



Tree-LSTMs for Scientific Relation Classification

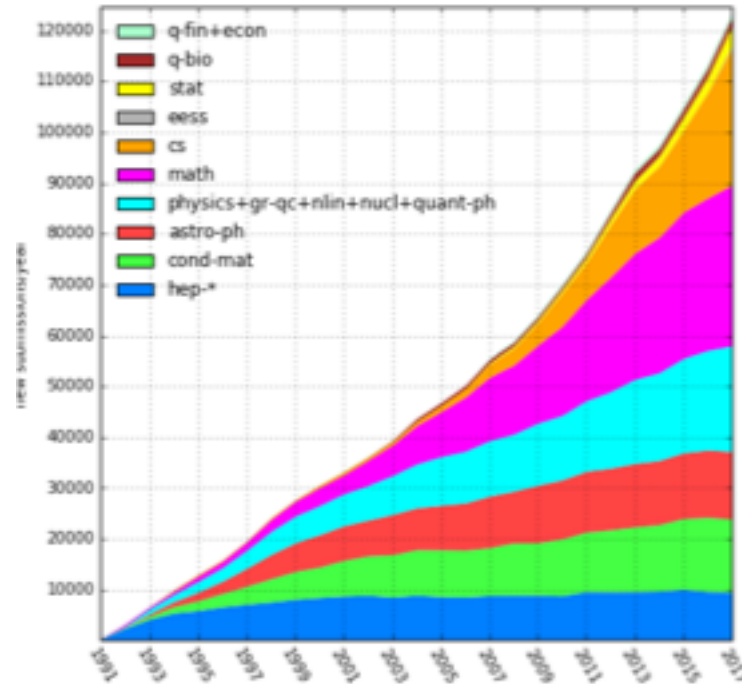
Sean MacAvaney, Luca Soldaini, Arman Cohan and
Nazli Goharian

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Preprint: arxiv.org/abs/1804.05408

The Problem

- There's currently an enormous amount of scientific literature generated
- Difficult to keep up-to-date
- Can we use NLP to capture important information?




https://arxiv.org/help/stats/2017_by_area/index

The Task

- Semantic Relation Extraction and Classification in Scientific Papers
- Given a set of entities in a document, identify and classify which entities are related

This paper proposes a practical approach employing **n-gram models** and **error-correction rules** for **Thai key prediction**. The paper also proposes **rule-reduction algorithm** applying **mutual information** to reduce the **error-correction rules**. Our algorithm reported more than 99% **accuracy** in both **language identification** and **key prediction**.



```
graph TD; Usage[Usage] --> ErrorCorrection[error-correction rules]; Usage --> ThaiKeyPrediction[Thai key prediction];
```

The Task

- SemEval 2018 Task 7 – Semantic Relation Extraction and Classification in Scientific Papers
- 6 types of relations
 - More than previous work examined
 - Usage, Model-Feature, Part-Whole, Compare, Result, and Topic
- Simplifying assumptions:
 - Task assumes correct entities
 - Relations do not span sentence boundaries
 - Only examine paper abstracts

The Relations

This paper proposes a practical approach employing **n-gram models** and **error-correction rules** for **Thai key prediction**. The paper also proposes **rule-reduction algorithm** applying **mutual information** to reduce the **error-correction rules**. Our algorithm reported more than 99% **accuracy** in both **language identification** and **key prediction**.

The diagram consists of a blue rectangular box labeled 'Usage' positioned above the text. Two blue arrows originate from the 'Usage' box: one points left towards the text 'Thai key prediction', and the other points right towards the text 'error-correction rules'.

The Relations

In this paper, we present the HybridTrim system which uses a machine learning technique to combine linguistic, statistical and positional information to identify topic labels for **headlines**

in a **text**.

A diagram illustrating the relationship between 'headlines' and 'text'. A blue arrow points from the word 'headlines' (highlighted in yellow in the text above) to a blue rectangular box labeled 'Part-Whole'. From this box, another blue arrow points to the word 'text' (highlighted in pink in the text above).

The Relations

Model-Feature



The method amounts to tagging **language models** with **confidence measures** and picking the best hypothesis corresponding to the LM with the best confidence.

The Relations

We find that simple **interpolation methods**, like log-linear and linear interpolation,



improve the **performance** but fall short of the performance of an oracle.

The Relations

We show that the trained SPR learns to select a **sentence plan** whose rating on average is



Compare

only 5% worse than the top **human-ranked sentence plan**.

The Relations

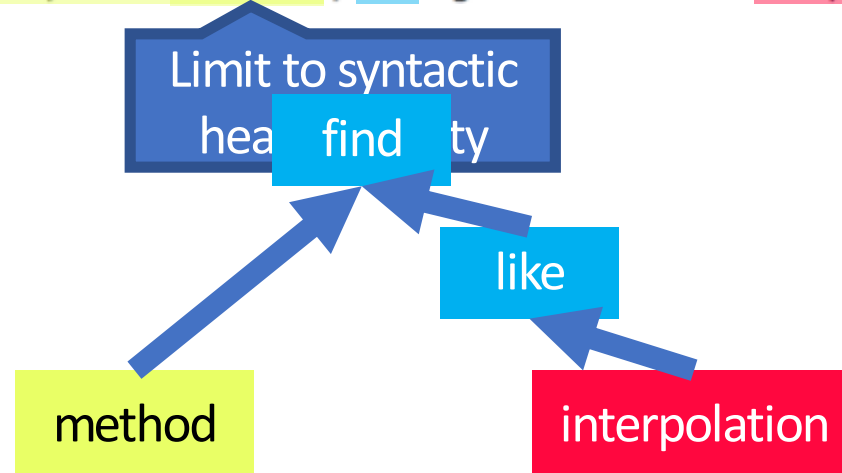
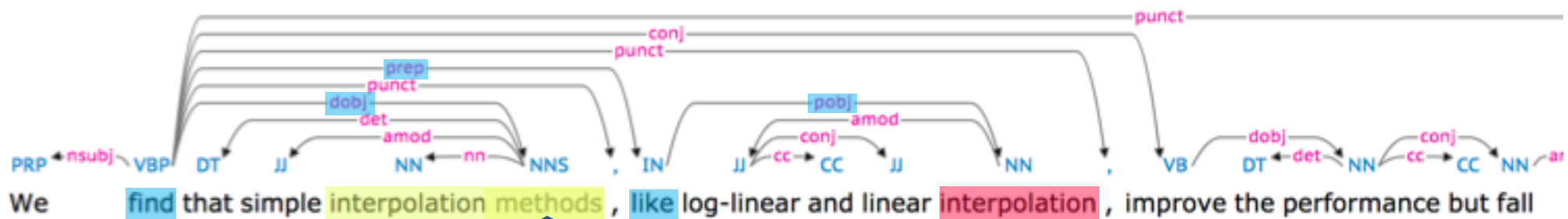
Topic



This paper presents a **formal analysis** for a large class of words called **alternative markers**, which includes other (than), such (as), and besides.

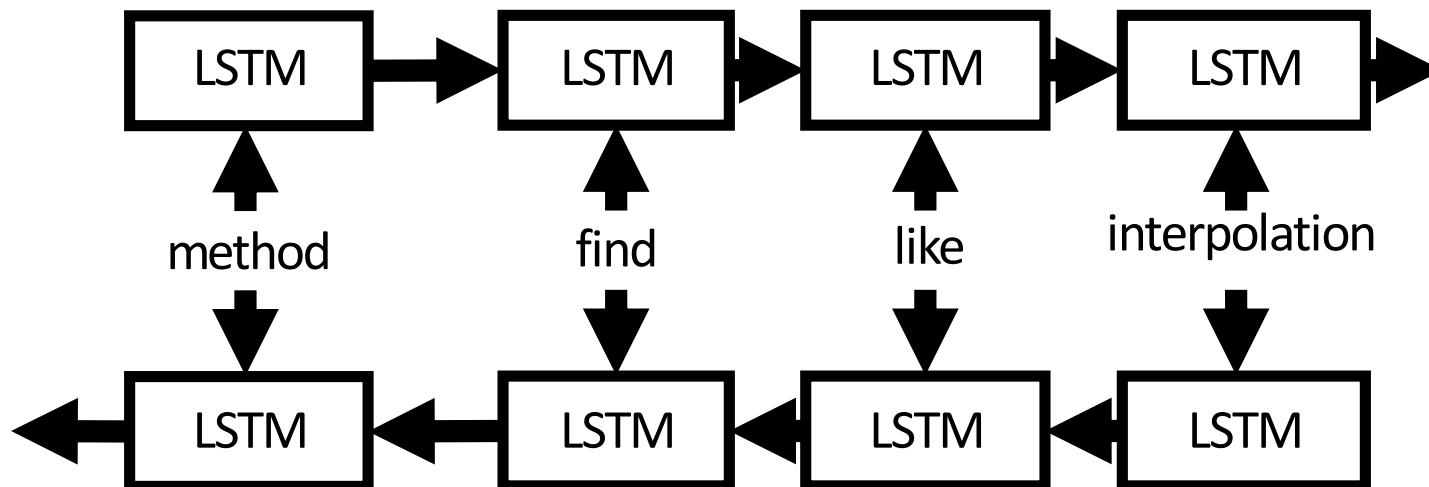
The Approach

- Tree structure: dependency graph



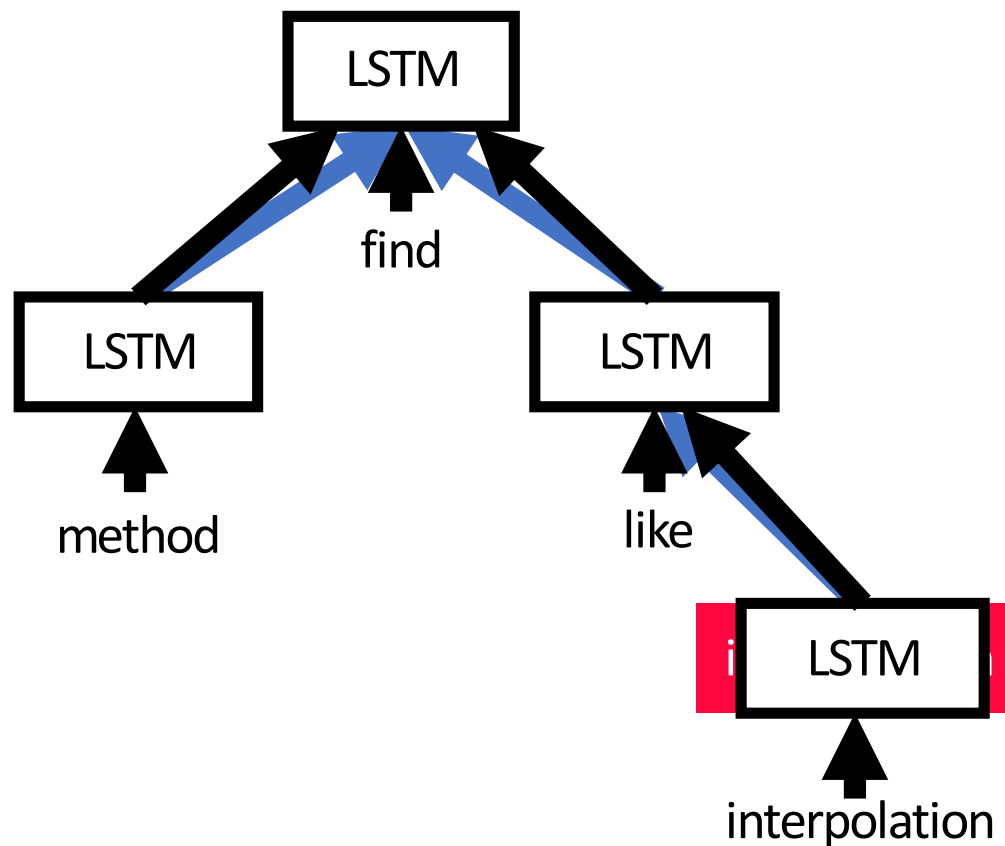
The Approach

- One technique: Bi-directional LSTM

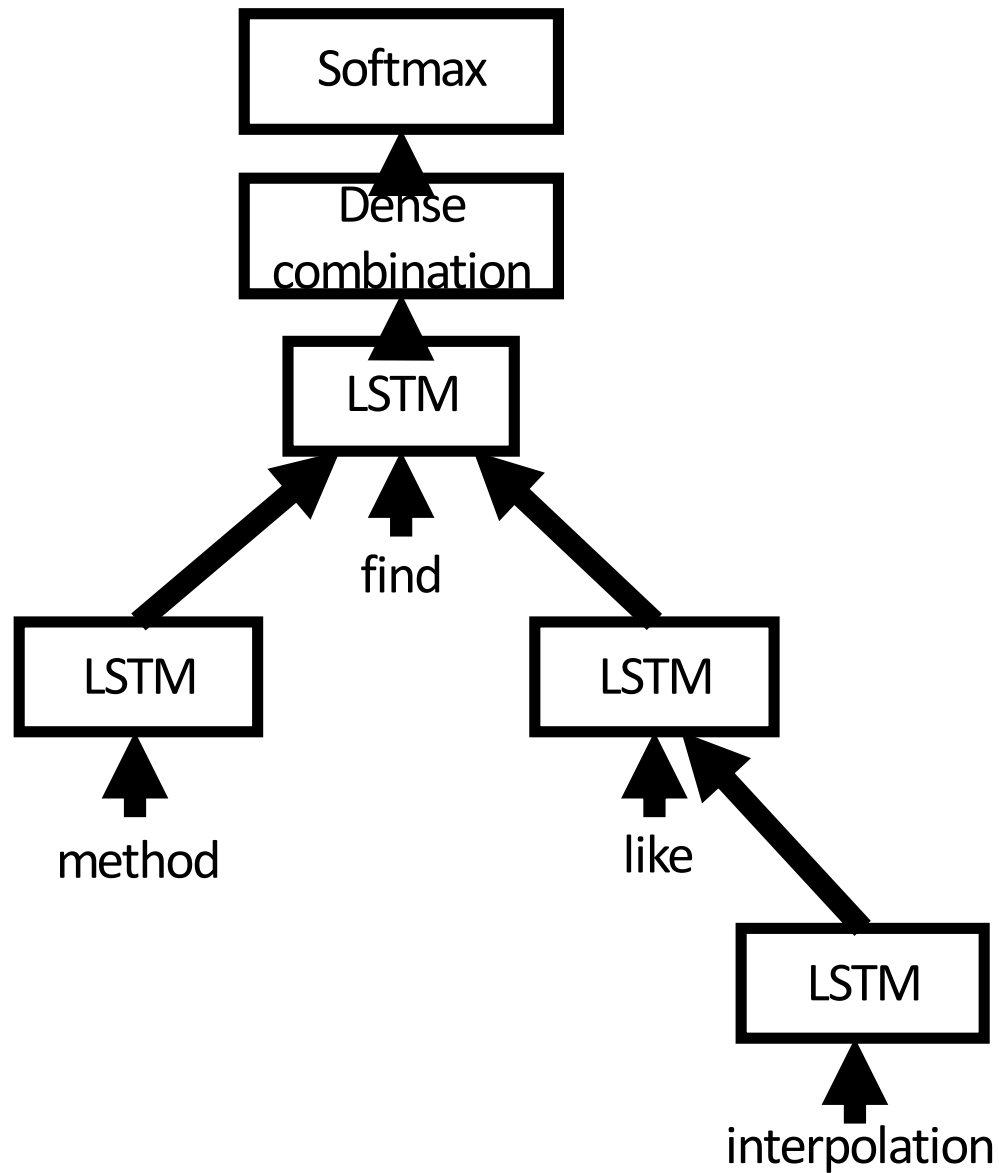


The Approach

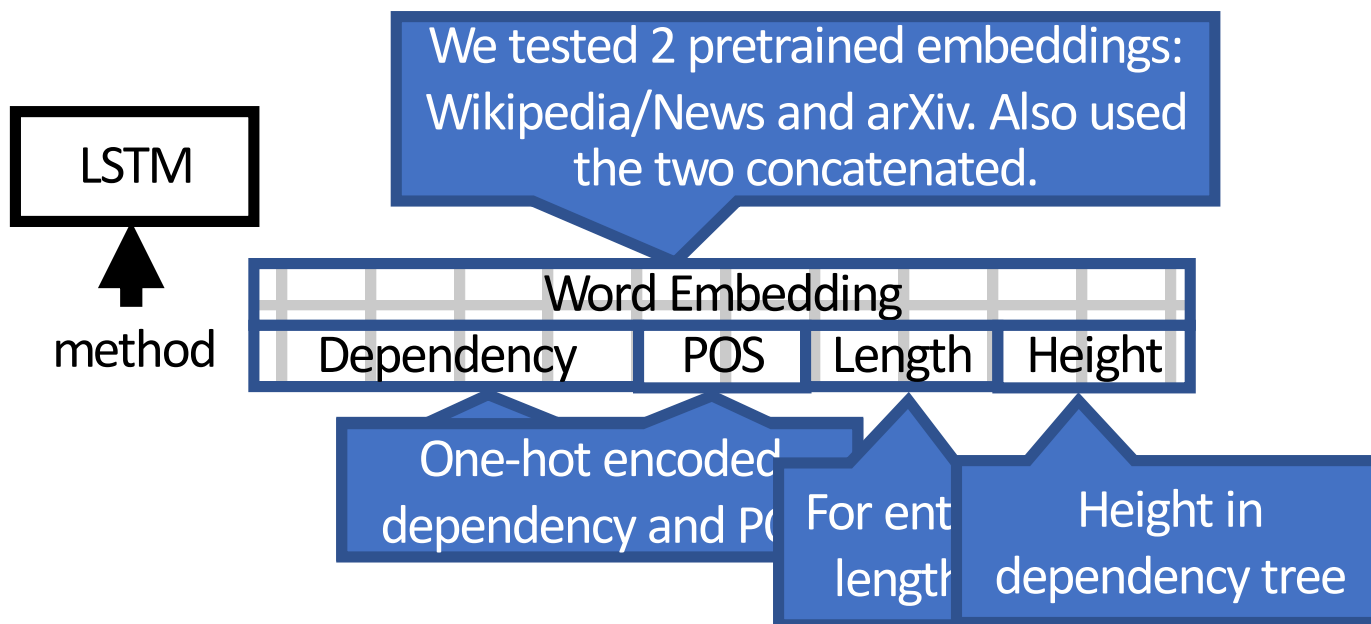
- Tree-LSTM cells: child-sum (Tai et al., 2015)
- Subset of parse tree



The Approach



The Representation

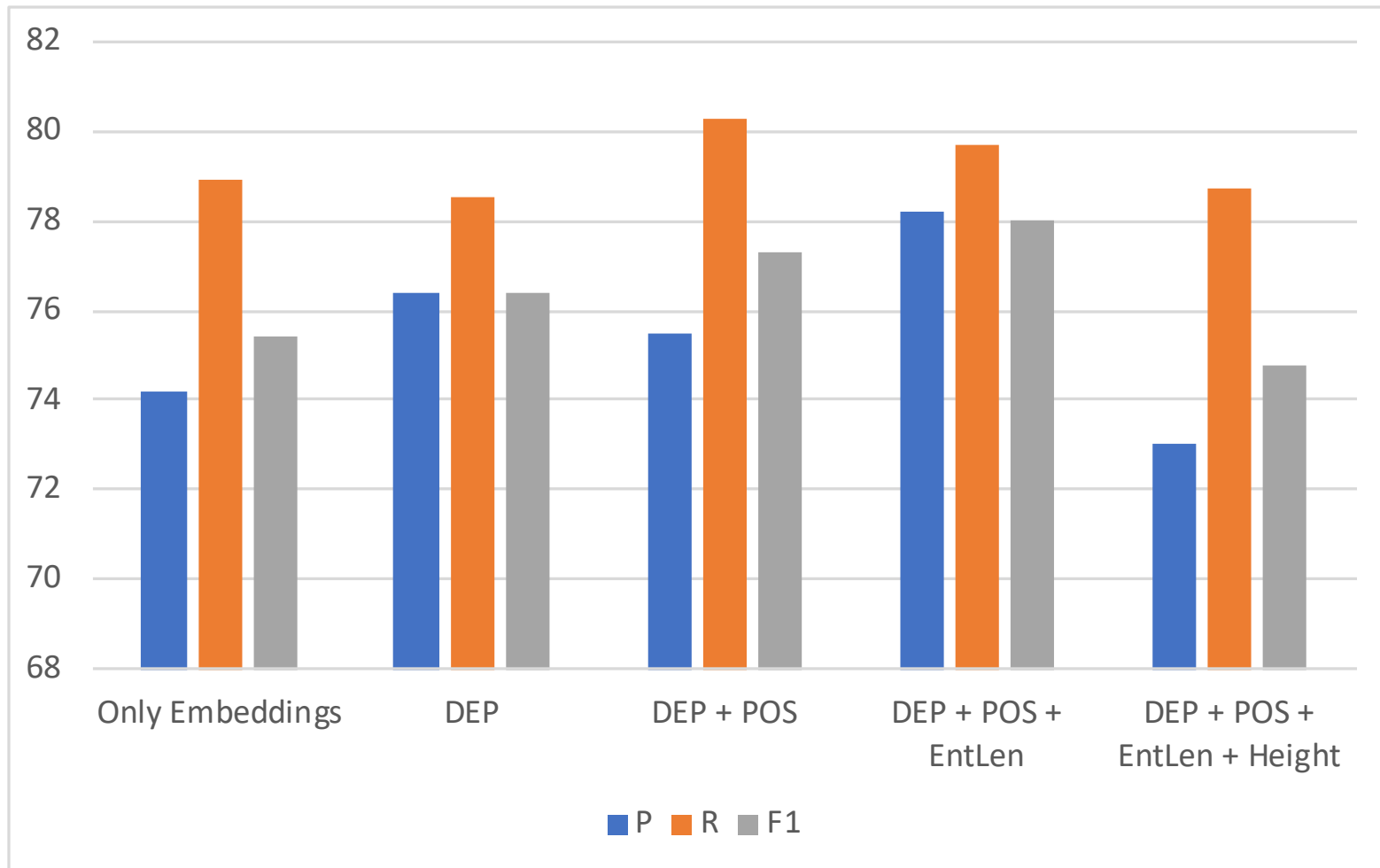


The Data

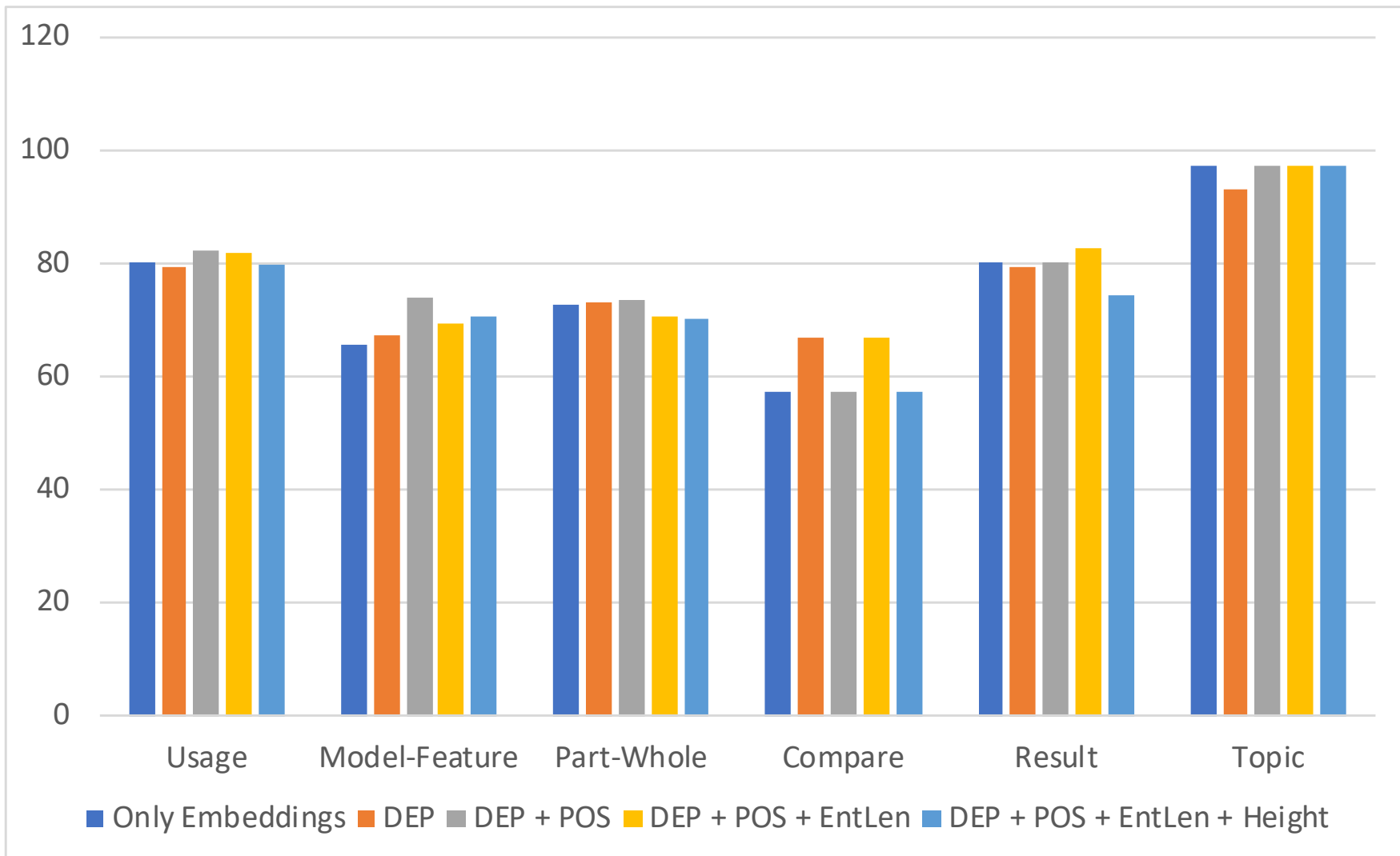
- Abstracts from ACL anthology

Dataset	Usage	Model-Feature	Part-Whole	Compare	Result	Topic
Train	363	124	162	29	94	207
Validation	107	51	34	12	29	36
Test	123	75	56	3	29	69

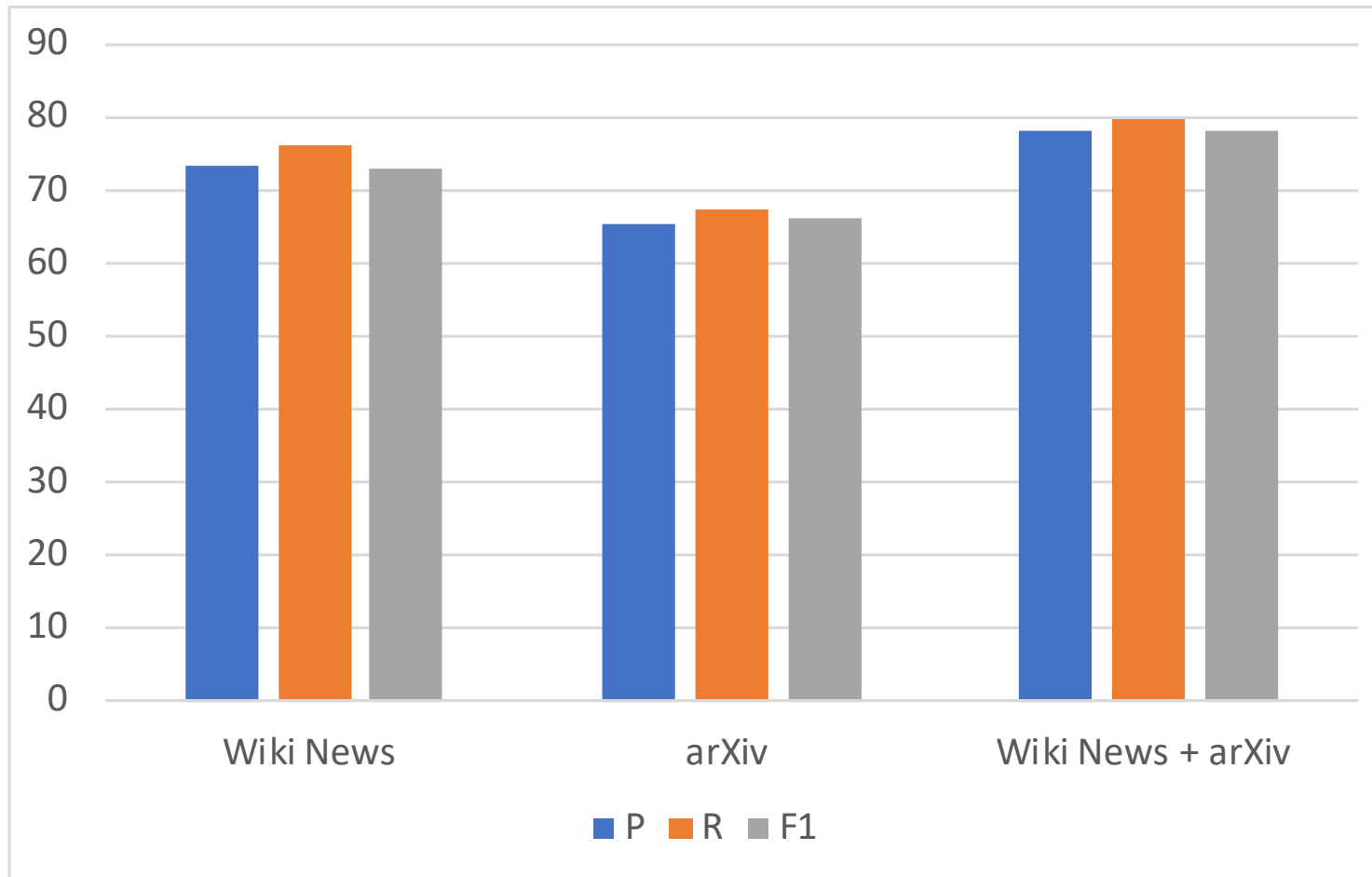
The Results



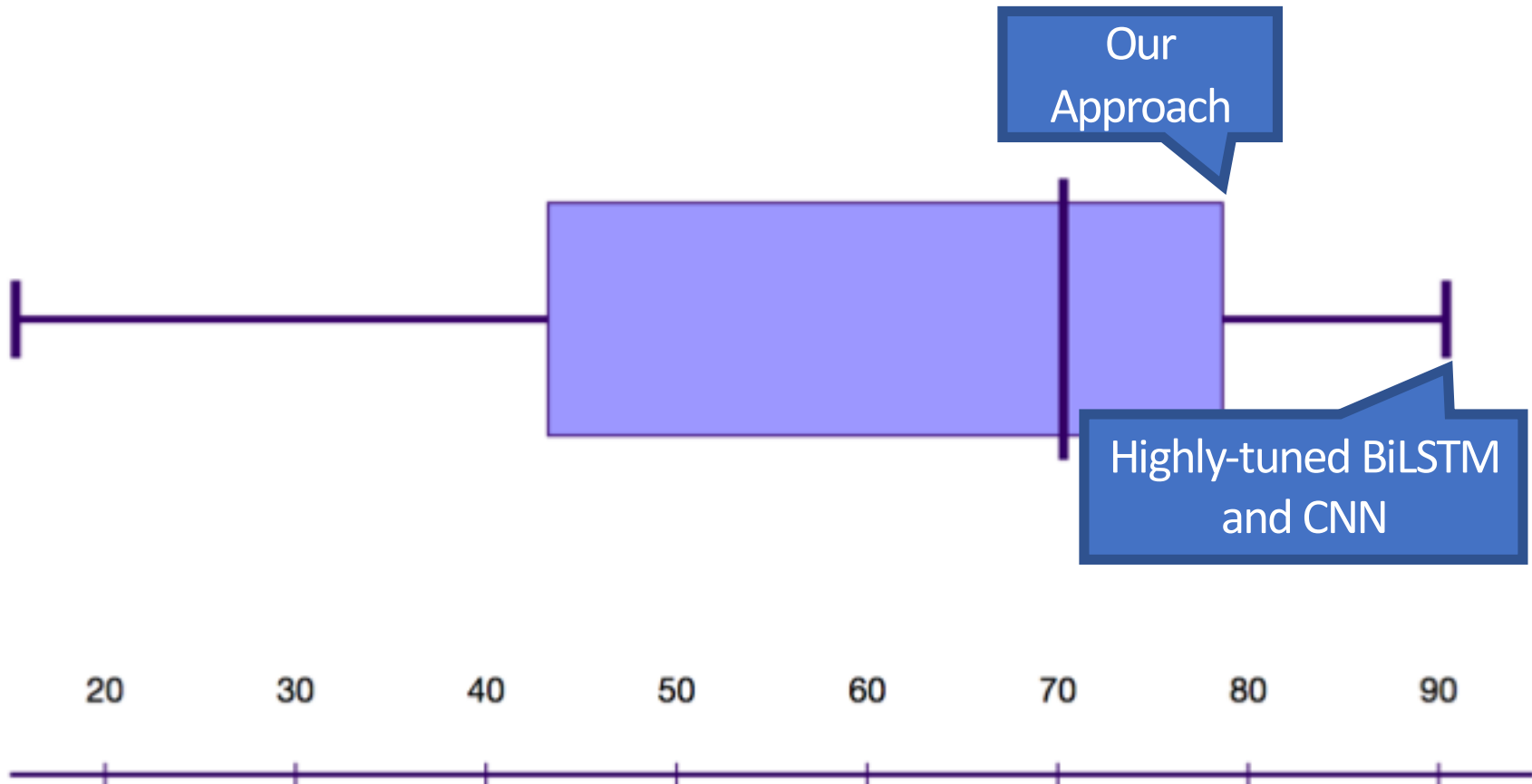
The Results



The Results



The Competition



The Conclusion

- Tree-LSTMs are a promising approach for scientific relation classification
- A combination of both general-language and task-specific word embeddings are valuable
- Code and embeddings available:
<https://github.com/Georgetown-IR-Lab/semEval2018-task7>
- Questions?