Building a Dua Ontology

Contributors to this Project:

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Domain Description

Our project is to build a Knowledge Graph for Duas in Islam. The ontology will be a collection of supplications mentioned in the Quran and authentic Ahadith, currently only from Sahih Bukhari. This Knowledge Graph will have information about the themes of Duas, their sources and narrators of the Hadith-based Duas.

Competency Questions and SPARQL Queries

1. Which Duas are from the Qur'an. Give their references.

```
PREFIX : <http://www.semanticweb.org/szm/dua-ontology#>
PREFIX qo: <http://quranontology.com/Resource/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT DISTINCT ?duaArabic ?duaEnglish ?chapName ?verseIndex
WHERE {
   ?dua rdf:type :QuranicDua.
   ?dua qo:IsPartOf ?verse.
   ?verse qo:VerseIndex ?verseIndex.
   ?dua :duaArabicText ?duaArabic.
   ?dua :duaEnglishText ?duaEnglish.
   ?verse qo:ChapterIndex ?chapIndex.
   ?chapter rdf:type qo:Chapter.
   ?chapter qo:ChapterIndex ?chapIndex.
   ?chapter rdfs:label ?chapName.
   FILTER (lang(?chapName) = "en")
}
```

2. Which Duas are from Ahadith. Give their references.

```
PREFIX : <http://www.semanticweb.org/szm/dua-ontology#>
PREFIX hVoc: <http://www.i-knex.com/ontology/hadith#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX schema: <http://schema.org/>

SELECT ?dua ?duaArabic ?duaEnglish ?hadithFullRef
WHERE {
        ?dua rdf:type :HadithDua.
   ?dua :duaArabicText ?duaArabic.
   ?dua :duaEnglishText ?duaEnglish.
   ?dua hVoc:isPartOfHadith ?hadith.
   ?hadith hVoc:fullHadithText ?hadithText.

   ?hadith hVoc:hadithReferenceNo ?hRefNo.

   ?hadith hVoc:isPartOfChapter ?hChap.
   ?hChap rdf:type hVoc:HadithChapter.
   ?hChap hVoc:name ?hChapName.

   ?hChap hVoc:isPartOfBook ?hBook.
   ?hBook rdf:type hVoc:HadithBook.
        ?hBook hVoc:name ?hBookName.

   ?hBook hVoc:isPartOfCollection ?hCollection.
   ?hCollection rdf:type hVoc:HadithCollection.
        ?hCollection hVoc:name ?hCollectionName.

   BIND(CONCAT(?hBookName, "-", ?hChapName, "-", ?hRefNo) AS
?hadithFullRef)
}
```

3. Show all duas, and their urdu translations.

```
PREFIX : <http://www.semanticweb.org/szm/dua-ontology#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
SELECT ?duaTitle  ?arabicText ?urduText
WHERE {
   ?dua rdf:type :QuranicDua.
   ?dua :duaUrduTitle ?duaTitle.
   ?dua :duaArabicText ?arabicText.
   ?dua :duaUrduText ?urduText.
```

```
}
```

4. Show categories to which each dua belongs to.

```
PREFIX : <http://www.semanticweb.org/szm/dua-ontology#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
SELECT ?duaTitle ?categoryName ?arabicText ?engText
WHERE {
   ?dua rdf:type :QuranicDua.
   ?dua foaf:topic ?category.
   ?category :categoryEnglishTitle ?categoryName.
   ?dua :duaEnglishTitle ?duaTitle.
   ?dua :duaEnglishText ?engText.
   ?dua :duaArabicText ?arabicText.
}
```

5. Which Duas are from Sahih Bukhari: Book of Invocations?

```
PREFIX : <http://www.semanticweb.org/szm/dua-ontology#>
PREFIX hVoc: <http://www.i-knex.com/ontology/hadith#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX schema: <http://schema.org/>

SELECT DISTINCT ?dua ?duaArabic ?hBookName
WHERE
{
   ?dua rdf:type :HadithDua.
   ?dua :duaArabicText ?duaArabic.
   ?dua hVoc:isPartOfHadith/hVoc:isPartOfChapter/hVoc:isPartOfBook
?hBook.
   ?hBook hVoc:name ?hBookName.
   FILTER contains(?hBookName,"Invocation")

}
```

6. List the root narrators for each dua.

```
PREFIX : <http://www.semanticweb.org/szm/dua-ontology#>
PREFIX qo: <http://quranontology.com/Resource/>
PREFIX hVoc: <http://www.i-knex.com/ontology/hadith#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX schema: <http://schema.org/>

SELECT DISTINCT ?dua ?duaArabic ?hRootNarrator ?narratorName
WHERE
{
        ?dua rdf:type :HadithDua.
   ?dua :duaArabicText ?duaArabic.
   ?dua hVoc:isPartOfHadith ?hadith.
   ?hadith
hVoc:hasNarratorChain/hVoc:hasRootNarratorSegment/hVoc:refersToNarrator
?hRootNarrator.
    ?hNarrator hVoc:name ?narratorName.
}
```

7. What duas should we recite in the evening?

```
PREFIX : <http://www.semanticweb.org/szm/dua-ontology#>
PREFIX qo: <http://quranontology.com/Resource/>
PREFIX hVoc: <http://www.i-knex.com/ontology/hadith#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX schema: <http://schema.org/>

SELECT DISTINCT ?dua ?duaArabic ?categoryEnglish
WHERE
{
   ?dua rdf:type :Dua.
   ?dua :duaArabicText ?duaArabic.
   ?dua foaf:topic ?category.
   ?category :categoryEnglishTitle ?categoryEnglish.
   FILTER contains (lcase(str(?categoryEnglish)), "evening")
}
```

8. List duas that provide protection.

```
 PREFIX : <http://www.semanticweb.org/szm/dua-ontology#>
PREFIX qo: <http://quranontology.com/Resource/>
PREFIX hVoc: <http://www.i-knex.com/ontology/hadith#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX schema: <http://schema.org/>

SELECT DISTINCT ?dua ?duaArabic ?categoryEnglish
WHERE
{
    ?dua rdf:type :Dua.
    ?dua :duaArabicText ?duaArabic.
    ?dua foaf:topic ?category.
    ?category :categoryEnglishTitle ?categoryEnglish.
    FILTER(strlen(?duaArabic) > 0)
    FILTER contains (lcase(str(?categoryEnglish)), "protect")
}
```

9. List duas for attaining Paradise.

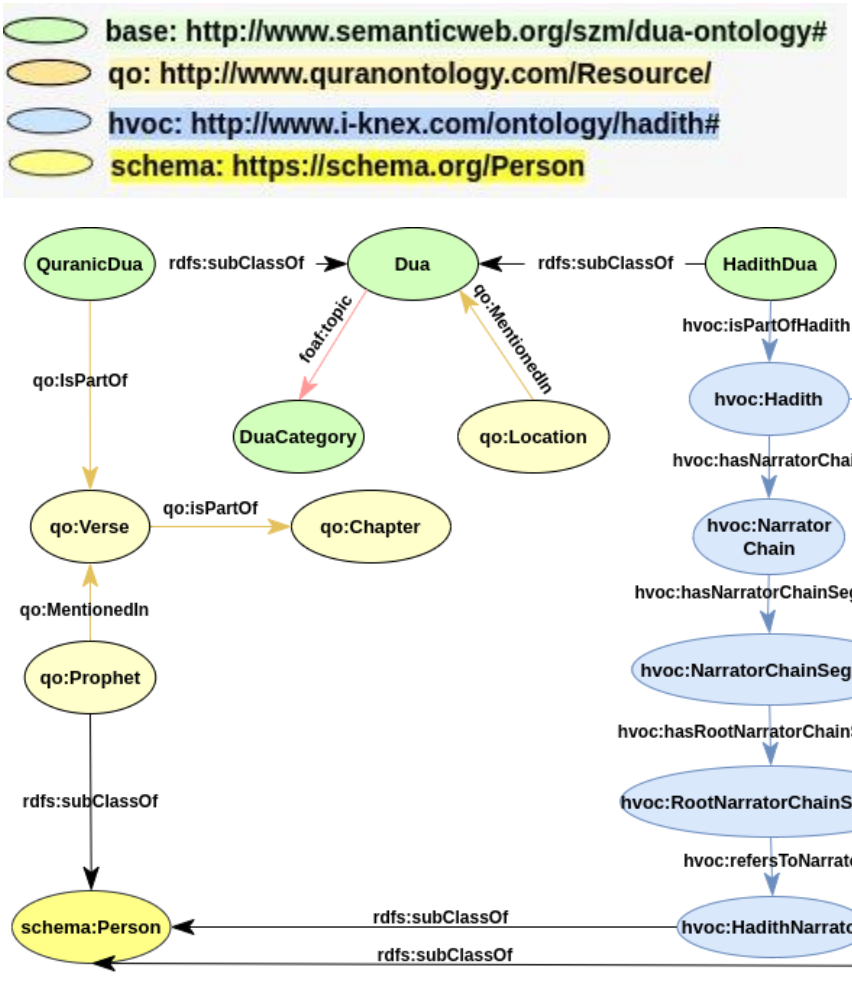
```
 PREFIX : <http://www.semanticweb.org/szm/dua-ontology#>
PREFIX qo: <http://quranontology.com/Resource/>
PREFIX hVoc: <http://www.i-knex.com/ontology/hadith#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX schema: <http://schema.org/>

SELECT DISTINCT ?dua ?duaArabic ?categoryEnglish
WHERE
{
    ?dua rdf:type :Dua.
    ?dua :duaArabicText ?duaArabic.
    ?dua foaf:topic ?category.
    ?category :categoryEnglishTitle ?categoryEnglish.
    FILTER(strlen(?duaArabic) > 0)
    FILTER contains (lcase(str(?categoryEnglish)), "paradise")
}
```

10. List the types of each dua.

```
PREFIX : <http://www.semanticweb.org/szm/dua-ontology#>
SELECT DISTINCT ?s ?o
WHERE {
        ?s :duaType ?o .
}
```

Conceptual Model

@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix hvoc: <http://www.i-knex.com/ontology/hadith#>
@prefix qo: <http://quranontology.com/Resource/> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix foaf: <http://xmlns.com/foaf/0.1#> .



Description of the Dataset

The dataset comprises the Duas from verses in the Qur'an and the Ahadith (sayings) of the Prophet Muhammad (Peace be upon him). The Ahadith are compiled into authentic books of Hadith. The dataset links Hadith-based Duas to their narrators and complete source references. Similarly, the dataset also links the Quran-based Duas to their location in the Qur'an.

Each of the Duas are taught to seek benefit or abundance, protection from unseen tribulations, express gratitude to God, or as a prayer to be said at specific occasions. Hence the Duas are classified into different themes.

Our dataset is described as follows:

We use 6 variables/labels to classify the data we have found.

1. category: The category label denotes what type of dua is being considered. For example, if a dua is related to the benefits of fasting we will describe it to be belonging to the category of 'Ramadan'. The 'category' will be of string type in the dataset.

   Some of the categories that can be found in our dataset are Ramadan, MorningDuas, EveningDuas, Praise, Durood, Knowledge to name a few.

2. id: This label assigns a unique identifier to each dua in our dataset. It is numerical in nature and takes the denary format. The first ID that occurs in the dataset starts with 1 and goes up to 63.

3. title_en: This label is in string format. The entries under this label are the assigned titles to the duas in our dataset. By the title we can infer what the dua is about. For instance, 'Supplications for Asking for Rain' is a dua related to requesting rain. The code 'en' is a standardized code to mean 'English', text assigned this code is considered to be in the English language

4. title_ur: Alike the previous label, title_en, this label has entries in string format as well. These entries however directly correspond to their respective title_en entries. The code 'ur' stands for Urdu, all text with this label is in the Urdu language. In our dataset, id[1] will have title_en and title_ur that stand for the same titles in different languages.

5. order: The order label is in denary format and has a numerical type. The order label starts from 1 and is assigned to each entry in our dataset in ascending order.

6. tags: This label is in string format and is multivalued i.e. more than one entry can be assigned to one item. The tags for any dua mean when is this dua applicable and when can it be used.

Furthermore, each Dua has further information about it that can be converted to RDF format as well.

1. dua_id: Numeric in type and ascending, assigns a unique integer to the Dua.
2. duaId: Alphanumeric in type - corresponds to dua_id. Assigns a unique id to the dua.
3. duaArabic: Of type string. Dua's textual meaning in the Arabic language. Dua is in Arabic text.
4. dua_ur: Of type string. Dua's textual meaning in the Urdu language. Stored in Urdu text.
5. dua_en: Of type string. Dua's textual meaning in the English language. Stored in English text.
6. duaReference_ur: Of type string. Carries reference of a Dua i.e. where it can be found in the Quran. Stored in Urdu text.
7. duaReference_en: Of type string. Meant to store the English text of [6].
8. duaType_ur: Of type string. Classifies what the Dua is meant for, what class it belongs to. Stored in Urdu text.
9. duaType_en Of type string. Classifies what the Dua is meant for, what class it belongs to. Stored in English text.
10. duaTitle_ur: Of type string. The title of the dua. In Urdu text.
11. duaTitle_en: Of type string. The title of the dua (english). In English text.

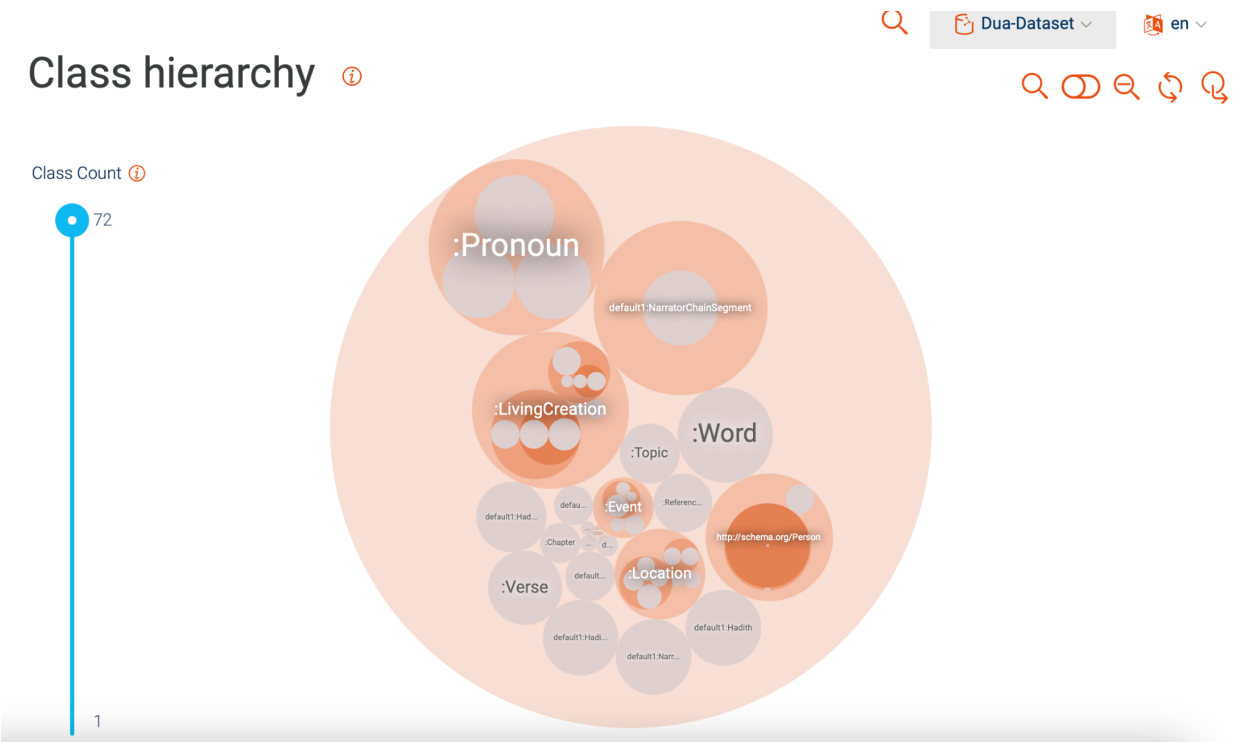
Other categories in our dataset are meant to be lookup/search tags to help us find the duas.

External Linked Datasets

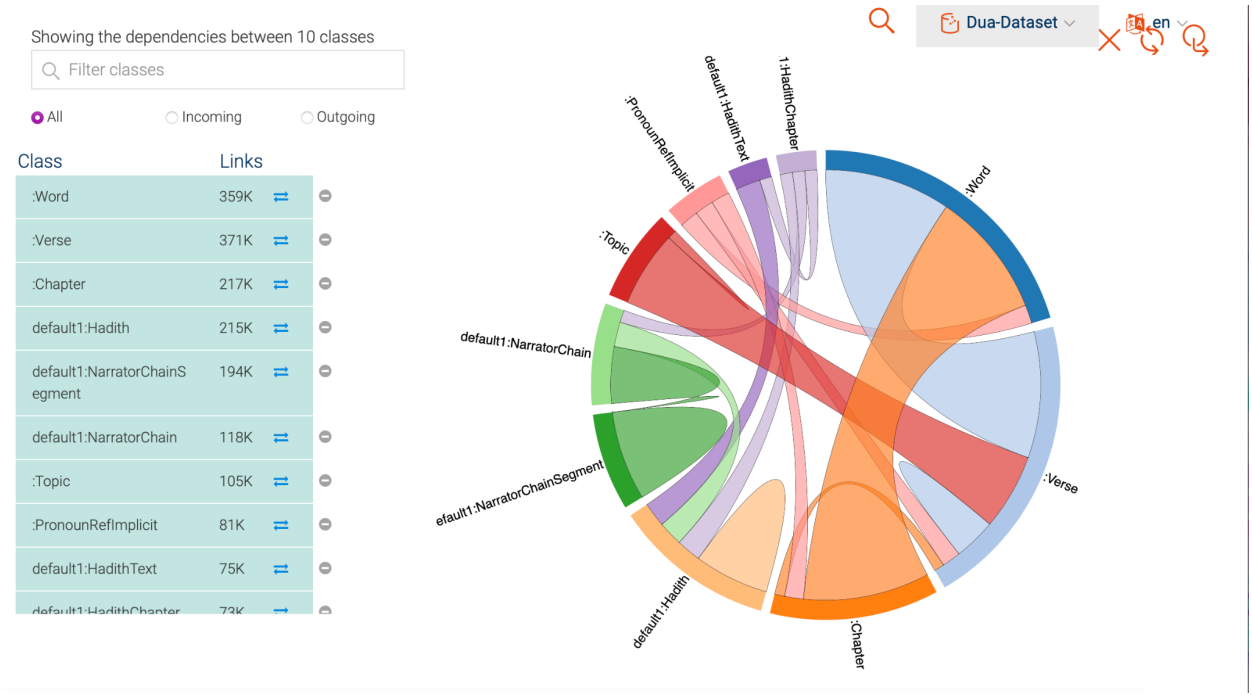
1. http://www.quranontology.com/Resource
2. http://www.i-knex.com/ontology/hadith#
3. http://schema.org/
4. http://xmlns.com/foaf/0.1/
5. http://dublincore.org/documents/dcmi-terms#

Some other datasets that are not directly linked data sources but are made available through QuranOntology and SemanticQuran are QuranyTopics, QuranCorpus and Tanzil, which may be used for building our knowledge base. We will also be using data from sunnah.com and quran.com.

Visualization



For our project we have been able to identify 72 classes, some of which are borrowed from existing ontologies such as :Location and :Person. Others are used to describe our dataset and entities we have in our graph data such as topics and verse and the chain of narrators.



This figure shows a nuanced look of the class relationships that exist in our graph data. The figure denotes the class dependencies between the 10 classes that have the most links.

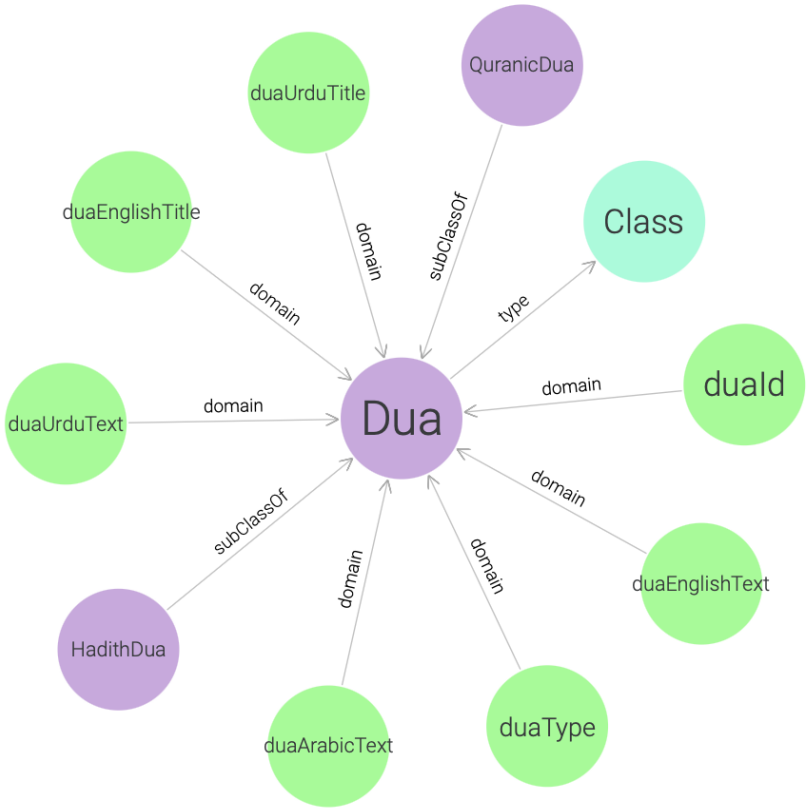
We can see that NarratorChain and NarratorChainSegments for these dependencies are recursive and don't link with any other class apart from the Hadith class. This is because NarratorChain and NarratorChainSegment classes are derived to describe the Hadith class. NarratorChain is further connected to the HadithChapter class as Hadith will contain HadithText and HadithChapter.

The :Topic class is only linked to the :Verse class and therefore has a lot of presence in the graph. Similarly, :Word is a class that occurs only in :Verse and :Chapter.

Upon further expansion of the aHadith related classes we can see they are heavily interconnected and describe each other.

Visual Graphs

Graph: Dua

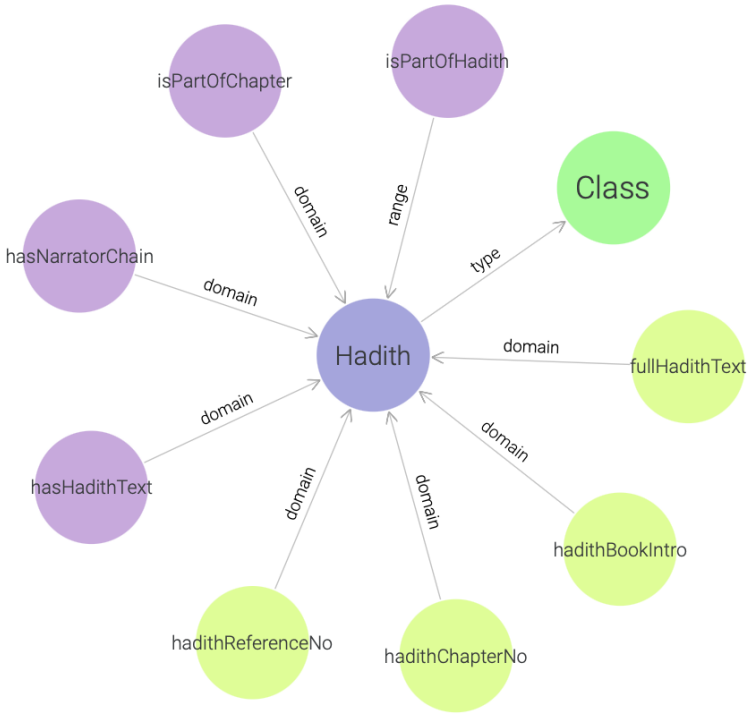


As we can see, our class of Dua belongs to HadithDua and QuranicDua that are disjoint classes. Dua itself is also a class that contains a variety of links.

- DuaUrduTitle: the dua's title, in urdu
- DuaEnglishTitle: the dua's title, in english
- duaUrduText: string value of dua's textual meaning in Urdu
- duaArabicText: string value of dua's textual meaning in Arabic
- duaType: where the dua is applicable
- duaId: unique alphanumeric id
- duaEnglishText: string value of dua's textual meaning in English

Are members of the Dua class and have been taken directly from our dataset and have been described above in detail.

Graph: Hadith



Same as for Dua, Hadith is a class that carries its members.

- hasHadithText: is a class that belongs to Hadith.
- hasNarratorChain: is a class that has information about the Narrator's of a particular aHadith
- isPartOfChapter: indicates what chapter the aHadith belongs to

And other members.

The class members highlighted in green are the classes that can be used to describe the Hadith: its text, the book it belongs to and how to reference it.

Similarly, the members highlighted in purple can be used to link the aHadith to reliable narrators and each other.

Reasoning

We have written a few SWRL rules to determine a few reasoning scenarios for the Dua Knowledge Graph.

SWRL Rule 1: LocationDuaRule

This rule highlights which duas contain the mention of a specific location. Examples could include Paradise or Hell being mentioned in a Dua.

```
Dua(?d) ^ ns1:Location(?l) ^ duaEnglishText(?d, ?t) ^ rdfs:label(?l, ?rl) ^
swrlb:containsIgnoreCase(?t, ?rl) -> ns1:Location(?l) ^ ns1:MentionedIn(?l, ?d)
```

SWRL Rule 2: ProphetDuaRule

This rule highlights which duas contain the mention of a specific prophet. Examples could include Muhammad SAW or Ibrahim AS being mentioned in a Dua.

```
Dua(?d) ^ ns1:Prophet(?p) ^ duaEnglishText(?d, ?t) ^ rdfs:label(?p, ?rl) ^
swrlb:containsIgnoreCase(?t, ?rl) -> ns1:Prophet(?p) ^ ns1:MentionedIn(?p, ?d)
```

SWRL Rule 3: ProtectionDuaRule

This rule highlights which duas should be recited for protection.

```
Dua(?d) ^ duaType(?d, ?t) ^ swrlb:containsIgnoreCase(?t, "protect") ->
ns1:ProtectionDua(?d)
```