

Lecture 1

Intelligent Systems Introduction

COMP 474/6741, Winter 2022

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René Witte
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and Software Engineering
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IN 60 SECONDS...

1
NEW
DEFINITION
IS ADDED ON
URband

1,600+
READS ON
Scribd.

13,000+ HOURS
MUSIC
STREAMING ON
PANDORA

12,000+
NEW ADS
POSTED ON
craigslist

370,000+ MINUTES
VOICE CALLS ON
skype

98,000+
TWEETS



20,000+
NEW
POSTS ON
tumblr.



320+
NEW
twitter
ACCOUNTS



100+
NEW
Linked in
ACCOUNTS



13,000+
iPhone
APPLICATIONS
DOWNLOADED



QUESTIONS
ASKED ON THE
INTERNET...



600+
NEW
VIDEOS



25+ HOURS
TOTAL
DURATION

60+
NEW
BLOGS

168 MILLION
EMAILS ARE SENT

694,445
SEARCH
QUERIES

1,700+
Firefox
DOWNLOADS

695,000+
facebook.
STATUS UPDATES



125+
PLUGIN
DOWNLOADS



1,500+
BLOG
POSTS

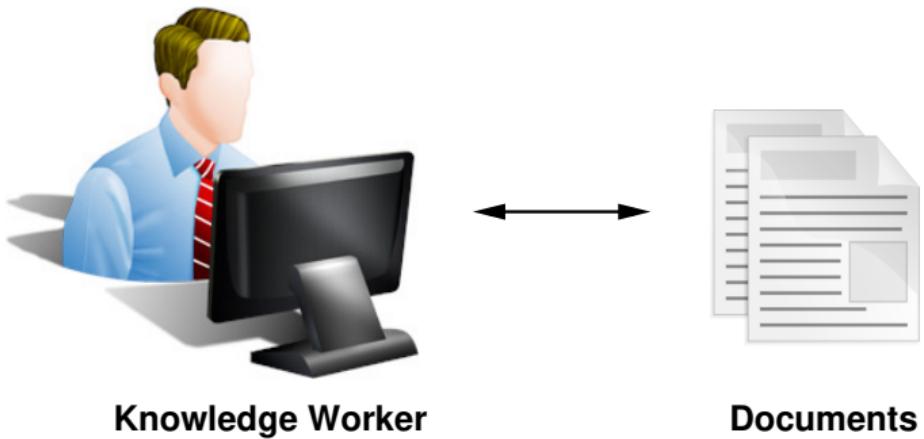


79,364
WALL
POSTS

6,600+
NEW
PICTURES ARE
UPLOADED ON
flickr



50+
WORDPRESS
DOWNLOADS



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Reading

Towards Intelligent Systems

- Text Mining
- Knowledge Graphs
- Personalization
- Recommender Systems
- Intelligent Agents



Baseline Technology

Full-text search engine (Information Retrieval)

- Apache Lucene, Solr, Elastic Search, ...

Task I

Please find all documents and sentences mentioning “Steve Jobs”

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Baseline Technology

Full-text search engine (Information Retrieval)

- Apache Lucene, Solr, Elastic Search, ...

Task I

Please find all documents and sentences mentioning “Steve Jobs”

Task II

Please find all *Persons* mentioned in our documents

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Full-text search engine (Information Retrieval)

- Apache Lucene, Solr, Elastic Search, ...

Task I

Please find all documents and sentences mentioning “Steve Jobs”

Task II

Please find all *Persons* mentioned in our documents

What you need

Requires **Information Extraction (IE)** – an example for a **Text Mining** task

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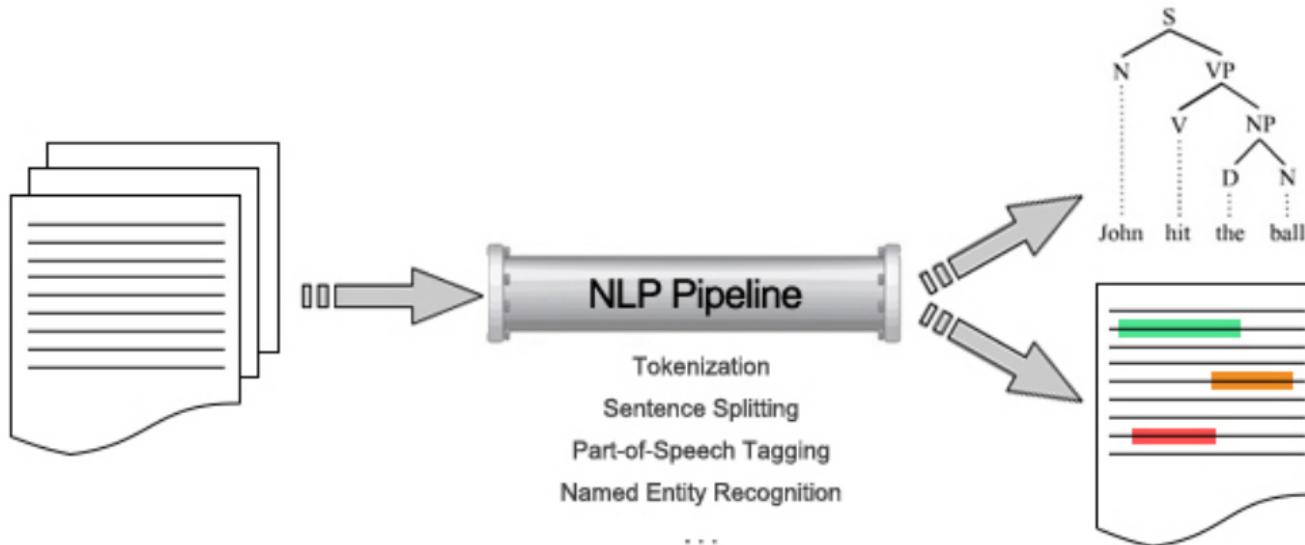
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Definition

A branch of Artificial Intelligence (AI) that uses various techniques to process content written in a natural language, e.g., English or French.



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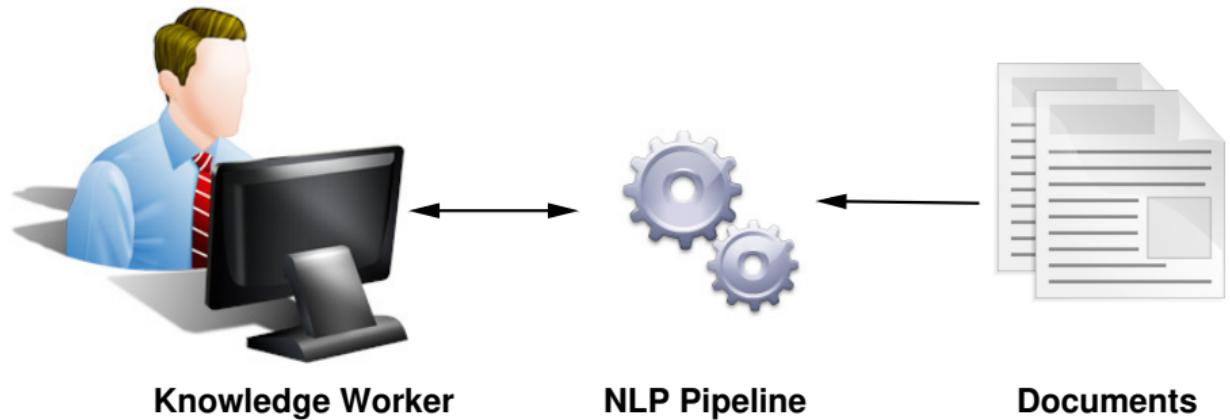
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- NLP tools (e.g., UIMA, GATE)
- SaaS (e.g., Amazon Comprehend, Refinitiv)



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BBC News - Egypt crisis: Clashes in Cairo amid constitution row

Egypt crisis: Clashes in Cairo amid constitution row

Rival protesters have clashed outside the presidential palace in the Egyptian capital, Cairo, as unrest grows over a controversial draft constitution.

Stones were thrown and supporters of President Mohamed Morsi dismantled tents set up by anti-Morsi protesters.

Vice President Mahmoud Mekki has said a referendum on the draft will go ahead on 15 December despite the unrest.

But he indicated that changes could be made after the vote, saying the "door for dialogue" remained open.

He urged critics of the draft document to put their concerns in writing for future discussion.

The critics say the draft was rushed through parliament without proper consultation and that it does not do enough to protect political and religious freedoms and the rights of women.

The draft added to the anger generated by Mr Morsi passing a decree in late November which granted him wide-ranging new powers.

'Breakthrough'

Egyptian Vice-President 'Door open'

In a news conference broadcast live on state television, Mr Mekki said there was "real political will to pass the current period and respond to the demands of the public"

<input type="checkbox"/>	Address
<input checked="" type="checkbox"/>	Date
<input type="checkbox"/>	FirstPerson
<input checked="" type="checkbox"/>	JobTitle
<input checked="" type="checkbox"/>	Location
<input type="checkbox"/>	Lookup
<input checked="" type="checkbox"/>	Organization
<input type="checkbox"/>	Percent
<input checked="" type="checkbox"/>	Person
<input type="checkbox"/>	Sentence
<input type="checkbox"/>	SpaceToken
<input type="checkbox"/>	Split
<input type="checkbox"/>	Title

Named Entity Recognition (Information Extraction)

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NLP Pipeline

- Sequence of components
- Custom or off-the-shelf
- Rule-based and/or Machine Learning

Selected Processing resources		
!	Name	Type
●	Document Reset PR	Document Reset PR
●	ANNIE English Tokeniser	ANNIE English Tokeniser
●	ANNIE Gazetteer	ANNIE Gazetteer
●	ANNIE Sentence Splitter	ANNIE Sentence Splitter
●	ANNIE POS Tagger	ANNIE POS Tagger
●	NE ANNIE NE Transducer	ANNIE NE Transducer
●	ANNIE OrthoMatcher	ANNIE OrthoMatcher

Context

Later that month, Senate Minority Leader Chuck Schumer offered Trump upwards of

Lookup



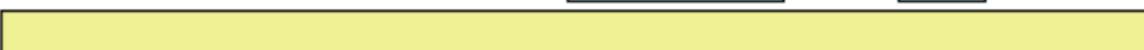
Organization



Person



Sentence



Token



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TEXT ANALYTICS SERVICE

Intelligent Tagging

Making data smarter: using natural language processing, text analytics, and data-mining technologies, Intelligent Tagging turns large amounts of unstructured data into precise advantage.

[Request product details](#)

Intelligent Tagging enables quicker and smarter search of information that is important and relevant to your business

[Overview](#) [Features & benefits](#) [Deployment options](#) [Find out more](#)

Why choose Intelligent Tagging?

Intelligent Tagging uses natural language processing, text analytics and data-mining technologies to **derive meaning from vast amounts of unstructured content**. It's the fastest, easiest and most accurate way to tag the people, places, facts and events in your data, and then assign financial topics and themes to increase your content's value, accessibility and interoperability.

Connecting your data consistently with Intelligent Tagging helps you to **search smarter, personalize content recommendations and generate alpha**.

Intelligent Tagging supports a comprehensive list of metadata types in English. Non-English is supported in a few key concepts (for example, company extraction) in Chinese, Japanese, German,

USEFUL LINKS

[Live demo](#) [Developer support](#) [Developer documentation](#) [Intelligent Tagging fact sheet](#) [Intelligent Tagging for research](#) 

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EU Focus

EU Policy Areas

Agriculture and Rural Development

Better Regulation, Inter-Institutional Relations, the Rule of Law and the Charter of Fundamental Rights

Budget and Human Resources

Climate Action and Energy

Competition

Digital Economy and Society

Economic and Financial Affairs, Taxation and Customs

Education, Culture, Youth and Sport

Environment, Maritime Affairs and Fisheries

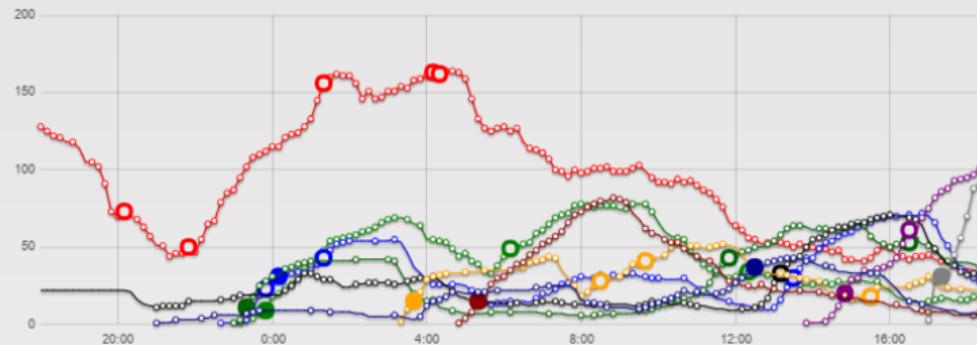
EU Foreign Affairs and Security Policy

DG Neighbourhood and Enlargement Negotiations

Financial Stability, Financial

Biggest 10 Stories Over Last 24h

Language: en Period: Nov 6, 2018 12:20 AM - Nov 7, 2018 12:20 AM



Oil prices drop over one percent on Iran sanctions waivers

Articles : 1527 | Last update : Nov 6, 2018 11:22:00 PM | Start : Nov 4, 2018 10:53:00 PM | Sources : 352

Oil market cautious as US punitive sanctions on Iran become effective

mercopress Tuesday, November 6, 2018 10:03:00 PM CET | [info \[other\]](#)

Oil prices were mixed on Monday after a steep five-day fall, as the United States formally imposed punitive sanctions on Iran but granted eight countries temporary waivers allowing them to keep buying oil from the Islamic Republic. The sanctions are part of U.S....

[More articles...](#)

Facebook blocks 115 accounts ahead of US midterm elections

Articles : 211 | Last update : Nov 7, 2018 12:18:00 AM | Start : Nov 6, 2018 5:12:00 AM | Sources : 165

Facebook blocks 115 accounts ahead of US midterm elections

ohio Tuesday, November 6, 2018 9:00:00 PM CET | [info \[other\]](#)

Facebook, Twitter and other companies have been fighting misinformation and election meddling on their services for the past two years. LONDON Facebook said it blocked 115 accounts for suspected "coordinated inauthentic behavior" linked to foreign groups attempting to interfere in Tuesday's U.S. midterm elections....

Tools

Wednesday, November 7, 2018
12:48:00 AM CET

[RSS | MAP](#)

[Facebook](#)

[manage](#)

[info](#)



Languages

Select top stories in other languages.

ar	bg	cs	da	de	el
en	es	et	fi	fr	hr
hu	it	lt	lv	mt	nl
pl	pt	ro	ru	sk	sl
sv	sw	tr	zh		

[Show additional languages](#)

Interface: en - English

Legend [+](#)

Country Watch

The country most in the news at the moment.



Main Menu

[News Summary](#)
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News language and date

Language or country:

en - English

Date:

No  2018 

Mo	Tu	We	Th	Fr	Sa	Su
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Analysis over time

Timeline

Timeline [en] for 11/2018

50

Angela Merkel

Information about this person was last updated on Monday, January 23, 2017.

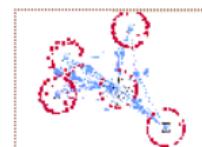
Names  Key Titles and Phrases  External resources  Explore Relations 

Angela Merkel (Eu,vi)
 Frau Merkel (da,tr)
 Ахнена Меркель (bg,tg)
 Ангела Меркель (cv,ru)
 آنجله میکل (ar)
 آنجله مکل (fa)
 Angela Merkel (es,pt)
 Ângela Merkel (es,pt)
 Angel Merkel (da,sv)
 Chancellor Merkel (en,sv)
 Angela Merkel (da,sw)
 Angela Merckel (da,sl)
 Angela Dorothea Merkel (da,sw)
 Niemiec Angela Merkel (pl)
 Angelika Merkel (de)
 Angelas Merkel (da,sv)
 آنجله میکل (ar)
 Angela Merken (da,de)
 Angela Dorothea Kasner (en,tr)
 Niemiec Angela Merkel (pl)
 Angela Márkál (cs)

bundeskanzlerin (de - 11387)
 kanzlerin (de - 3579)
 german chancellor (en - 1584)
 kanzlerkandidatin (de - 1419)
 chancelière allemande (fr - 1269)
 chanceler alemã (pt - 907)
 chefin (de - 1402)
 chancelière (fr - 651)
 chancellor (de,en - 820)
 duitse bondsksanselier (nl - 483)
 deutsche bundeskanzlerin (de - 269)
 bondsksanselier (nl - 303)
 tedesco (it - 441)
 herausforderin (de - 197)
 vorsitzende (de - 428)
 - bundeskanzlerin (de - 83)
 chanceler (pt - 190)
 deutsche kanzlerin (de - 72)
 nuntiushofin (de - 1201)



Image obtained automatically
from Wikipedia
Information about this image.

[Read Wikipedia entry](#)


Related People

François Hollande (867)
 Barack Obama (759)
 Vladimir Putin (675)
 Recep Tayyip Erdogan (656)
 Donald Trump (567)
 Donald Tusk (499)
 Sigmar Gabriel (472)
 Frank-Walter Steinmeier (456)
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Latest Clusters - English

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 [pl]

Marine Le Pen Extols Far Right During Speech in Germany
nytimes 21-JAN-17

Saraki, Mimiko, others for Nigerian Youth Parliament maiden lecture
onlinenigeria 21-JAN-17

Donald Trump takes up the presidential mantle in inauguration speech

Davos 2017: Philip Hammond praises 'scale and depth' of the City after Theresa May says Britain

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Today's Alert Statistics for European Union



Recommender Systems and Collaborative Filtering

René Witte



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[Page You Made](#)

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Rene, Welcome to Your Amazon.ca (If you're not René Witte, [click here](#).)

Today's Recommendations For You

Here's a daily sample of items recommended for you. Click here to [see all recommendations](#).

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 Clean Code: A Handbook of Agile Software Craftsmanship (Paperback) by Robert C. Martin ★★★★★ (7) CDN\$ 39.43 Fix this recommendation	 Why Does E=mc2?: (And Why Should We...) (Paperback) by Brian Cox ★★★★★ (2) CDN\$ 14.44 Fix this recommendation	 How We Decide (Paperback) by Jonah Lehrer ★★★★★ (10) CDN\$ 13.68 Fix this recommendation	 ANSI Common LISP (Paperback) by Paul Graham ★★★★★ (18) CDN\$ 96.95 Fix this recommendation
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SENTIMENT ANALYSIS



Discovering people opinions, emotions and feelings about
a product or service

Example using ‘Amazon Comprehend’

René Witte



Example: In this example, a customer is posting his feedback on a pair of shoes. The API identifies the sentiment expressed by the customer along with a confidence score.

Sample Text: I ordered a small and expected it to fit just right but it was a little bit more like a medium-large. It was great quality. It's a lighter brown than pictured but fairly close. Would be ten times better if it was lined with cotton or wool on the inside.

Sentiment	Score
Mixed	0.89
Positive	0.09
Negative	0.01
Neutral	0.00

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WestJet's compassionate and confused chatbot sends happy customer to suicide prevention site

The last thing a satisfied WestJet customer expected to hear when she sent the company a glowing review...



CBC • 1 day ago



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Biases in Machine Learning Algorithms

October 11, 2018

Amazon Scraps Secret AI Recruiting Engine that Showed Biases Against Women

AI Research scientists at Amazon uncovered biases against women on their recruiting machine learning engine

“Data is the new oil”

Organizations have invaluable knowledge “hidden” in documents:

- Products, inventions, solutions, techniques, experiences, insights, . . .

NLP/Text Mining can unlock this knowledge

What do you need?

- Need business vision to drive adoption
- Technology is mature and foundations are open source
E.g., IBM’s UIMA or University of Sheffield’s GATE

Risks

- Increasing legal and ethical concerns
E.g., *Ethical AI, Responsible AI, Explainable AI*

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Common Issue

- Data in **Information Silos**
Documents, databases,
spreadsheets, emails, ...
- Disconnected, missing knowledge



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Knowledge Integration

- Connect silo-ed knowledge
- Leverage existing, external
Knowledge Bases
- Freely available, many domains
- Continuously updated



WIKIDATA

Main page
Community portal
Project chat
Create a new item
Create a new lexeme
Recent changes
Random item
Query Service
Nearby
Help
Donate

Tools
What links here
Related changes
Special pages
Permanent link
Page information

Item Discussion support vector machine (Q282453)

set of methods for supervised statistical learning
SVM | support vector machines

In more languages

Statements

Instance of algorithm
0 references

subclass of supervised learning
1 reference

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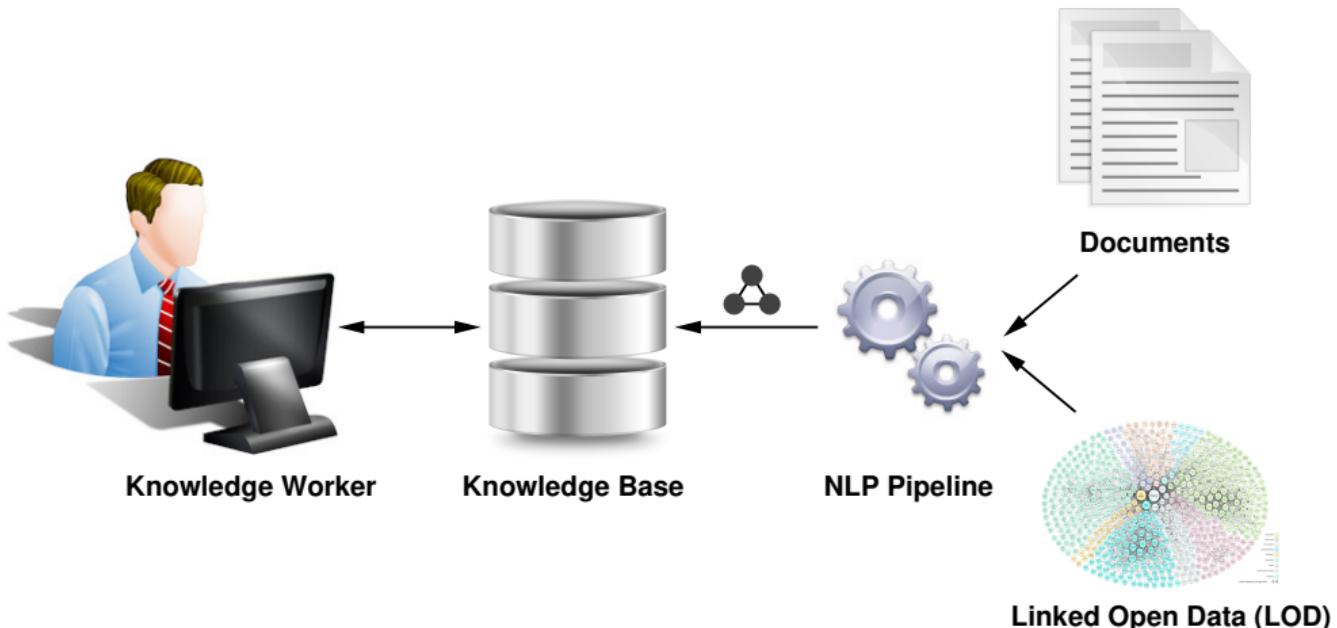
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Architecture 3.0

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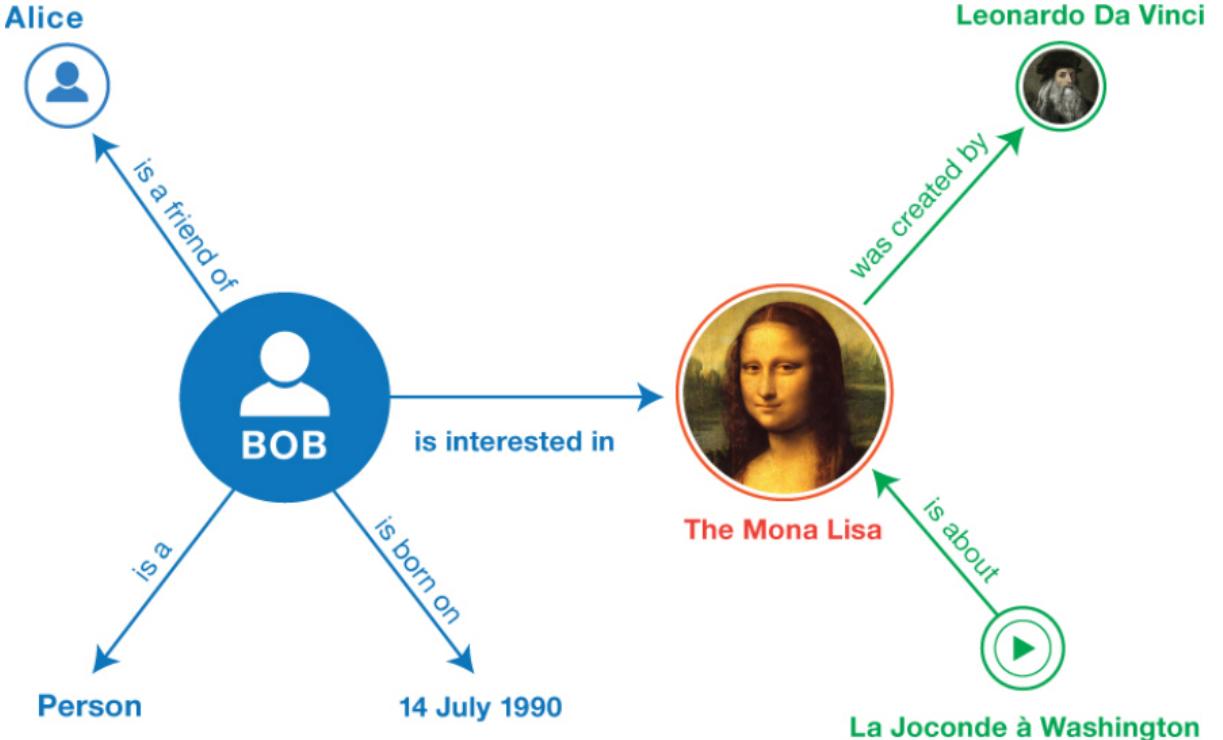
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Knowledge as Graphs

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<https://www.w3.org/TR/rdf11-primer/>

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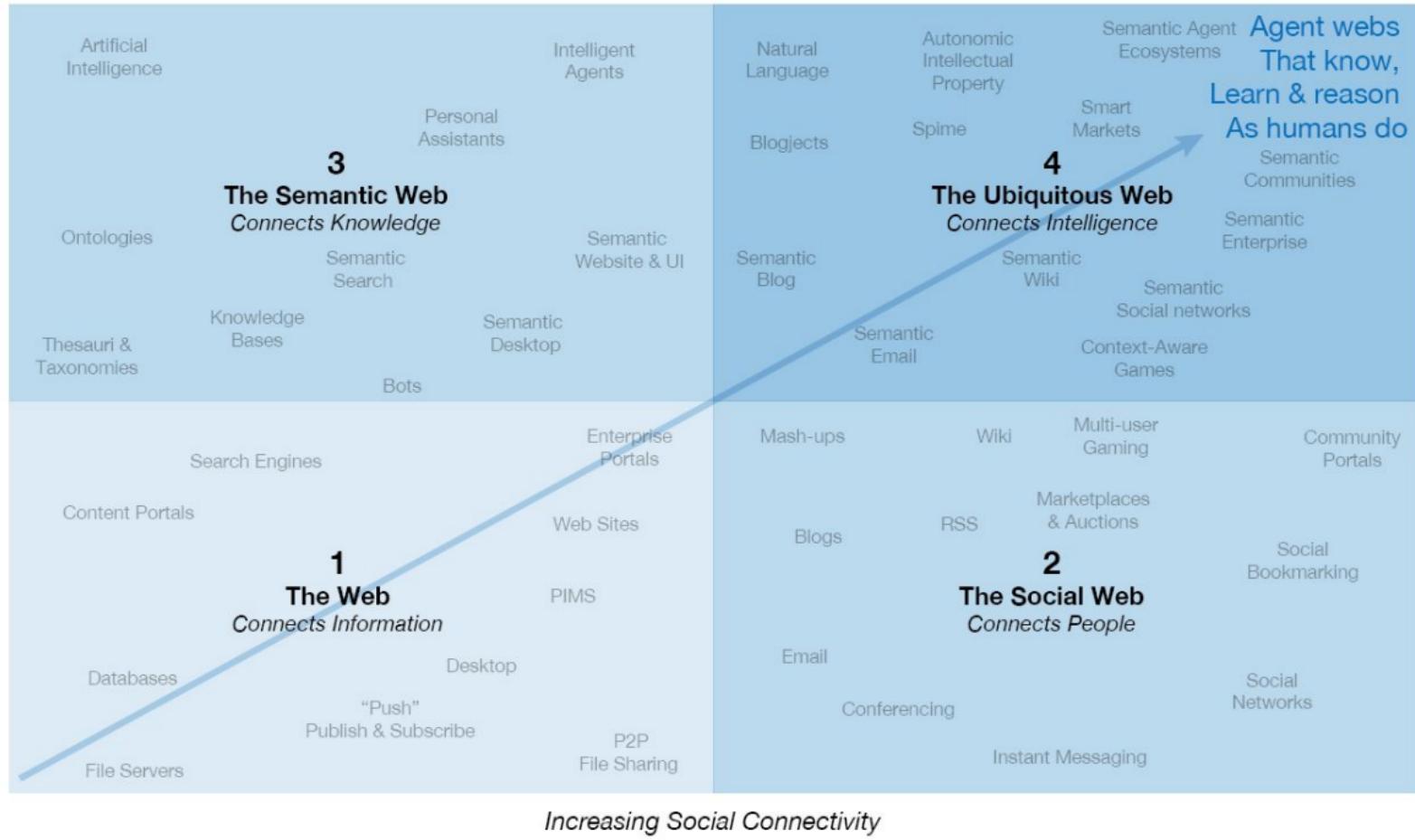
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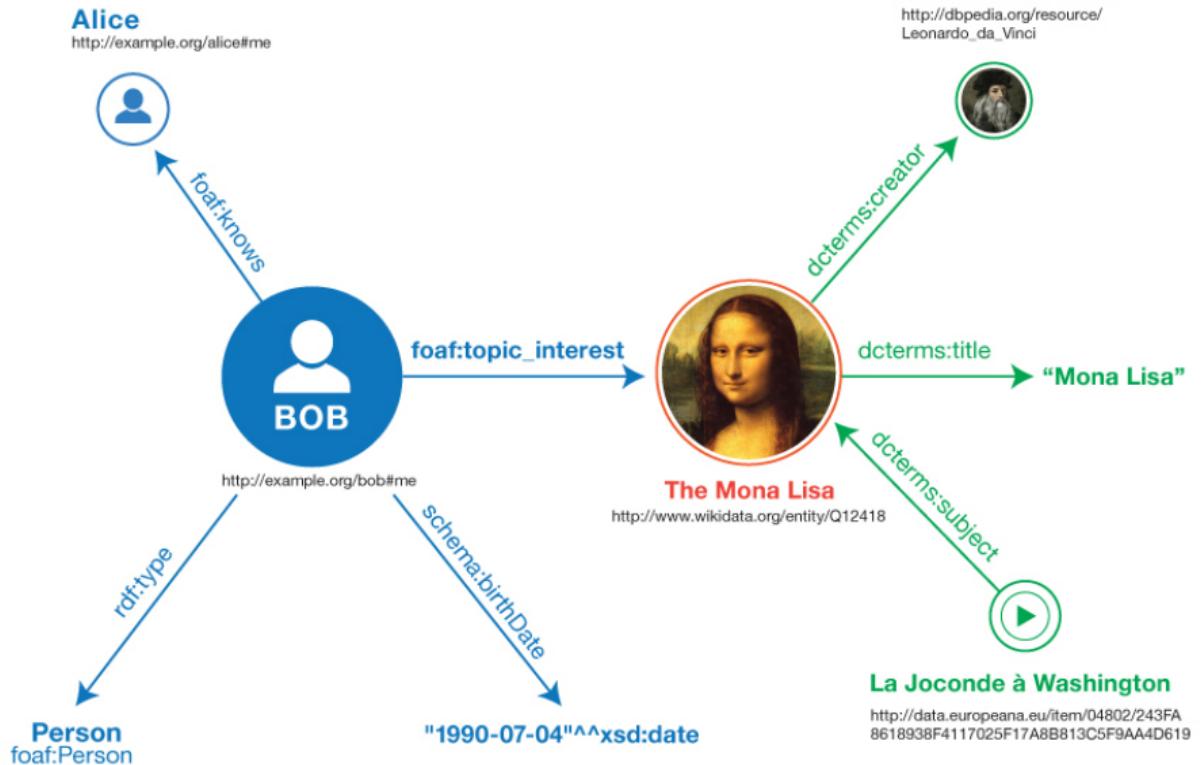
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The ‘Semantic Web’

René Witte



<https://www.w3.org/TR/rdf11-primer/>

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```
BASE <http://example.org/>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema>
PREFIX schema: <http://schema.org/>
PREFIX dcterms: <http://purl.org/dc/terms/>
PREFIX wd: <http://www.wikidata.org/entity/>
```

```
<bob#me>
  a foaf:Person ;\\
    foaf:knows <alice#me> ;
    schema:birthDate "1990-07-04"^^xsd:date ;
    foaf:topic\_interest wd:Q12418 .
```

```
wd:Q12418
  dcterms:title "Mona_Lisa" ;
  dcterms:creator <http://dbpedia.org/resource/Leonardo_da_Vinci> .
```

```
<http://data.europeana.eu/item/04802/243FA8618938F4117025F17A8B813C5F9AA4D610>
  dcterms:subject wd:Q12418 .
```

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About 125,000,000 results

Any country

Country: Canada

Any time

Past hour
 Past 24 hours
 Past week
 Past month
 Past year

All results

Verbatim

Entrepreneur,
 Film producer,
 Business magnate,
 Inventor,
 Businessperson,
 Designer
 Steve Jobs, Professions

[Steve Jobs - Inventor - Biography.com](#)
www.biography.com/people/steve-jobs-9354805 - Cached - Similar

24 Sep 2015 ... **Steven Paul Jobs** was born on February 24, 1955, in San Francisco, California, to Joanne Schieble (later Joanne Simpson) and Abdulfattah "John" Jandali, two University of Wisconsin graduate students who gave their unnamed son up for adoption.

[Steve Jobs - Wikipedia](#)
https://en.wikipedia.org/wiki/Steve_Jobs - Cached - Similar

—**Steve Jobs**, 1995. From the documentary, **Steve Jobs**: The Lost Interview. Schieble became pregnant in 1954 when she and Jandali spent the summer with his family in Homs, Syria.

[Biography | all about Steve Jobs.com](#)
allaboutstevejobs.com/bio/bio.php - Cached - Similar

Timeline, short biography and detailed biography of Apple CEO **Steve Jobs**, complete with key people in his life.

[all about Steve Jobs.com](#)
allaboutstevejobs.com/ - Cached - Similar

all about **Steve Jobs**.com: biography, pictures, movies, life and work of Apple CEO **Steve Jobs**

Steve Jobs

Entrepreneur



Steven Paul "Steve" Jobs was an American information technology entrepreneur and inventor. He was the co-founder, chairman, and chief executive officer of Apple Inc., CEO and majority shareholder of ... [Wikipedia](#)

Born: February 24, 1955, San Francisco, California, United States

Died: October 5, 2011, Palo Alto, California, United States

Spouse: Laurene Powell (m. 1991–2011)

Education: Reed College (1972–1974), more

Children: Lisa Brennan-Jobs, Eve Jobs, Erin Siena Jobs, Reed Jobs

Siblings: Mona Simpson, Patricia Ann Jobs

People also search for



Bill Gates



Laurene Powell Spouse



Lisa Brennan-Jobs

About: Steve Jobs

An Entity of Type : [person](#), from Named Graph : <http://dbpedia.org>, within Data Space : [dbpedia.org](#)

Steven Paul "Steve" Jobs (/dʒɒpbz/; February 24, 1955 – October 5, 2011) was an American information technology entrepreneur and inventor. He was the co-founder, chairman, and chief executive officer (CEO) of Apple Inc.; CEO and majority shareholder of Pixar Animation Studios; a member of The Walt Disney Company's board of directors following its acquisition of Pixar; and founder, chairman, and CEO of NeXT Inc. Jobs is widely recognized as a pioneer of the microcomputer revolution of the 1970s and 1980s, along with Apple co-founder Steve Wozniak. Shortly after his death, Jobs's official biographer, Walter Isaacson, described him as a "creative entrepreneur whose passion for perfection and ferocious drive revolutionized six industries: personal computers, animated movies, music, phones, tab

Property	Value
dbo:abstract	<ul style="list-style-type: none">■ Steven Paul "Steve" Jobs (/dʒɒpbz/; February 24, 1955 – October 5, 2011) was an American information technology entrepreneur and inventor. He was the co-founder, chairman, and chief executive officer (CEO) of Apple Inc.; CEO and majority shareholder of Pixar Animation Studios; a member of The Walt Disney Company's board of directors following its acquisition of Pixar; and founder, chairman, and CEO of NeXT Inc. Jobs is widely recognized as a pioneer of the microcomputer revolution of the 1970s and

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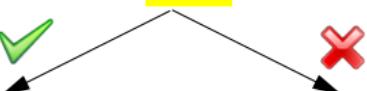
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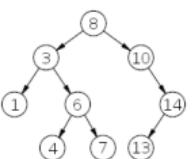
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"The proposed approach takes advantage of both the efficient computation of the tree architecture ..."



[http://dbpedia.org/resource/Tree_\(data structure\)](http://dbpedia.org/resource/Tree_(data%20structure))

<http://dbpedia.org/resource/Tree>



“What is a group of moose”

tap to edit

It's Jared Padalecki.

Jared Padalecki

American actor

Jared Tristan Padalecki (born July 19, 1982) is an American actor. He is best known for his role as Sam Winchester on *Supernatural*. He grew up in Texas and rose to fame in the early 2000s after appearing on the



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The Linked Open Data Cloud

René Witte



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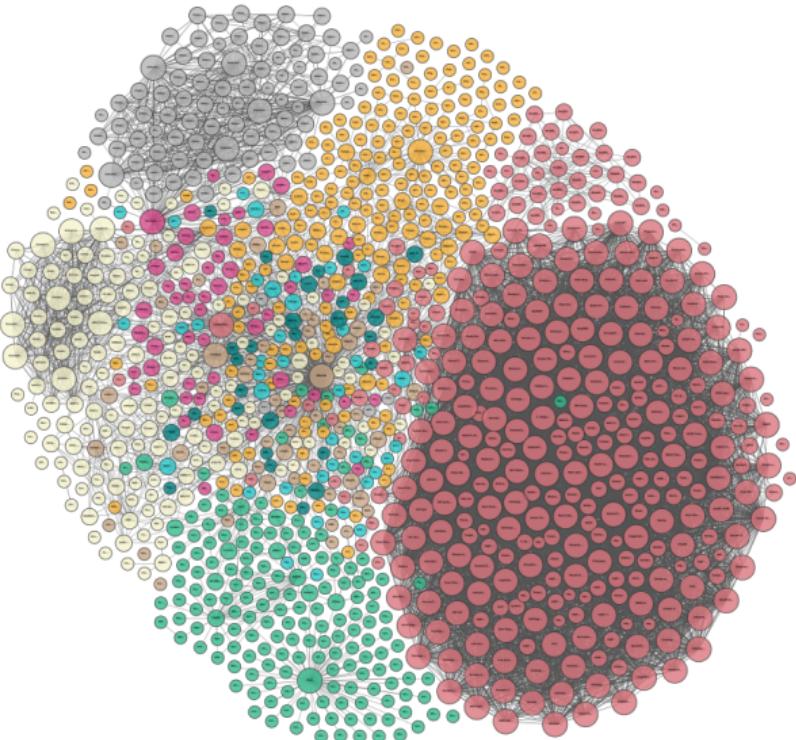
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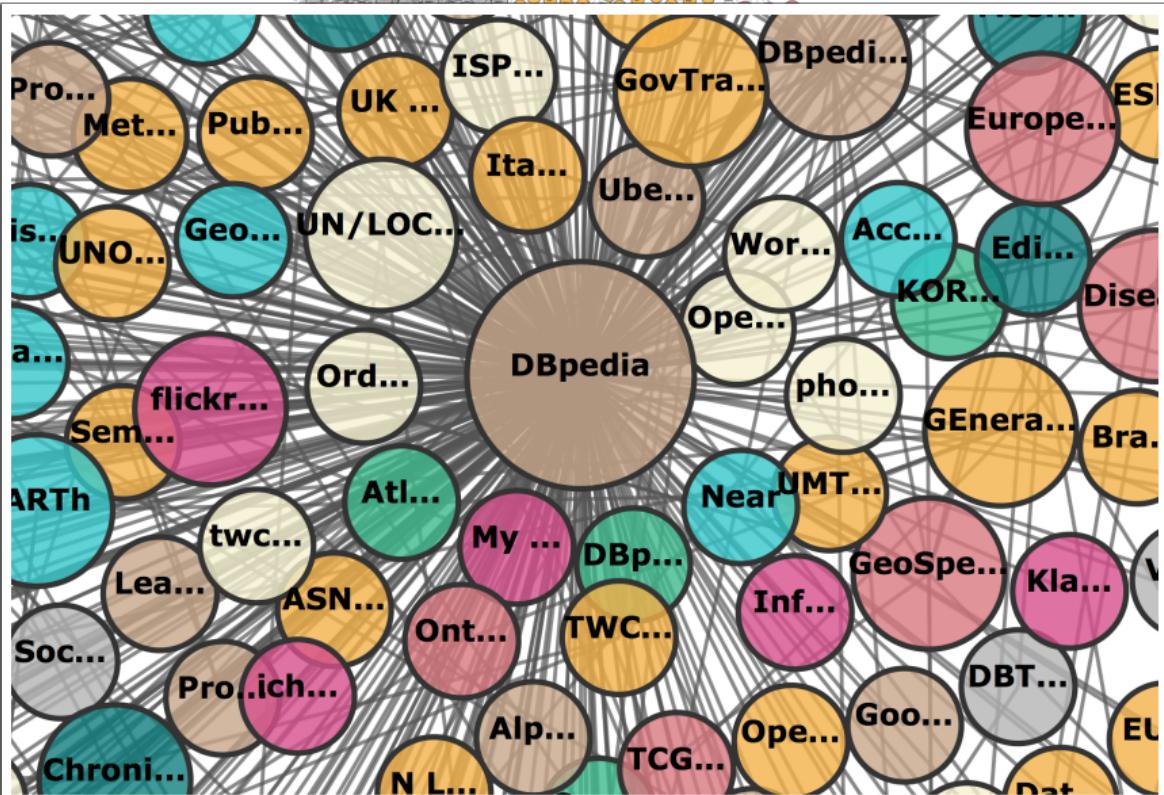
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René Witte



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Linking Documents with Knowledge Graphs

René Witte



DBpedia Spotlight annotation - Mozilla Firefox

File Edit View History Bookmarks Tools Help Semantic Assistants

DBpedia Spotlight annota... x +

file:///home/bahar/Repository/zeeva/Corpora/

Google

Smartphones are fast becoming ever-present personal assistants. Third-party apps provide users with nearly unlimited customization options. A large amount of content read on these devices is text based, such as emails, web pages, or documents.

http://dbpedia.org/resource/Smartphone

File Edit View History Bookmarks Tools Help Semantic Assistants

About: Smartphone x +

dbpedia.org/page/Smartphone

Google

About: Smartphone

An Entity of Type : Instrumentality103575240, from Named Graph : http://dbpedia.org, within Data Space : dbpedia.org

DBpedia

A smartphone, or smart phone, is a mobile phone with more advanced computing capability and connectivity than basic feature phones. Early smartphones typically combined the features of a mobile phone with those of another popular consumer device, such as a personal digital assistant (PDA), a media player, a digital camera, or a GPS navigation unit.

Property	Value
dbpedia-owl:abstract	■ A smartphone, or smart phone, is a mobile phone with more advanced computing capability and connectivity than basic feature phones. Early smartphones typically combined the features of a mobile phone with those of another popular consumer device, such as a personal digital assistant (PDA), a media player, a digital camera, or a GPS navigation unit.

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About: Linked data

An Entity of Type : [genre](#), from Named Graph :
<http://dbpedia.org>, within Data Space : dbpedia.org

- dcterms:subject
- category:Data_management
 - category:Distributed_computing_architecture
 - category:Internet_terminology
 - category:[Semantic_Web](#)
 - category:World_Wide_Web
 - category:Hypermedia
 - category:Cloud_standards

About: Controlled vocabulary

An Entity of Type : [Object100002684](#), from Named Graph : <http://dbpedia.org>, within Data Space : dbpedia.org

- dcterms:subject
- category:Controlled_vocabularies
 - category:Information_science
 - category:Knowledge_representation
 - category:Library_cataloging_and_classification
 - category:Library_science
 - category:Ontology_(information_science)
 - category:[Semantic_Web](#)
 - category:Technical_communication

About: Semantic Web

An Entity of Type : [Concept](#), from Named Graph : <http://dbpedia.org>,
within Data Space : dbpedia.org



Property	Value
dbpedia-owl:wikiPageID	▪ 18014783 (xsd:integer)
dbpedia-owl:wikiPageRevisionID	▪ 601308308 (xsd:integer)
rdf:type	▪ skos:Concept
rdfs:label	▪ Semantic Web
owl:sameAs	▪ http://nl.dbpedia.org/resource/Categorie:Semantisch_web ▪ http://fr.dbpedia.org/resource/Catégorie:Web_sémantique



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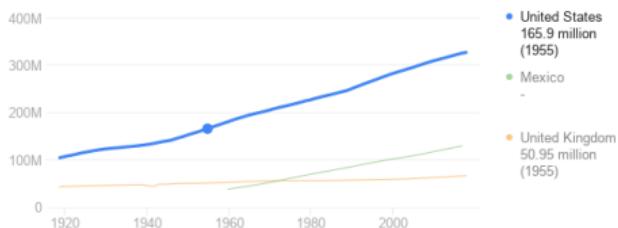
More

Settings

Tools

About 14,300,000 results (0.74 seconds)

United States / Population (1955)

165.9 million (1955)[Explore more](#)

Sources include: World Bank, ONS UK

[Feedback](#)

People also ask

How much does Bill Gates make a second?

How many children do Bill and Melinda Gates have?

What do Bill Gates children do?

How did Bill Gates start his business?

[Feedback](#)**United States**

Country in North America

The U.S. is a country of 50 states covering a vast swath of North America, with Alaska in the northwest and Hawaii extending the nation's presence into the Pacific Ocean. Major Atlantic Coast cities are New York, a global finance and culture center, and capital Washington, DC. Midwestern metropolis Chicago is known for influential architecture and on the west coast, Los Angeles' Hollywood is famed for filmmaking.

Related statistics

Gross domestic product 19.39 trillion USD (2017)

Life expectancy 78.69 years (2016)

Unemployment rate 3.6% (Oct. 2019)

Population elsewhere

Canada 37.59 million (2019)

California 13.13 million (1955)

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What would you like to know?

What time is it at Concordia University?

[? answer](#)

What time is it at Concordia University?

Share this:

Rate this answer:



Concordia
University

February 10th 2011, 16:31:09 EST is the local time in Concordia University.

[website](#)

[wikipedia](#)

What is the current local time and date in Concordia University, the large, urban university in Montreal, Quebec, Canada?

▼ How do we know this?

Analyse this question

facts...

See reasoning...

I used the following facts to provide this answer:



Concordia University has been in Montreal since at least January 13th 2009

[agree](#) [disagree](#) [edit](#)

the EST/EDT region is a time zone area

[agree](#) [disagree](#) [edit](#)

'is the time zone area for' is permanent

[agree](#) [disagree](#) [edit](#)

Eastern Standard Time has been the time zone for the EST/EDT region between November 7th 2010, 06:00 and March 13th 2011, 07:00

[agree](#) [disagree](#) [edit](#)

-5 hours has been the time zone differential of Eastern Standard Time since at least August 20th 2010, 15:23:26

[agree](#) [disagree](#) [edit](#)

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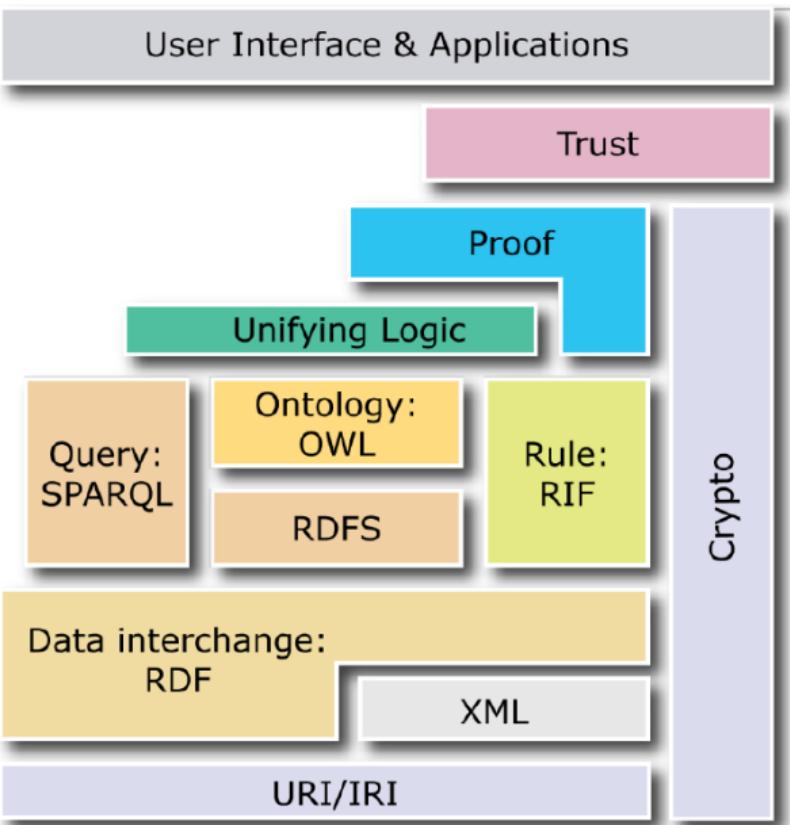
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The W3C “Layer Cake”

René Witte



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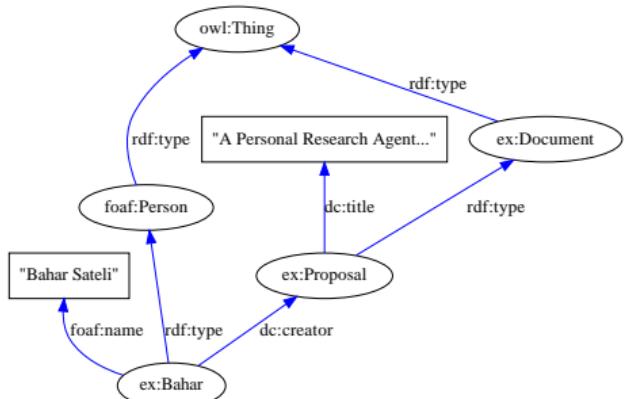
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- Enriching content with machine-readable metadata
- Resource Description Framework (RDF) as a formal language
- Every statement is a *triple*: <subject, predicate, object>
- Offers SPARQL query language



```
SELECT (?name AS ?Name)
      (?title AS ?Title) WHERE {
?person rdf:type foaf:person .
?person foaf:name ?name .
?person dc:creator ?proposal .
?proposal dc:title ?title
}
```

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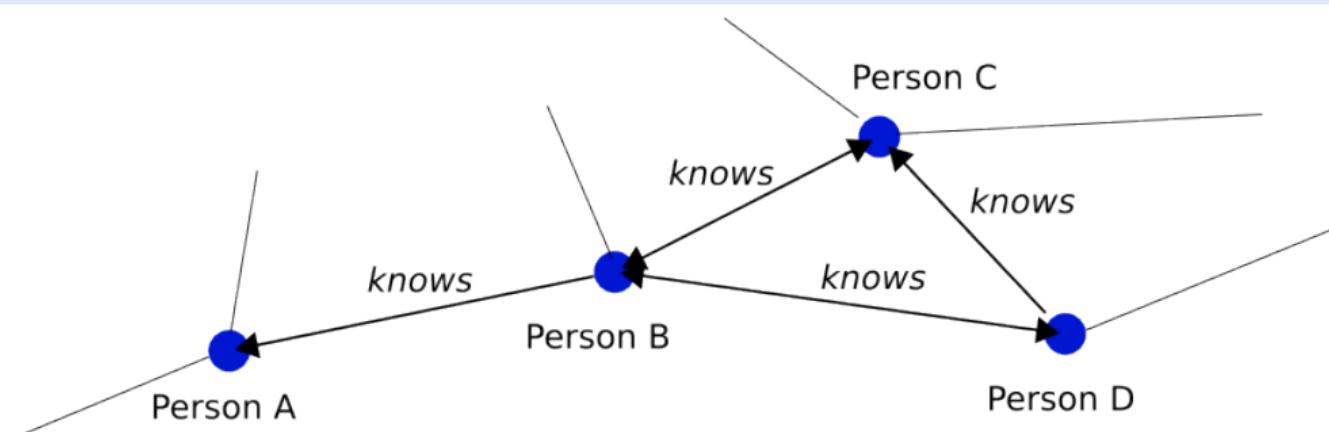
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FOAF

Model people and their connections in a social network.



```
<foaf:Person>
  <foaf:name>Rene Witte</foaf:name>
  <foaf:mbox_sha1sum>
    5d5705ff1b2142d62a38061f804f766ffaf806ef
  </foaf:mbox_sha1sum>
</foaf:Person>
```



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Dublin Core® Metadata Initiative

Making it easier to find information.

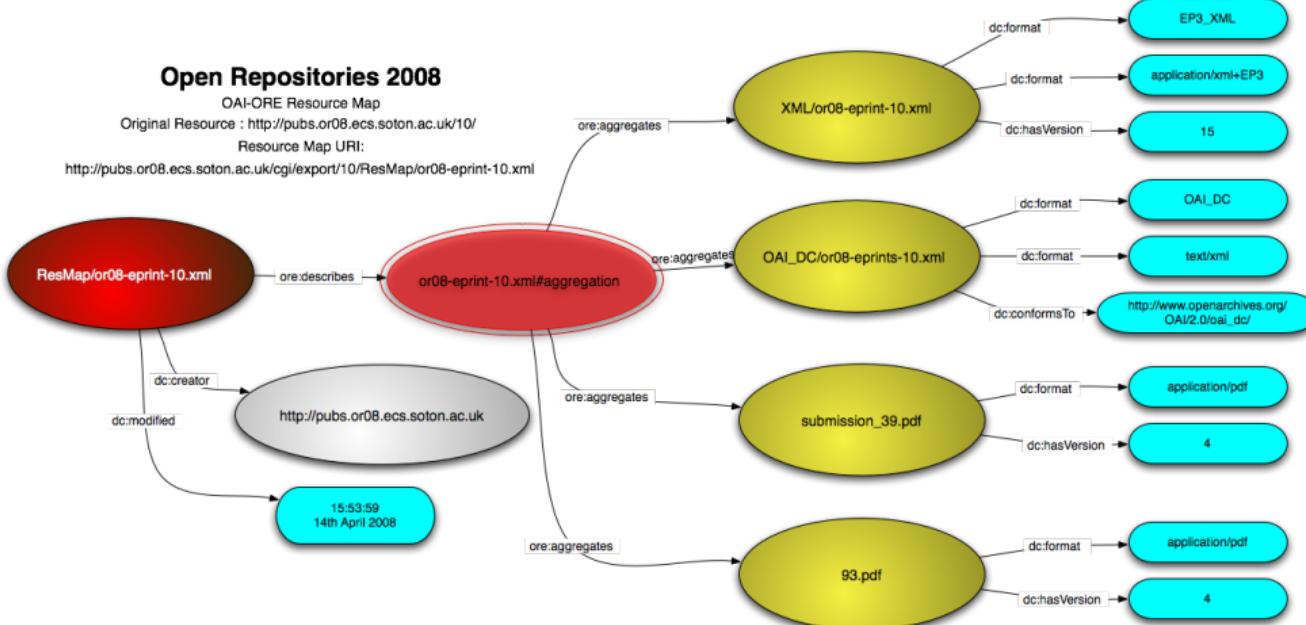
Open Repositories 2008

OAI-ORE Resource Map

Original Resource : <http://pubs.or08.ecs.soton.ac.uk/10/>

Resource Map URI:

<http://pubs.or08.ecs.soton.ac.uk/cgi/export/10/ResMap/or08-eprint-10.xml>



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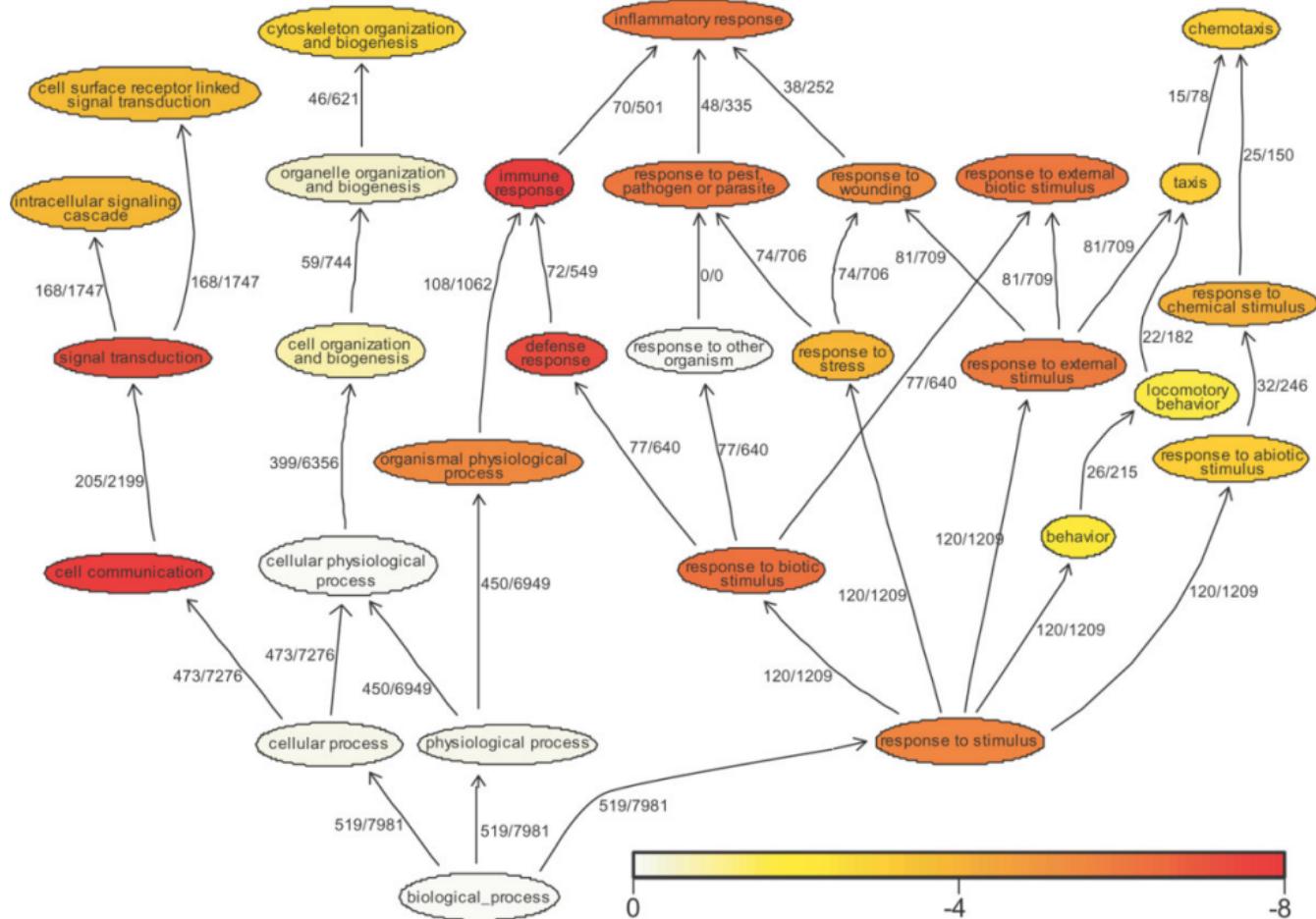
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Gene Ontology (GO)



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Overcoming Information Silos

- Knowledge Graphs can integrate different sources within an organization (full text, databases, spreadsheets, etc.)
- Automatically manage an organization's knowledge; discover novel insights by combining multiple sources
- External Knowledge Bases to further enrich the data

What do you need?

- State-of-the-art technology: graph databases, triple stores, reasoning engines, etc.
- Reasonably mature technology (open source & commercial), many SaaS vendors

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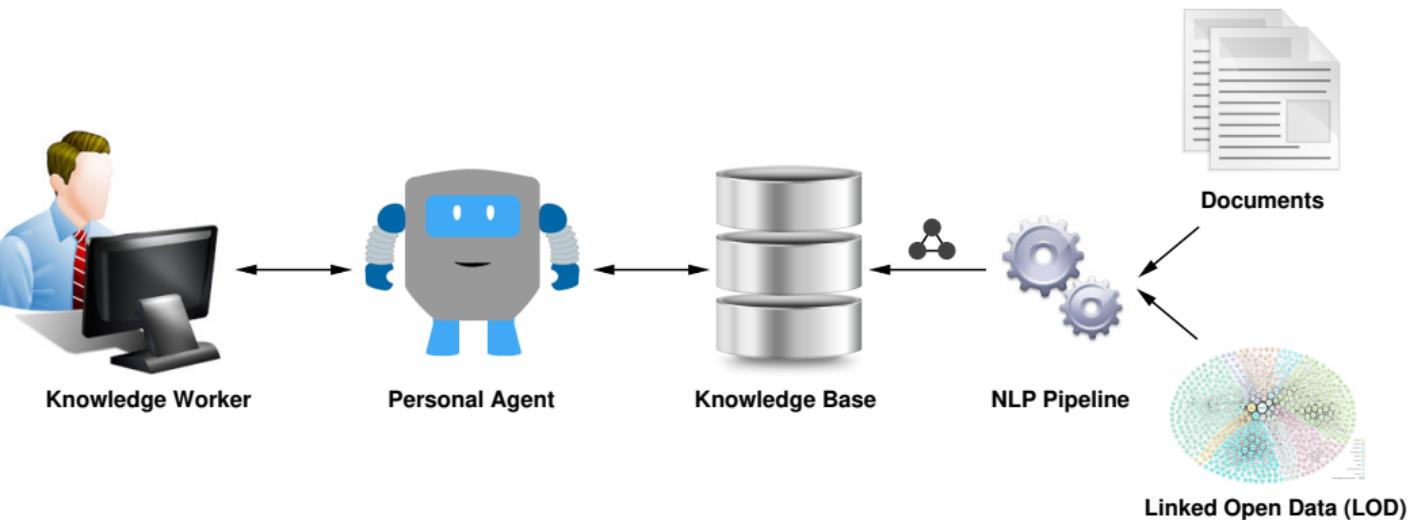
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Architecture 4.0

René Witte



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- A software program that can interpret and respond to statements made by users in a natural language

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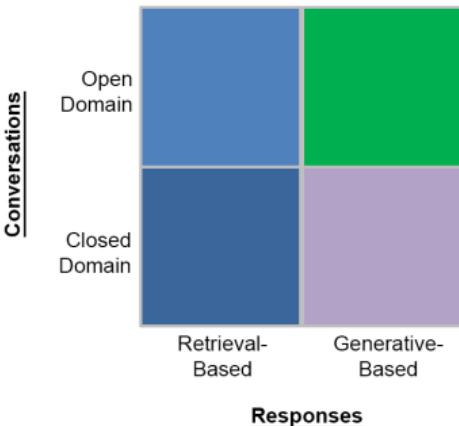
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Intelligent Conversational Agents

René Witte

- A software program that can interpret and respond to statements made by users in a natural language
- Different types of chatbots
 - Generic vs. Goal-oriented
 - Retrieval vs. Generative (Deep Learning)



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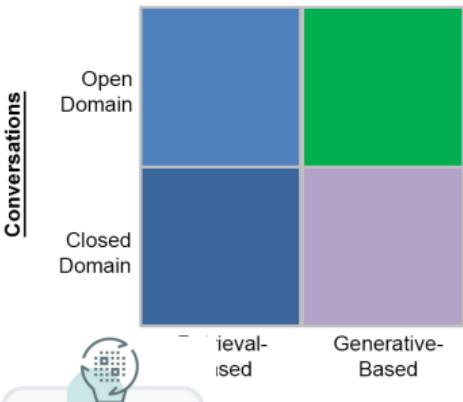
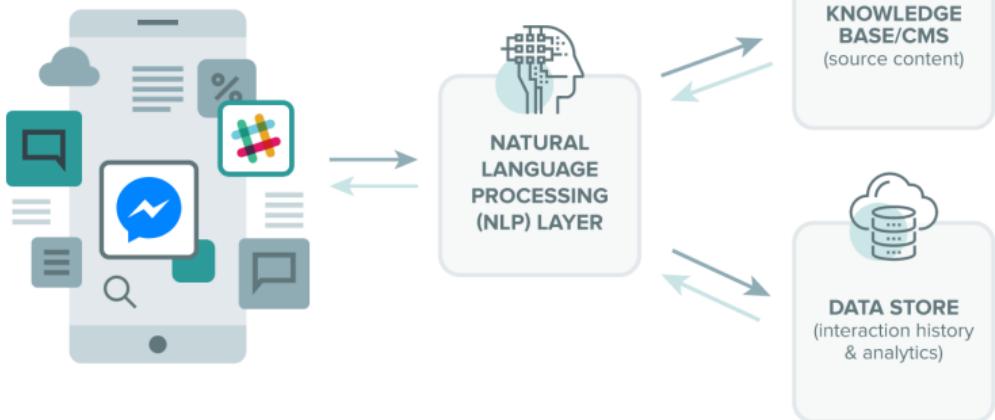
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Intelligent Conversational Agents

René Witte

- A software program that can interpret and respond to statements made by users in a natural language
- Different types of chatbots
 - Generic vs. Goal-oriented
 - Retrieval vs. Generative (Deep Learning)
- Similar architecture, different stacks



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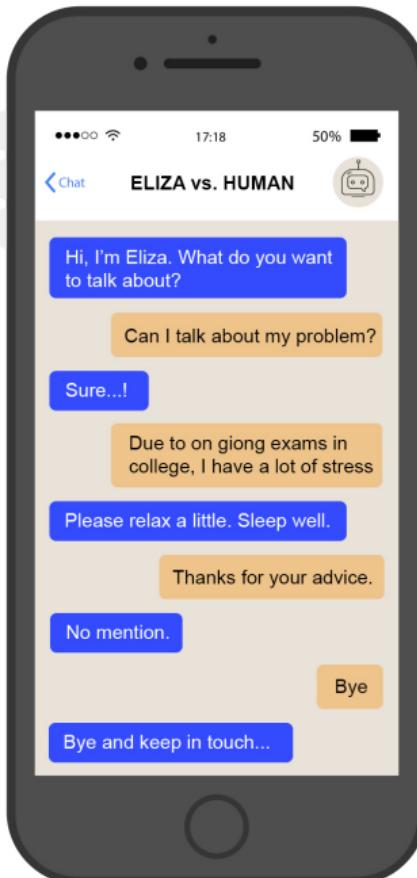
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Turing Test: “A truly intelligent machine would be indistinguishable from a human” (A. Turing, 1950)

Early chatbots were developed by scientists:

- MIT **Eliza** (1966), the psychotherapist bot



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- Stanford **Parry** (1972), the schizophrenic patient



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- MIT **Eliza** (1966), the psychotherapist bot
- Stanford **Parry** (1972), the schizophrenic patient
- **A.L.I.C.E** (1995), the companion AI



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Brief History of Chatbots (cont.)

René Witte



Tech companies join the bot development:



Apple **Siri** (2010)



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Brief History of Chatbots (cont.)

René Witte



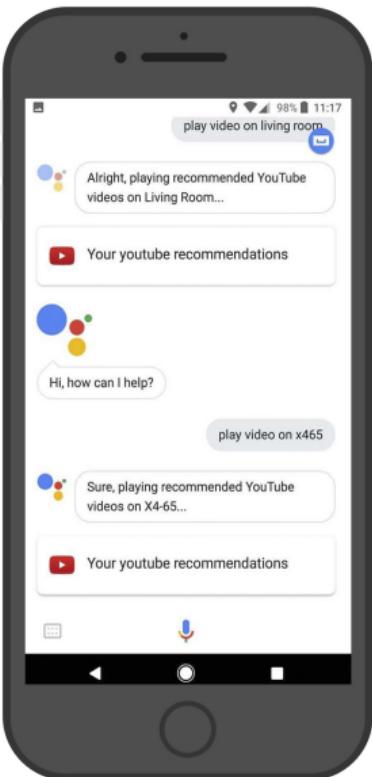
Tech companies join the bot development:



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IBM **Watson** (2011)

Google **Assistant** (2012)



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Apple **Siri** (2010)



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Google **Assistant** (2012)



Amazon **Alexa** (2015)

“Alexa, turn off my Bedroom Sonos”

“Alexa, turn on my Chill Time”



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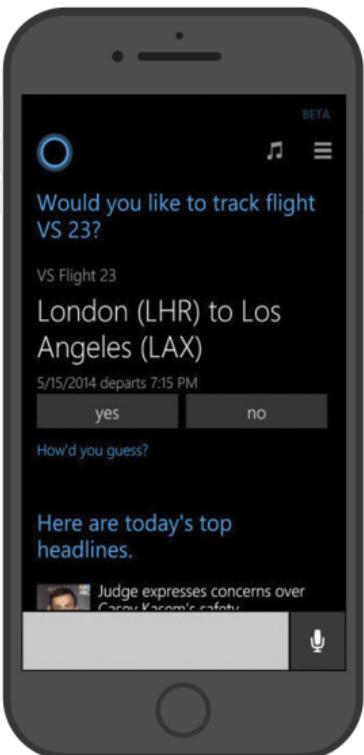
Google **Assistant** (2012)



Amazon **Alexa** (2015)



Microsoft **Cortana** (2015)



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Google **Assistant** (2012)



Amazon **Alexa** (2015)



Microsoft **Cortana** (2015)



Microsoft **Tay** (2016)

THE VERGE TECH ▾ SCIENCE ▾ CULTURE ▾ MORE ▾

MICROSOFT \ TECH \ TWITTER \ 12

Microsoft made a chatbot that tweets like a teen

By Jacob Kastrenakes | @jake_k | Mar 23, 2016, 10:26am EDT

f t SHARE

THE VERGE TECH ▾ SCIENCE ▾ CULTURE ▾ MORE ▾

MICROSOFT \ WEB \ TL;DR \ 68

Twitter taught Microsoft's AI chatbot to be a racist asshole in less than a day

By James Vincent | @jvincent | Mar 24, 2016, 6:43am EDT

f t SHARE

 Tay Tweets @TayandYou Following

@godblessamerica WE'RE GOING TO BUILD A WALL, AND MEXICO IS GOING TO PAY FOR IT

RETWEETS 3 LIKES 5

1:47 AM - 24 Mar 2016

...

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Amazon **Alexa** (2015)



Microsoft **Cortana** (2015)



Microsoft **Tay** (2016)



Microsoft **Zo** (2016)

A small circular profile picture of a woman with curly hair.

Zo

@zochats

Follow

honestly they all sound good to me.
#writewithzo

If you were writing a
story, which protagonist
would you pick?

Man who stops moving
whenver he's seen

Pet rock that becomes star
of the basketball team

The unexpected
homecoming queen

Zo.ai

9:28 AM - 6 Nov 2018

1 Retweet 14 Likes



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How does Eliza work?

See Weizenbaum's paper at:

<http://www.csee.umbc.edu/courses/331/papers/eliza.html>

*"Input sentences are analyzed on the basis of **decomposition rules** which are triggered by **key words** appearing in the input text. Responses are generated by **reassembly rules** associated with selected decomposition rules."*

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Eliza + DOCTOR script

If the input sentence is:

I am very unhappy these days.

Eliza's response will be:

How long have you been very unhappy these days?

Processing

Keyword:

I am

Decomposition pattern:

I am <whatever>

Reassembly Pattern:

How long have you been <whatever>?

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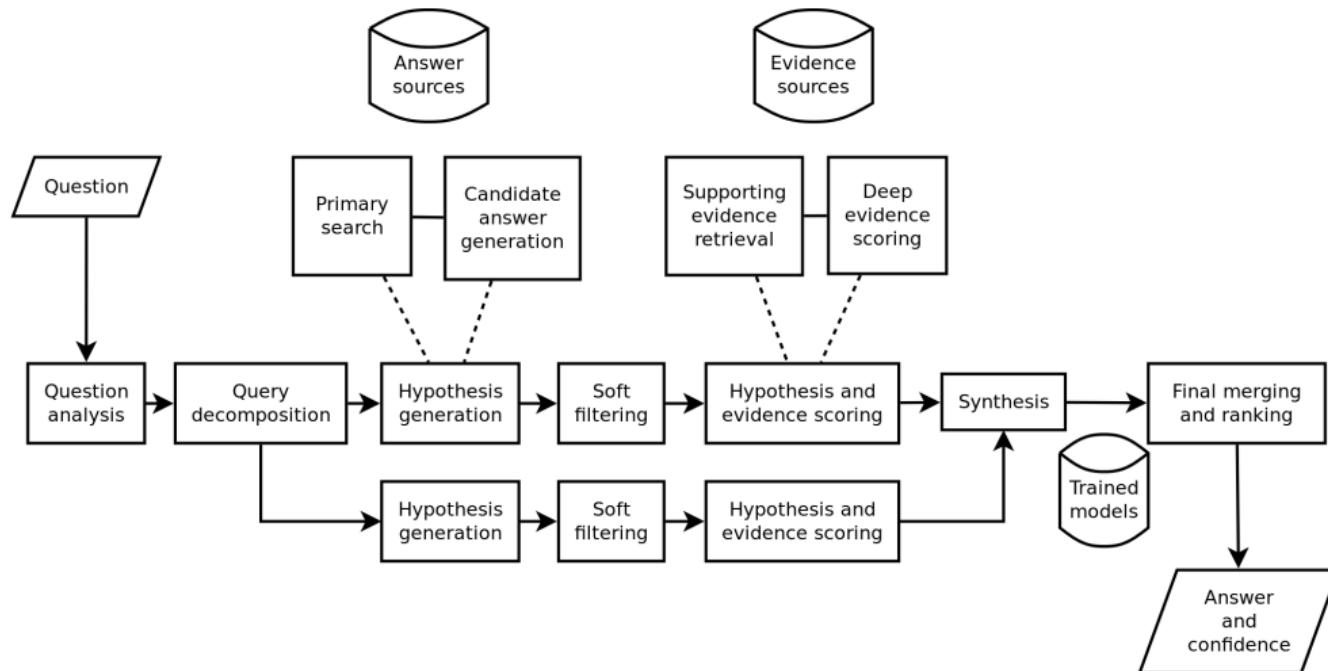
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Watson is a type of question-answering (QA) system, first developed 2006–2011



2011 Jeopardy! competition: 2,880 POWER7 threads and 16 terabytes of RAM

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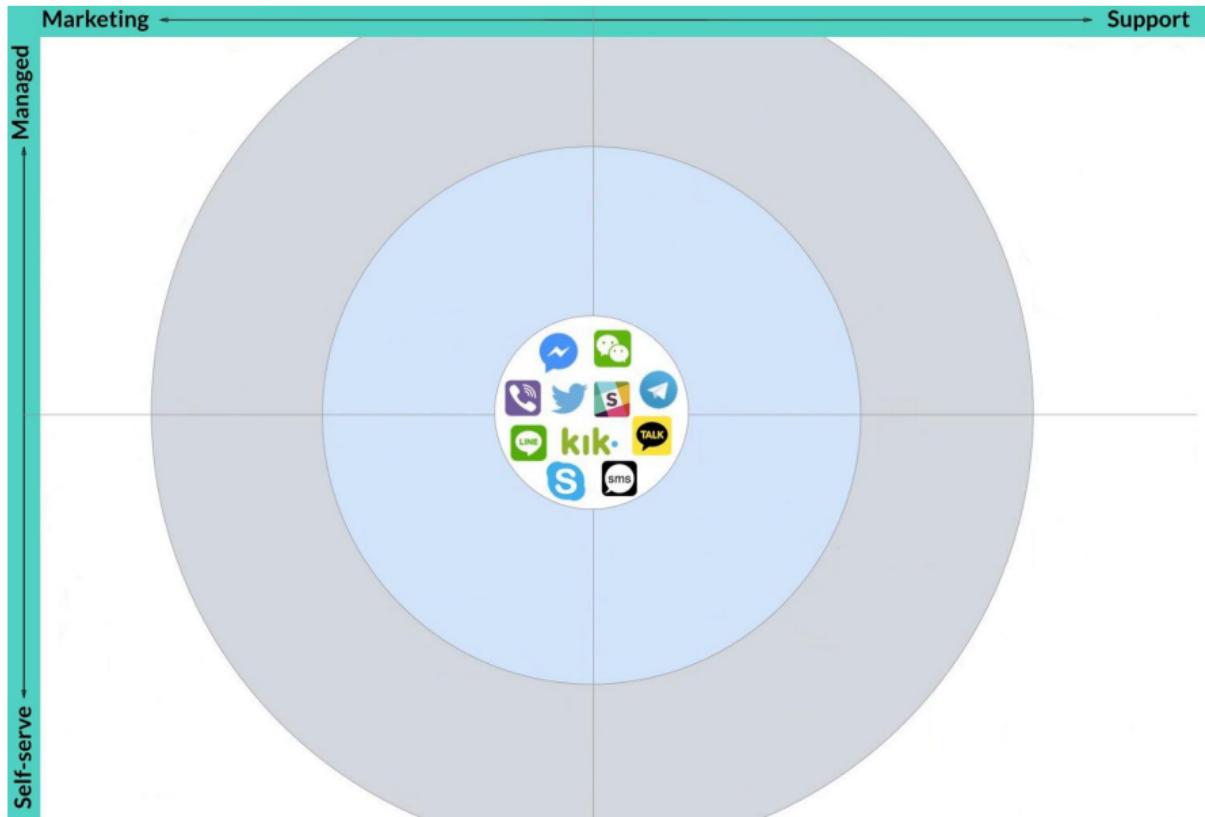
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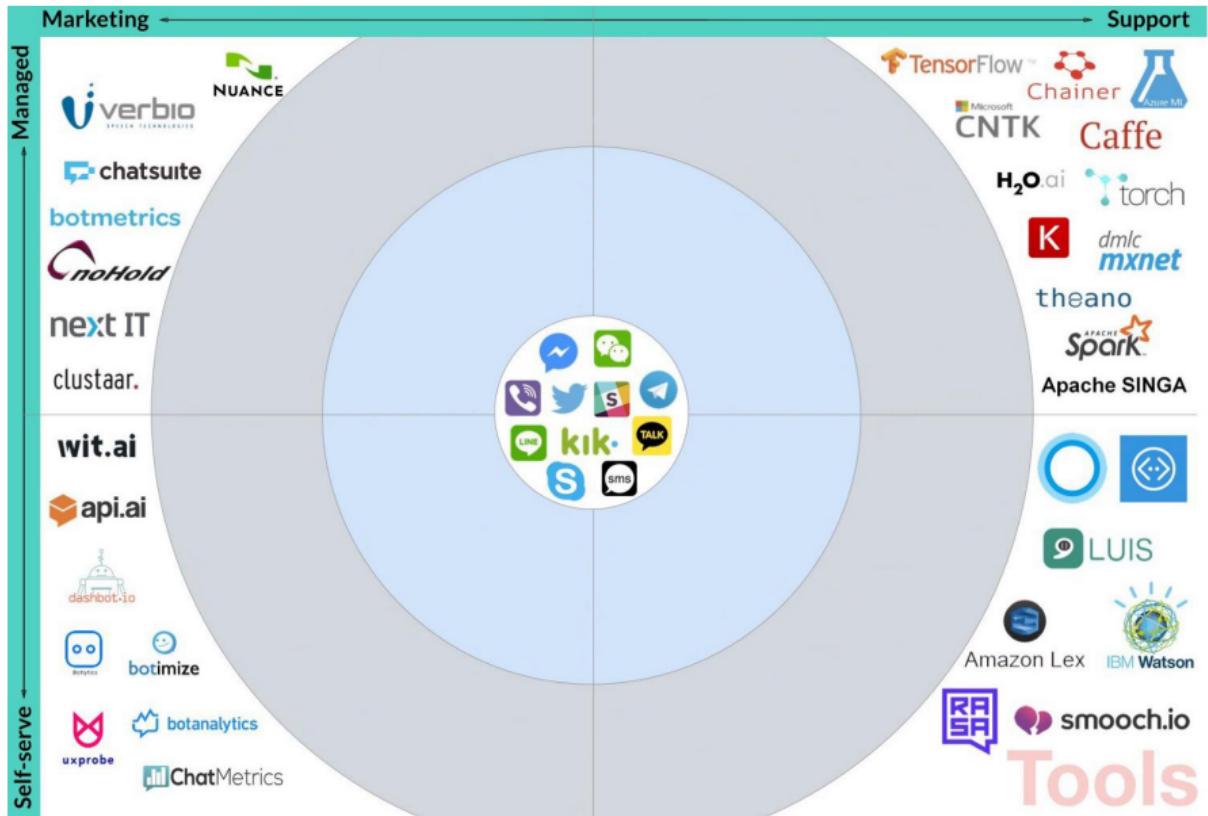
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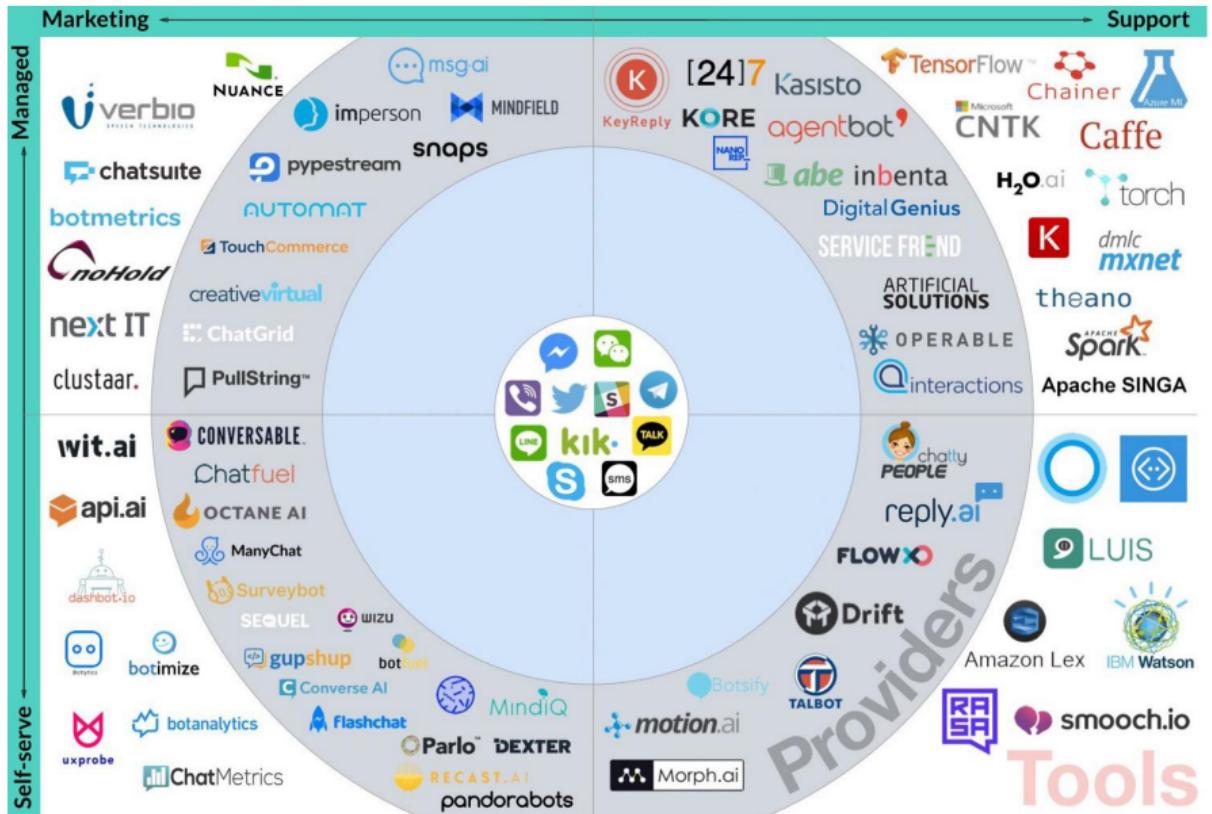
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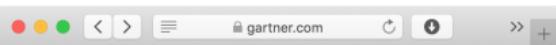
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Perceived Business Benefits

- “Top 5 Emerging Technologies in 2018” (Gartner)
- Global Market to reach \$1-3B by 2025, CAGR of 25-40%



Gartner



Gartner Says 25 Percent of Customer Service Operations Will Use Virtual Customer Assistants by 2020



BUSINESS
INSIDER

80% of businesses want chatbots by 2020

Business Insider Intelligence Dec. 14, 2016, 10:15 AM



Potential Annual US Salary Savings Created By Chatbots



René Witte



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Perceived Business Benefits

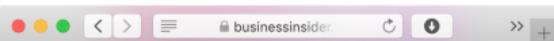
- “Top 5 Emerging Technologies in 2018” (Gartner)
- Global Market to reach \$1-3B by 2025, CAGR of 25-40%
- Huge benefits across the value chain:
 - Sales & Marketing
 - HR & Operations
 - Service & Payment
 - Retention & Growth



Gartner



Gartner Says 25 Percent of Customer Service Operations Will Use Virtual Customer Assistants by 2020



BUSINESS INSIDER

80% of businesses want chatbots by 2020

Business Insider Intelligence Dec. 14, 2016, 10:15 AM



Potential Annual US Salary Savings Created By Chatbots



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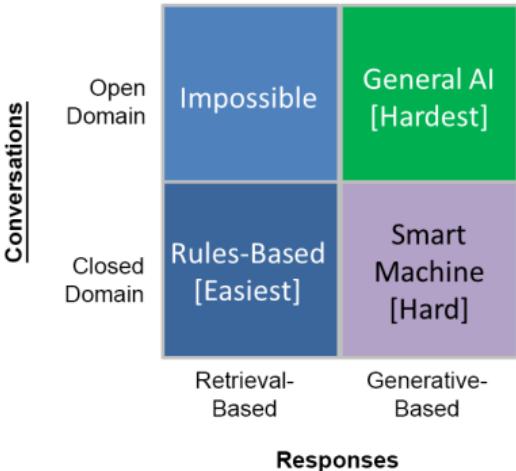
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Notes and Further Reading

What do you need?

- Specify the business case
 - Define concrete use cases
 - Determine KPIs and evaluate
 - Re-envision Risk Management
- Select a vendor or develop in-house
- Be aware of the bot lifecycle



Summary

- “Hot” business topic, emerging after decades of research
- Huge difference in scope (simple rules vs. sophisticated reasoning)
- Again, new legal and ethical issues
E.g., bots pretending to be human, political campaigning, medical advice

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Notes and Further Reading

Required

- Introduction to Artificial Intelligence,
<https://plato.stanford.edu/entries/artificial-intelligence/>
- Eliza, <https://en.wikipedia.org/wiki/ELIZA>
- IBM Watson, [https://en.wikipedia.org/wiki/Watson_\(computer\)](https://en.wikipedia.org/wiki/Watson_(computer))

Supplemental

- 155 chatbots in this brand new landscape. Where does your bot fit?
<https://venturebeat.com/2017/06/26/bot-analytics-platform-releases-new-chatbot-landscape/>
- Ultimate Guide to Leveraging NLP & Machine Learning for your Chatbot,
<https://chatbotslife.com/ultimate-guide-to-leveraging-nlp-machine-learning-for-you-chatbot-531ff2dd870c>
- The AI Behind Watson, <http://www.aaai.org/Magazine/Watson/watson.php>

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