QALD-Mini-Project

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https://github.com/LukasBluebaum/QALD-Mini-Project

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Overview

Task Description

- Building a Question Answering Engine that is able to get an F-measure of at least 0.1
- Using DBpedia as knowledge base

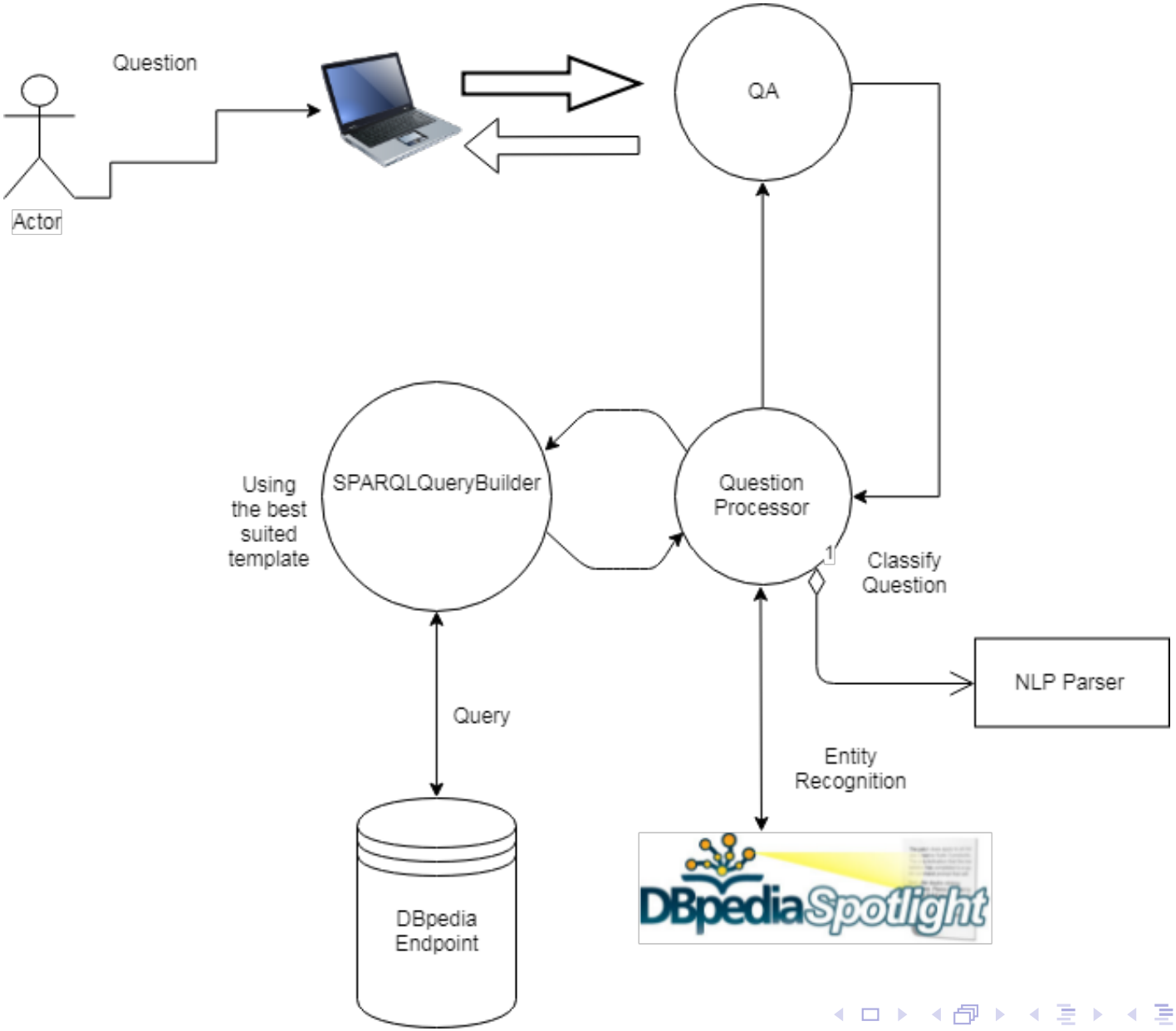
Given

- Library qa.annotation (finding entities, properties, classes) and qa.commons (load / store QALD Datasets)
- A wrapper to plug in GERBIL QA

Our Approach

- Template based
- Classify question types and apply natural language processing to get important keywords
- Find entities, classes, and properties that match the question
- Build SPARQL query templates for the most common types of questions

Simplified Procedure



QA System

- Three modes:
  - Run offline: tries to answer one committed question
  - Answer Dataset Questions: Load a QALD Dataset and save the result as a JSON-File (list of questions and their answers)
  - Can be used as a web service

Webservice

- Using the GerbilQA-Benchmarking-Template
  - Web server via the Spring Framework
  - Takes an HTTP-POST request containing the question
- Passes the question to the QuestionEngine
- Returns a JSON-String containing the answer and the used query

Question Preprocessing

- Determining which method to build a SPARQL query should be applied
- Classifies questions by their starting word
  - e.g. "When": we can conclude from that, that the given result should be from the datatype date or year
  - Distinguishes between ASK and SELECT clause

Question Preprocessing

- Requesting Spotlight to get all named entities in the question
- Using the Stanford CoreNLP to find keywords that give us information about the relations from the question
- FindClasses/findProperties: Using IndexDBO_classes from the qa.annotation library on nouns, verbs and adjectives

Sparql Query Templates

Templates for different types of questions

- Boolean questions such as: "Do Prince Harry and Prince William have the same parents?"
- List questions
- Who, Which, When, Where
- How (much/many)

- Further differentiation which template to use based on the number of classes/entities and comparison words
- Requests DBpedia endpoint using Apache Jena library

Sparql Query Templates

Example Query

Example (most basic query)

- Question: "Who was the doctoral supervisor of Albert Einstein?"
- One Entity: Albert Einstein
- Doctoral supervisor maps to property dbo:doctoralAdvisor

Query ⇒ SELECT DISTINCT ?answer WHERE {
?answer a foaf:Person.
<http://dbpedia.org/resource/Albert_Einstein>
<http://dbpedia.org/ontology/doctoralAdvisor> ?answer .
}

Sparql Query Templates

Comparison

- Predefined comparison enum for questions containing superlatives or comparatives

```
package utils;

import java.util.ArrayList;

public enum Comparison {
     LONG("http://dbpedia.org/ontology/length" ),
     LONGER("http://dbpedia.org/ontology/length", "DESC"),
     LONGEST("http://dbpedia.org/ontology/length", "DESC"),
     OLD("http://dbpedia.org/ontology/openingYear,http://dbpedia.org/ontology/birthDate"),
     OLDER("http://dbpedia.org/ontology/openingYear,http://dbpedia.org/ontology/birthDate", "DESC"),
     OLDEST("http://dbpedia.org/ontology/openingYear,http://dbpedia.org/ontology/birthDate", "DESC"),
     TALL("http://dbpedia.org/ontology/height"),
     TALLER("http://dbpedia.org/ontology/height","DESC"),
     TALLEST("http://dbpedia.org/ontology/height", "DESC"),
     SHORT("http://dbpedia.org/ontology/height"),
     SHORTER("http://dbpedia.org/ontology/height","ASC"),
     SHORTEST("http://dbpedia.org/ontology/height" , "ASC"),
     HIGH("http://dbpedia.org/ontology/elevation"),
     HIGHER("http://dbpedia.org/ontology/elevation,http://dbpedia.org/property/higher","DESC"),
     HIGHEST("http://dbpedia.org/ontology/elevation,http://dbpedia.org/property/highest" , "DESC"),
     SMALL("http://dbpedia.org/ontology/areaTotal"),
     SMALLER("http://dbpedia.org/ontology/areaTotal","ASC"),
     SMALLEST("http://dbpedia.org/ontology/areaTotal" , "ASC"),
     LARGE ("http://dbpedia.org/ontology/areaTotal"),
     LARGER("http://dbpedia.org/ontology/areaTotal","DESC"),
     LARGEST("http://dbpedia.org/ontology/areaTotal", "DESC"),
     BIG("http://dbpedia.org/ontology/areaTotal"),
     BIGGER("http://dbpedia.org/ontology/areaTotal","DESC"),
     BIGGEST("http://dbpedia.org/ontology/areaTotal","DESC");

      private String order;
      private ArrayList<String>  uri = new ArrayList<String>();

      Comparison(String pURI){
           String[] uris = pURI.split(",");
            for(String u: uris) {
              uri.add(u);
            }

      }

      Comparison(String pURI, String pOrder) {
        this.order = pOrder;
        String[] uris = pURI.split(",");
        for(String u: uris) {
          uri.add(u);
        }
    }

    public String getURI(int i) {
        return uri.get(i);
    }


    public String getOrder() {
        return this.order;
    }
}
```

Sparql Query Templates

Example Query

Example (largest)

- Question: "What is the largest country in the world?"
- Zero Entities
- One Class: Country
- Comparison enum: largest (dbo:areaTotal)
- Order: DESC
- Query ⇒ SELECT ?answer WHERE {
  ?answer rdf:type <http://dbpedia.org/ontology/Country>.
  ?answer <http://dbpedia.org/ontology/areaTotal> ?area .}
  ORDER BY DESC(?area) LIMIT 1 OFFSET 0

Benchmarking

QALD8 Test

GERBIL Experiment

Experiment URI: http://gerbil-qa.aksw.org/gerbil/experiment?id=201807180000 and http://w3id.org/gerbil/qa/experiment?id=201807180000
Type: QA
Matching: Me - strong entity match

Annotator	Dataset	Language		Micro F1	Micro Precision	Micro Recall	Macro F1	Macro Precision	Macro Recall	Error Count	avg millis/doc	Macro F1 QALD	Timestamp	GERBIL version
QA (uploaded)	QALD8 Test Multilingual	en		0,42	0,75	0,2917	0,3831	0,3862	0,3821	0	0	0,5271	2018-07-18 00:04:09	0.2.3
QA (uploaded)	QALD8 Test Multilingual	en	Answer Type	1	1	1	1	1	1	0			2018-07-18 00:04:09	0.2.3
QA (uploaded)	QALD8 Test Multilingual	en	C2KB	0,5031	0,5714	0,4494	0,4862	0,4951	0,4919	0			2018-07-18 00:04:09	0.2.3
QA (uploaded)	QALD8 Test Multilingual	en	P2KB	0,4524	0,5429	0,3878	0,4309	0,4431	0,4358	0			2018-07-18 00:04:09	0.2.3
QA (uploaded)	QALD8 Test Multilingual	en	RE2KB	0,3571	0,4286	0,3061	0,3659	0,3618	0,374	0			2018-07-18 00:04:09	0.2.3

- http://gerbil-qa.aksw.org/gerbil/experiment?id=201807180000

Benchmarking

QALD8 Train

GERBIL Experiment

Experiment URI: http://gerbil-qa.aksw.org/gerbil/experiment?id=201807180003 and http://w3id.org/gerbil/qa/experiment?id=201807180003
Type: QA
Matching: Me - strong entity match

Annotator	Dataset	Language		Micro F1	Micro Precision	Micro Recall	Macro F1	Macro Precision	Macro Recall	Error Count	avg millis/doc	Macro F1 QALD	Timestamp	GERBIL version
QA (uploaded)	QALD8 Train Multilingual	en		0,0407	0,0433	0,0384	0,2784	0,2805	0,3261	0	0	0,4504	2018-07-18 22:35:43	0.2.3
QA (uploaded)	QALD8 Train Multilingual	en	Answer Type	1	1	1	1	1	1	0			2018-07-18 22:35:43	0.2.3
QA (uploaded)	QALD8 Train Multilingual	en	C2KB	0,4339	0,5754	0,3483	0,4	0,4519	0,3894	0			2018-07-18 22:35:43	0.2.3
QA (uploaded)	QALD8 Train Multilingual	en	P2KB	0,3164	0,4398	0,2471	0,2793	0,3196	0,2756	0			2018-07-18 22:35:43	0.2.3
QA (uploaded)	QALD8 Train Multilingual	en	RE2KB	0,2411	0,3351	0,1882	0,2177	0,2306	0,2245	0			2018-07-18 22:35:43	0.2.3

- http://gerbil-qa.aksw.org/gerbil/experiment?id=201807180003