ELERFED – End of Workshop Report

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ENTITY DISAMBIGUATION

David Copperfield or *The Personal History, Adventures, Experience and Observation of David Copperfield the Younger of Blunderstone Rookery (which he never meant to be published on any account)* is a novel by Charles Dickens, first published in 1850.

David Copperfield (born **David Seth Kotkin**) is a multi Emmy Award winning, American magician and illusionist best known for his combination of illusions and storytelling. His most famous illusions include making the Statue of Liberty "disappear"; "flying"; "levitating" over the Grand Canyon; and "walking through" the Great Wall of China.

TWO TYPES OF ENTITY DISAMBIGUATION

- **CROSS-DOCUMENT COREFERENCE**
  - Extension of **INTRA-DOCUMENT COREFERENCE**
  - Cluster entity descriptions
- **WEB ENTITY**
  - One-entity-per-document assumption
  - Cluster documents

OUR APPROACH TO ENTITY DISAMBIGUATION

- Clustering of ENTITY DESCRIPTIONS containing
  - Distributional information
  - information extracted through relation extraction techniques
- Building on the results of INTRA-DOCUMENT COREFERENCE (IDC)

IDC AND ENTITY DISAMBIGUATION

On Friday, Datuk Daim added spice to an

On Friday, <E_M>Datuk Daim</E_M> added spice to an otherwise unremarkable address on Malaysia's proposed budget for 1990 by ordering

<entity id= "DOCID-37639">

<relation>

<predicate **"linked-with"**>

<arg1 "DOCID-37639">

<arg2 "DOCID-38941" >

</relation>

…..

</entity>

State of the art IDC systems I

[Petrie Stores Corporation, Secaucus, NJ,] said an uncertain economy and faltering sales probably will result in a second quarter loss and perhaps a deficit for the first six months of fiscal 1994

[The women's appareil specialty retailer] said sales at stores open more than one year, a key barometer of a retain concern strength, declined 2.5% in May, June and the first week of July.

[The company] operates 1714 stores.

In the first six months of fiscal 1993, **[the company]** had net income of $1.5 million ….

State of the art IDC systems II

Petrie Stores Corporation, Secaucus, NJ, said an uncertain economy and faltering sales probably will result in a second quarter loss and perhaps a deficit for **[the first six months of fiscal 1994]**

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The company operates 1714 stores.

In **[the first six months of fiscal 1993],** the company had net income of $1.5 million ….

Encyclopedic knowledge in IDC

[The FCC] took [three specific actions] regarding [AT&T]. By a 4-0 vote, it allowed AT&T to continue offering special discount packages to big customers, called Tariff 12, rejecting appeals by AT&T competitors that the discounts were illegal. …..

…..

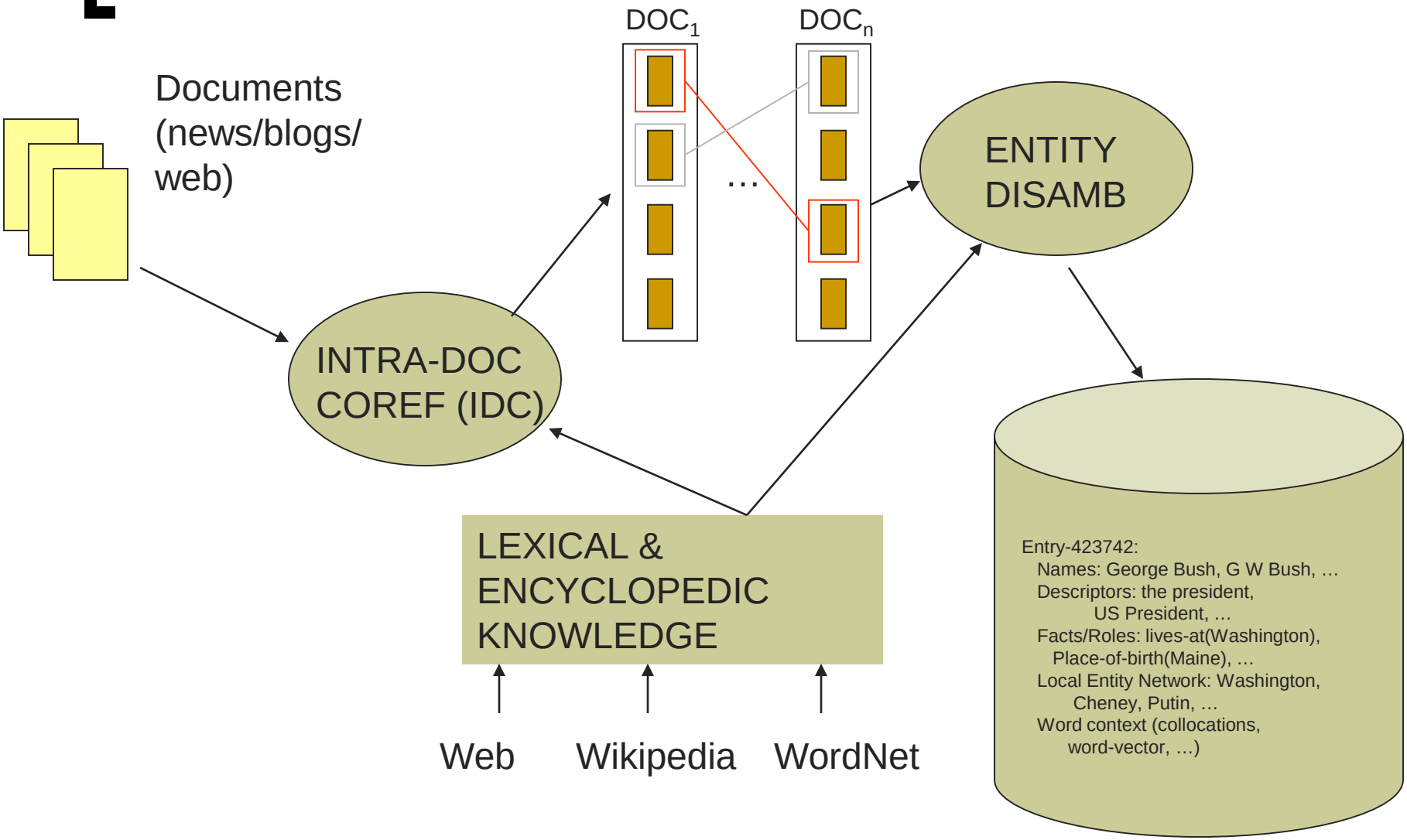
[The agency] said that because MCI's offer had expired AT&T couldn't continue to offer its discount plan.

Why Wikipedia may help addressing the encyclopedic knowledge problem

http://en.wikipedia.org/wiki/FCC:

The **Federal Communications Commission (FCC)** is an independent United States government agency, created, directed, and empowered by Congressional statute (see 47 U.S.C. § 151 and 47 U.S.C. § 154).

The overall picture



WHAT WE DID IN THE SUMMER

- Developed new corpora for evaluating both CDC and IDC
  - New ACE CDC
  - New ARRAU IDC

CDC annotation of ACE 2005

- Callisto / EDNA annotation tool
- ACE 05 CDC:
  - 257K
  - 18K entities
  - 55K mentions

ARRAU IDC CORPUS

- Includes texts from several genres
  - Penn Treebank II
  - Other text
  - Spoken dialogue
- All mentions
- A variety of features (agreement, semantic type)
- Bridging, discourse deixis, ambiguity

WHAT WE DID IN THE SUMMER

- Developed new corpora for evaluating both CDC and IDC
- Developed a variety of Web people and CDC systems evaluated
  - using Spock for Web People
  - ACE CDC05 for CDC
  - Including three different relation extraction systems

Entity disambiguation: Clustering methods

- Greedy agglomerative
- Metropolis-Hastings
- Gibbs sampling

Entity disambiguation: Features

- Basic features:
  - bags of words
  - nominals
- Topic models
- Relations
  - supervised
  - unsupervised

Relation extraction

- ACE:
  - Supervised: Su & Yong
  - Supervised: Giuliano
- Spock:
  - Unsupervised: Mann

Summary

- Web people: achieved improvements both through the improved clustering methods & the additional features
- CDC: very high baseline, but obtained improvements nevertheless
- Relation extraction: significant difference with / without IDC

WHAT WE DID IN THE SUMMER

- Developed resources for evaluating both CDC and IDC
- Developed a variety of Web people and CDC systems
- IDC:
  - Developed a platform for exploring IDC methods
  - Implemented a variety of techniques for extracting knowledge from the Web and Wikipedia
  - Tested better ML methods

AN ARCHITECTURE FOR IDC (Working name: ELKFED / BART)

Can handle

- Different preprocessing methods (e.g. chunkers vs parsers)
- Different methods for generating training instances
- Different decoding methods
- Different types of output (including MUC, APF)

- Easy to customize
- Support for error analysis through MMAX2

Using lexical & encyclopedic knowledge

- Tested around 20 features
- Developed both
  - New methods for extracting knowledge
  - New methods for using this knowledge
- Improved mention detection crucial

Extracting lexical and commonsense knowledge

- From WordNet
  - A variety of similarity measures (Ponzetto & Strube, 2006)
- From the Web
  - Hyponymy (Markert & Nissim, 2005; Versley, 2007)
- From Wikipedia
  - From the categories (Ponzetto & Strube, 2006)
  - From a Wikipedia-extracted taxonomy
  - From the relatedness links

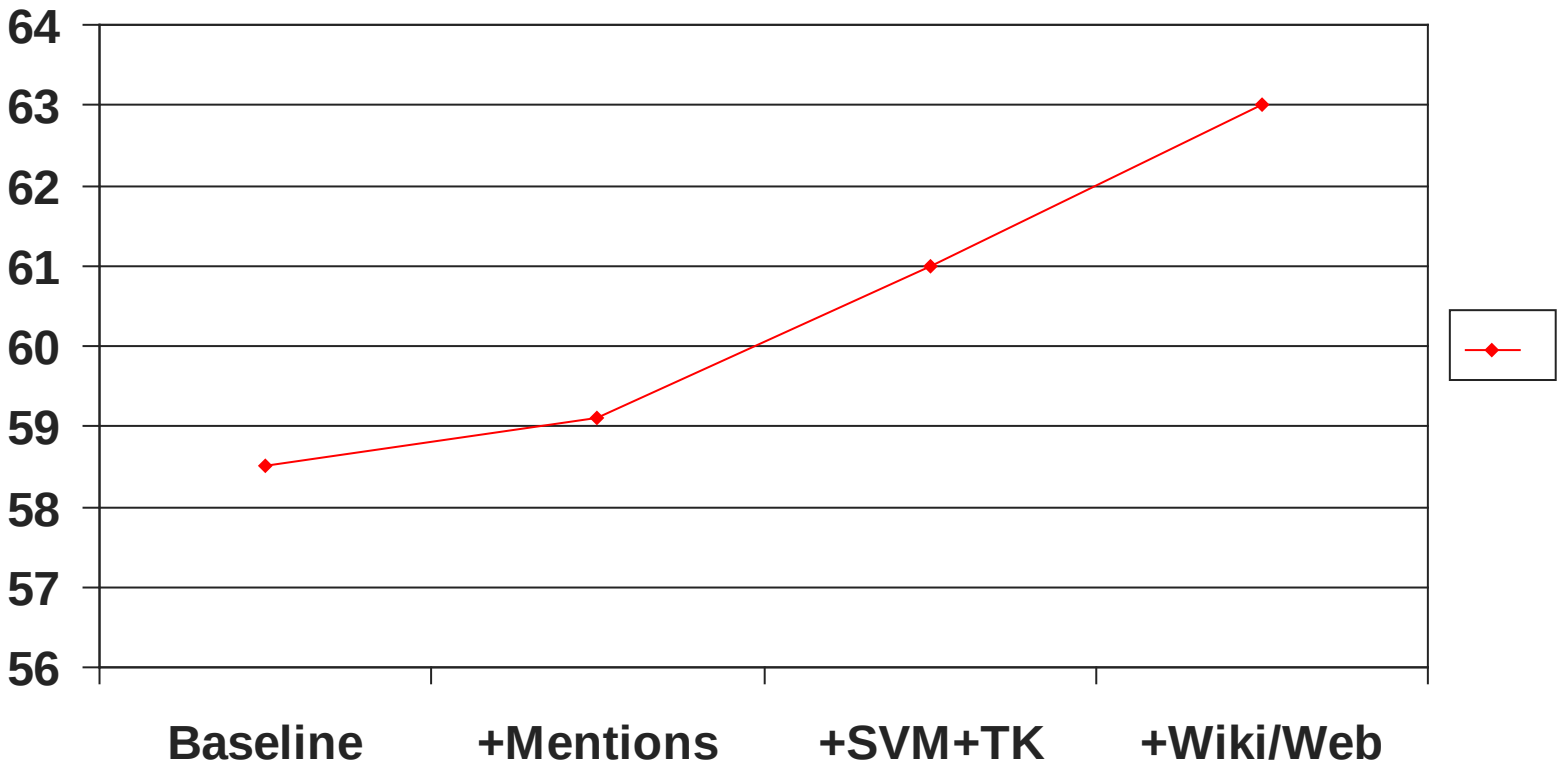
Using lexical & encyclopedic knowledge

- To detect SIMILARITY
  - GOP – the Republican Party
- To detect INCOMPATIBILITY
  - the first six months of fiscal 1994
  - the first six months of fiscal 1993

ML models

- Support Vector Machines
  - To detect ‘structured’ similarity / dissimilarity
- ‘Split’ models
  - Pronouns / definite descriptions
- Ranked models
- Global models

Results: quantitative (ACE02 bnews)



Summary of contributions Conclusions

- Developed two new corpora for evaluating CDC and IDC
- Demonstrated that improvements in Web People can be obtained using
  - Topic models
  - Metropolis-Hastings, Gibbs sampling
- Developed a new platform for IDC
- Achieved improvements in IDC using
  - Lexical and Encyclopedic knowledge
  - Support vector machines
  - (And the contributions are additive)

Program

- Resources & evaluation
- ED: web people, CDC, and relation extraction
- IDC development tool
- Extraction of lexical and commonsense knowledge
- SVMs

Conclusions

Summary again

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Members of the team

- Senior staff on site
  - Artstein Day Duncan Hitzeman Mann Moschitti Poesio Strube Su Yang
- PhDs
  - Hall Ponzetto Smith Versley Wick
- Undergrads
  - Eidelman Jern
- Externals
  - Giuliano Hoste Jemison Pradhan Yong
  - Daelemans Hinrichs

Thanks

- The sponsors
- EML Research (MMAX2, the initial code for BART)
- UMass Amherst (Rob Hall)
- MITRE (David Day, Janet Hitzeman)
- I^2R
- EPSRC Project ARRAU (corpus, Gideon Mann)
- DoD (Jason Duncan)
- JHU Center of Excellence (Paul McNamee)

Immediate future: some ideas

- Delivering the corpora (LDC) and BART (SourceForge)
- More experiments with the new corpora (ARRAU, OntoNotes)
- Improved mention detectors
- ‘Backoff’ model of Wiki / Web / WN knowledge use
- Global models
- Semantic trees & incompatibility
  - With global models / with SVMs
- Relation extraction with ‘real’ IDC