

Lecture 1: Course Introduction

CMPSCI 585, Fall 2014

Introduction to Natural Language Processing



<http://people.cs.umass.edu/~brenocon/inlp2014/>

Brendan O'Connor (<http://brenocon.com>)



*Some material borrowed from
Chris Manning and Jacob Eisenstein*

Who, where, when

Instructor:		Brendan O'Connor	Office hours: Thursday after lecture (4pm–?), room 222
TA:		David Belanger	Office hours TBD (starts week of 9/8)
Lectures:	CS Building room 142, Tues and Thurs, 2:30–3:45pm		

- My email: brenocon@cs.umass.edu
- Course website:
<http://people.cs.umass.edu/~brenocon/inlp2014/>
(Reachable from my website)

What

- Learn fundamental principles and methods in natural language processing
 - Hands-on implementation experience
 - Appreciation of basic linguistic issues
 - Know about useful open-source NLP tools
 - Know when NLP works and when it doesn't
 - Be able to read current research papers in NLP
- “AI systems”

Requirements

- *[Submit all homeworks electronically via moodle.umass.edu]*
- (~15%) Short exercises (~weekly): basic linguistic analysis to sharpen intuitions, <1 hour of work. Due before class; bring paper copy to class.
- (~25%) Problem sets (several): conceptual and programming problems.
 - Python preferred. We provide starter code.
 - IPython Notebook: <http://ipython.org/notebook.html>
- (~20%) Midterm (in-class, mid-October)
- (~20%) Final exam
- (~20%) Group-based final projects

First exercise - due Thursday

- Find several ambiguous sentences from news articles, and explain.
- Exercise will be posted on website later today.
- Due this Thursday, electronic submission before class.
Bring paper copy to class!

Readings

- Readings will be provided -- see website.
- Suggested textbook:
 - Jurafsky and Martin, *Speech and Language Processing*
- Other great references:
 - Murphy, *Machine Learning: a Probabilistic Perspective*
 - Bender, *Linguistic Fundamentals for NLP*
 - Smith, *Linguistic Structure Prediction*
(free access from UMass campus)
 - Manning and Schütze, *Foundations of Stat. NLP*

Related courses at UMass

- **Computational Linguistics: Ling 409, 492B (Bhatt, Dillon)**
Intended to prepare non-CS students for 585

<https://sites.google.com/site/umasslx409/home>

<http://www.umass.edu/linguist/courses/detail.php?cid=571>

- **Speech: Ling 592B (Yu)**

<http://courses.umass.edu/linguist592b-kmyu/category/info.html>

- **Information Retrieval: CS 446, 646 (Allan, Croft)**

<http://ciir.cs.umass.edu/cmpsci446/>

<http://ciir.cs.umass.edu/~allan/cs646/>

NLP is interdisciplinary

Algorithms

Linguistics

Statistics +
Machine Learning

Cognitive Science

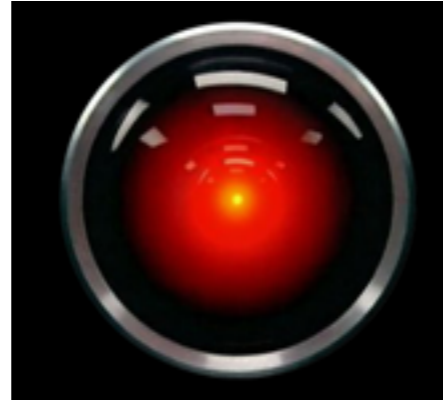
Artificial Intelligence

“Can Machines Think?”



- British mathematician and founding figure in computer science
- Alan Turing (1950)
- How do we know when we have AI?
- “Imitation Game”

NLP imagined



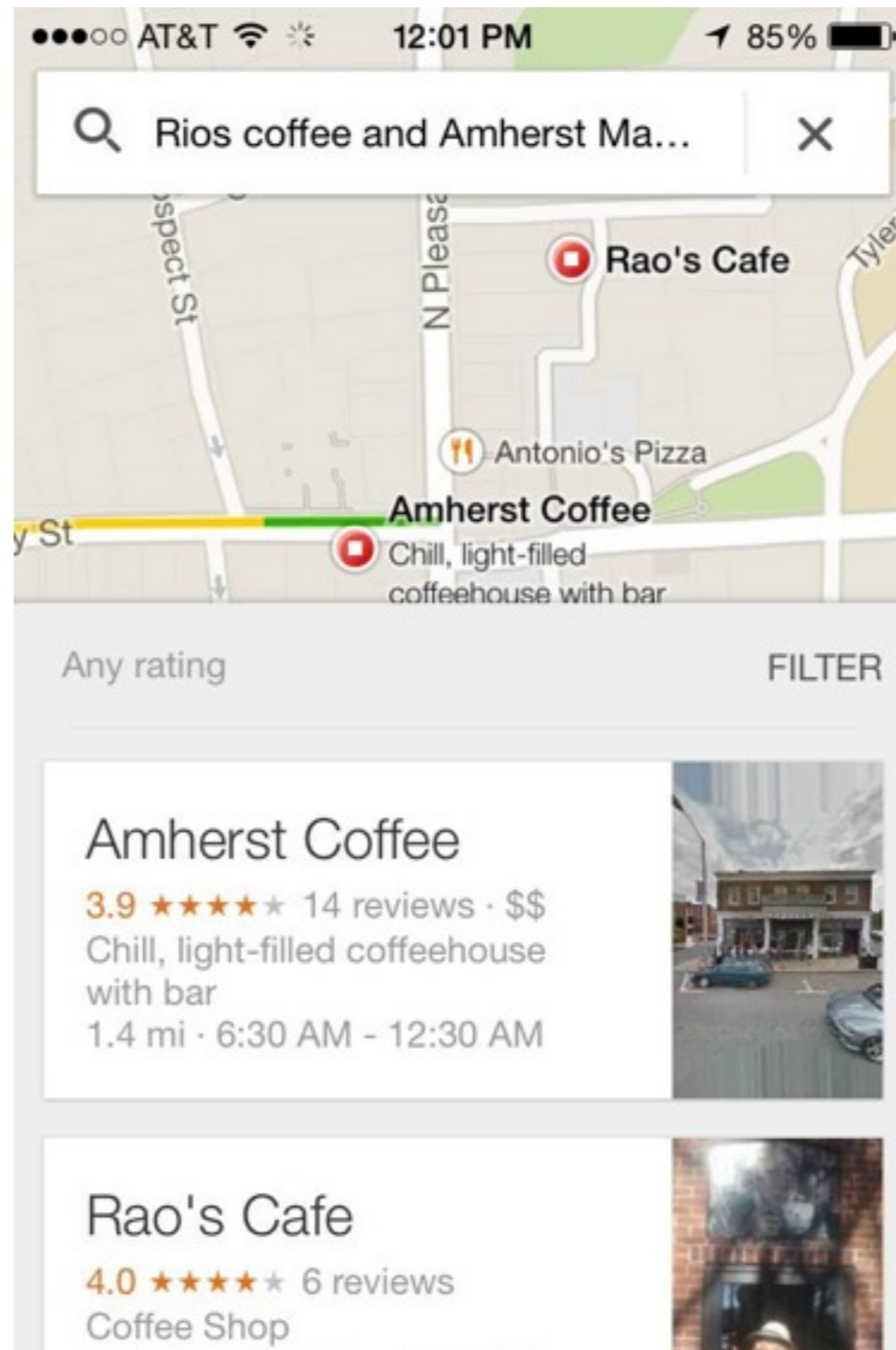
NLP today

- Speech interfaces
- Machine translation
- Sentiment analysis
- Search engines
- ...

NLP today: Speech interfaces



“Rao’s coffee in Amherst, Massachusetts”



NLP today: Question answering

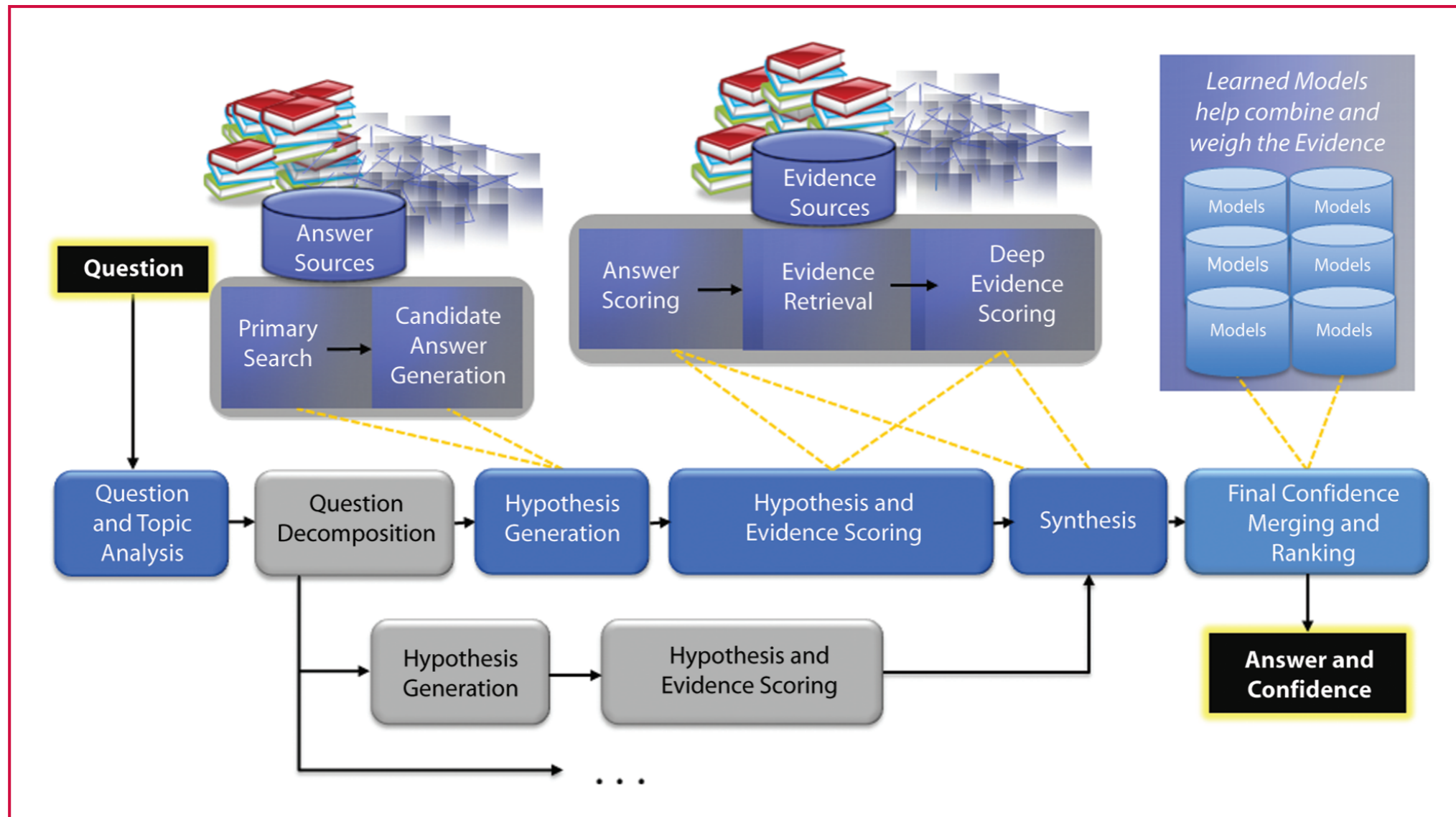


IBM Watson

Wanted for general evilness, last seen at the Tower of Barad-Dur. It's a giant eye, folks, kinda hard to miss

NLP today: Question answering

From IBM Journal of Research and Development, 2012



IBM Watson

25 engineers, 4 years, 200 subsystems,
2,880 CPU cores, 15 TB storage

NLP today: Machine translation

The screenshot shows the Google Translate interface. At the top left is the Google logo, and at the top right is a 'Sign in' button. Below the logo is the word 'Translate' in red. The interface has two language selection menus. The left menu shows 'English', 'Spanish', 'French', and 'Chinese - detected'. The right menu shows 'English', 'Spanish', and 'Arabic'. A blue 'Translate' button is positioned between the two menus. Below the menus, there are two text boxes. The left box contains the original Chinese text, and the right box contains the translated English text. The Chinese text is: '新华网北京9月2日电（记者刘华）中共中央政治局常委、中央书记处书记刘云山2日在北京会见了由主席斯塔尼舍夫率领的欧洲社会党代表团。刘云山说，中方高度重视中欧关系，愿与欧方一道落实习近平主席与欧方领导人达成的重要共识，围绕打造和平、增长、改革、文明四大伙伴关系，执行好《中欧合作2020战略规划》，深化各领域务实合作。中国共产党愿与欧洲社会党发展良好党际关系，通过多种形式深化治国理政经验交流，促进中欧全面战略伙伴关系持续健康发展。刘云山应询介绍了中共党建有关情况。' The English translation is: 'Xinhua Beijing September 2 (Reporter Liu) Politburo Standing Committee of the CPC Central Committee Liu Yunshan the 2nd met with the delegation led by the main 席斯塔尼舍夫 European Socialists in Beijing. Liu Yunshan said China attaches great importance to China-EU relations and is willing to work together with the EU President Xi Jinping and implement the important consensus reached by leaders of the EU, around to create peace, growth, reform and civilization of the four partnerships, implementation of good "2020 China-EU cooperation in strategic planning.", deepen pragmatic cooperation in various fields. Communist Party of China is willing to develop good inter-party relations with the European Socialist Party, through various forms of

NLP today: Machine translation

The screenshot shows the Google Translate interface. At the top left is the Google logo, and at the top right is a 'Sign in' button. Below the logo is the word 'Translate' in red. The interface has two language selection menus: the left one is set to 'Chinese - detected' and the right one is set to 'English'. A blue 'Translate' button is positioned between the two menus. Below the menus, there are two text boxes. The left box contains the original Chinese text, and the right box contains the translated English text. The Chinese text is a news report from Xinhua dated September 2, 2014, reporting on a meeting between Liu Yunshan, a member of the Politburo Standing Committee of the CPC, and a delegation of the European Socialist Party led by Stanislas Bouffande. The English translation is a direct translation of the Chinese text.

English Spanish French Chinese - detected ↕ English Spanish Arabic Translate

新华网北京9月2日电（记者刘华）中共中央政治局常委、中央书记处书记刘云山2日在北京会见了由主席斯塔尼舍夫率领的欧洲社会党代表团。

刘云山说，中方高度重视中欧关系，愿与欧方一道落实习近平主席与欧方领导人达成的重要共识，围绕打造和平、增长、改革、文明四大伙伴关系，执行好《中欧合作2020战略规划》，深化各领域务实合作。中国共产党愿与欧洲社会党发展良好党际关系，通过多种形式深化治国理政经验交流，促进中欧全面战略伙伴关系持续健康发展。刘云山应询介绍了中共党建有关情况。

Xinhua Beijing September 2 (Reporter Liu) Politburo Standing Committee of the CPC Central Committee Liu Yunshan the 2nd met with the delegation led by the main 席斯塔尼舍夫 European Socialists in Beijing.

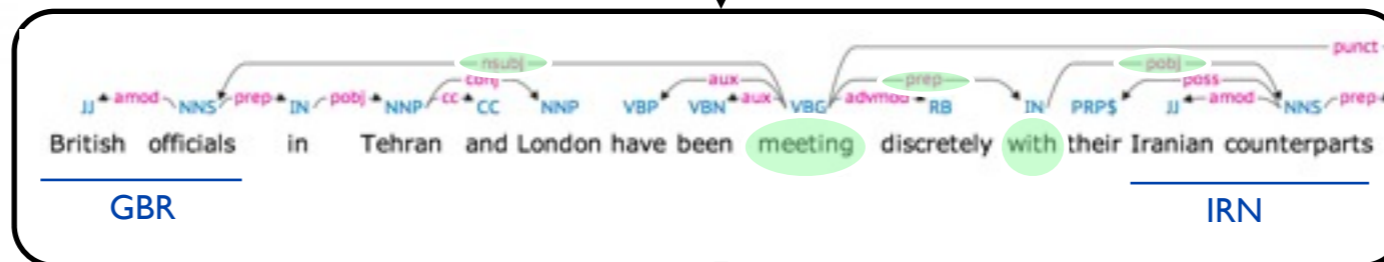
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NLP today: Trend analysis



Data: news articles

Dependency parsing to identify events



Machine learning from text:

(1) **Event class dictionaries**

(2) **Political dynamics**

“diplomacy”

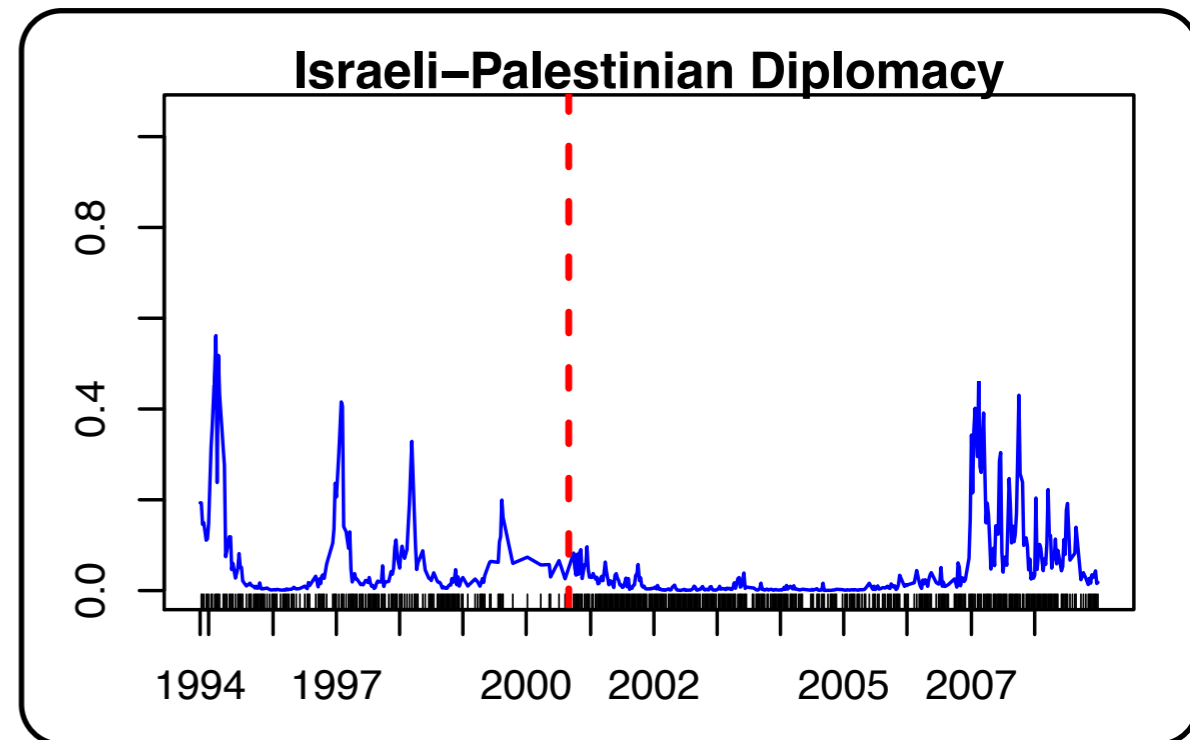
arrive in, visit, meet with, travel to, leave, hold with, meet, meet in, fly to, be in, arrive for talk with, say in, arrive with, head to, hold in, due in, leave for, make to, arrive to,

“verbal conflict”

accuse, blame, say, break with, sever with, blame on, warn, call, attack, rule with, charge, say←ccomp come from, say ←ccomp, suspect, slam, accuse government ←poss,

“material conflict”

kill in, have troops in, die in, be in, wound in, have soldier in, hold in, kill in attack in, remain in, detain in, have in, capture in, stay in, about ←pobj troops in, kill, have troops



NLP today: Story generation

INVESTING 8/28/2014 @ 10:00AM | 121 views



Earnings for OmniVision Technologies Expected to Fall

Narrative Science

By [Narrative Science](#)

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Opinions expressed by Forbes Contributors are their own.

Wall Street is expecting lower profit for **OmniVision Technologies** when the company reports its first quarter results on Thursday, August 28, 2014. Analysts are expecting earnings per share of 39 cents after the company booked a profit of 42 cents a share a year earlier.

The consensus estimate has risen from 16 cents over the past three months. Analysts are expecting earnings of 99 cents per share for the fiscal year. Revenue is projected to eclipse the year-earlier total of \$373.7 million by 2%, finishing at \$381.5 million for the quarter. For the year, revenue is projected to come in at \$1.39 billion.

<http://www.forbes.com/sites/narrativescience/>

NLP today: Search/summarization

yelp Find tacos, cheap dinner, Max's Near amherst, ma Sign Up Log In

Home About Me Write a Review Find Friends Messages Talk

Oriental Flavor

★ ★ ★ ★ ★ 54 reviews Details

\$\$ · Szechuan, Dim Sum, Cantonese Edit

Write a Review Add Photo Share Bookmark

Map: Amherst Center, Amity St, Jones Library, Spring St, Church St, Lessey St

Photos: Crystal shrimp dumplings, Pork buns, Scallion pancakes, Xiaolongbao



“We had the **crystal shrimp dumplings** that is seen wowing all yelpers, and they were superb.” in 5 reviews

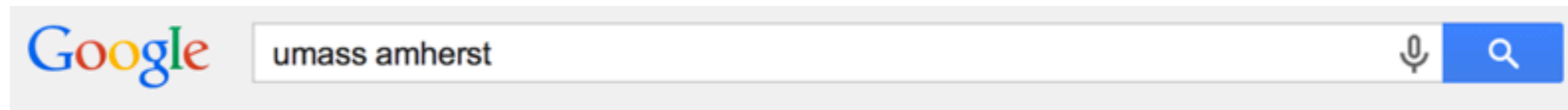


“In addition to having the best pork buns in the area, they also have the best **scallion pancakes** and xiaolongbao.” in 8 reviews



“Usually I eat at the large dim sum restaurants in Boston with the rolling **carts**, but this experience was as good as any.” in 5 reviews

NLP today: Search/summarization



Web **News** Images Maps Videos More ▾ Search tools

About 8,510 results (0.42 seconds)



UMass Amherst breaks a world record

[wwlp.com](#) - 17 hours ago

AMHERST, Mass. (WWLP) – **UMass Amherst** has broken a world record by serving over 3,000 people a New England clambake in one and a ...

UMass Amherst starts semester with giant clambake

[SouthCoastToday.com](#) - 1 minute ago

UMass creates, sets new record for most clambake meals served ...

[The Republican - masslive.com](#) - 14 hours ago

UMass gets \$37.5 million for environmental projects

[The Recorder](#) - 14 hours ago

No cheers here for UMass football program

Opinion - [Boston Globe](#) - 10 hours ago



[wwlp.com](#)



[Boston Globe](#)



[The Massac...](#)



[WCVB Boston](#)

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UMass football players struggle academically


[Boston Globe](#) - Aug 30, 2014

The **University of Massachusetts Amherst** football team has struggled not only on the field, but in the classroom as well, leaving it barely above ...

NLP today: Search/summarization

TOP SECRET//COMINT//REL TO USA, AUS, CAN, GBR, NZL

Entity Extraction



- Have technology (thanks to R6) – for English, Arabic and Chinese
- Allow queries like:
- Show me all the word documents with references to IAEO
- Show me all documents that reference Osama Bin Laden
- Will allow a 'show me more like this' capability

TOP SECRET//COMINT//REL TO USA, AUS, CAN, GBR, NZL

NSA slides from Snowden leaks

<http://www.theguardian.com/world/interactive/2013/jul/31/nsa-xkeyscore-program-full-presentation>

Ambiguity: why NLP is hard

- Juvenile Court to Try Shooting Defendant
- Hospitals Are Sued by 7 Foot Doctors
- Alice saw Bob with a telescope.
- Our company is training workers.
- They found that in order to attract settlers -- and make a profit from their holdings -- they had to offer people farms, not just tenancy on manorial estates.

Natural interfaces?



Where is **A Bug's Life** playing in **Mountain View**?

A Bug's Life is playing at the Century 16 Theater.

When is **it** playing **there**?

It's playing at 2pm, 5pm, and 8pm.

OK. I'd like 1 **adult** and 2 **children** for the **first show**.
How much would **that** cost?



But we need **domain knowledge**, **discourse knowledge**, **world knowledge**, linguistic knowledge.

Demo

- Many constraints for meaning
We use probability to combine
- Full language understanding is a long ways off
- But it is surprising how far simple methods can get you