Constructing a Knowledge Base on Aging

An Automated Approach

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Outline

1. Automatically Constructing Knowledge Bases

2. Extracting Facts in a Structured Format

3. Results & Discussion

Overview

- CREA is constructing a knowledge base to study and understand the human aging process.

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- New discoveries are published quickly and in large volume.
- It is infeasible to construct the knowledge base by hand.
- Working on software to construct the knowledge base automatically.

Introduction

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How to Automatically Construct the Knowledge Base

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- Build a spam filter to get rid of non-scientific sentences.
- Extract scientific facts from the sentences and save them in a structured format.
- Provide a graphical interface that allows users to search and otherwise explore the knowledge base.

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- Devised and implemented the method for finding simple facts in sentences, extracting them in a structured format.

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- Began work on a web viewer for the knowledge base.

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Tokenization

- Input a text document and read it, one sentence at a time.

Example: Tokenization

```
scala> tokens(”The man walks. The dog eats.”)
res0: List[String] = List(The man walks., The dog eats.)
```

Parsing

- For each sentence, generate a constituent tree that describes its phrase structure.

Example: Parsing

```
scala> parse(”The man walks the dog.”)
res0: Tree[String] = (ROOT
  (S
    (@S
      (NP (DT The) (NN man))
      (VP (VBZ walks)
        (NP (DT the) (NN dog))))
    (. .)))
```

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  - Parses sentences from the Wall Street Journal by hand.
- The Berkeley Parser is software that guesses how to parse a sentence from the notation and examples specified by the Penn Treebank.

Compilation

- Extract facts from each constituent tree.

Example: Compilation

```
scala> compile(”The man walks the dog.”).shows
res0: String = [<compound:walk(<atom:man>, <atom:dog>)>]
```

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1. Extracting nouns from noun phrases (NP).
2. Extracting predicates and nouns from verb phrases (VP).
3. Extracting facts from complete clauses (S), making logical assertions with nouns and predicates.

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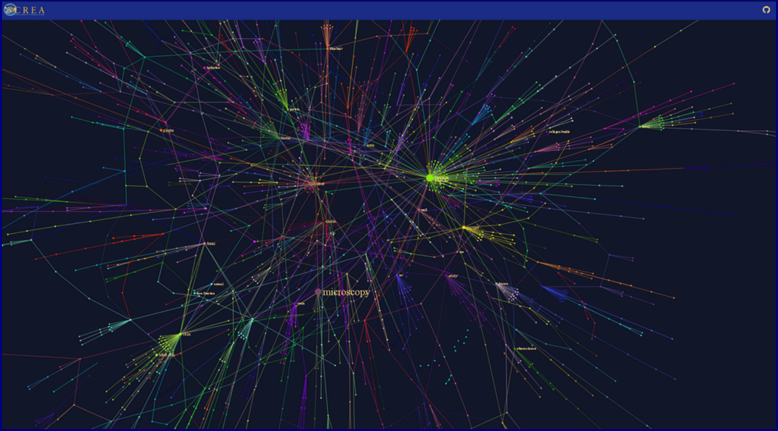
Software Demonstration

A preview of CREA's knowledge base, compiled from PubMed abstracts.



Performance

Parallelization

- It is possible to extract facts from many sentences at the same time.

Accuracy

- Filter spam sentences from documents.

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- Filter spam sentences from documents.
- The accuracy of the parser could be optimized:
  - Should be trained to identify more nouns from the biomedical domain.
- Define more patterns for extracting facts:
  - The software succeeds around 50% of the time.

Missing Features

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- Facts can contradict each other:
  - Store the probability that is true as the weight of its edge on the knowledge base's graph.
- Scale and launch the software service.

Conclusion

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- Showed how to extract facts from English text in the knowledge base's structured format.
- Discussed the need to improve software accuracy by lensing in on the biomedical domain.
- Suggested how the software implementation can be scaled for production usage.