An Attentive Neural Architecture for Fine-grained Entity Type Classification

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Entity Type Classification

• Assigning semantic types to entity mentions
• Sentences are segmented beforehand

Segmented Text

It was won by the [Ottawa Senators], coached by [Dave Gill].

Person

Organization
Fine-grained entity type classification

- A fine-grained set of types
  - [Ling and Weld AAAI’12], [Yosef+ ACL’12], [Gillick+ arXiv’14], [Yogatama+ ACL’15]

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Applications

- Useful for Relation Extraction

Imposing constraints based on entity types [Carlson +, AAAI’10]

Using entity types as input features of a relation classifier [Ling and Weld, AAAI’12]

Kryzewski coaches the Blue Devils.

Figure 3: Precision / Recall curves for relation extraction.
Importance of Context

• Some labels are impossible to correctly predict *without context* [Gillick+ arXiv’14]

A match against [New Zealand] is held on Monday
Claim

• Previous Models have been too simplistic when handling contextual information
  – Linear Classifiers with sparse, hand-crafted features [Ling+12], [Yosef+12],[Gillick+14], [Yogatama+15]
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• To address this limitation,
  – We apply RNNs to model context
  – We introduce a novel attention mechanism to encourage the model to focus on important expressions
General Model

• Separately Encoding Mention and Context

Logistic Regression

Mention Representation

Encode

Ottawa Senators

Context Representation

Encode

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Mention

Context (left and right)
Mention Representation

• Averaging embeddings of mention words
• More complex models tend to overfit
Context Representation

Averaging Encoder

- Averaging left and right context embeddings
Context Representation

**LSTM Encoder**

- Recurrently compose left and right context

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Context Representation

**Attentive Encoder**

- Attention modules on top of bi-LSTM layers
Context Representation

*Attentive Encoder*

- Attention modules on top of bi-LSTM layers

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**Word Embeddings**, coached by Dave Gill
Context Representation

**Attentive Encoder**

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Context Representation

Attentive Encoder

- Attention modules on top of bi-LSTM layers

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Proposed Architecture

/organization, /organization/sports_team

- **Mention Representation**
- **Context Representation**
- **Word Embeddings**
- **LSTM Layers**
- **Attentions**

Diagram:

- Mention Representation
- Context Representation
- Word Embeddings
- LSTM Layers
- Attentions

Text:
a match series against New Zealand is held on Monday
Experiment

• FIGER Type System [Ling and Weld AAAI’12]
  – 112 types from Freebase

• FIGER dataset [Ling and Weld AAAI’12]
  – Train: 2.6 Million mentions from Wikipedia
  – Test: 563 manually annotated mentions
Results


Strict  Loose Macro F1  Loose Micro F1
British comedy film starring Googie Withers, Tyrell Davis and [Rex Harrison].

He returned to the Riverina in 1913 and died of [endocarditis] in Hay, survived by his daughter.

Hall in Amsterdam, Netherlands for a live DVD titled [Live from Amsterdam].

the 1947-48 season to play a five-match Test series against [Australia].
Conclusion

• **State of the art** with 74.94% loose micro F1
  2.59% relative improvement

• First work to apply RNN to model context

• A novel attention mechanism
  – Success in learning to attend over informative expressions
Extensions

• Recently, we have published the extension of this work [arXiv:1604.05525]!

  Neural Architectures for Fine-grained Entity Type Classification

  – New state of the art
  – Hierarchical label encoding
  – Quantitative analysis of the attention mechanism, relating it to hand-crafted features