

# Chapter NLP:IV

## IV. Words

- ❑ Morphology
- ❑ Word Classes
- ❑ **Named Entities**

# Named Entities

## Entities

An **entity** represents an object from the real world. They are a basic semantic concept in natural language processing.

- **Named entities** are objects that can be denoted with a proper name.

Prof. Dr. Abdul Nachtigaller in Finsterberge at Nachtschule

- **Numeric entities** are values, quantities, proportions, ranges, or similar.

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# Named Entities

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**Named entities** are the semantic equivalent of proper nouns: Everything that can be referred to by name is an entity.

The most common types of named entities are:

- ❑ **PER** (Person): people, characters, ...  
Turing is a giant of computer science.
- ❑ **LOC** (Location): regions, rivers, ...  
The Ilm is a small river.
- ❑ **ORG** (Organization): companies, sports teams, ...  
The IPCC warned about climate change.
- ❑ **GPE** (Geo-Political Entity): countries, states, ...  
Weimar lies in Thuringia.

[Deere and Co. ORG] said it reached a tentative agreement with the [machinists union ORG] at its [Horicon, Wis. LOC] plant, ending a month-old strike by workers at the facility.

# Named Entities

## Named Entities

A more complete set of entities is used by OntoNotes. [[Weischedel et al](#)]

### Names, Named Entities

<b>PERSON</b>	People, including fictional
<b>NORP</b>	Nationalities, parties, ...
<b>FACILITY</b>	Buildings, highways, ...
<b>ORGANIZATION</b>	Companies, institutions, ...
<b>GPE</b>	Countries, cities, ...
<b>LOCATION</b>	mountains, rivers, ...
<b>PRODUCT</b>	Vehicles, foods, ...
<b>EVENT</b>	Hurricanes, sports events , ...
<b>WORK OF ART</b>	Titles of books, songs, ...
<b>LAW</b>	Named documents, laws
<b>LANGUAGE</b>	Any named language

### Values

<b>DATE</b>	Dates or periods
<b>TIME</b>	Times smaller than a day
<b>PERCENT</b>	Percentage (including "%")
<b>MONEY</b>	Monetary values, including unit
<b>QUANTITY</b>	weights, distances, /dots
<b>ORDINAL</b>	“first”, “second”
<b>CARDINAL</b>	other numerals

Although there is a linguistic difference between *entities* and *values* they are often treated as equivalent in NLP.

## Remarks:

Named entity tagsets vary by corpus and use case:

- ❑ Spacy uses the OntoNotes Tagset for its English models.
- ❑ 7 Entity types (NameType) are recognized by [Universal Dependencies](#)  
GEO (Geographical Name), GIV (Given Name), SUR (Surname), NAT (Nationality), COM (Company), PRO (product), OTH (other)
- ❑ 6 Entity types by WNUT Emerging Entity Recognition [\[Derczynski et al.\]](#)  
PERSON, LOCATION (GPE, facility), CORPORATION, PRODUCT (tangible goods, well-defined services), CREATIVE-WORK (song, movie, book), GROUP (music band, sports team, non-corporate organisations)
- ❑ 64 Entity types (incl. subtypes) by the [BBN Pronoun Coreference and Entity Type Corpus](#)  
BBN annotates **entity types** and **subtypes** from 3 **groups** of entities in XML:

<ENAMEX TYPE="ORGANIZATION:CORPORATION">Deere and Co.</ENAMEX> said  
it reached a tentative agreement with the<ENAMEX TYPE="PER\_DESC"> machinists  
</ENAMEX> <ENAMEX TYPE="ORG\_DESC:OTHER"> union</ENAMEX> [...] ending a  
<TIMEX TYPE="DATE:AGE"> month-old </TIMEX> strike.

# Named Entities

## Named Entity Recognition

Finding and labeling entities in a text is called **Named Entity Recognition**. Alternative: Named Entity Tagging, Named Entity Resolution.

NER is a span recognition problem. Entities often span multiple tokens, so a tagger needs to:

- ❑ Distinguish entities from non-entities.  
apple vs. [apple ORG]
- ❑ Find the boundaries of the entity.  
the [brandenburg LOC] gate vs [the brandenburg gate LOC]  
on [Washington's LOC] [Capitol Hill LOC]
- ❑ Disambiguate different entity types.  
[Washington PER] vs [Washington LOC] vs [Washington GPE] vs [Washington ORG]

Span recognition problems are typically solved by BIO tagging.

# Named Entities

## BIO Tagging

**Idea:** Model NER as a sequence labeling problem and tag word-by-word. Encode boundary and entity type in each tag.

BIO tagging:

1. Assign the first token in an entity a B for beginning and its tag.  
on Washington's/B-LOC Capitol/B-LOC Hill stands ...
2. Assign all non-first tokens in an entity a I for inside and its tag.  
on Washington's/B-LOC Capitol/B-LOC Hill/I-LOC stands ...
3. Assign all non-entity tokens an O for outside.  
on/O Washington's/B-LOC Capitol/B-LOC Hill/I-LOC stands/O ...

As span recognition problem: [Deere and Co. ORG] said it ...

As sequence labeling problem: Deere/B-ORG and/I-ORG Co./I-ORG said/O it/O ...

Now we can solve NER with any sequence labeler.

## Remarks:

- ❑ Two popular variations of BIO are IO and BIOES.
- ❑ IO is a generalization of BIO and encodes less information. Each B-TAG is instead tagged as I-TAG. It might be easier to fit models with IO if resources are scarce.
- ❑ BIOES is an extension of BIO and encode more information. The last token in an entity is tagged as E-TAG for ending. If entities consist of only one token, it is tagged as S-TAG for single.