



Assignment: Named Entity Recognition

Empirical Methods in Natural Language Processing

Philipp Koehn and Annette Leonhard

29 January 2007

based on the 2006 slides by Sebastian Riedel



Outline

1. **Introduction**

- Information Extraction
- Named Entity Recognition
- CoNLL Shared Task

2. **Choices**

3. **Assessment**



Information Extraction

- **Extract information salient to the needs of the users**
 - Information about house prices from real estate magazines
 - Character relations from novels
 - Location of terrorist attacks from newspapers
- **Extract structured data from unstructured or semi structured natural language data, e.g. from newspapers**
- **Task involving Natural Language Understanding and Information Retrieval**



Information Extraction Tasks

- **Named Entity Recognition**

- ☐ Which phrases refer to **what kind of entities**

- **Coreference Resolution**

- ☐ Which phrases refer to the **same entity**

- **Relation Extraction**

- ☐ Which entities are related in **what kind of relationships**

- **Event Extraction**

- ☐ Which events are mentioned with which attributes



Named Entity Recognition

- **Named entity** is an object of interest such as a person, organization, or location
- Identifying word sequences
- Labelling those sequences

Example:

Meg Whitman, CEO of eBay, said in New York...

- Label Meg Whitman as **PERSON**
- Label eBay as **ORGANISATION**
- Label New York as **LOCATION**



CoNLL Shared Task 2003

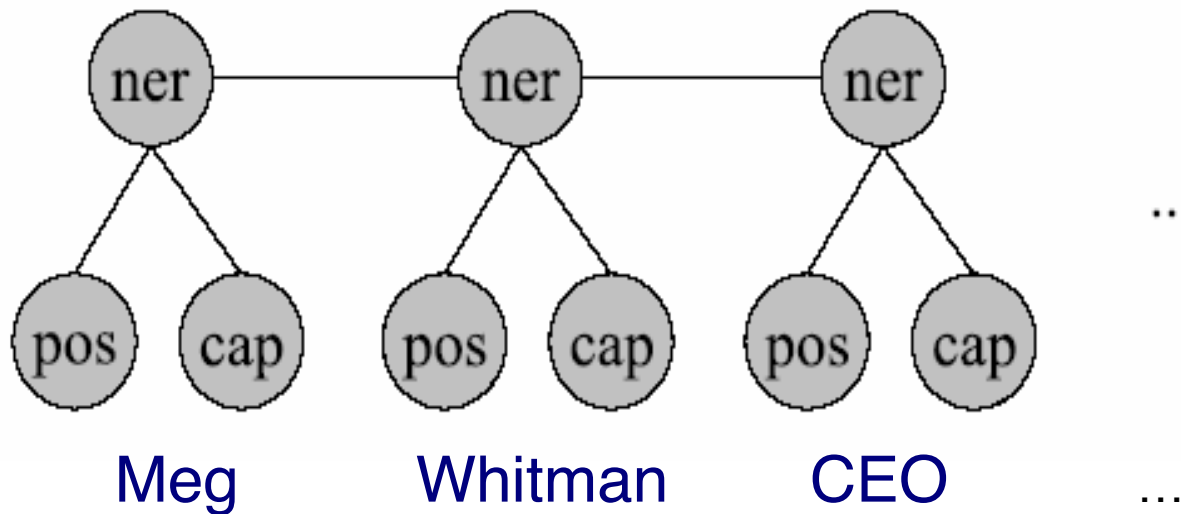
- Brings together researchers in Computational Natural Language Learning
- Aims at evaluating different Machine Learning approaches
- Gives training, development and test sets for NER in German and English
- Identify entities and classify as **PERSON**, **LOCATION**, **ORGANISATION** and **MISC**

IOB Scheme in CoNLL

- Inside, **O**utside, **B**egin
- For each type of entity there is an I-XXX and a B-XXX tag
- Non-entities are tagged O
- B-XXX only used if two entities of same type next to each other
- Assumes that named entities are non-recursive and don't overlap

Example: Meg Whitman CEO of eBay
I-PER B-PER O O I-ORG

A Graphical Model for NER



- The NER framework covers
 - Features
 - Local classifiers
 - Sequential constraints



Features

- **Features are the most important aspect of almost every Machine Learning system**
 - ☐ Is the word capitalised?
 - ☐ Is the word at the start of a sentence?
 - ☐ What is the POS tag?
 - ☐ Info from gazetteers
- **The more useful features you incorporate, the more powerful your learner gets**



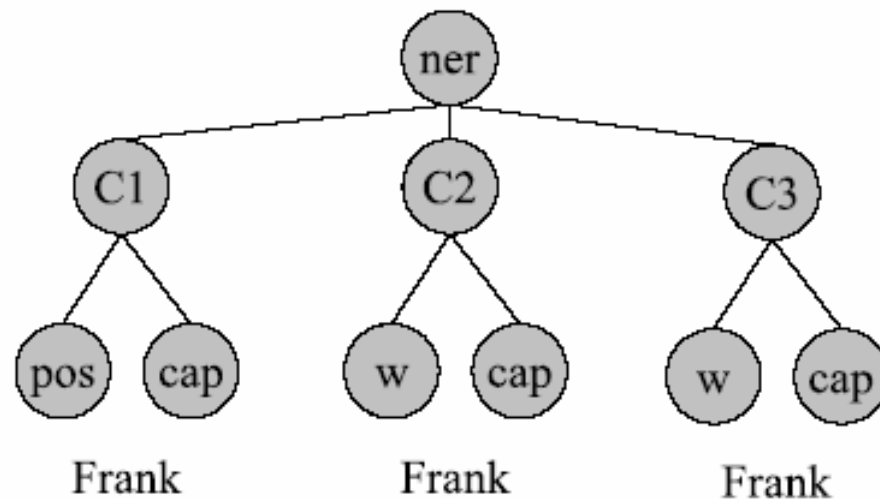
Local Classifier

Find
 $p(\text{tag}|\text{features})$

- Maximum Entropy Classifier (Berger et al. 1996)
- Large Margin approach such as support vector machines (SVMs) (Vapnik 1995)
- Naive Bayes (strong independence assumption)
- Whatever you like

Ensemble Methods

- Take a set of diverse classifiers
- Let them vote on the tag of a single token (or average their probabilistic output)
- Diversity through different feature sets, different learners, different training data (Dietterich 2000)



Sequential Modelling

- Tags interdepend

$$p(t_1, t_2, t_3 \dots | f_1, f_2, f_3 \dots) \neq \prod_i^n p(t_i | f_i)$$

- Could use a model such as:

$$p(t_1, t_2, t_3 \dots | f_1, f_2, f_3 \dots) = p(t_1 | f_1) \prod_{i=2}^n p(t_i | f_i) p(t_i | t_{i-1})$$



Software

- Use any programming language you want
- Try to find good toolkits
 - Maxent Toolkit of Zhang Lee (very good and fast training)
 - CRF++ framework (supports sequential modelling)
 - Weka (easy to use but memory intensive and slow)
 - SVM light, LibSVM (long training time, usually good performance)



Timetable

20 & 21/02 Presentation of the results for your
baseline system

16/03 Hand in your paper and code!



Assessment Criteria

- **Quality of paper**
 - ☐ Structure
 - ☐ Use of literature
 - ☐ Error Analysis
- **Performance of your system**
- **Creativity**