NLP & Semantic Computing Group

# A Sentence Simplification System for Improving Open Relation Extraction

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## Introduction

- task of Open Relation Extraction (RE): recognizing the assertion of relationships between two or more entities in natural language text without requiring any relation-specific human input
- problem: In **syntactically complex sentences**, relations often span several clauses or are presented in a non-canonical form, **thus posing a challenge for current Open RE approaches**, which are prone to make incorrect extractions, while missing others, when operating on sentences with an intricate structure.
- objective of our work: improve the performance of state-of-the-art Open RE systems by simplifying the linguistic structure of NL text

## Method

- simplifies a sentence by separating out components that supply secondary information
- transforms complex sentences into simpler stand-alone context sentences
- the simplified set of sentences are easier to process for subsequently applied Open RE systems

**original sentence**

↓ set of hand-crafted simplification rules

**simplified version** consisting of
- **core sentence**: gist
- **context sentences**: background information

## Definition of Simplification Rules

- **linguistic analysis** of sentences from Wikipedia to identify syntactic elements that provide only secondary information:
  - non-restrictive relative clauses
  - non-restrictive and restrictive appositive phrases
  - participial phrases offset by commas
  - adjective and adverb phrases delimited by punctuation
  - particular prepositional phrases
  - lead noun phrases
  - intra-sentential attributions
  - parentheticals
  - conjoined clauses
- **specification of a set of hand-crafted grammar rules** for carrying out the simplification operations based on the syntactic features of those components

## Application of the Simplification Operations

1. identification of a **syntactic element** that is to be separated out of the source sentence
2. construction of a **context sentence**
3. reduction of the **main sentence**

"A few hours later, Matthias Goerne, a German baritone, offered an all-German program at the Frick Collection."

↓

**syntax-based sentence simplification**

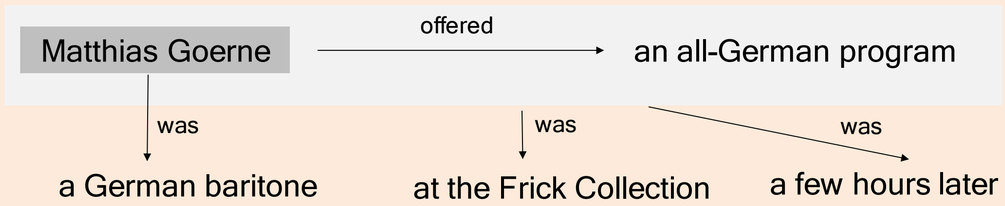
↓

- **core sentence:** Matthias Goerne offered an all German program.
- **context sentence:** Matthias Goerne was a German baritone.
- **context sentence:** This was a few hours later.
- **context sentence:** This was at the Frick Collection.

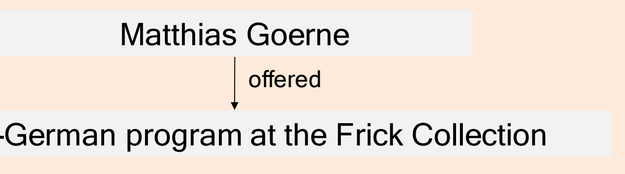
## Result of the Simplification Process

- transformation of a complex source sentence into a simplified **two-layered representation** in the form of core facts and accompanying contexts
- impact on Open RE:
  - complexity of determining intricate predicate-argument structures with **variable arity** and **nested structures** is removed
  - relations can be more easily extracted under a binary/ternary predicate-argument structure

Extracted relations when operating on the simplified sentences:




Result without a prior simplification step:




**accuracy** of the extracted relations:

| | precision | recall | F1 |
|---|---|---|---|
| ***without* simplification** | 84% | 22% | 35% |
| ***with* simplification** | 71% | 27% | 39% |

**information loss**:

| | noun chunks lost |
|---|---|
| ***without* simplification** | 60.4% |
| ***with* simplification** | 49.7% |

## Conclusions

State-of-the-art Open RE approaches obtain
- a **higher accuracy**
- a **lower information loss**

when operating on sentences that have been preprocessed with our text simplification framework.

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