Implementation of Name Entity Recognition System and its Evaluation

Group 28

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To build a MaxEnt Model

Feature Selection

Select proper and precise features that can best help to distinguish a word entity from “others” and “name”.

1

Feature Weighting

Use the training methods to assign each feature an importance weight for further prediction.

2

Model Evaluation

The assigned values of weights determines the behavior of the model. The model predicts each word entity with the observed features and weights.

3

Feature Selection

Frontend-Server Model

Evaluations and Demo

Feature Selection

/ Feature Selection

8 custom features + 3 baseline features

Internal Pattern Features

Internal

Analyzes word patterns

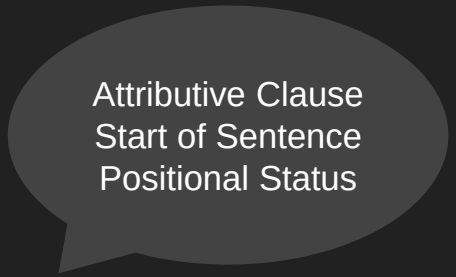
Assumes that some specific pattern could distinguish names

Library Features

Semi-Internal

Base on the experiences

Assumes that a word that is in some class is likely or not likely to be classified as a name



Contextual Features

External

Base on the contextual environment

Assumes that a word that has certain contextual environment is likely or not likely to be a name

/ Feature Selection / Internal Pattern Features

Internal Pattern Features

Internal

Analyzes word patterns

Assumes that some specific pattern could distinguish names

Feature Name		Description	Explanation	Match Examples
Positive Patterns	*p_cap_low*	Start with Capital Letter, and the rest of the letters are lowercase. There may be: - A prime after the first letter; - A second cap letter in the third or forth letter's space.	In English, names always start with a capital letter. There are some special styles that is quite unique in names.	Jonathan, Jason MacArthur, McDonald O'Brien
	p_cap_period	A single capital letter followed by a period.	In English, this pattern in most circumstances represent human name initials.	Donald **J.** Trump George **W.** Bush
Negative Patterns	*p_noun_like*	A word that has an ending like a noun. Specifically: *-tion, -ment, -ness, -ship, -hood, -age, -ance, -ence*	These suffixes are used to derive a noun from an adjective or adverb. These derivations are less likely to be names compared to other nouns.	movement, action, correctness, membership, likelihood, usage, allowance

/ Feature Selection / Library Features

Library Features

Semi-Internal

Base on the experiences

Assumes that a word that is in some class is likely or not likely to be classified as a name

Libraries		Python Package Name	Examples
Positive Library	Useful Names	nltk.corpus.names	James, Jonathan, …
Negative Libraries	Week Names	*self-defined*	Tuesday, Wednesday, Thursday, …
	Month Names	*self-defined*	January, February, March, April, …
	Country Names	geonamescache.countries	China, Japan, United States, …
	City Names	geonamescache.cities	London, Zhuhai, Hong Kong, Macau, …
	Stopwords	nltk.corpus.stopwords	He, She, is, that, …

/ Feature Selection / Contextual Features

Attributive Clause
Start of Sentence
Positional Status

Contextual Features

External

Base on the contextual environment

Assumes that a word that has certain contextual environment is likely or not likely to be a name

Feature Name		Description	Explanation
Positive Context	*is_start_of_sentence*	A word being at the start of a sentence. - This word has position of 0. - This word is after a concrete period.	It is highly likely that a word entity that fits the pattern of a name defined before is the start of the sentence.
	is_target_of_clause	Is the target of the restricted attributive clause.	We often refer someone with addition informations using restricted attributive clause. For instance: *Jane, who was my friend, went to the park.* This clause puts high probability to the target entity that it is a name.
	is_after_status	Is after the social status in English, like Mr., Ms.	It is very common to put names after social statuses.

/ Feature Selection / Contextual Features / Clause

Attributive Clause
Start of Sentence
Positional Status

Attributive Clause Examples

Donald J. Trump**, who** was a former US president, was a successful business man.

Michael Rosen**, whose** son died before him, wrote *We're Going on a Bear Hunt.*

Contextual Features

External

Base on the contextual environment

Assumes that a word that has certain contextual environment is likely or not likely to be a name

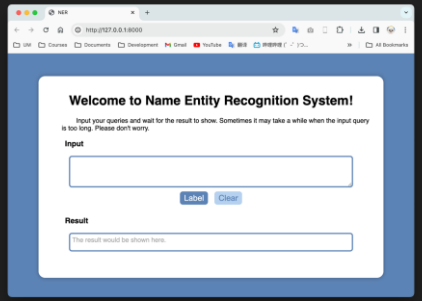
Clause Form

<Entity>, who/whose *<verb-phrase>.*

Highly Likely to be a name!

Frontend-Server Model

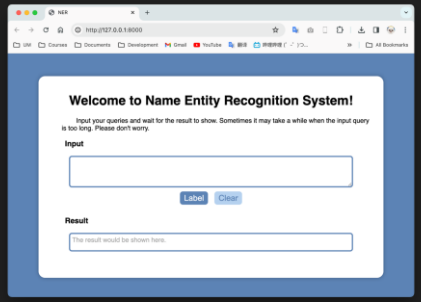
/ Frontend-Server Model



Frontend Framework
HTML + CSS + JS

Backend Framework
Django + Python

/ Frontend-Server Model / Frontend Framework



Frontend Framework
HTML + CSS + JS

HTML + CSS:

- Structure & Style of website.

JavaScript:

- Defines how the input query is submitted to the backend (XMLHTTPRequest, etc).
- Define how the response from the server is handled.

/ Frontend-Server Model / Backend Framework

Backend Framework
Django + Python

Django: Model-Template-View Framework

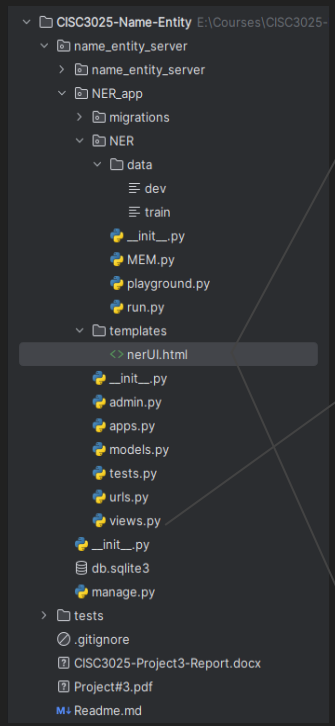
View: Defines how the backend respond to the frontend, facing some specific requests.

In this case:

- The predicted query of the MaxEnt Model is the response from the backend.
- The backend responds the frontend in JSON format.

/ Frontend-Server Model / Backend Framework

Backend Framework
Django + Python



1

```
// Send form data.
document.getElementById('result').classList.add('empty-field');
document.getElementById('result').innerHTML = "Processing...";
xhr.send(new URLSearchParams(formData).toString());
```

```
1 usage  Yanzhen Huang +1
def resultView(request):
    input_query = request.POST.get("input-query", "<blank>")

    # Add your name entity processing here!!!
    # Please never alter the path!!!!!
    model_pkl_path = os.path.abspath('name_entity_server/static/model.pkl').replace( old: '\\', new: '/')
```

2

```
    # Get modified name string
    names, labels = playground.predict(input_query, MEM, model_pkl_path)
    output_query = (
            names
            # + " <br> "
            # + labels
    )
```

Invoke Model

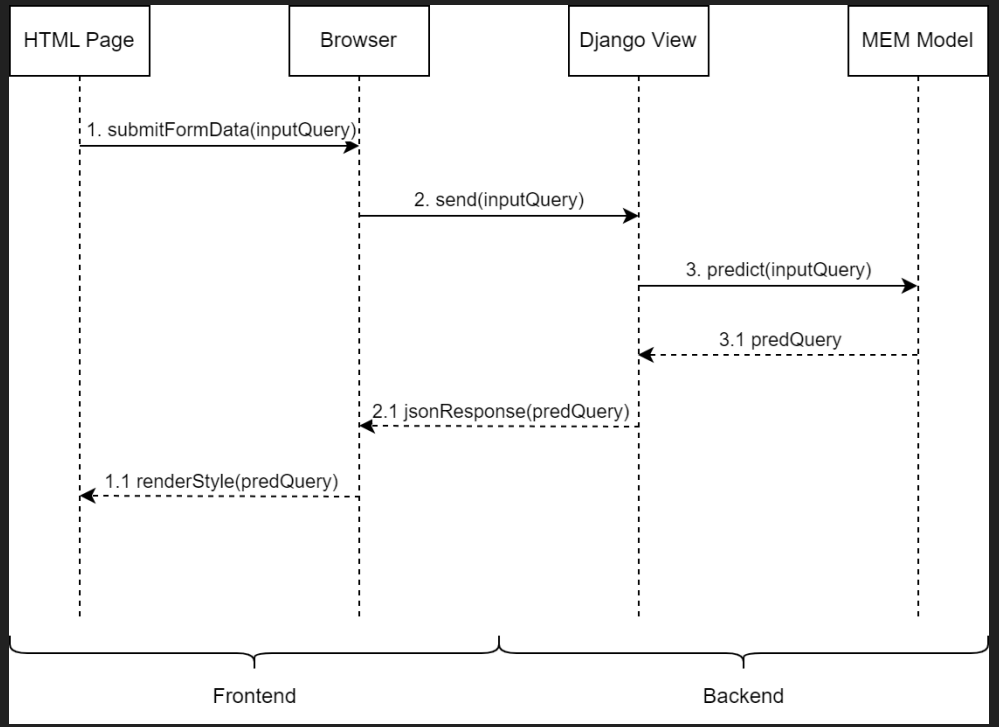
```
    # output_query = input_query + " ---- from backend"
    return JsonResponse({"result": output_query})
```

3

```
// Async. Register a response Handler event listener.
xhr.onload = function() {
    if (this.status === 200) {
        let response = JSON.parse(this.responseText);
        document.getElementById('result').innerHTML = response.result;
        document.getElementById('result').classList.remove('empty-field');
    }
};
```

/ Frontend-Server Model / Backend Framework

Backend Framework
Django + Python



Evaluations and Demo

/ Evaluations and Demo /

Training Result

```
Training classifier...
  ==> Training (5 iterations)

     Iteration    Log Likelihood    Accuracy
     ---------------------------------------
            1          -0.69315       0.055
            2          -0.09506       0.946
            3          -0.07840       0.967
            4          -0.06727       0.976
        Final          -0.05937       0.981
<ConditionalExponentialClassifier: 2 labels, 23877 features>
PS E:\Courses\CISC3025-Name-Entity\name_entity_server\NER_app\NER>
```

Testing Result

```
Testing classifier...
f_score=        0.9202
accuracy=       0.9752
recall=         0.8145
precision=      0.9609

PS E:\Courses\CISC3025-Name-Entity\name_entity_server\NER_app\NER>
```

Show Examples

```
PS E:\Courses\CISC3025-Name-Entity\name_e
  Words          P(PERSON)  P(O)
----------------------------------------
  EU               0.0126  *0.9874
  rejects          0.0426  *0.9574
  German           0.0202  *0.9798
  call             0.0426  *0.9574
  to               0.0087  *0.9913
  boycott          0.0426  *0.9574
  British          0.0203  *0.9797
  lamb             0.0426  *0.9574
  .                0.0087  *0.9913
  Peter           *0.5999   0.4001
  Blackburn       *0.3352   0.6648
  BRUSSELS         0.1707  *0.8293
  1996-08-22       0.0431  *0.9569
  The              0.0206  *0.9794
  European         0.1043  *0.8957
  Commission       0.1043  *0.8957
  said             0.0385  *0.9615
  on               0.0087  *0.9913
  Thursday         0.0202  *0.9798
  it               0.0087  *0.9913
  disagreed        0.0426  *0.9574
  with             0.0087  *0.9913
```

What we think

- Unbelievably “Good”
- Recall too high, may indicate more overfitting

/ Evaluations and Demo /

Live Demo

Thanks for Listening!