

Christopher Manning

Pandu Nayak

Introduction to **Information Retrieval**

CS276: Information Retrieval and Web Search
Lecture 19: Web Question Answering

Web Search in 2020?

The web, it is a changing.

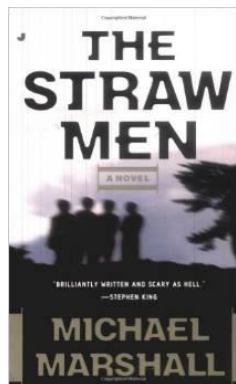
What will people do in 2020?

- Type key words into a search box?
- Use the Semantic Web?
- Speak to your computer with natural language search?
- Use social or “human powered” search?

Getting information

The common person's view? [From a novel]

"I like the Internet. Really, I do. Any time I need a piece of shareware or I want to find out the weather in Bogota ... I'm the first guy to get the modem humming. But as a source of information, it sucks. You got a billion pieces of data, struggling to be heard and seen and downloaded, and anything I want to know seems to get trampled underfoot in the crowd."



Michael Marshall. *The Straw Men*. HarperCollins, 2002.

“Information retrieval”

- The name “information retrieval” is standard, but as traditionally practiced, it’s not really right
- All you get is document retrieval, and beyond that the job is up to you

What do we know that's happening?

- Much of what is going on is in the products of companies, and there isn't exactly careful research explaining or evaluating it
- So most of this is my own meandering observations giving voice over to slides from others

Google

What's been happening? 2014–2015

- “Mobilegeddon” (Apr 21, 2015):
 - “Mobile friendliness” as a major ranking signal
- “Pigeon” update (July 2014):
 - More use of distance and location in ranking signals
- “App Indexing” (Android, iOS support May 2015)
 - Search results can take you to an app
- Why?
 - About half of all searches are now from mobile
 - Making/wanting good changes, but obvious self-interest in trying to keep people using mobile web rather than apps

Google

What's been happening? 2014

- New search index at Google: “Hummingbird”
 - <http://www.forbes.com/sites/roberthof/2013/09/26/google-just-revamped-search-to-handle-your-long-questions/>
- Answering long, “natural language” questions better
 - Partly to deal with spoken queries on mobile
- More use of the Google Knowledge Graph
 - Concepts versus words

What's been happening

- Google Knowledge Graph
- Facebook Graph Search
- Bing's Satori
- Things like Wolfram Alpha

Common theme: Doing graph search over structured knowledge rather than traditional text search

What's been happening

- More semi-structured information embedded in web pages
 - schema.org

The screenshot shows the top navigation bar of The New York Times website, including 'SECTIONS', 'HOME', 'SEARCH', and 'The New York Times' logo. Below the navigation are several article thumbnails with titles like 'After Nadal and Ferrer, Spanish Tennis Talent Pool Looks Thin', 'Romanian Keeps Elevating Her Game and Her Confidence', and 'Rangers and Kings Share High-Pressure Achievers'. A large advertisement for Chromecast is visible, stating 'Everything you love, now on your TV. For \$35.' with a 'Buy Now' button.

TENNIS

After Nadal and Ferrer, Spanish Tennis Talent Pool Looks Thin

JUNE 2, 2014

On Tennis

By CHRISTOPHER CLAREY

PARIS — The future of Spanish tennis may not be Spanish in the future.

✉ EMAIL

Garbiñe Muguruza, the last unseeded player remaining in the



```

275 <p class="byline-column">
276     On Tennis </p>
277 <p class="byline">By <span itemprop="author creator" itemscope
itemtype="http://schema.org/Person"
itemid="http://topics.nytimes.com/top/reference/timestopics/people/c/christopher_clarey/index.html">
278     <a
href="http://topics.nytimes.com/top/reference/timestopics/people/c/christopher_clarey/index.html" rel="author"
title="More Articles by CHRISTOPHER CLAREY"> <span class="byline-author" data-byline-
name="Christopher Clarey" itemprop="name">CHRISTOPHER CLAREY</span>
279     </a> </span>
280 </p>

```

What's been happening

- Move to mobile favors a move to speech which favors “natural language information search”
 - Will we move to a time when over half of searches are spoken?



Towards intelligent agents

Two goals

- Things not strings
- Inference not search

Two paradigms for question answering

- Text-based approaches
 - TREC QA, IBM Watson
- Structured knowledge-based approaches
 - Apple Siri, Wolfram Alpha, Facebook Graph Search

(And, of course, there are hybrids, including some of the above.)

At the moment, structured knowledge is back in fashion, but it may or may not last

Example from Fernando Pereira (GOOG)

painkillers that don't thin blood



Search

painkillers that don't **thin blood**

painkillers that don't **cause constipation**

painkillers that don't **cause nausea**

painkillers that don't **upset stomach** frequent query

painkillers that don't

About 89,300 results (0.14 seconds)

[Advanced search](#)

painkillers that don't upset stomach



Search

About 29,700 results (0.15 seconds)

[Advanced search](#)

► [Symptoms of Crohn's](#)

Sponsored link

www.crohnonline.com

Do You Know the Signs of Crohn's? Read About Symptoms and More Now.

[Best Pain Reliever, Over the Counter Pain Relievers, Prescription ...](#)

For **stomach upset**, eating or drinking milk before you take a painkiller can help. ... **Don't** expect **painkillers** to relieve all your pain, but the best pain ...

www.healthblurbs.com/best-pain-reliever-over-the-counter-pain-relievers-prescription-analgesic-painkillers/ - [Cached](#) - [Similar](#)

[Why do painkillers make your stomach hurt? - Yahoo! Answers](#)

Aug 30, 2008 ... **stomach upset**, reflux/indigestion, or if severe ulcers ... I often take **painkillers** FOR **stomach** aches lol. **Don't** do this again. 2 years ago ...

answers.yahoo.com > [Health](#) > [Other - Health](#) - [Cached](#) - [Similar](#)

[How are painkillers bad for you?](#) - Apr 13, 2010

[What effect do painkillers have on you?](#) - Sep 30, 2009

[What's the difference between OTC painkillers? \(Advil, Aleve ...](#) - Nov 19, 2008

[Is it bad to take painkillers on an empty stomach ?](#) - Aug 20, 2008

[More results from answers.yahoo.com »](#)

[Phys Ed: Does Ibuprofen Help or Hurt During Exercise? - NYTimes.com](#)

Sep 1, 2009 ... When are ibuprofen and other anti-inflammatory **painkillers** justified? ... Can't take NSAIDS due to **upset stomach**. — bonemri ... Perhaps part of the problem is that you **don't** always have the option to rest your injury if ...

well.blogs.nytimes.com/.../phys-ed-does-ibuprofen-help-or-hurt-during-exercise/ - [Cached](#) - [Similar](#)

class negation synonyms

painkillers that **don't** **upset** stomach



Search

About 29,700 results (0.15 seconds)

[Advanced search](#)

► [Symptoms of Crohn's](#)

Sponsored link

www.crohnonline.com

Do You Know the Signs of Crohn's? Read About Symptoms and More Now.

[Best Pain Reliever, Over the Counter Pain Relievers, Prescription ...](#)

For **stomach upset**, eating or drinking milk before you take a painkiller can help. ... **Don't** expect **painkillers** to relieve all your pain, but the best pain ...

www.healthblurbs.com/best-pain-reliever-over-the-counter-pain-relievers-prescription-analgesic-painkillers/ - [Cached](#) - [Similar](#)

[Why do **painkillers** make your **stomach** hurt? - Yahoo! Answers](#)

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answers.yahoo.com › [Health](#) › [Other - Health](#) - [Cached](#) - [Similar](#)

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[What's the difference between OTC **painkillers**? \(Advil, Aleve ...](#) - Nov 19, 2008

[Is it bad to take **painkillers** on an empty **stomach** ?](#) - Aug 20, 2008

[More results from answers.yahoo.com »](#)

[Phys Ed: Does ibuprofen Help or Hurt During Exercise? - NYTimes.com](#)

Sep 1, 2009 ... When are ibuprofen and other anti-inflammatory **painkillers** justified? ... Can't take NSAIDS due to **upset stomach**. — bonemri ... Perhaps part of the problem is that you **don't** always have the option to rest your injury if ...

well.blogs.nytimes.com/.../phys-ed-does-ibuprofen-help-or-hurt-during-exercise/ - [Cached](#) - [Similar](#)

"painkillers such as * tylenol"



Search

About 19,200 results (0.21 seconds)

[Advanced search](#)

[TYLENOL® Official Site](#)

Sponsored link

[Tylenol.com](#) Pain Relief from TYLENOL. Get Information and Coupons Here.
Head & Body Pain - Arthritis Pain - Sinus - Cold & Flu

[Ovarian hyperstimulation syndrome \(OHSS\): Treatments and drugs ...](#)

To ease abdominal discomfort, take over-the-counter painkillers such as acetaminophen Tylenol others) or ibuprofen (Advil, Motrin, others). ...

[www.mayoclinic.com/.../DSECTION=treatments-and-drugs](#) - Cached - Similar

tylenol ⇒ painkiller

painkiller "adverse effects include" stomach



Search

About 266,000 results (0.14 seconds)

[Advanced search](#)

[Painkiller Comparison Chart](#)

Oct 31, 2008 ... Chart showing prescription and non-prescription **painkillers** and what they are used for. ... menstrual pain, fever, Common **adverse effects include**: nausea, ... asthma, **upset stomach**, not for last pregnancy trimester. ...

www.disabled-world.com/.../painkiller-chart.shtml - [Cached](#) - [Similar](#)

[\[PDF\] List of Painkillers and what they are used for: Over the Counter ...](#)

File Format: PDF/Adobe Acrobat - [Quick View](#)

Common **adverse effects include**: nausea, dyspepsia, gastrointestinal ulceration/bleeding. ... **upset stomach**, not for last pregnancy trimester. Individuals ...

healingwithsoftlasers.com/.../Painkiller%20side%20effects%20chart%20.pdf

upset stomach \Rightarrow adverse effect (on stomach)

tylenol stomach



Search

About 1,390,000 results (0.28 seconds)

[Advanced search](#)

► [Pain Relievers And Upset Stomach - Tylenol Extra Strength Pain ...](#)

Tylenol Extra Strength Pain Reliever Fever Reducer 100 Caplets - User Rating: 5 stars.

Review Summary: Taking the wrong pain reliver can cause you **stomach** ...

[www.epinions.com](#) > [Wellness & Beauty](#) > [Health Aids](#) - [Cached](#) - [Similar](#)

[Treatment: Pain: Merck Manual Home Edition](#)

TYLENOL has virtually no useful anti-inflammatory activity, does not affect the blood's ability to clot, and has almost no adverse effects on the **stomach** ...

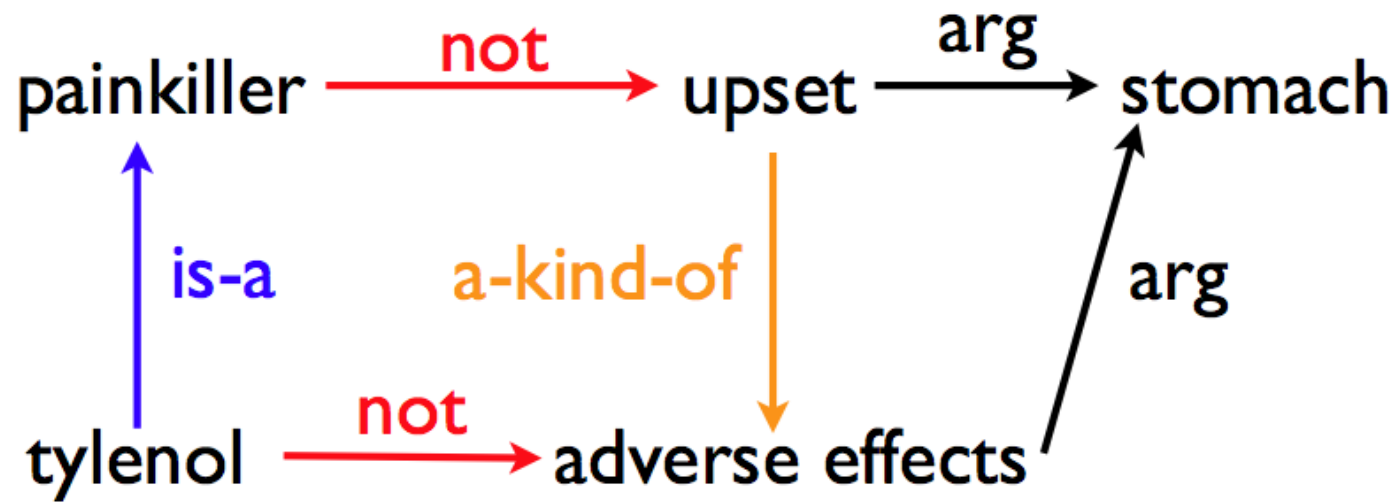
[www.merck.com/mmhe/sec06/ch078/ch078d.html](#) - [Cached](#) - [Similar](#)

tylenol ⇒ no adverse effects (on stomach)
⇒ no upset stomach

painkiller

upset

stomach



“Things, not strings”

From	To	Requires
Term	Concept	Parsing, disambiguation, coreference
Term identity	Entailment	Concept relations
Co-occurrence	Syntactic relation	Document structure, parsing
Term index	Semantic index	Concept disambiguation, inference

Slides from Patrick Pantel (MSFT)

The image shows a screenshot of a Yahoo! search result for "Seven Samurai". The search bar contains "Seven Samurai" and shows "82,800,000 result". Below the search bar are tabs for "WEB", "IMAGES", "VIDEO", "SHOPPING", "BLOGS", and "MORE". The main result is for the movie "Seven Samurai (1954)" from "movies.yahoo.com". The description reads: "Yahoos B+ A Japanese farming village, constantly beseiged and pillaged by an army of bandits, recruits seven independent... more". Below the description is a box with structured data: "Running Time: 2 hr 40 min", "Directed by: Akira Kurosawa", and "Starring: Takashi Shimura, Toshiro Mifune, Yoshio Inaba, Seiji Miyaguchi, ... more". On the left side, there is a "RELATED MOVIES" section with a list of movies: "Dreams", "Ran", "Dersu Uzala", "Throne of Blood", "Yojimbo", and "Stray Dog".

Entity Detection (points to the search bar)

Structured Recommendations (points to the Related Movies list)

Play trailer (points to the movie poster)

Structured Data (points to the movie details box)

bing
Web

flights to maui

Web Flights More ▾

Flights from Seattle, WA to Maui, HI

FROM Seattle, WA (SEA) - Seatl TO Kahului, HI (OGG) - Kahul

LEAVE 03/23/2012 RETURN 03/25/2012 Find flights

bing.com/travel

WEEKEND ESTIMATES
\$639 Depart March 09
\$748 Depart March 16
\$649 Depart March 23

Price prediction

Task completion

bing
Web

royal lahaina resort

Web Hotels Images More ▾

Royal Lahaina Resort - Bing Travel



2780 Kekaa Dr · Lahaina
(808) 661-9469
Details · Photos · Amenities · Directions · Website
★★★★☆ (12)
Sample rate: \$230

Compare rates from major travel sites

CHECK IN 03/15/2012 CHECK OUT 03/17/2012 Find rate

bing.com/travel/hotels/search?q=royal+lahaina+resort

Aggregate ratings

Task completion






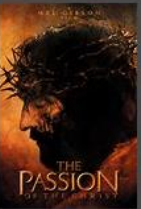



bing mel gibson movies

Web Images Videos Maps News More

9 Sign in

Mel Gibson - movies

All genres Popular first

									
The Expendables 3 (2014) ★★★★★	Mad Max (1980) ★★★★★	Braveheart (1995) ★★★★★	Mad Max 2: The Road Warrior (1982) ★★★★★	Get the Gringo (2012) ★★★★★	Edge of Darkness (2010) ★★★★★	The Passion of the Christ (2004) ★★★★★	Apocalypse (2006) ★★★★★	Mad Max Beyond Thunderdome... (1985) ★★★★★	Let's... (1985) ★★★★★

Mel Gibson - IMDb

www.imdb.com/name/nm0000154

Born Jan 03, 1956 · 59 years old · 368 photos

Mel Gibson, Actor: **Braveheart**. Mel Columcille Gerard **Gibson** was born January 3, 1956 in Peekskill, New York, USA, as the sixth of eleven children of Hutton **Gibson**, a ...
Biography · Awards · Films · News





Mel Gibson Movies | Movies.com

www.movies.com/actors/mel-gibson/mel-gibson-movies/p181347

50 rows · Get the full list of all **Mel Gibson** movies. See who they starred with and ...
Linda Hunt · Beth Orton · Watch at Home · Contact Us · Bill Kerr · Mad Max

Videos of mel gibson movies

bing.com/videos

			
Ransom (1996) - Full Movie YouTube	'The Beaver' Trailer YouTube	Ransom Trailer HQ (1996) YouTube	Payback Trailer YouTube

See more videos of mel gibson movies

Mel Gibson - Wikipedia, the free encyclopedia

en.wikipedia.org/wiki/Mel_Gibson

Mel Colm-Cille Gerard **Gibson** AO (born January 3, 1956) is an American actor and filmmaker. He is most well known as an action hero, for roles such as Martin Riggs in ...
Early life · Career · Film work · Prospective films · Personal life

Mel Gibson filmography - Wikipedia, the free encyclopedia

Mel Gibson

American Actor



Mel Colm-Cille Gerard Gibson AO is an American actor and filmmaker. He is most well known as an action hero, for roles such as Martin Riggs in the Lethal Weapon buddy cop film series and Max Rockatansky in the first three films in the Ma... +



Wikipedia



IMDb



Facebook

Born: Jan 03, 1956 (age 59) · Peekskill

Height: 5' 10" (1.77 m)

Romance: Oksana Grigorieva · Oksana Pochepa

Spouse: Robyn Moore Gibson (1980 - 2011)

Children: Hannah Gibson (Daughter) · Christian Gibson (Son) · Edward Gibson (Son) · Louis Gibson (Son) · William Gibson (Son) +

Upcoming movies: Hacksaw Ridge

People also search for

See all (10+)



Oksana Grigorieva
Former partner



Sylvester Stallone



Harrison Ford



Arnold Schwarzenegger



Robert Downey Jr.



How old is mariah carey



manning@stanford.edu

Web Images News Shopping Videos More Search tools

About 102,000,000 results (0.55 seconds)

45 years (March 27, 1970)

Mariah Carey, Age



Direct Answer



Madonna 56 years



Nick Cannon Spouse 34 years



Jennifer Lopez 45 years

Feedback

Mariah Carey - Wikipedia, the free encyclopedia

en.wikipedia.org/wiki/Mariah_Carey

Mariah Carey was born on March 27, 1969 or 1970 in Huntington, New York. Her father, Alfred Roy, was of African American and Venezuelan (including Afro-Venezuelan) descent, while her mother, Patricia (Hickey), is of White Irish descent.

Nick Cannon - Tommy Mottola - Albums - Me. I Am Mariah... The Elusive ...

Nick Cannon & Mariah Carey Fighting: Split Caused By ...

hollywoodlife.com/.../nick-cannon-mariah-carey-fightin...

Aug 22, 2014 - Nick Cannon and Mariah Carey announced their separation after six years of marriage, and now HollywoodLife.com has learned EXCLUSIVELY what caused the power couple to split up. Nick Cannon, 33, and Mariah Carey, 44, have separated after six years of marriage, and two beautiful children together.

Mariah Carey - Biography - Music Producer, Film Actress ...

www.biography.com/people/mariah-carey-9542177

Mariah Carey was born March 27, 1970, in Huntington, Long Island, New York, and began taking voice lessons at age four. At 18 she signed with Columbia ...

Mariah Carey Divorce Explained: Nick Cannon Cheating ...

www.celebdirtylaundry.com/.../mariah-carey-divorce-nick-cannon-cheat...

Aug 29, 2014 - Mariah Carey Divorce Explained: Nick Cannon Cheating and Paying For 23-Year Old Mistress Jasmine Sanders and Dancer Brittany Dailey.

Mariah Carey

Structured Data

Singer-songwriter

Listen now

Google Play

Listen with free trial

Spotify

Listen for free

Mariah Carey is an American singer, songwriter, record producer, and occasional actress. She rose to prominence after releasing her self-titled debut studio album Mariah Carey in 1990; it went multiplatinum ...

Born: March 27, 1970 (age 45), Huntington, NY

Height: 5' 9" (1.75 m)

Children: Moroccan Scott Cannon, Monroe Cannon

Spouse: Nick Cannon (m. 2008), Tommy Mottola (m. 1993–1998)

Songs

Without You	1993	Music Box
Hero	1993	Music Box
I Want to Know Wh...	2009	Memoirs of an I...
I'll Be There	1990	Mariah Carey
We Belong Together	2005	The Emancipatio...

Albums

View 20+ more





how old is christopher manning



manning@stanford.edu

Web

News

Shopping

Images

Videos

More

Search tools



About 11,000,000 results (0.54 seconds)

48 years (September 18, 1965)

Christopher D. Manning, Age

Feedback

Christopher Manning, Stanford NLP - The Stanford NLP

nlp.stanford.edu/manning/

Mar 1, 2013 - **Chris Manning** works on systems and formalisms that can intelligently process and produce human languages. His research concentrates on ...

Rocchio algorithm - Wikipedia, the free encyclopedia

en.wikipedia.org/wiki/Rocchio_algorithm

From **Wikipedia**, the free encyclopedia **Christopher D. Manning**, Prabhakar Raghavan, Hinrich Schütze: An Introduction to Information Retrieval, page 181.

[Algorithm](#) - [Time complexity](#) - [Usage](#) - [Limitations](#)



how old is Pandu Nayak



manning@stanford.edu

Web

Images

News

Videos

Maps

More

Search tools



About 1,440,000 results (0.42 seconds)

Pandu Nayak

www.pandunayak.com/

About me. I am currently at Google, working on various aspects of Search Quality. I am particularly interested in query understanding and helping users ...

Pandu Nayak | LinkedIn

www.linkedin.com/pub/pandu-nayak/1/ab7/b20

Houston, Texas Area - Engineering Manager, Product Management at FMC Technologies

As a LinkedIn member, you'll join 250 million other professionals **who** are sharing connections, ideas, and opportunities. See **who** you and **Pandu Nayak** know ...

PANDU NAYAK profiles | LinkedIn

www.linkedin.com/pub/dir/PANDU/NAYAK

View the profiles of professionals named **PANDU NAYAK** on LinkedIn. There are 5 professionals named **PANDU NAYAK**, **who** use LinkedIn to exchange ...

Patrick Pantel talk (Then) Current experience

The screenshot shows a Bing search results page for the query "jetbeam rrt-0". The page includes a navigation bar at the top with links for "Web Images Videos Shopping News Maps More | MSN Hotmail", a user profile for "Thomas" with a Facebook icon, and a "Sign out" link. The search bar contains the text "jetbeam rrt-0" and a magnifying glass icon. Below the search bar, there are tabs for "Web", "Videos", and "More". The search results are displayed in a grid format. On the left side, there are "RELATED SEARCHES" including "JETBeam RRT 0 Review", "JETBeam Flashlights", "JETBeam RRT-0 R5", "JETBeam Raptor", "JETBeam M1X", "JETBeam RRT-0 R5", and "240 Lumens". Below these are "SEARCH HISTORY" options: "Search more to see your history", "See all", and "Clear all · Turn off". The main search results area shows "ALL RESULTS" and "1-10 of 6,600 results · Advanced". The first result is titled "JETBeam RRT-0 R5 with Infinite Ramping LED Flashlight ..." and includes a snippet: "Going Gear JETBeam RRT-0 R5 with Infinite Ramping LED Flashlight [jetbeamrrt0r5] - The popular RRT-0 has been updated to be an even more versatile flashlight, ... goinggear.com/index.php?main_page=product_info&cPath=14_22&products_id=438 · Mark as spam". The second result is titled "Jetbeam RRT-0" and includes a snippet: "Now In Stock! Model: RRT-0 (S2) Specially designed for Military, Law Enforcement, Self-defense, Hunting, Search & Rescue and General Outdoors The Rapid ... www.jetbeamusa.com/products/RRT%2d0.html · Mark as spam". The third result is titled "JETBeam RRT-0 Overview With Lots of Pictures" and includes a snippet: "I got my JETBeam RRT-0 Raptor today. All I can say is to JETBeam! This thing is a ... PICTURES QUICKLY.... BEFORE MY HEAD EXPLODES!!! Ok... it didnt ... 323 replies since November 2009 www.candlepowerforums.com/vb/showthread.php?248375-JETBeam-RRT-0-Overview-With-Lots-of... · Mark as spam". The fourth result is titled "JETBeam Flashlights" and includes a snippet: "Specification: Model: JETBeam RRT-0(R2) Flashlight; Specially designed for Military, Law Enforcement, Self-defense, Hunting, Search & Rescue and Outdoorsman jetbeamblog.com · Mark as spam".

Desired experience: Towards actions

Recognize
entity in query

Actions easily
accessible

Web Images Videos Shopping News Maps More | MSN Hotmail

Thomas Sign out Rewards

bing MS Beta

jetbeam rrt-0

Web Videos More ▾

ENTITY

ALL RESULTS 1-10 of 6,600 results · [Advanced](#)

JETBeam RRT-0 Flashlight (Product)

JETBeam RRT-0 R5 with Infinite Ramping LED Flashlight ...
 Going Gear JETBeam RRT-0 R5 with Infinite Ramping LED Flashlight [jetbeamrrt0r5] - The popular RRT-0 has been updated to be an even more versatile flashlight, ...
goinggear.com/index.php?main_page=product_info&cPath=14_22&products_id=438 · Mark as spam

Jetbeam RRT-0
 Now In Stock! Model: RRT-0 (S2) Specially designed for Military, Law Enforcement, arch & Rescue and General Outdoors The Rapid ...
[Amazon.com](#) · [CandlePowerForums](#) · [Epinions.com](#) · [FlashlightReviews.com](#) · [review With Lots of Pictures](#)
 more ... 323 replies since November 2009
www.candlepowerforums.com/vb/showthread.php?248375-JETBeam-RRT-0-Overview-With-Lots-of-... · Mark as spam

RELATED SEARCHES

[JETBeam RRT 0 Review](#)
[JETBeam Flashlights](#)
[JETBeam Flashlights](#)
 Specification: Model: JETBeam RRT-0(R2) Flashlight; Specially designed for Military, Law Enforcement, Self-defense, Hunting, Search & Rescue and Outdoorsman
jetbeamblog.com · Mark as spam

ACTIONS

[Read Reviews](#)

[Watch Demo Video](#)

[Product Comparisons](#)

[Social Discounts](#)

[Find Locally](#)

[Buy Online](#)

[Price Predictions](#)

Politician

Recognize entity in query

Actions easily accessible

The screenshot shows a Bing search results page for the query "Obama". At the top, there are navigation links for "Web Images Videos Shopping News Maps More | MSN Hotmail" and user account information "Thomas f Sign out Rewards". The Bing logo with "MS Beta" is on the left. The search bar contains "Obama" and a magnifying glass icon. Below the search bar are tabs for "Web", "Visual Search", "News", "Images", "Videos", and "More".

The main results area is titled "ENTITY" and "ALL RESULTS" with "1-10 of 511,000 results - Advanced". On the left, there is a portrait of Barack Obama with the text "Barack Obama (President)".

On the right, the first result is an advertisement for the "Official Obama Website" with the URL "www.BarackObama.com" and the text "Respect. Empower. Include. Win. Join Barack Obama's campaign now." Below this are "Other ideas: obama barack bio - president obama website".

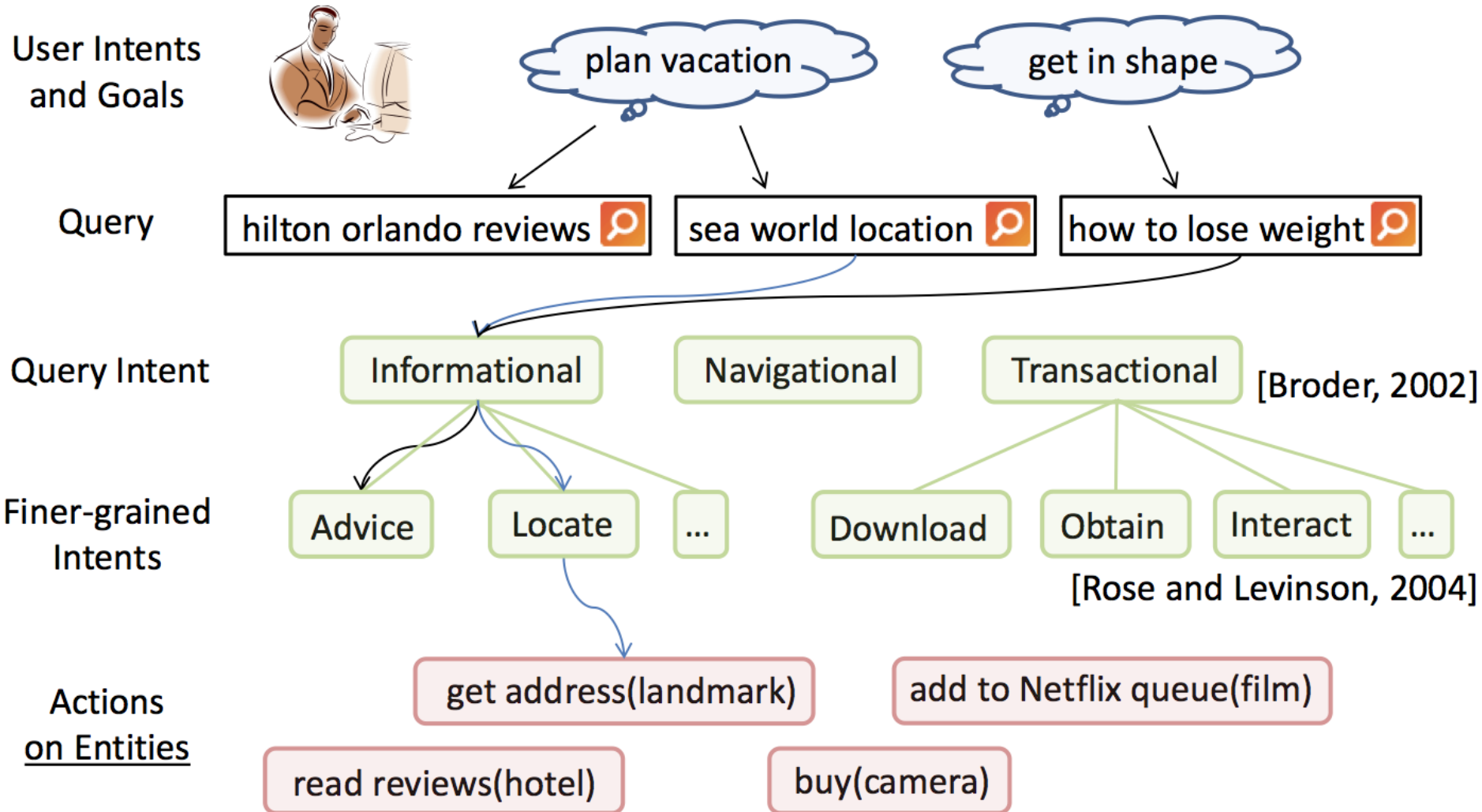
The second result is "Obama for America | 2012" with the text "Barackobama.com is the official re-election campaign website of President Barack Obama. Visit the site for the latest updates from the Obama campaign, 2012 election news ..." and the URL "www.barackobama.com - Mark as spam". Below this is a social media snippet showing "Ronojoy Chakrabarti and Caroline Mackey like Barack Obama".

The third result is "Barack Obama - Wikipedia, the free encyclopedia" with a snippet: "career - Legislative career ... - Presidential campaigns in Obama II (born August 4, 1961) is the 44th and current President of ... ates. He is the first African American to hold the office. Obama ... org/wiki/Obama - Mark as spam".

Below the main results is an "ACTIONS" section with links: "Watch Weekly Address", "Follow Social Updates", "Read Biography", "View Approval Ratings", and "Support Candidacy". A social media menu is open, showing icons for Facebook, Twitter, LinkedIn, MySpace, and "more ...".

At the bottom, there is a "RELATED SEARCHES" section with the text "k Obama and other U.S. politicians by office, state, and branch of government".

Actions vs. Intents



Learning actions from web usage logs

- Three months of us-en web logs
- Annotate with Freebase entities
- Keep queries with an entity in set of 21 types
- Filter out navigational queries
- Filter out clicked hosts that weren't clicked at least 100 times

2,164,579
(query, host) pairs
over 3 months

235,385 entities

21 types

129,088 contexts

58,123 hosts

get reviews



Orlando hotel reviews

read biography

Does Hope Solo have a boyfriend?

download software

Free Winzip download

watch shows online

watch family guy online

The screenshot shows a Bing search results page for the query "hannah montana". The browser address bar shows "http://www.bing.com/ser... hannah montana - Bing". The search bar contains "hannah montana". The page displays various search results, including a top result for "Hannah Montana Forever | Disney Channel" with a description: "Explore the Hannah Montana Forever home page for videos, full-length episodes, character bios, games, photos, downloads, music, and more!". A red callout box highlights two bullet points: "A hodgepodge of related strings" and "Only actionable through search". Other results include "Miley Cyrus Angry With Dad Over Hannah Montana Slur" and "Hannah Montana - Wikipedia, the free encyclopedia". The right sidebar features sponsored sites like "Hannah Montana Forever" and "Hannah Montana Items".

- A hodgepodge of related strings
- Only actionable through search



NASHVILLE, Tenn. (AP) — Billy Ray Cyrus says the Disney TV show "Hannah Montana" destroyed his family, causing his divorce and sending daughter Miley Cyrus spinning out of... [Yahoo Finance](#) · 10 hours ago

[Miley Cyrus Angry With Dad Over Hannah Montana Slur](#) [Entertainmentwise](#)
 Popservations: Lady Gaga at the Grammys, HBO shows and [Hannah Montana](#) [Florida Times-Union](#)

[Hannah Montana - Wikipedia, the free encyclopedia](#)

[Production](#) · [Cast](#) · [Episodes](#) · [Films](#)
Hannah Montana is an American television series, which debuted on March 24, 2006 on Disney Channel, and also airs Saturday mornings on ABC as part of the ABC Kids block.
en.wikipedia.org/wiki/Hannah_montana · [Mark as spam](#)

[Character Bios | Hannah Montana Forever | Disney Channel](#)

Meet Miley, Lilly, Oliver, Rico, and the rest of the gang from Disney Channel's **Hannah Montana Forever!**
tv.disney.go.com/disneychannel/hannahmontana/characters/index.html · [Mark as spam](#)

[Make Bing your homepage](#)

Sponsored sites
[Hannah Montana Forever](#)
 Pre-Order The Final Season Ultimate Fan Experience. Free Charm Set!
www.DisneyShoppingCart.com/Hannah

[Watch TV Shows at Bing™](#)
 Browse Video Clips and Popular Episodes at Bing Today!
bing.com/videos

[Hannah Montana](#)
 Free Shipping \$50 on 100,000 Items Shop **Hannah** etc. Online at Target.
www.Target.com

[Hannah Montana Items](#)
 We Have The **Hannah Montana** Items To Complete Any Fans Collection!
 Hannah-Montana.
BradfordExchange.com

[From Hannah Montana](#)
 Compare Choices and Prices. Everything You Want and Need!
Shopzilla.com

[See your message here](#)

[Internal preview](#) [Help improve Bing](#)

http://www.bing.com/search?q=hannah montana - Bing

Web Images Videos Shopping News Maps More | MSN Hotmail Sign in Redmond, Washington Preferences

bing MS Beta br1011 hannah montana

Web Videos News TV Shopping Images More

ALL RESULTS 1-10 of 14,500,000 results · [Advanced](#)

RELATED PRODUCTS

- Girl Talk Game ★★★★★
- Hannah Montana Doll ★★★★★
- Kids Rock Guitar ★★★★★

RELATED PEOPLE

- Billy Ray Cyrus
- Aaron Kelly

RELATED MUSIC

- Miley Cyrus: Soundtrack 2009
- Taylor Swift: Our Song 2010

RELATED VIDEOS

- Miley Cyrus Performs At Idol

Hannah Montana Forever | Disney Channel
 Explore the **Hannah Montana** Forever home page for videos, full-length episodes, character bios, games, photos, downloads, music, and more!
tv.disney.go.com/disneychannel/hannahmontana · [Mark as spam](#)

Hannah Montana Games	Sonny With A Chance
Disney Channel	TV Shows
Games	Phineas & Ferb
Good Luck Charlie	Fish Hooks

[Show more results from tv.disney.go.com](#)

Entertainment News: hannah montana

- Billy Ray Cyrus: 'Hannah Montana' destroyed family
 NASHVILLE, Tenn. (AP) -- Billy Ray Cyrus says the Disney TV show "Hannah Montana" destroyed his family, causing his divorce and sending daughter Miley Cyrus spinning out of... [Yahoo Finance](#) · 10 hours ago
- Miley Cyrus Angry With Dad Over Hannah Montana Slur [Entertainmentwise](#)
- [Popservations: Lady Gaga at the Grammys, HBO shows and Hannah Montana](#)
[Florida Times-Union](#)

Hannah Montana - Wikipedia, the free encyclopedia
 Production · Cast · Episodes · Films
Hannah Montana is an American television series, which debuted on March 24, 2006 on Disney Channel, and also airs Saturday mornings on ABC as part of the [â](http://en.wikipedia.org/wiki/Hannah_montana)
en.wikipedia.org/wiki/Hannah_montana · [Mark as spam](#)

Character Bios | Hannah Montana Forever | Disney Channel
 Meet Miley, Lilly, Oliver, Rico, and the rest of the gang from Disney Channel's **Hannah Montana Forever!**
tv.disney.go.com/disneychannel/hannahmontana/characters/index.html · [Mark as spam](#)

Sponsored sites

- Watch TV Shows at Bing**
 Browse Video Clips and Popular Episodes at Bing Today!
bing.com/videos
- Hannah Montana**
 Free Shipping \$50 on 100,000 Items Shop **Hannah** etc. Online at Target.
www.Target.com
- Hannah Montana Items**
 We Have The **Hannah Montana** Items To Complete Any Fans Collection!
Hannah-Montana.BradfordExchange.com
- From Hannah Montana**
 Compare Choices and Prices. Everything You Want and Need!
Shopzilla.com
- Hannah Montana Wigs**
 15,000 Costumes - All Sizes & Styles. Low Prices & Same Day Shipping!
www.BuyCostumes.com
[See your message here](#)

Internal preview Help improve Bing

Web Images Videos Shopping News Maps More | MSN Hotmail

Sign in Redmond, Washington Preferences



RELATED PRODUCTS

- Girl Talk Game
- Hannah Montana Doll
- Kids Rock Guitar

RELATED PEOPLE

- Billy Ray Cyrus
- Aaron Kelly

RELATED MUSIC

- Miley Cyrus Soundtrack 2009
- Taylor Swift Our Song 2010

RELATED VIDEOS

- Miley Cyrus Performs At Idol

Shopping results for 'Hannah Montana Girl Talk Game' on Bing. The main product is priced at \$8.25. The description says: 'Grab your girlfriends and take center stage in this fun, interactive game! Spin the wheel to answer a question, tell a secret or perform a silly skit just like the Hannah Montana would do. Ask each other fun questions and see what you know about the Hannah... more...'

Show more results from tv.disney.go.com

Facebook profile for Billy Ray Cyrus. The profile shows a cover photo, a profile picture, and a bio: 'Billy Ray Cyrus (BillyRay Cyrus) is a singer, actor, and songwriter from Nashville, Tennessee.' There are also sections for 'About and Entertainment', 'Friends', and 'Recent Activity'.

en.wikipedia.org/wiki/Hannah_montana · Mark as spam

[Character Bios | Hannah Montana Forever | Disney Channel](#)

Meet Miley, Lilly, Oliver, Rico, and the rest of the gang from Disney Channel's Hannah Montana Forever!

tv.disney.go.com/disneychannel/hannahmontana/characters/index.html · Mark as spam

Big Wins

- Typed relations
- User Interface accesses structured data
- Click through experience can now leverage strongly-typed identifier

... says the Disney TV show "Hannah Montana" is ending his divorce and sending daughter Miley Cyrus to live in the mountains for 10 hours ago

[Hannah Montana Slur](#) Entertainmentwise
[Hannah Montana](#) Mys, HBO shows and [Hannah Montana](#)

[Encyclopedia](#)

... which debuted on March 24, 2006 on Disney Channel as part of the 'a'

[Montana.BradfordExchange.com](#)

[From Hannah Montana](#)
Compare Choices and Prices. Everything You Want and Need!
[Shopzilla.com](#)

[Hannah Montana Wigs](#)
15,000 Costumes - All Sizes & Styles. Low Prices & Same Day Shipping!
[www.BuyCostumes.com](#)

[See your message here](#)

The screenshot shows a Bing search results page for the query "hannah montana". The browser address bar shows "http://www.bing.com/search?q=hannah montana". The search results are categorized into several sections: "RELATED PRODUCTS", "RELATED PEOPLE", "RELATED MUSIC", and "RELATED VIDEOS".

RELATED PRODUCTS: Includes "Girl Talk Game" (with an "Add to Amazon cart" annotation), "Hannah Montana Doll", and "Kids Rock Guitar".

RELATED PEOPLE: Includes "Billy Ray Cyrus" (with a "Connect on Twitter" annotation) and "Aaron Kelly".

RELATED MUSIC: Includes "Miley Cyrus: Soundtrack" (with a "Play track" annotation) and "Taylor Swift: Our Song".

RELATED VIDEOS: Includes "Miley Cyrus Performs At Idol".

The main search results include a link to "Hannah Montana Forever | Disney Channel" and a Wikipedia entry for "Hannah Montana".

Annotations: Green arrows point from callouts to specific items: "Add to Amazon cart" points to the Girl Talk Game, "Connect on Twitter" points to Billy Ray Cyrus, and "Play track" points to Miley Cyrus: Soundtrack.

Callout Box: A green box titled "Big Wins" contains a bulleted list:

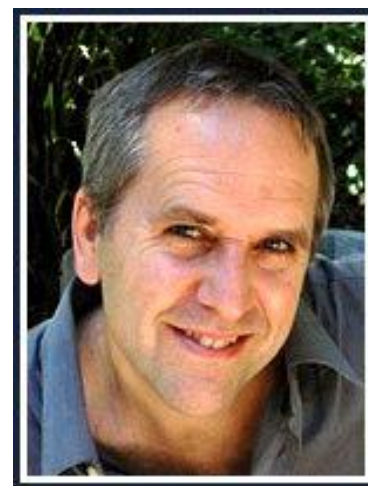
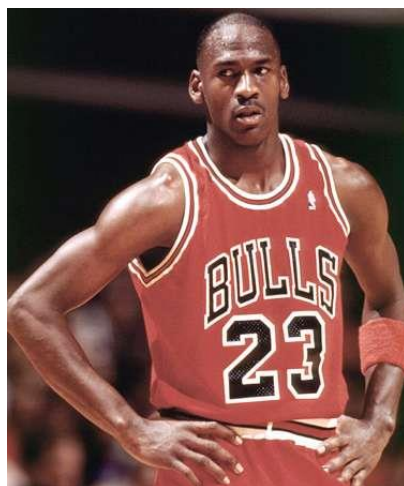
- Typed relations
- User Interface accesses structured data
- Click through experience can now leverage strongly-typed identifier
- **Brokered Actions (one click conversions)**

Right Side Ads: Includes "Montana.BradfordExchange.com", "From Hannah Montana" (Shopzilla.com), and "Hannah Montana Wigs" (BuyCostumes.com).

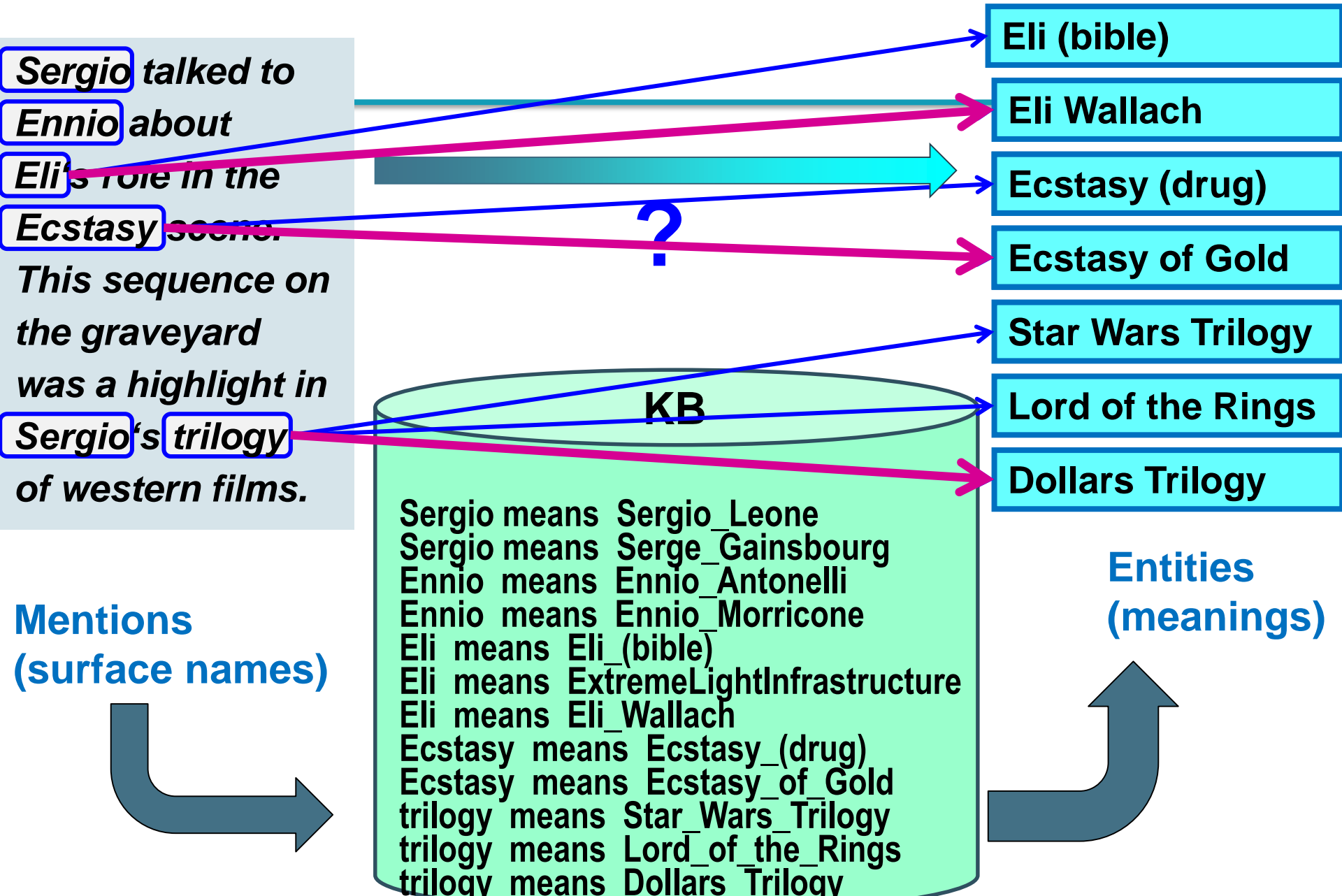
Footer: "Internal preview" and "Help improve Bing".

Entity disambiguation and linking

- Key requirement is that entities get identified
 - Named entity recognition (e.g., Stanford NER!)
- and disambiguated
 - Entity linking (or sometimes “Wikification”)
 - e.g., Michael Jordan the basketballer or the ML guy



Mentions, Meanings, Mappings [G. Weikum]

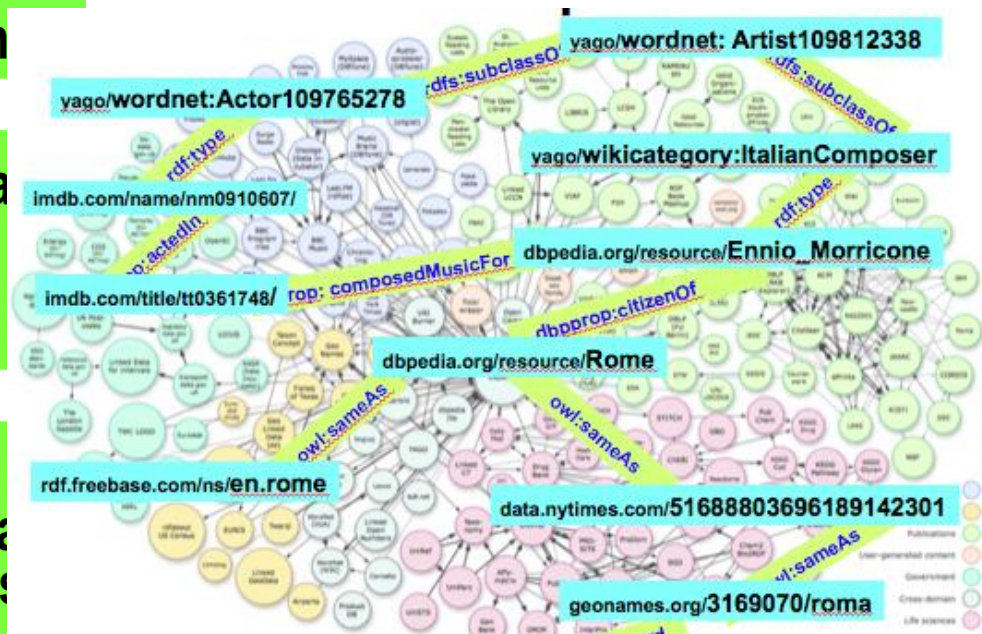


- and linked to a canonical reference
 - Freebase, dbPedia, Yago2, (WordNet)

http://.../wiki/Dollars_Triology
http://.../wiki/The_Good_the_Bad,
http://.../wiki/Clint_Eastwood
http://.../wiki/Honorary_Academ







http://.../wiki/The_Good_the_Ba
<http://.../wiki/Metallica>
[http://.../wiki/Bellagio_\(casino\)](http://.../wiki/Bellagio_(casino))
http://.../wiki/Ennio_Morricone

http://.../wiki/Sergio_Leone
http://.../wiki/The_Good_the_Ba
http://.../wiki/For_a_Few_Dollars
http://.../wiki/Ennio_Morricone





Facebook Graph Search

Search for people, places and things

-  My friends
-  Photos of my friends
-  Restaurants nearby
-  Games my friends play
-  Music my friends like
-  Photos I have liked

places

-  Cities visited by my family
-  Restaurants in **San Francisco, California**
-  Indian restaurants liked by my friends from **India**
-  Tourist attractions in **Italy** visited by my friends
-  Restaurants in **New York** liked by Chefs
-  Countries my friends have visited

Facebook interface showing music recommendations and social search/QR overlay.

Navigation bar: f Music I may like Christopher Home

Section: Get more music recommendations from your friends
255 of your friends can recommend music for you
[?] Select Friends to Ask

Item 1: **Johnny Cash** ✓
Musician/Band
Released *June Carter and Johnny Cash: Duets, American VI: Ain't No...*
12,512,930 like this
People also like **Bob Dylan**, **June Carter Cash** and other musicians
Serafim Batzoglou, Sef Kloninger and 6 other friends like this
[Like] [...]

Item 2: **Hank Williams Jr.** ✓
Musician/Band
Released *Whiskey Bent and Hell Bound, Three Hanks: Men with Brok...*
2,561,252 like this
People also like **The Charlie Daniels Band**, **George Jones - The Possu...**
Jenny Finkel likes this
[Like] [...]

Item 3: **Moby** ✓
Musician/Band
Released *Ambient, Last Night (Moby album)* and 25 other albums
2,432,329 like this
People also like **Everything but the Girl**, **Massive Attack** and other mu...
Serafim Batzoglou likes this
[Like] [...]

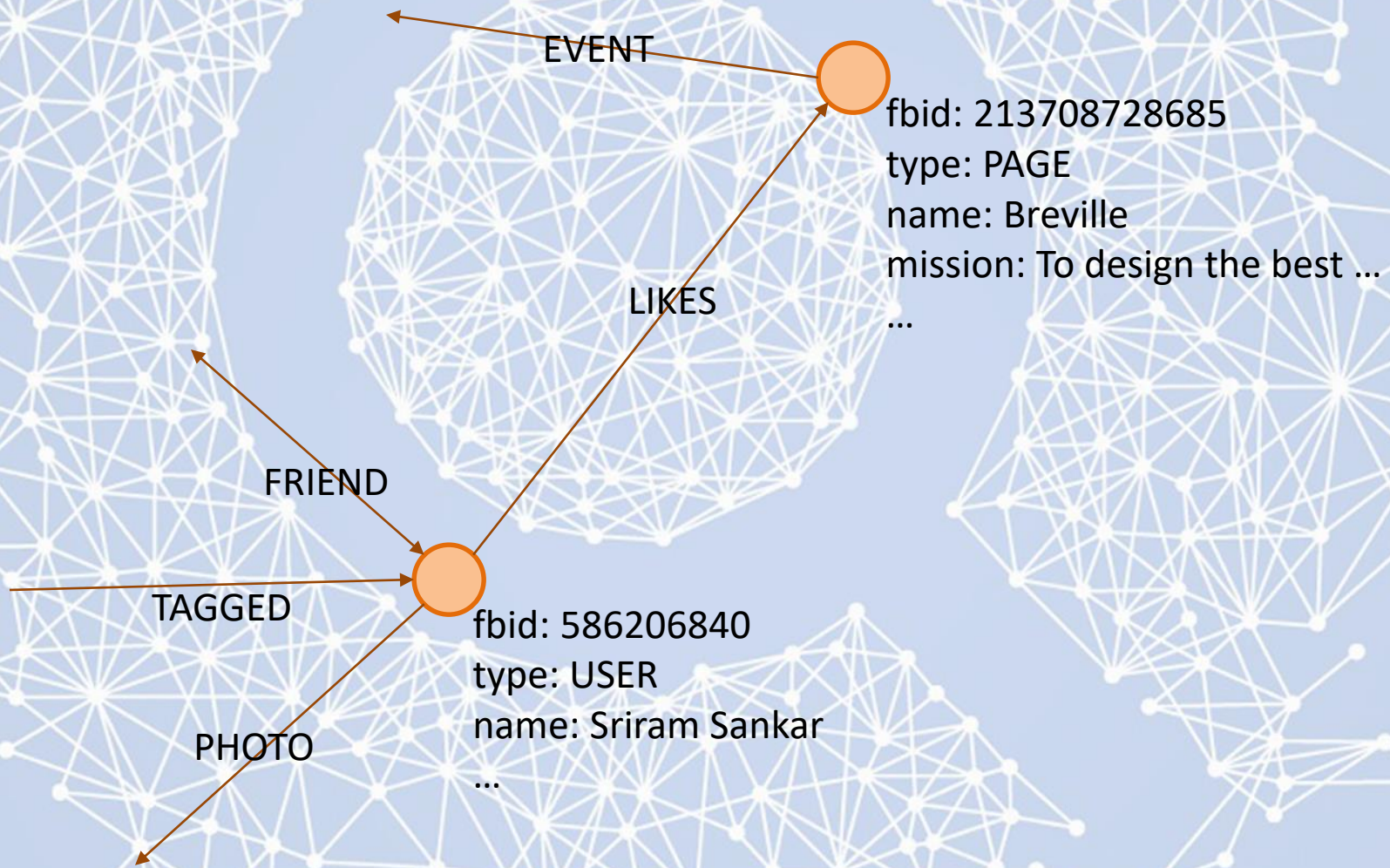
Item 4: **Robyn Adele Anderson**
Musician/Band
People also like **Scott Bradlee**, **Puddles Pity Party** and other musicians
28,633 like this
Eleni Miltsakaki likes this

Overlay: Social search/QR
More
Recommended for [Me] [Add]
Give Feedback

The Facebook Graph

- Collection of entities and their relationships
- Entities (users, pages, photos, etc.) are *nodes*
- Relationships (friendship, checkins, tagging, etc.) are *edges*
- Nodes and edges have metadata
- Nodes have a unique id – the *fbid*

Facebook Graph Snippet



- Sriram Sankar
- News Feed
- Messages
- Search Team 1
- Search Quality and ...
- Events 18
- Search Managers
- Posts Search 1
- Search Infra Team 3
- See More...
- Xiao Li 1h
- Ganesh Ramanaray... 1d
- Rajat Raina 1h
- Scott Chen
- Mohit Talwar
- Ching-Chih Brian Weng
- MORE FRIENDS - 43
- Abhinav Sharma
- Aditya Agarwal
- Ariel Evnine
- Niranjan Nagar is listening to Blurred Lines on Rdio.
- Chat

- People named "chris manning" who work at **Stanford University** · 450 Serra Mall, Stanford, California 94305 · 524,838 like this
- People named "chris manning" who go to **Stanford University** · 450 Serra Mall, Stanford, California 94305 · 524,838 like this
- People named "chris manning" who live in **Stanford, California** · City · 3,674 like this
- People named "chris manning" from **Stanford, California** · City · 3,674 like this
- People named "chris manning" who live in **Stanford, Kentucky** · City · 1,286 like this
- People named "chris manning" who graduated from **Stanford University** · 450 Serra Mall, Stanford, California 94305 · 524,838 like this
- People named "chris manning" who work at **Stanford University in Palo Alto, California** · City · 46,973 like this
- chris manning stanford
Web Search

SEE MORE



Like Comment Share

our software engineering job.

Like 82 people like Artemis Internet.

Look Who's In Walmart Now
You won't believe who we found shopping in Walmart. Click to see for yourself.

Now store more, free.
evault.com
Try a better business backup and recovery solution and 100GB of free cloud storage.

764 ms



Julia Szabo

Bronx, New York

Friends with **Simon Firth** since October 2008 · Simon has been friends w...
Lives in **Bronx, New York**
Read **The Great Gatsby, Shelby's Grace - The Book and The Twisted T...**
1 mutual friend: **Simon Firth**

[Add Friend](#) [Message](#) [...](#)



Sharon Marcus

Professor at Columbia University in the City of New York

Friends with **Simon Firth** since December 2011 · Simon has been friends...
Lives in **New York, New York** · From **Forest Hills, New York**
Went to **Jamaica High School**
1 mutual friend: **Simon Firth**

[Add Friend](#) [Follow](#) [Message](#) [...](#)



Irina Rish

Research at IBM

Friends with **Peter Norvig** and other friends
Lives in **Rye Brook, New York**
Studied Applied Mathematics at **Gubkin Russian State University of Oil ...**
4 mutual friends including **Yann LeCun** and **Andrew Ng**

[Add Friend](#) [Message](#) [...](#)



Gunnar Rättsch

New York, New York

Friends with **Koby Crammer** and other friends
Lives in **New York, New York** · From **Neuruppin**
Listens to **Reinald Grebe**
4 mutual friends including **Yann LeCun** and **Jeff Bilmes**

[Add Friend](#) [Message](#) [...](#)



Jim Hendler

Works at Rensselaer Polytechnic Institute (RPI)

Friends with **Andrew McCallum** and other friends
Lives in **Albany, New York**
Studied at **Brown University**
21 mutual friends including **Yann LeCun** and **Graeme Hirst**

[Add Friend](#) [Message](#) [...](#)



New York

135,119 like this

[Like](#)

State

New York is a state in the Northeastern and Mid-Atlantic regions of the United States. New York is the 27th-most extensi...

[see more](#)

www.ny.gov

More Than 1,000 People

[Share](#)

Gender [Add...](#)

Relationship [Add...](#)

Employer [Add...](#)

Lives in [New York](#)

Hometown [Add...](#)

School [Add...](#)

Friendship [My friends of friends](#) [Adk](#)

Name [Add...](#)

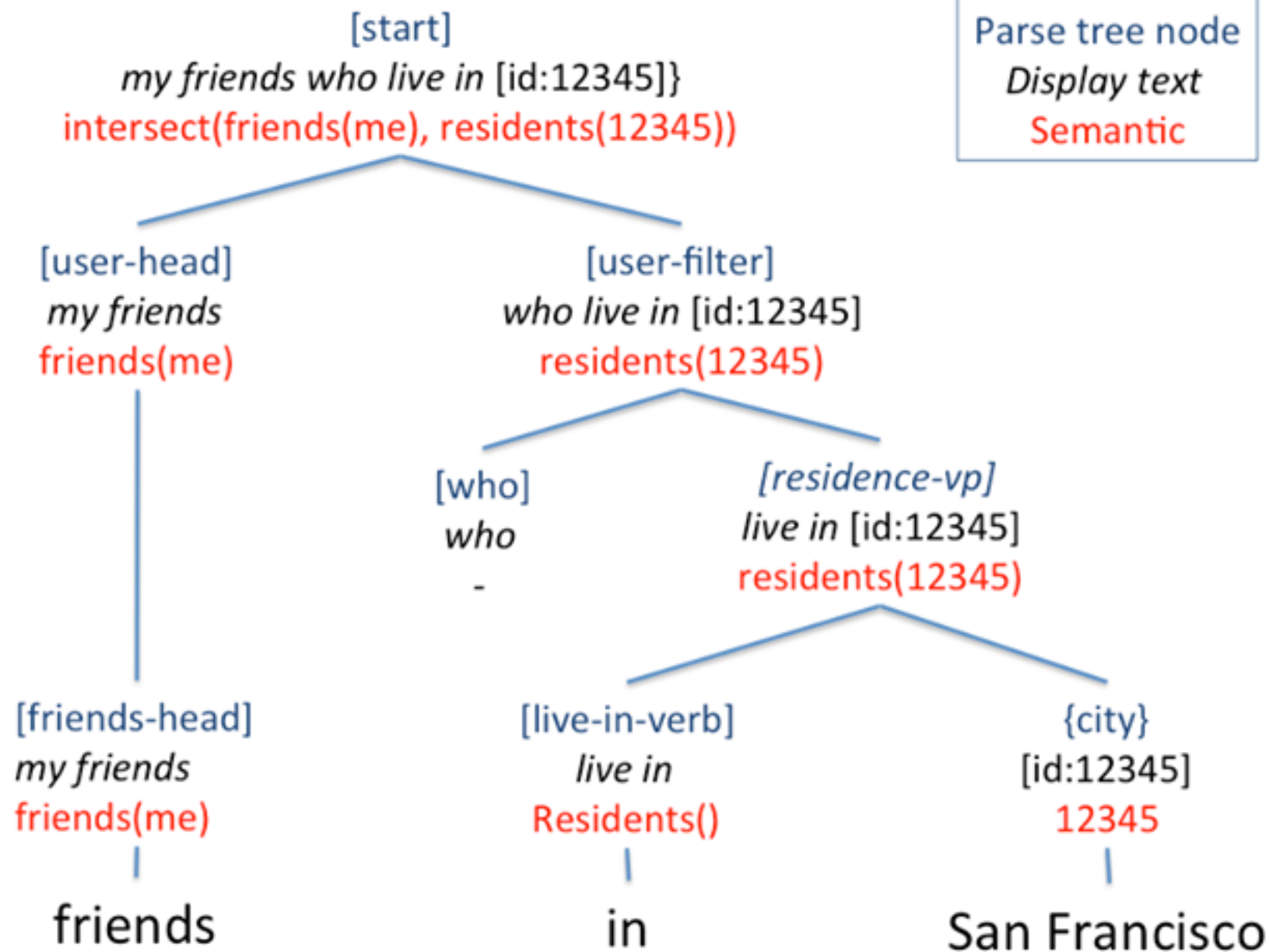
[SEE MORE FILTERS](#)

[Give Feedback](#)

[Chat \(8\)](#)

Facebook Graph Search

- Uses a weighted context free grammar (WCFG) to represent the Graph Search query language:
- [start] => [users] \$1
- [users] => my friend friends(me)
- [users] => friends of [users] friends(\$1)
- [users] => {user} \$1
- [start] => [photos] \$1
- [photos] => photos of [users] photos(\$1)
- A terminal symbol can be an entity, e.g., {user}, {city}, {employer}, {group}; it can also be a word/phrase, e.g., friends, live in, work at, members, etc. A parse tree is produced by starting from [start] and expanding the production rules until it reaches terminal symbols.



The parse tree, semantic and entity ID used in the above example are for illustration only; they do not represent real information used in Graph Search Beta

Browser window showing a Google search for "third prime minister of australia".

Search results for "third prime minister of australia":

- About 34,400,000 results (0.34 seconds)
- Chris Watson**
The 3rd Prime Minister of Australia
- 
- Chris Watson**
Former Prime Minister of Australia
- John Christian Watson, commonly known as Chris Watson, was a Chilean Australian politician who served as the third Prime Minister of Australia. [Wikipedia](#)
- Born:** April 9, 1867, Valparaíso, Chile
- Died:** November 18, 1941, Sydney, Australia
- Party:** Australian Labor Party
- Previous offices:** Member of the Australian Parliament (1906–1910), [More](#)
- People also search for [View 10+](#)
- [Chris Watson - Wikipedia, the free encyclopedia](#)
en.wikipedia.org/wiki/Chris_Watson - Wikipedia
- 3rd Prime Minister of Australia** ... He was the first prime minister from the Australian Labour Party, and the first prime minister from the labour movement in the ...
- Early life - Union activities and colonial ... - Federation - Prime Minister in 1904
- [List of Prime Ministers of Australia - Wikipedia, the free ...](#)

Taskbar: Socher-MVRNN-D12-....pdf, MarcPPT.pptx, Larry-Emmott-Social....pptx, Show All

The image shows a browser window displaying a Google search for "australia's third prime minister". The search bar contains the query, and the results show three entries, all from Wikipedia. The first entry is for "Chris Watson", the second is for "List of Prime Ministers of Australia by time in office", and the third is for "List of Prime Ministers of Australia". The browser's taskbar at the bottom shows three open files: "Socher-MVRNN-D12-....pdf", "MarcPPT.pptx", and "Larry-Emmott-Social....pptx".

https://www.google.com/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=australia's+third+pri...

Google australia's third prime minister

Web News Images Videos Shopping More Search tools

About 2,550,000 results (0.41 seconds)

Chris Watson - Wikipedia, the free encyclopedia
en.wikipedia.org/wiki/Chris_Watson - Wikipedia
3rd Prime Minister of Australia ... He was the first **prime minister** from the **Australian** Labour Party, and the first **prime minister** from the labour movement in the ...
Early life - Union activities and colonial ... - Federation - Prime Minister in 1904

List of Prime Ministers of Australia by time in office - Wikipe...
en.wikipedia.org/.../List_of_Prime_Ministers_of_Australia_by... - Wikipedia
This is a list of **Prime Ministers** of **Australia** by time in office. The basis of ... Rank:
No: **Prime Minister**: Portrait: Party: District: Assumed Office **3rd**, Chris Watson

List of Prime Ministers of Australia - Wikipedia, the free ...
en.wikipedia.org/wiki/List_of_Prime_Ministers_of_Australia - Wikipedia
Below is a list of **Prime Ministers** of the Commonwealth of **Australia**. The parties shown are those to which ... 17 February 1917, 9 February 1923, —, **3rd** Hughes.
Edmund Barton - Protectionist Party - Longest serving Prime Ministers

Socher-MVRNN-D12-....pdf MarcPPT.pptx Larry-Emmott-Social....pptx Show All

Google search for "australia's 3rd prime minister". The search bar shows the query and the user's email address, manning@stanford.edu. The search results show approximately 712,000 results in 0.50 seconds. A table snippet is displayed, showing the 24th entry: 3rd Prime Minister, Chris Watson (1867-1941), Labor Party, Bland, NSW (1901-1906). Below the table snippet, there are search results for "List of Prime Ministers of Australia by time in office - Wikipedia" and "Chris Watson - Wikipedia, the free encyclopedia". The bottom of the image shows a taskbar with open files: Socher-MVRNN-D12-....pdf, MarcPPT.pptx, and Larry-Emmott-Social....pptx.

Search results for "australia's 3rd prime minister":

24.	3rd	Chris Watson (1867-1941)	Labor	Bland, NSW (1901-1906)
-----	-----	-----------------------------	-------	---------------------------

36 more rows, 5 more columns

[List of Prime Ministers of Australia by time in office - Wikipedia](#)
en.wikipedia.org/.../List_of_Prime_Ministers_of_Australia_by_ti... Wikipedia ▾

[Chris Watson - Wikipedia, the free encyclopedia](#)
en.wikipedia.org/wiki/Chris_Watson ▾ Wikipedia ▾
3rd Prime Minister of Australia ... He was the first **prime minister** from the **Australian Labour Party**, and the first **prime minister** from the labour movement in the ...
Early life - Union activities and colonial ... - Federation - Prime Minister in 1904

[List of Prime Ministers of Australia by time in office - Wikipe](#)

3 approaches to question answering: Knowledge-based approaches (Siri)

- Build a semantic representation of the query
 - Times, dates, locations, entities, numeric quantities
- Map from this semantics to query structured data or resources
 - Geospatial databases
 - Ontologies (Wikipedia infoboxes, dbPedia, WordNet, Yago)
 - Restaurant review sources and reservation services
 - Scientific databases
 - Wolfram Alpha

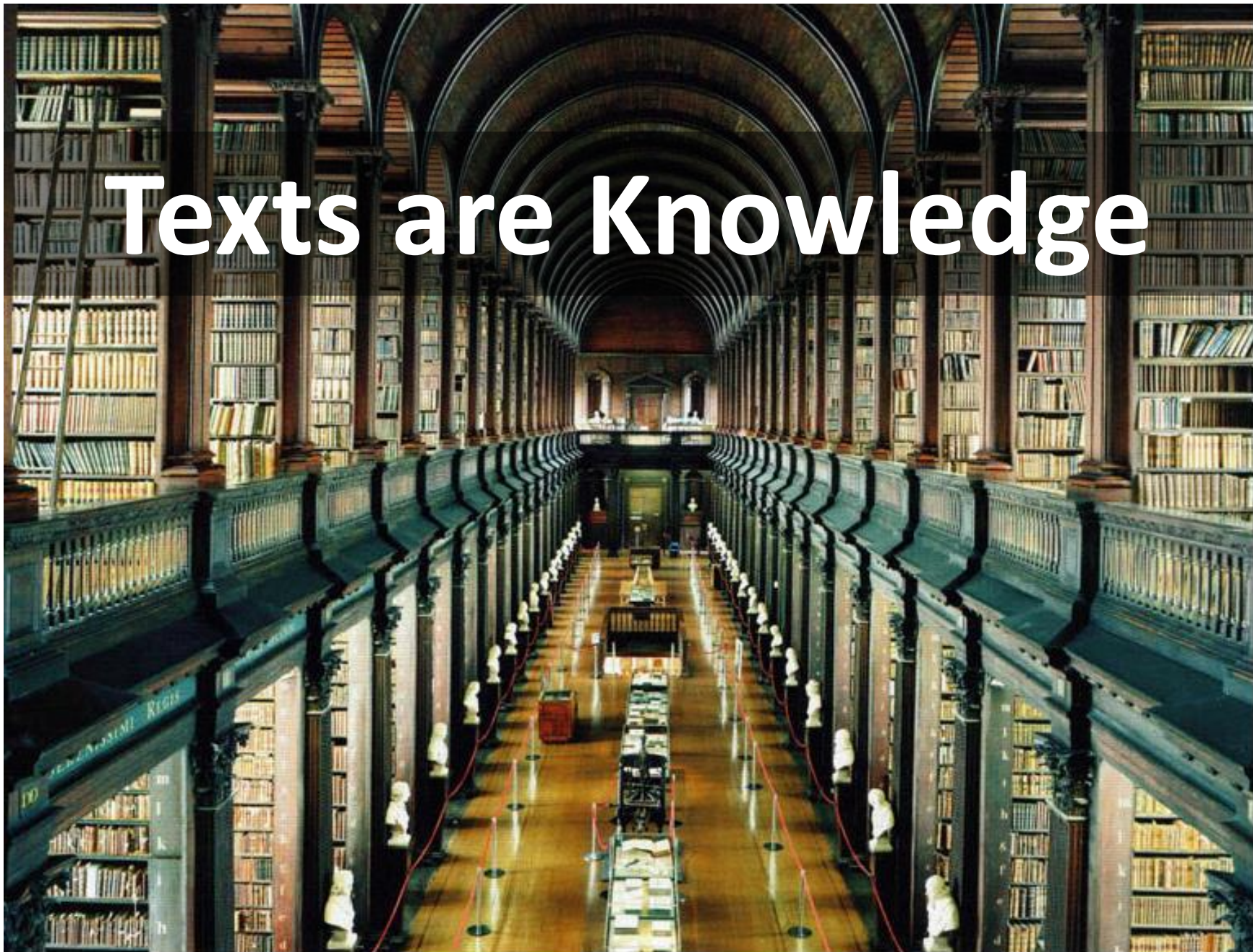
Text-based (mainly factoid) QA

- QUESTION PROCESSING
 - Detect question type, answer type, focus, relations
 - Formulate queries to send to a search engine
- PASSAGE RETRIEVAL
 - Retrieve ranked documents
 - Break into suitable passages and rerank
- ANSWER PROCESSING
 - Extract candidate answers (as named entities)
 - Rank candidates
 - using evidence from relations in the text and external sources

Hybrid approaches (IBM Watson)

- Build a shallow semantic representation of the query
- Generate answer candidates using IR methods
 - Augmented with ontologies and semi-structured data
- Score each candidate using richer knowledge sources
 - Geospatial databases
 - Temporal reasoning
 - Taxonomical classification

Texts are Knowledge

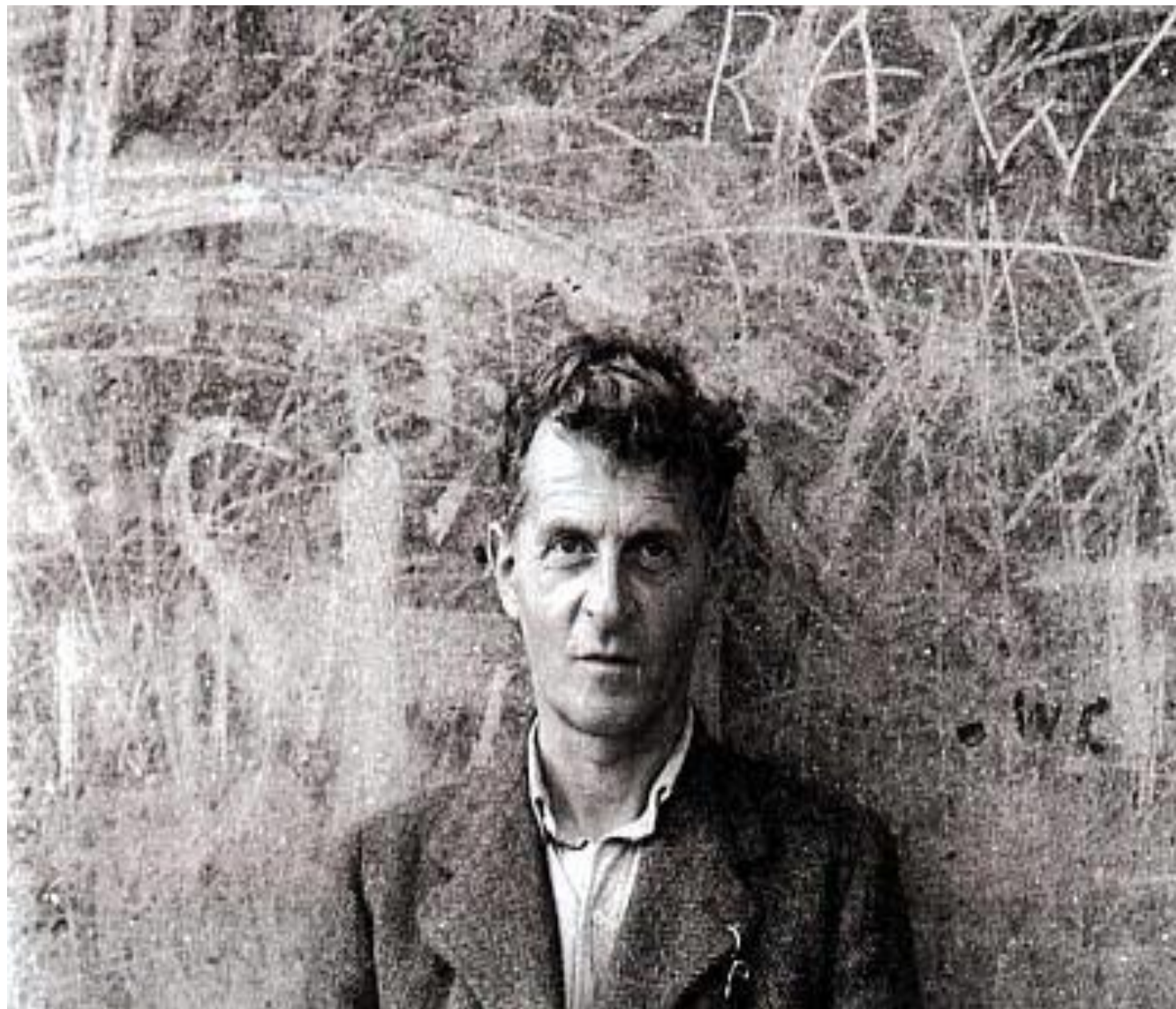


Knowledge: Jeremy Zawodny sez ...



Is the goal to go from language to knowledge bases?

- For humans, going from the largely unstructured language on the web to actionable information is effortlessly easy
 - But for computers, it's rather **difficult!**
 - This has suggested to many that if we're going to produce the next generation of intelligent agents, which can make decisions on our behalf
 - Answering our routine email
 - Booking our next trip to Fiji
- then we still first need to construct **knowledge bases**
- To go *from languages to information*





Knowledge: Not just semantics but pragmatics

Pragmatics = taking account of context in determining meaning

Search engines are great because they inherently take into account pragmatics (“associations and contexts”)

- [the national] → The National (a band)
- [the national ohio] → The National - Bloodbuzz Ohio – YouTube
- [the national broadband] → www.broadband.gov



Inference directly in text: Natural Logic

(van Benthem 2008, MacCartney & Manning 2009)

Q *Who is Beyoncé Knowles's husband?*

Q' *Beyoncé Knowles's husband is X.*

A *Beyoncé's marriage to rapper Jay-Z and portrayal of Etta James in Cadillac Records (2008) influenced her third album I Am... Sasha Fierce (2008).*



Task – Answer Sentence Selection

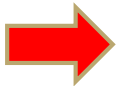
- Given a factoid question, find the sentence that
 - Contains the answer
 - Can sufficiently support the answer

Q: Who won the best actor Oscar in 1973?

S₁: Jack Lemmon was awarded the Best Actor Oscar for Save the Tiger (1973).

S₂: Academy award winner Kevin Spacey said that Jack Lemmon is remembered as always making time for others.

Who won the best actor Oscar in 1973?



Lemmon was awarded the [Best Supporting Actor Oscar](#) in 1956 for [Mister Roberts](#) (1955) and the [Best Actor Oscar](#) for [Save the Tiger](#) (1973), becoming the first actor to achieve this rare double...

Source: *Jack Lemmon* -- Wikipedia

Jack Lemmon



www.imdb.com

John Uhler "Jack" Lemmon III was an American actor and musician. He starred in more than 60 films including Som... +
en.wikipedia.org

[Jack Lemmon](#) - Wikipedia, the free encyclopedia

Who won the best actor Oscar in 1973?



American actor and musician. He starred in more than 60 films including ...

[Jack Lemmon - IMDb](#)

www.imdb.com/name/nm0000493



Born Feb 08, 1925 · Died Jun 27, 2001 · [News](#) · [341 photos](#) · [Biography](#)
Actor: [The Apartment](#) (1960) · [Some Like It Hot](#) (1959) · [Glengarry Glen Ross](#) (1992) · [Grumpy Old Men](#) (1993). **Jack Lemmon's** father was the ...

Spouse: [Felicja Farr](#) (1962 - 2001) · [Cynthia Stone](#) (1950 - 1956)

Children: [Chris Lemmon](#) · [Courtney Lemmon](#)

Buried: [Westwood Village Memorial Park Cemetery](#)

Awards: [Academy Award for Actor in a Leading Role](#) +

[Images of jack lemmon](#)

bing.com/images



Word Alignment for Question Answering

TREC QA (1999-2005)

What is the fastest car in the world?

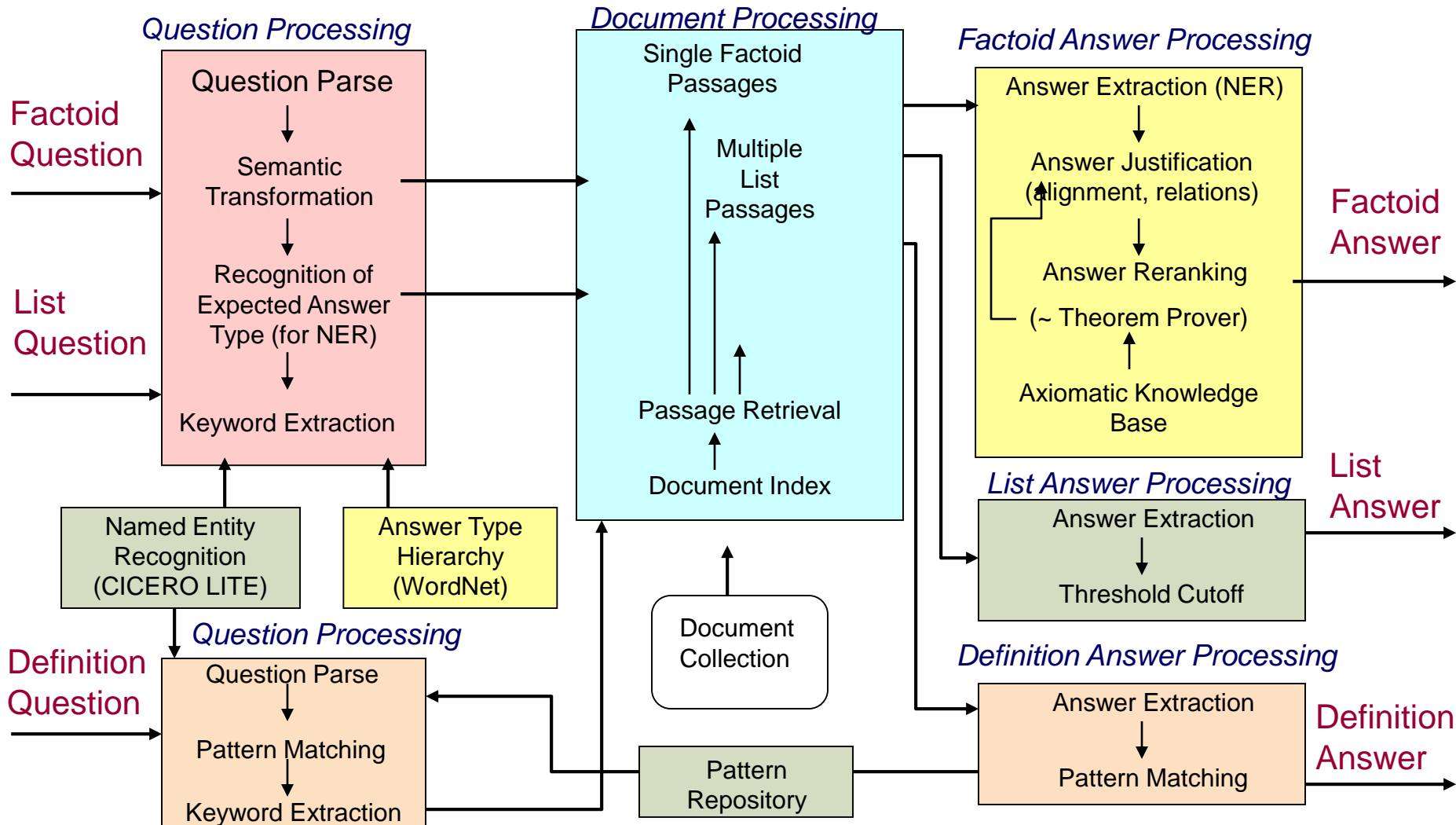
The Jaguar XJ220 is the dearest, fastest and most sought after car on the planet.

[Harabagiu & Moldovan, 2001]

- Assume that there is an underlying alignment
 - Describes which words in Q and A can be associated
- See if the (syntactic/semantic) relations support the answer

Full NLP QA: LCC (Harabagiu/Moldovan)

[below is the architecture of LCC's QA system circa 2003]



Thanks

everyone! 😊

