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Concept Extraction Challenge: University of Twente at #MSM2013

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Agenda

- Introduction.
- Named Entity Extraction:
  - SVM.
  - CRF.
  - Hybrid approach.
- Named Entity Categorization :
  - Named Entity Disambiguation.
  - Entity Categorization.
- Results.
- Conclusion.

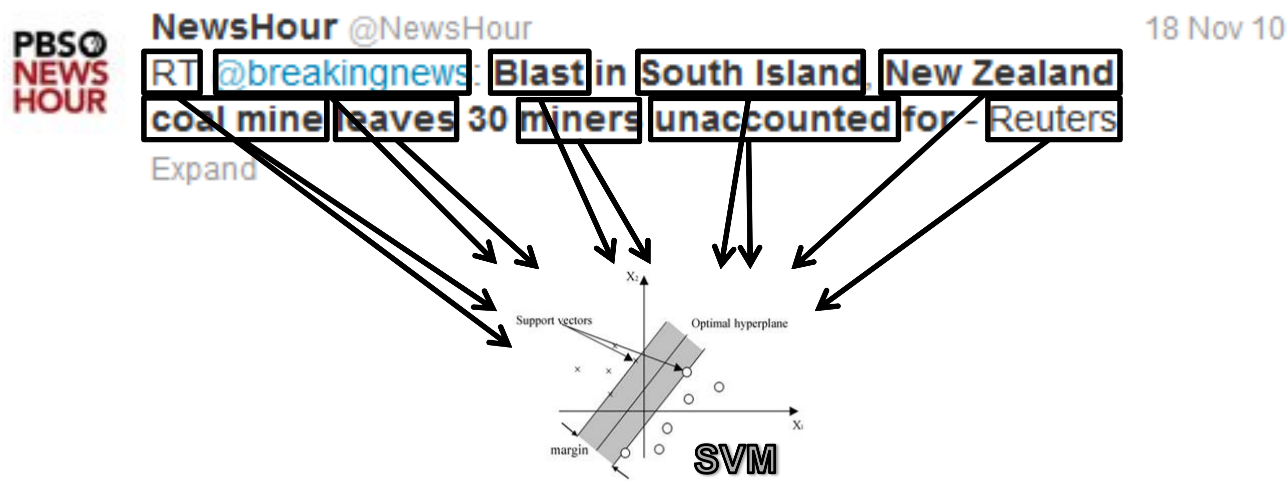
Introduction

Name Entity Recognition = **Name Entity Extraction** + **Name Entity Categorization**

Name Entity Categorization = **Name Entity Disambiguation** + **Entity Categorization**

Named Entity Extraction

- SVM:
  - Use TwiNER (Li et al @ SIGIR 2012) approach for segmenting tweet.
  - Yago KB is also used to enrich the NE candidates to achieve high recall.
  - Some hypothesis are applied to improve precision (removing stop words & verbs)



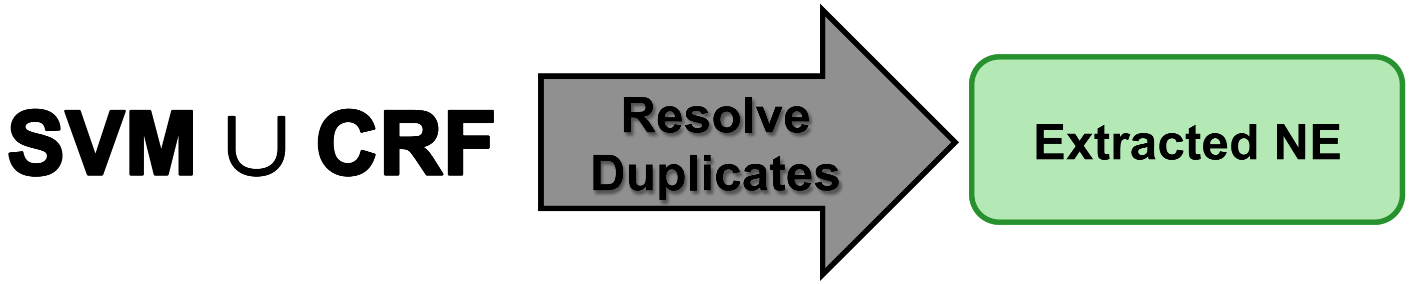
  - Different features are extracted for each segment to train and test the SVM (like POS, AIDA disambiguation score, MS Web-Ngram probability, Shape features, frequency, etc.)

Named Entity Extraction

- CRF:
  - CRF is popular for sequence labeling. But training of CRFs can be very expensive due to the global normalization (linear-chain CRFs):
    - **quadratic** in the size of the label set and almost **quadratic** in the size of the training sample
  - We used method called *empirical training*.
    - The maximum likelihood estimation (MLE) of the *empirical training* has a closed form solution, and it does not need iterative optimization and global normalization. (Fast!)
    - The MLE of the *empirical training* is also a MLE of the standard training. (Precise!)
- Tweet text is tokenized. For each token, the following features are extracted and used to train the CRF:
  - The Part of Speech (POS) tag of the word.
  - The word shape.

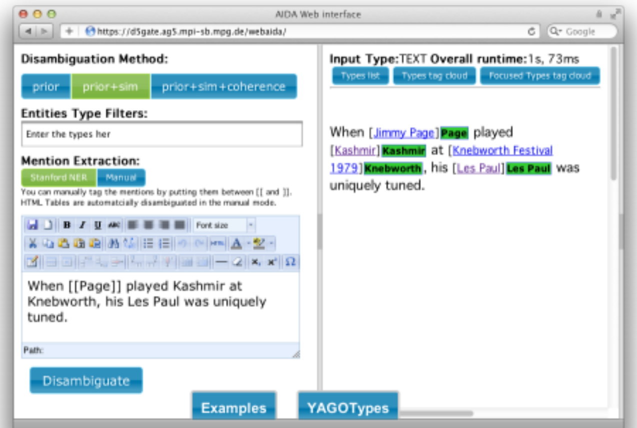
Named Entity Extraction

- Hybrid approach:
  - We take the union of the CRF and SVM results, after removing duplicate extractions, to get the final set of annotations.
  - For overlapping extractions we select the entity that appears in Yago, then the one having longer length.



Named Entity Categorization

- Named Entity Disambiguation:
  - AIDA disambiguation system is used to disambiguated the extracted NE.
  - ~75.8% of training data NEs ∈ YAGO KB.
  - For NEs ∉YAGO, we look for the first token in the NE if it ∈ YAGO, if found we pick the entity with the higher prior probability. (Ex: "*Sara MacDonald*" is assigned to ".../ *wiki/Sara_Sidle*")
  - Other NEs ∉YAGO at all are assigned to --NME--.



Named Entity Categorization

- Entity Categorization:
  - We build a profile for each category (PER, LOC, ORG, and MISC) from the Wikipedia Categories of each disambiguated entity.
  - If (NE $\in$ Training set) → Use category with the highest prior probability;
  - Else if (NE assigned to an entity) → Find the most similar category profile to the Wikipedia Categories of the disambiguated entity;
  - Else → Assign NE to PER category; //used with 2.8% of the extracted entities.

Results

- 4-fold cross validation.

Extraction Results

	Pre.	Rec.	F1
Twiner Seg.	0.0997	0.8095	0.1775
Yago	0.1489	0.7612	0.2490
Twiner∪Yago	0.0993	0.8139	0.1771
Filter(Twiner∪Yago)	0.2007	0.8066	0.3214
SVM	0.7959	0.5512	0.6514
CRF	0.7157	0.7634	0.7387
CRF∪SVM	0.7166	0.7988	**0.7555**

Extraction and Classification Results

	Pre.	Rec.	F1
CRF	0.6440	0.6324	0.6381
AIDA Disambiguation + Entity Categorization	0.6545	0.7296	**0.6900**

Conclusion

- We split the NER task into two separate tasks:
  - NEE which aims only to detect entity mention boundaries in text.
  - NEC which assigns the extracted mention to its correct entity type.
- For NEE we used a hybrid approach of CRF and SVM to achieve better results.
- For NEC we used AIDA disambiguation system to disambiguate the extracted named entities and hence find their type.

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Thank You

Cases where SVM extracts other NE than CRF

217: "_Mention_ : Joy ! ***MS*** **Office** now syncs with ***Google*** **Docs** -LRB- well , in beta anyway -RRB- . We are soon to be one big happy collaborative Click family . ***Ric***"

245: _Mention_ " `` valleylist " " v135 r. 1 - - electricity -LRB- **jerry yang** and david filo -RRB- <NEWLINE> _URL_ "

Bold → SVM
Italic → CRF