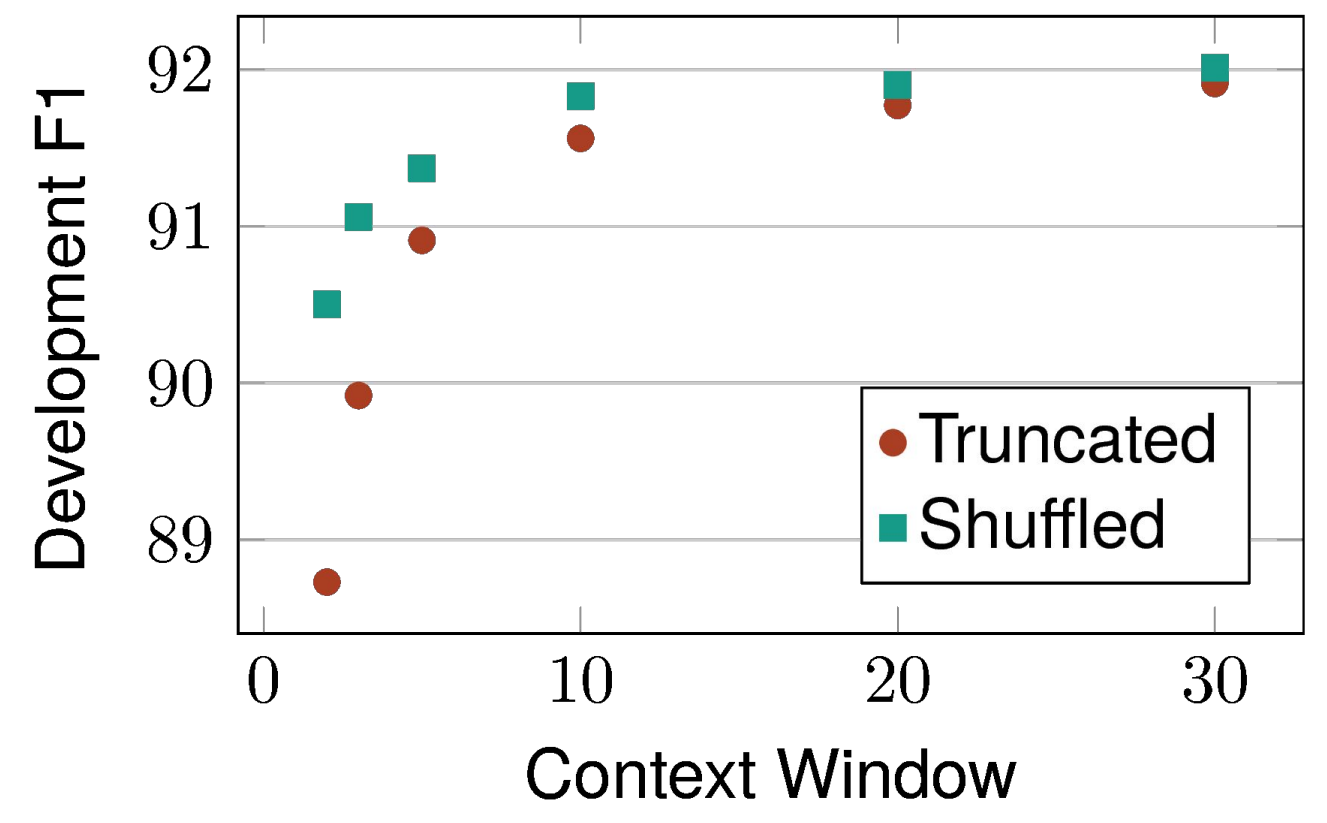
Almost a full point of F1 is lost by truncating context 5 words away from span endpoints and half a point with 10 words

Is the word order of distant context captured?

Yes!



Shuffling words outside a window around span endpoints hurts performance even with large context windows



Neural parsers no longer have much of the model structure provided to classical parsers.

How do they perform so well without it?

What about lexicon features?

The character LSTM captures the same information

Heavily engineered lexicons used to be critical to good performance, but neural models typically don't use them

Word features from the Berkeley Parser (Petrov and Klein 2007) can be predicted with over **99.7%** accuracy from the character LSTM representation

What word representations do we need?

A character LSTM is sufficient

Word Only	91.44
Word and Tag	92.09
Character LSTM Only	**92.24**
Character LSTM and Word	92.22
Character LSTM, Word, and Tag	92.24

Do LSTMs introduce useful inductive bias compared to feedforward networks?

Yes!

We compare a truncated LSTM with feedforward architectures that are given the same inputs

The LSTM outperformed the best feedforward by **6.5 F1**