

# RECHERCHE D'INFORMATION ... RESSOURCES ? POUR QUOI ?

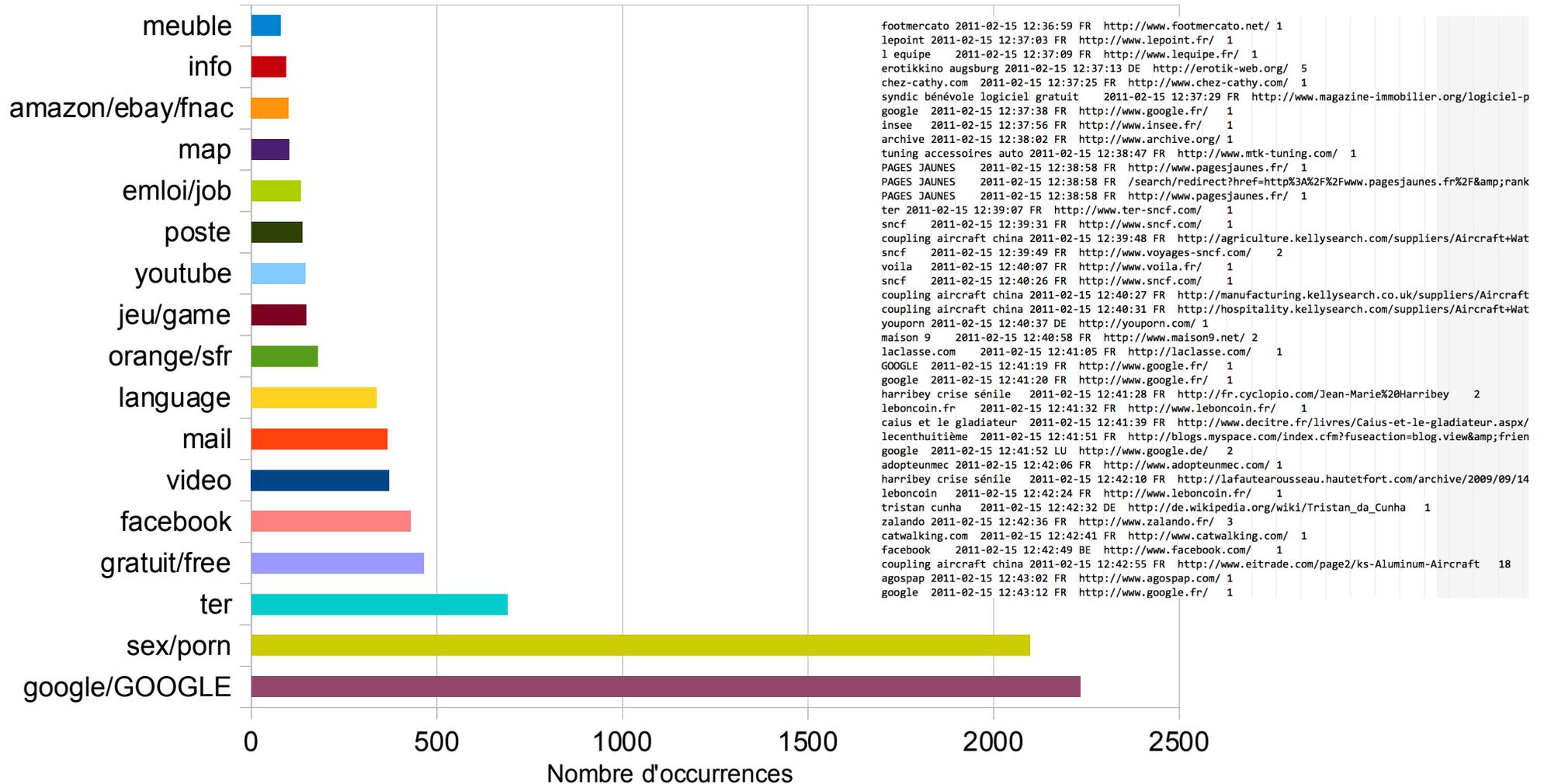
Patrice Bellot

Aix-Marseille Université - CNRS (LSIS UMR 7296) — OpenEdition

[patrice.bellot@univ-amu.fr](mailto:patrice.bellot@univ-amu.fr)

# A real query log (sample)

## Occurrence de requêtes courtes

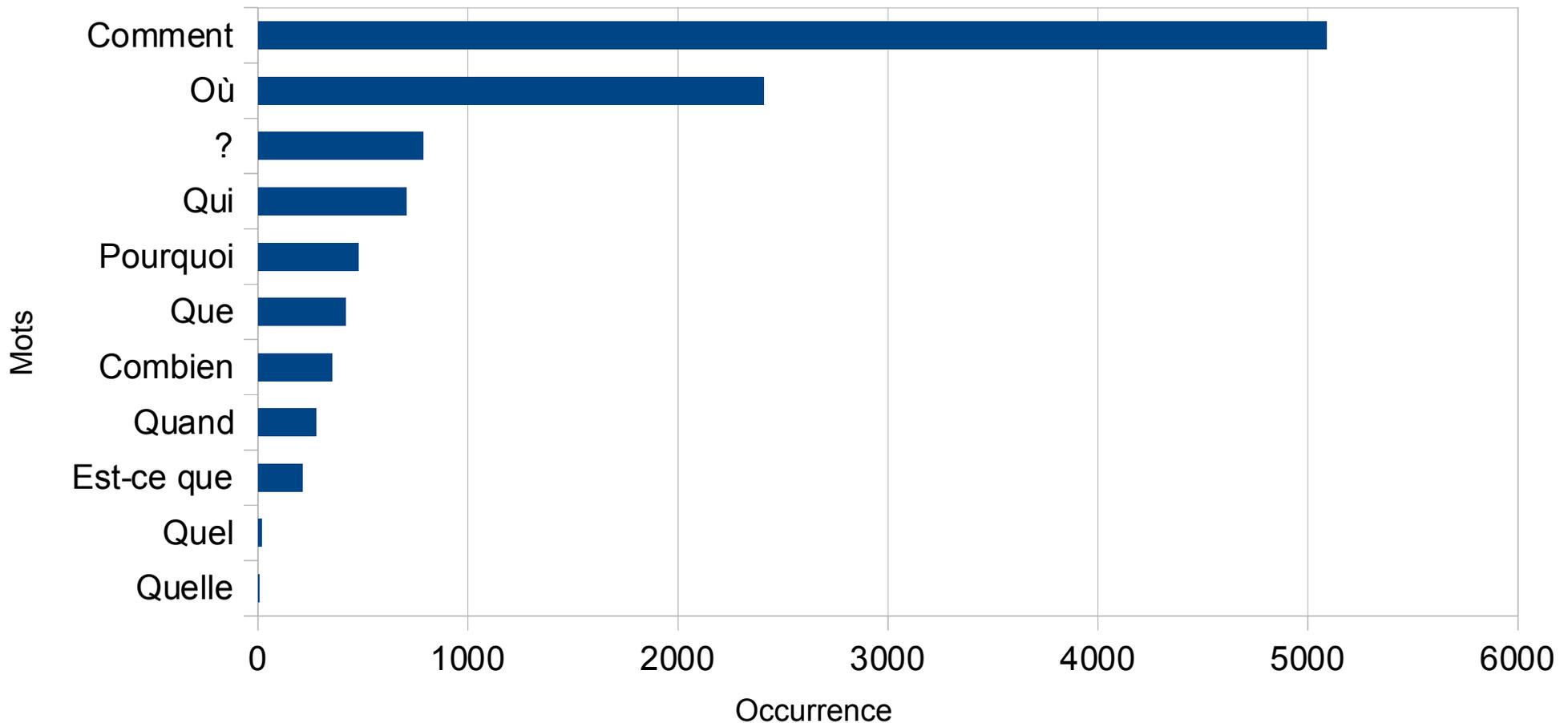


50% queries very short = only 1 word  
 2% = Natural Language questions (long)

# A real query log (sample)

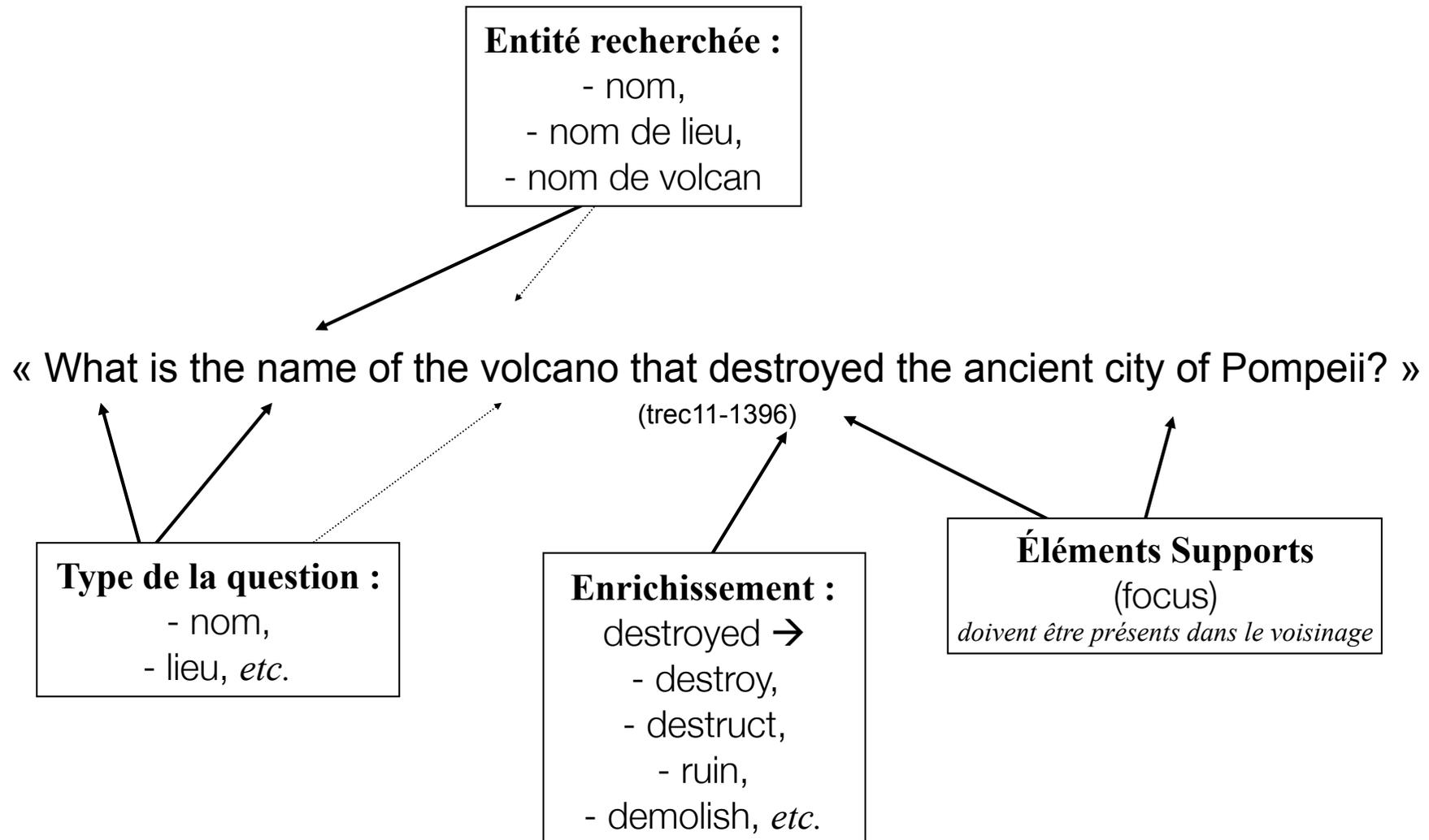
```
COMMENT 9A MARCJE-
qui se comprend bien s'énonce bien-
comment ca marche-
comment ouvrir fichier iso sous windows-
comment modifier un exe-
comment ca marche-
qui veut gagner sa palce-
qui veut gagner sa place-
Comment faire la vidange d'un 807 Peugeot-
comment promouvoir un artiste-
qu'est ce que la CMU-
comment paramettrer msn messenger pour utilisation avec mozilla firefox-
comment promouvoir un chanteur-
comment faire ses relations de presse-
comment faire relations de presse musicales-
comment faire relations de presse artistes-
```

## Occurrence des caractères interrogatifs



# Conceptualisation des questions

- **Objectif** : **extraire** de la question le **+ d'informations** → **localiser** la réponse



# Similarités de surface ?

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**Google**

Web Results 1 - 20 of about 51,200

**Population of France + their flag and capital city**  
Learn about France's population, capital city, flag and more.  
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**WikiAnswers - What is the population of France not including ...**  
France question: What is the population of France not including overseas speaking countries? Answer 62299000 million including inhabitation of the over sea ...  
[wiki.answers.com/Q/What\\_is\\_the\\_population\\_of\\_France\\_not\\_including\\_overseas\\_speaking\\_countries](#) - 43k - [Cached](#) - [Similar pages](#)

**Facts about France, with the population of France and general ...**  
Facts about France, including the French flag, geography, figures and population of France.  
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**France : geography, population cities, map, flag, gdp gnp economy ...**  
France : geography, maps, flag, statistics, photos and cultural information about France.  
[www.studentsoftheworld.info/country\\_information.php?Pays=FRA](#) - 46k - [Cached](#) - [Similar pages](#)

**Demographics of France - Wikipedia, the free encyclopedia**  
At the beginning of the twentieth century, France's population was low ... Between 1815 and 2000, if the population of France had grown at the same rate as ...  
[en.wikipedia.org/wiki/Demographics\\_of\\_France](#) - 110k - [Cached](#) - [Similar pages](#)

**France - Wikipedia, the free encyclopedia**  
In 2003, France's natural population growth (excluding immigration) was responsible for almost all natural population growth in the European Union. ...  
[en.wikipedia.org/wiki/France](#) - 339k - [Cached](#) - [Similar pages](#)  
[More results from en.wikipedia.org »](#)

**France - Population**  
The population of France in 2003 was estimated by the United Nations at 60144000 , which placed it as number 20 in population among the 193 nations of the ...  
[www.nationsencyclopedia.com/Europe/France-POPULATION.html](#) - 51k - [Cached](#) - [Similar pages](#)

**Population Of France**  
The population of France, as estimated in late 2006, is **60,742,000**.  
The Capital City of France is **Paris**

**A:** **WikiAnswers**™ Q&A the wiki way  
**Answer**  
65 million people. (this was in January)

**France This Way** [France Newsletter](#) · [Get paid to write about France](#) · [Send us a photo!](#)

Google Custom Search

**France information** > Facts

**Facts about France**  
This section looks at some important facts about France - population, demographics, religion, geography of France etc

**Population of France**  
The population of France at July 2006 is estimated at 60.9 million people, of a total world population of 6.5 billion people. This makes it the 23rd most populated country in the world. 16.4% of the population of France are 65 years old or more.

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Population	
(January 1, 2008 estimate)	
Total <sup>[1]</sup>	64,473,140 <sup>[5]</sup> (20th)
- Metropolitan France	61,875,822 <sup>[4]</sup> (20th)
- Density <sup>[6]</sup>	114/km <sup>2</sup> (89th) 295/sq mi

# SBS Collection : des requêtes réelles issues du forum Library Thing

```

▼<topic id="812">
  <title>Schumann Biography</title>
  <group>Music History, Performance, and Theory</group>
  <user>PhoenixTerran</user>
  ▼<narrative>
    Does anyone have a recommendation for a biography of Robert Schumann?Thanks!
  </narrative>
  ▼<types>
    <type>subject</type>
  </types>
  ▼<genres>
    <genre>non-fiction</genre>
  </genres>
</topic>

```

```

<topic id="1116">
  <title>Which LISP?</title>
  <mediated_query>introduction book to Lisp</mediated_query>
  <group>Purely Programmers</group>
  <narrative> It'll be time for me to shake things up and learn a new language soon. I had started on Erlang a while back and getting back to it might be fun. But I'm starting to lean toward Lisp--probably Common Lisp rather than Scheme. Anyone care to recommend a good first Lisp book? Would I be crazy to hope that there's one out there with an emphasis on using Lisp in a web development and/or system administration context? Not that I'm unhappy with PHP and Perl, but the best way for me to find the time to learn a new language is to use it for my work...
</narrative>
  <feedback_tags>['artificial intelligence', 'Computing', 'Computers', 'non-fiction', 'ai', 'Reference', 'computer science', 'programming', 'programming languages', 'Computer programming', 'lisp', 'artificial intelligence', 'ai', 'Reference', 'computer science', 'Computing', 'own', 'wishlist', 'cs', 'commonlisp', 'Emacs', 'Emacs']
</feedback_tags>
</topic>

```

<http://social-book-search.humanities.uva.nl>

```

<topic>
  <topicid>99309</topicid>
  <query>Politics of Multiculturalism</query>
  <title>Politics of Multiculturalism Recommendations?</title>
  <group>Political Philosophy</group>
  <request> I'm new, and would appreciate any recommended reading on
    the politics of multiculturalism. <a href="/author/parekh">Parekh
    </a>'s <a href="/work/164382">Rethinking Multiculturalism: Cultural
    Diversity and Political Theory</a> (which I just finished) in the end
    left me unconvinced, though I did find much of value I thought he
    depended way too much on being able to talk out the details later. It
    may be that I found his writing style really irritating so adopted a
    defiant skepticism, but still... Anyway, I've read
    <a href="/author/sen">Sen</a>, <a href="/author/rawles">Rawls</a>,
    <a href="/author/habermas">Habermas</a>, and

    <a href="/author/nussbaum">Nussbaum</a>, still don't feel like I've
    wrapped my little brain around the issue very well and would
    appreciate any suggestions for further anyone might offer.
  </narrative>
  <examples>
    <example>
      <workid>164382</workid>
      <booktitle>Rethinking Multiculturalism: Cultural Diversity and Political Theory</booktitle>
      <author>Bhikhu Parekh</author>
    </example>
  </examples>
  <catalog>
    <work>
      <workid>9036</workid>
      <booktitle>The Confessions of St. Augustine</booktitle>
    <author>Saint Augustine, Bishop of Hippo</author>
    <publication-year>397</publication-year>
    <cataloguing-date>2007-09</cataloguing-date>
    <rating>0.0</rating>
    <tags></tags>
  </work>
  <work>
    ...
  
```

Le catalogue de  
la personne qui  
pose la question

Et... que cherche-t-on ?

*Qu'est-ce qu'une réponse pertinente ?*

# Approche générale de RI

## Example

This is a famous example given by Dr. David Grossman and Dr. Ophir Frieder of the Illinois Institute of Technology.

There are 3 documents,

D1 = "Shipment of gold damaged in a fire"

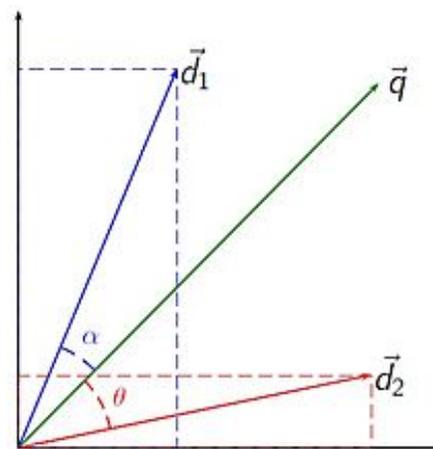
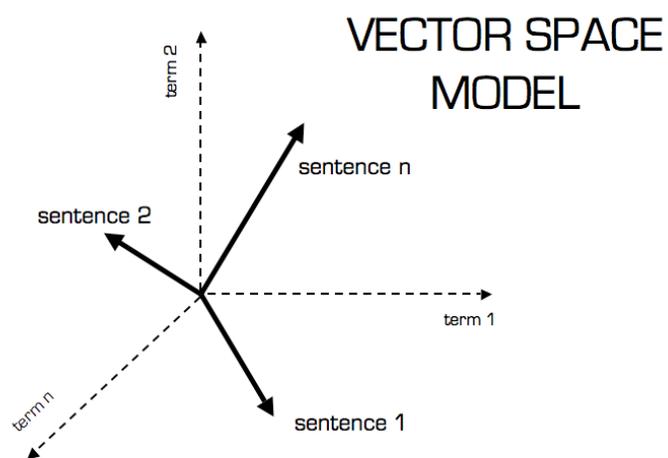
D2 = "Delivery of silver arrived in a silver truck"

D3 = "Shipment of gold arrived in a truck"

Q = "gold silver truck"

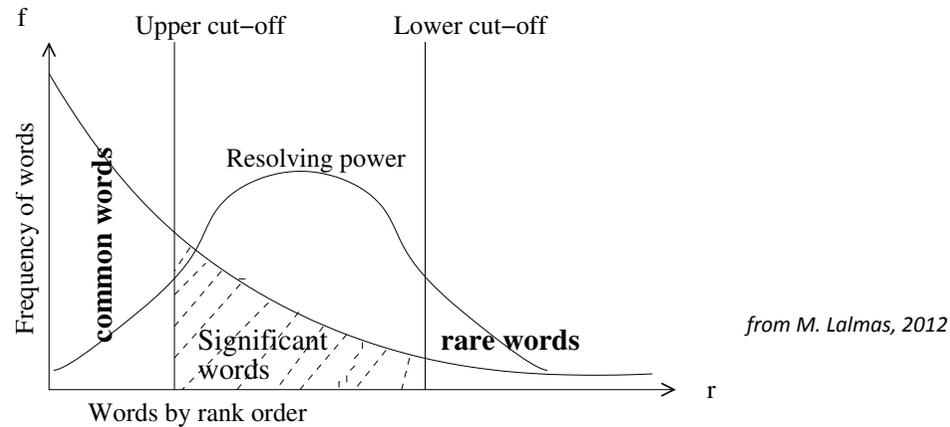
No. of docs,  $D = 3$  ; Inverse document frequency,  $IDF = \log(D/df_i)$

Terms	tfi				dfi	D/dfi	IDFI	Weights = tfi * IDFI			
	Q	D1	D2	D3				Q	D1	D2	D3
a	0	1	1	1	3	1	0.0000	0.0000	0.0000	0.0000	0.0000
arrived	0	0	1	1	2	1.5	0.1761	0.0000	0.0000	0.1761	0.1761
damaged	0	1	0	0	1	3	0.4771	0.0000	0.4771	0.0000	0.0000
delivery	0	0	1	0	1	3	0.4771	0.0000	0.0000	0.4771	0.0000
gold	1	1	0	1	2	1.5	0.1761	0.1761	0.1761	0.0000	0.1761
fire	0	1	0	0	1	3	0.4771	0.0000	0.4771	0.0000	0.0000
in	0	1	1	1	3	1	0.0000	0.0000	0.0000	0.0000	0.0000
of	0	1	1	1	3	1	0.0000	0.0000	0.0000	0.0000	0.0000
shipment	0	1	0	1	2	1.5	0.1761	0.0000	0.1761	0.0000	0.1761
silver	1	0	2	0	1	3	0.4771	0.4771	0.0000	0.9542	0.0000
truck	1	0	1	1	2	1.5	0.1761	0.1761	0.0000	0.1761	0.1761



# Term Weighting

- **Luhn's hypothesis** (1957) : the frequency of a word is a measurement of its significance ... and then a criterion that measures the capacity of a word to discriminate documents by their content



- In a given document, a word is important (discriminant) if it occurs often and it is rare in the collection

$$\text{QteInfo}(m_i) = \log_2 P(m_i) \longrightarrow IDF(m_i) = -\log \frac{n_i}{N}$$

# Vector Space Model : some drawbacks

- The dimensions are orthogonal
  - “automobile” and “car” are as distant as “car” and “apricot tree”...
  - > the user query must contain the same words than the documents that he wishes to find...
- The word order and the syntax are not used
  - the cat drove out the dog of the neighbor
  - $\approx$  the dog drove out the cat of the neighbor
  - $\approx$  the cat close to the dog drives out
  - It assumes words are statistically independent
  - It does not take into account the syntax of the sentences, nor the negations...
    - *this paper is about politics VS. this paper is not about politics :*  
very similar sentences...

# One-hot representation (local)

$$\text{Dim} = |V|$$

$$\text{sim}(\text{banana}, \text{mango}) = 0$$

banana 

0	0	0	0	0	1	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

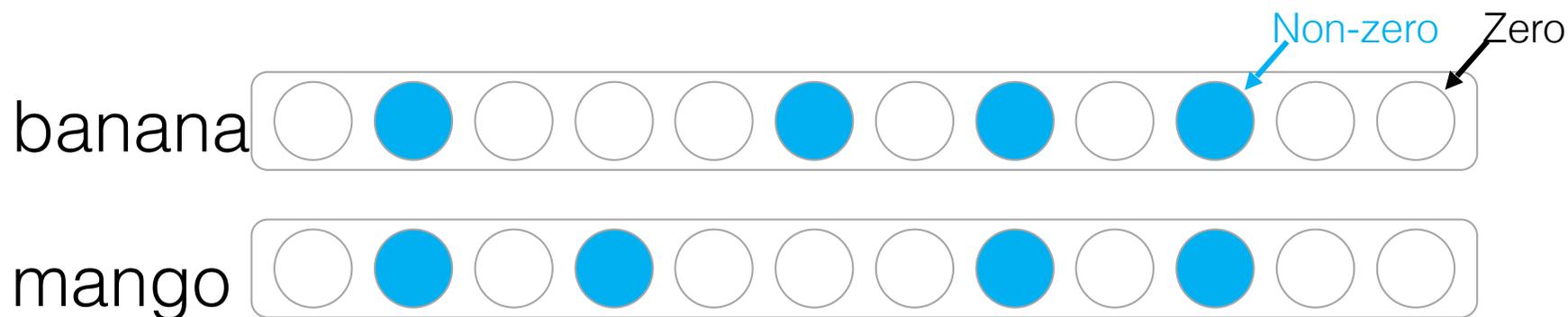
mango 

0	0	0	0	0	0	0	0	0	0	1	0
---	---	---	---	---	---	---	---	---	---	---	---



Notes: 1) Popular sim() is cosine, 2)  
Words/tokens come from some  
tokenization and transformation

# Context-based distributed representation



$\text{sim}(\text{banana}, \text{mango}) > 0$   
Appear in same documents  
Appear near same words



“You shall know a word by the company it keeps”

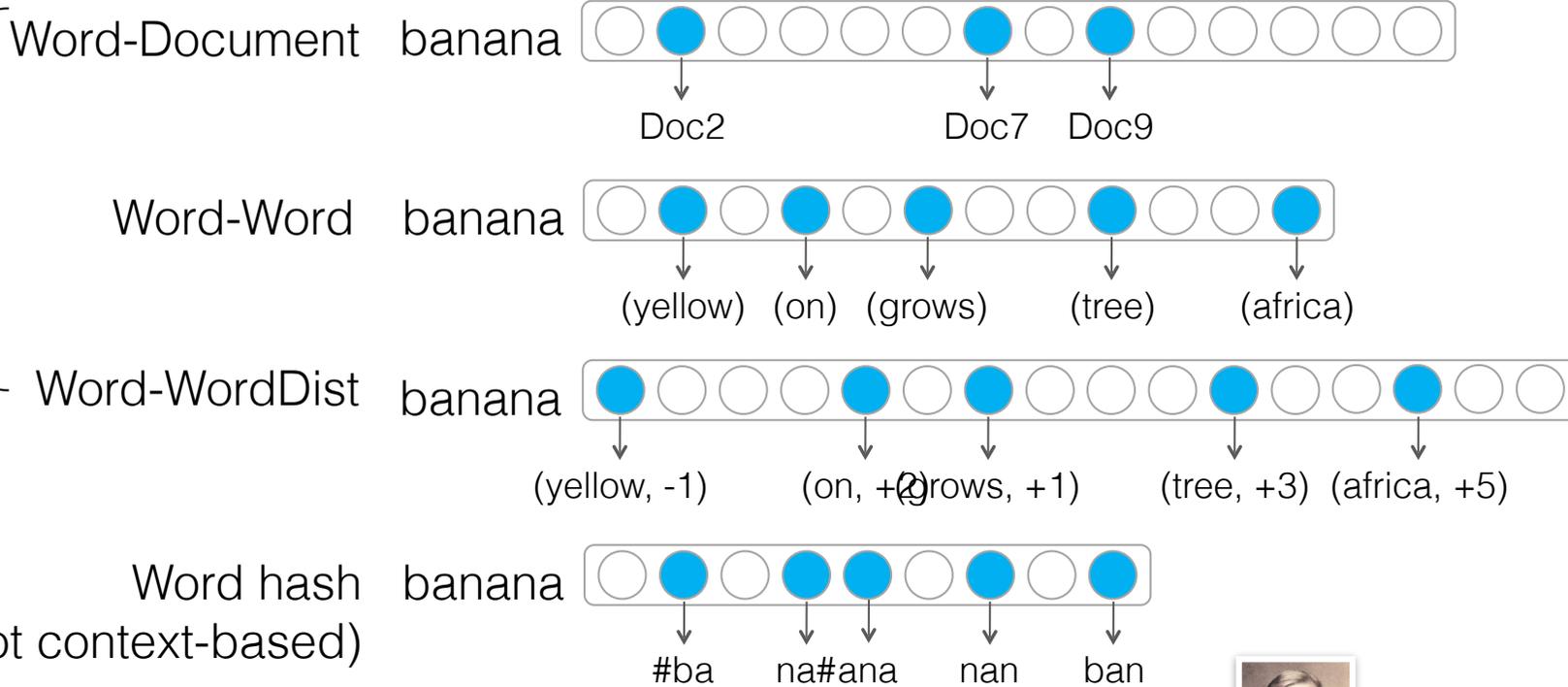
Firth, J. R. (1957). A synopsis of linguistic theory 1930–1955. In *Studies in Linguistic Analysis*, p. 11. Blackwell, Oxford.



Turney and Pantel. [From frequency to meaning: Vector space models of semantics](#). Journal of artificial intelligence research 2010

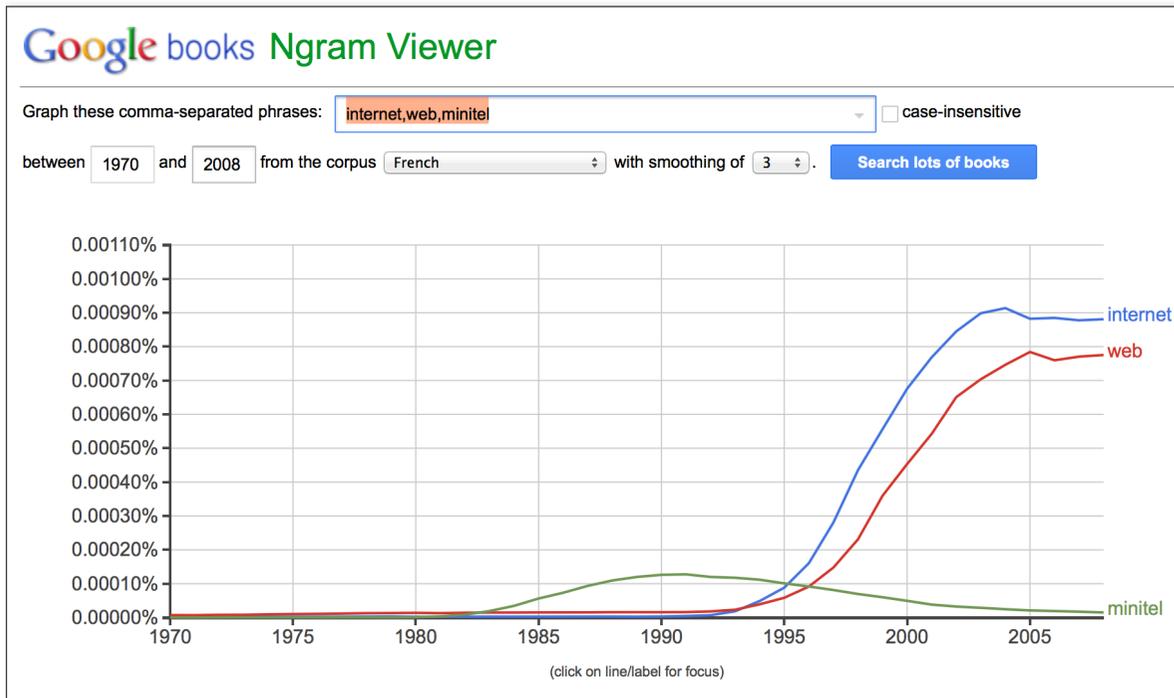
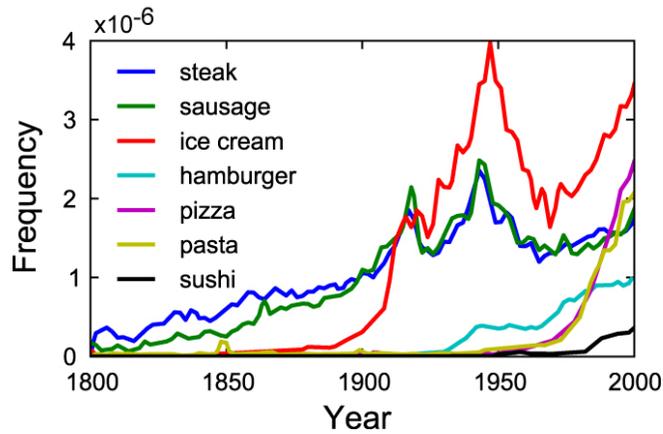
<http://bit.ly/NeuIRTutorial-WSDM2017>

Distributional Semantics



“You shall know a word by the company it keeps”

# Google books



> 5 million books  
unigrams,  
bi-grams...  
5-grams

*downloadable*

<http://storage.googleapis.com/books/ngrams/books/datasetsv2.html>

<https://books.google.com/ngrams>

# Latent Semantic Analysis / Indexing

$$\mathbf{A} \quad \begin{matrix} \text{M} \\ T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \\ \vdots \\ T_m \end{matrix} \begin{pmatrix} D_1 & D_2 & D_3 & D_4 & D_5 & D_6 & \dots & D_n \\ 0.00060 & 0.00012 & 0.00003 & 0.00003 & 0.00333 & 0.00048 & \dots & a_{1n} \\ 0 & 0 & 0 & 0 & 0 & 0 & \dots & a_{2n} \\ 0 & 2.98862 & 0 & 0 & 0 & 1.49431 & \dots & a_{3n} \\ 0 & 0 & 0 & 13.32555 & 0 & 0 & \dots & a_{4n} \\ 0 & 0 & 0 & 0 & 0 & 0 & \dots & a_{5n} \\ 1.03442 & 1.03442 & 0 & 0 & 0 & 3.10326 & \dots & a_{6n} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & a_{m3} & a_{m4} & a_{m5} & a_{m6} & \dots & a_{mn} \end{pmatrix}$$

$$\mathbf{B} \quad \mathbf{U}_k \quad \begin{matrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \\ \vdots \\ T_m \end{matrix} \begin{pmatrix} C_1 & C_2 & C_3 & \dots & C_m \\ a_{11} & a_{12} & a_{13} & \dots & a_{1m} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2m} \\ a_{31} & a_{32} & a_{33} & \dots & a_{3m} \\ a_{41} & a_{42} & a_{43} & \dots & a_{4m} \\ a_{51} & a_{52} & a_{53} & \dots & a_{5m} \\ a_{61} & a_{62} & a_{63} & \dots & a_{6m} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & a_{m3} & \dots & a_{mm} \end{pmatrix}$$

$$\Sigma = \sum_k \begin{matrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ \vdots \\ T_m \end{matrix} \begin{pmatrix} D_1 & D_2 & D_3 & \dots & D_n \\ a_{11} & 0 & 0 & \dots & 0 \\ 0 & a_{22} & 0 & \dots & 0 \\ 0 & 0 & a_{33} & \dots & 0 \\ 0 & 0 & 0 & \dots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \dots & a_{mm} \end{pmatrix}$$

$$\mathbf{V}_k^T \quad \begin{matrix} C_1 \\ C_2 \\ C_3 \\ C_4 \\ \vdots \\ C_n \end{matrix} \begin{pmatrix} D_1 & D_2 & D_3 & \dots & D_n \\ a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \dots & a_{3n} \\ a_{41} & a_{42} & a_{43} & \dots & a_{4n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \dots & a_{nn} \end{pmatrix}$$

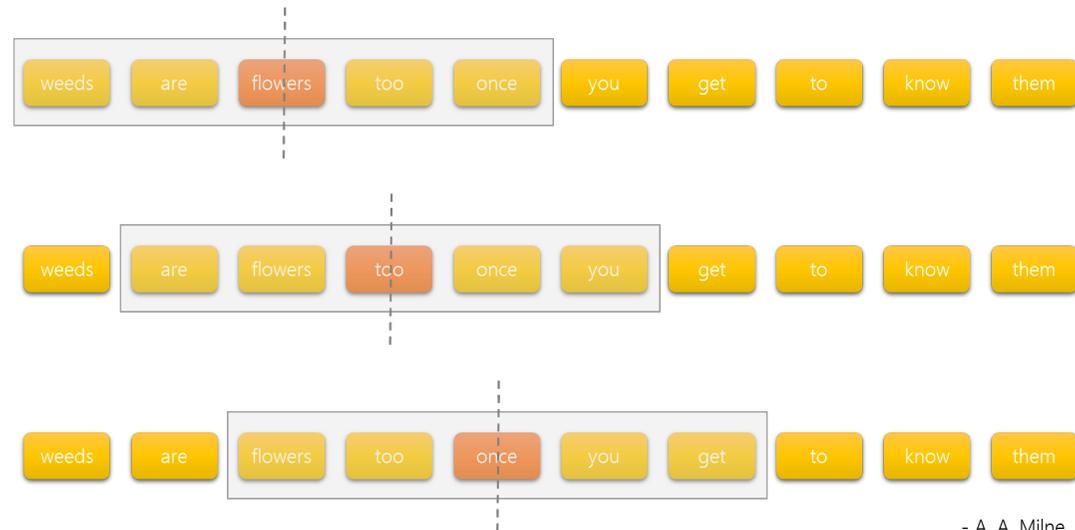
# Word2vec

Goal: simple (shallow) neural model learning from billion words scale corpus

Predict middle word from neighbors within a fixed size context window

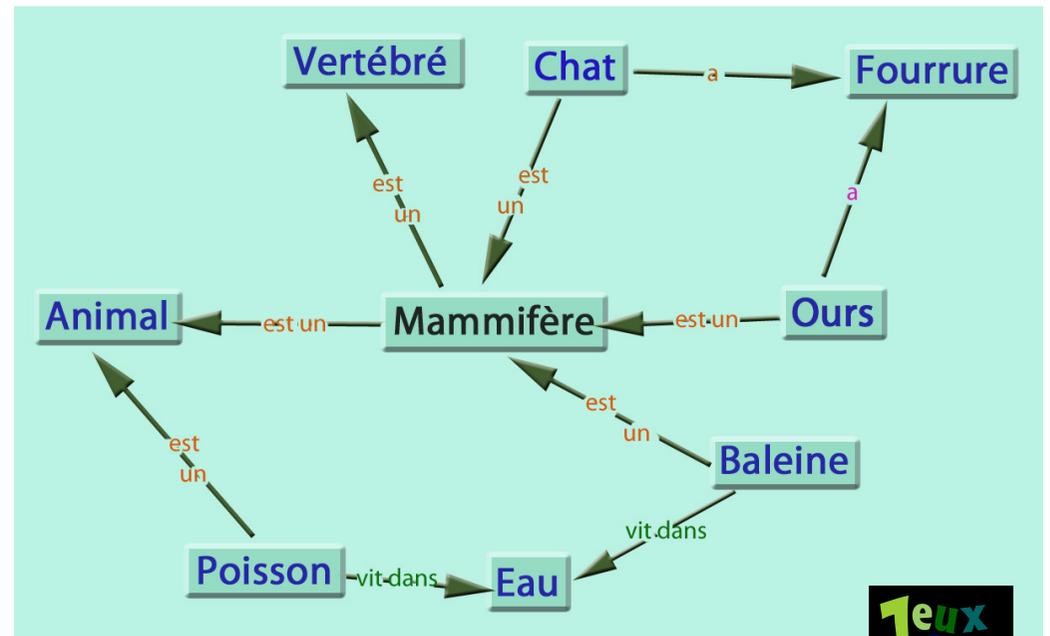
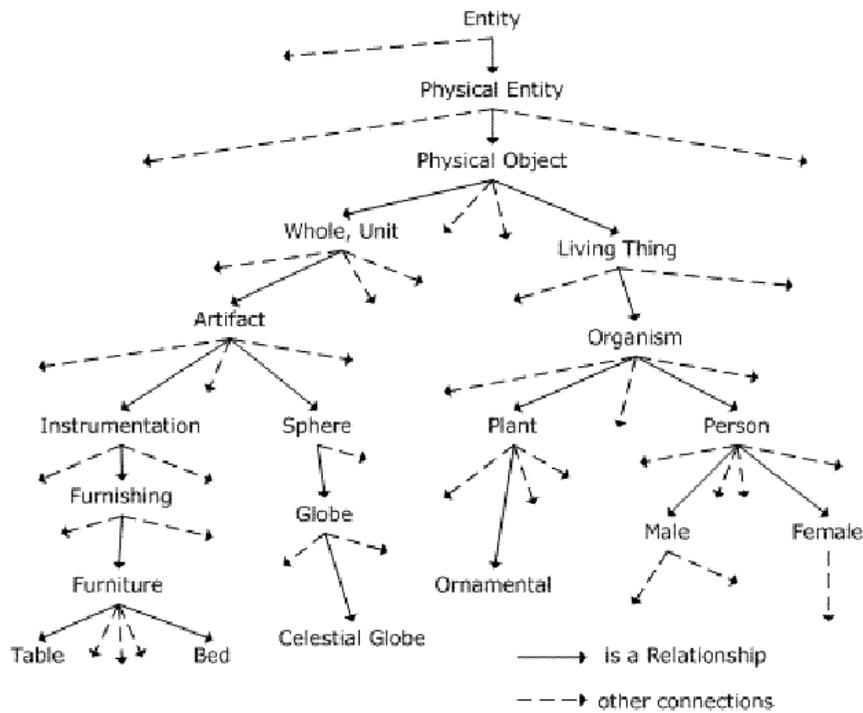
Two different architectures:

1. Skip-gram
2. CBOW



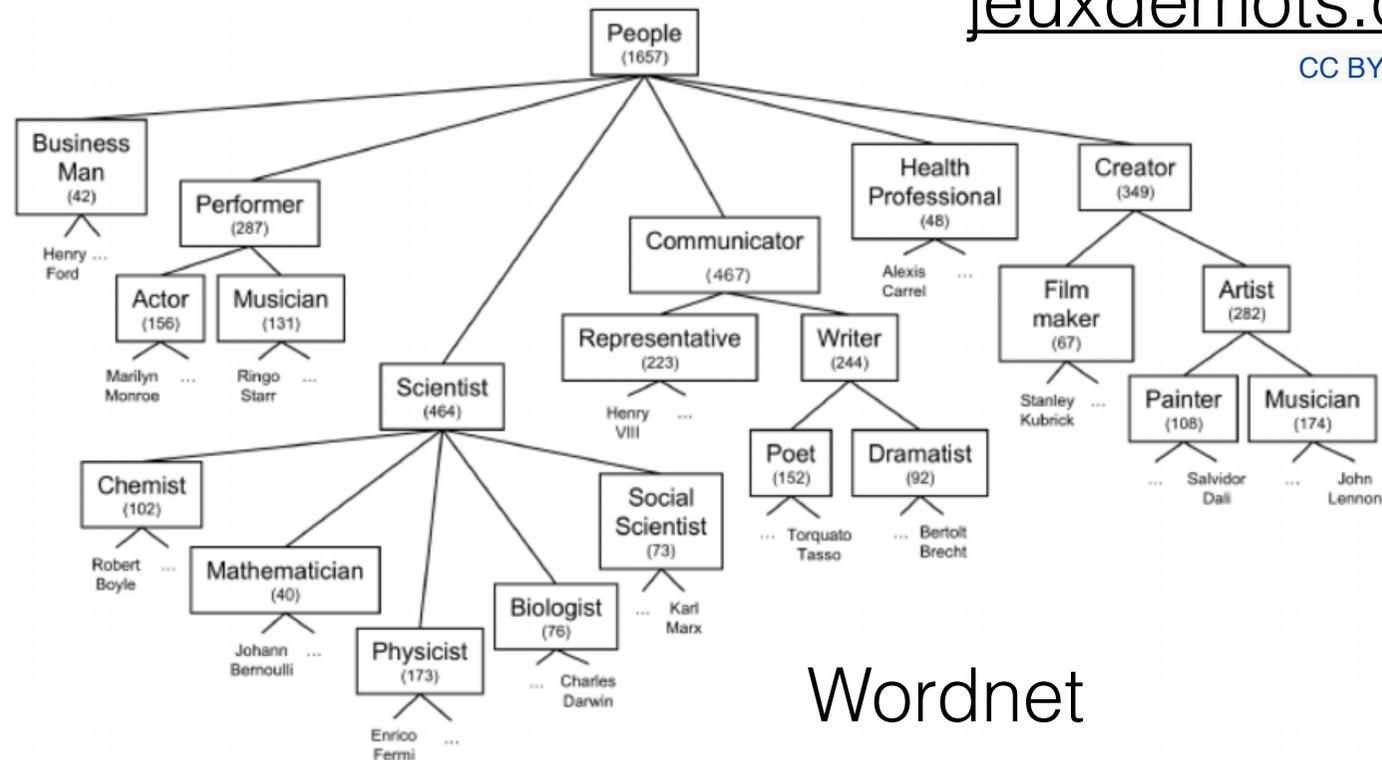
- A. A. Milne





[jeuxdemots.org](http://jeuxdemots.org)

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**Semantic similarity methods in wordNet and their a retrieval on the web**

G Varelas, E Voutsakis, P Raftopoulou... - ... on Web information  
Abstract Semantic Similarity relates to computing the similarity betw  
not lexicographically similar. We investigate approaches to computi  
mapping terms (concepts) to an ontology and by examining their re  
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**[PDF] The use of WordNet in information retrieval**

R Mandala, T Takenobu... - Use of WordNet in Natural ..., 1998 - a  
Abstract WordNet has been used in information retrieval research  
failed to improve the performance of their retrieval system. Thereb  
investigate why the use of WordNet has not been successful. Base  
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**[LIVRE] WordNet**

C Fellbaum - 1998 - Wiley Online Library  
... Information retrieval, document summarization, and machine tr  
applications that require ... text understanding is reasoning, that is,  
that is ... WordNet is the basis for software designed to help people  
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**Using WordNet to disambiguate word senses for te**

EM Voorhees - ... on Research and development in information re  
Abstract This paper describes an automatic indexing procedure tha  
contained within WordNet and the set of nouns contained in a text  
plysemous noun in the text. The result of the indexing procedure is  
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**WordNet: a lexical database for English**

GA Miller - Communications of the ACM, 1995 - dl.acm.org  
... In information retrieval, a query intended to elicit material relev  
polysemous word may elicit unwanted material relevant to other se  
WordNet lists the alternatives from which choices must be made. ...  
Cité 9110 fois [Autres articles](#) [Les 33 versions](#) [Web of Science:](#)

**[PDF] Text categorization and information retrieval**

P Rosso, E Ferretti, D Jiménez, V Vidal - ... International WordNet  
Abstract. In this paper we study the influence of semantics in the Te  
and Information Retrieval (IR) tasks. The K Nearest Neighbours (l  
perform the text categorization. The experimental results were obta  
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**An effective approach to document retrieval via util recognizing phrases**

S Liu, F Liu, C Yu, W Meng - ... and development in information r  
Abstract Noun phrases in queries are identified and classified into four types: proper names,  
dictionary phrases, simple phrases and complex phrases. A document has a phrase if all

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**An ontology-based approach to information retrieval**

A Meštrović, A Cali - Semantic Keyword-based Search on Structured Data ..., 2016 - Springer  
... Comput. Biomed. Res. 23(5), 410-425 (1990)CrossRefGoogle Scholar. 7. Mandala,  
R., Tokunaga T., and Tanaka H.: The use of WordNet in information retrieval. In:  
Proceedings of the Conference on Use of WordNet in Natural ...  
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**[PDF] A Novel Information Retrieval Approach using Query Expansion and Spectral-based**

S Alnofaie, M Dahab, M Kamal - information retrieval, 2016 - researchgate.net  
... This research aims to design a QESBIRM that can retrieve the document relevant to the ... C. Query  
Expansion and Proximity-Based Information Retrieval Model Park [3] expands the query using ...  
He uses LSI and WordNet synonyms to extend the query over fuzzy proximity model. ...  
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**A survey of query auto completion in information retrieval**

F Cai, M de Rijke - ... and Trends@ in Information Retrieval, 2016 - nowpublishers.com  
... 31-6-51115274 The preferred citation for this publication is F. Cai and M. de Rijke. A Survey of  
Query Auto Completion in Information Retrieval. Foundations and TrendsR in Signal Processing,  
vol. 10, no. 4, pp. ... A Survey of Query Auto Completion in Information Retrieval ...  
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**Back to the sketch-board: Integrating keyword search, semantics, and information retrieval**

J Azzopardi, F Benedetti, F Guerra, M Lupu - Semantic Keyword-based ..., 2016 - Springer  
... [6] proposed to use a VSM where the index terms adopted are the synsets extracted from WordNet. ...  
on text-only representations does not outperform the best KE4IR configuration described in [3]  
that uses semantic information. ... 4.2 Retrieval Using Terms and Filter on Concepts. ...  
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**Hybridization of an Index Based on Concept Lattice with a Terminology Extraction Model for Semantic Information Retrieval Guided by WordNet**

F Fkih, MN Omri - International Conference on Hybrid Intelligent Systems, 2016 - Springer  
Abstract In this paper, we present IRAFCA-WN an information retrieval system from textual  
documents. Our model includes an automatic extraction module of terminology and a  
module based on formal concept analysis (FCA) guided by WordNet for indexing. The  
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**Semantic indexing of Arabic texts for information retrieval system**

MA Abderrahim, M Dib, MEA Abderrahim... - International Journal of ..., 2016 - Springer  
... Using Arabic WordNet for semantic indexation in information retrieval system. ... On the evaluation  
and improvement of Arabic WordNet coverage and usability. ... Achour, H., & Zouari, M. (2013).  
Multilingual learning objects indexing and retrieving based on ontologies. ...  
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**[HTML] Improving biomedical information retrieval by linear combinations of different query expansion techniques**

https://scholar.google.fr/scholar?as\_ylo=2016&q=wordnet+information+retrieval&hl=fr&as\_sdt=0,5 nedcentral, ...

# An Effective Approach to Document Retrieval via Utilizing WordNet and Recognizing Phrases

Shuang Liu, Fang Liu, Clement Yu  
Department of Computer Science  
University of Illinois at Chicago  
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## Word Sense Disambiguation

**Step 1.** If  $t_2$  or a synonym of  $t_2$  is found in the definition of a synset of  $t_1$ , say  $S$ ,  $S$  is determined to be the sense of  $t_1$ .

**Example 4.1:** *Suppose a query contains the phrase “incandescent light”. In WordNet, the definition of a synset of “incandescent” contains the word “light”. Thus, this synset of “incandescent” is used.*

**Example 4.3:** *Suppose the query is “tropical storm”. A hyponym of the synset {storm, violent storm} is “hurricane” whose definition contains the word “tropical”. As a result, the sense of “storm” is determined.*

# Query Expansion Using WordNet

*incandescent light*

## (1) Add Synonyms.

**Example 4.4:** *In Example 4.1, the synset containing “incandescent” also contains “candent”. It can be verified that the synset is dominant for “candent” and therefore “candent” is added to the query.*

## (2) Add Definition Words.

**Example 4.5:** *For query term “euro” whose definition is “the basic monetary unit of ...”, the noun phrase “monetary unit” from the definition can be added to the query if it is highly globally correlated with “euro”.*

## (3) Add Hyponyms.

**Example 4.6:** *In Example 4.3, the definition of the hyponym synset of “hurricane” contains “tropical”, and “hurricane” is the only element in this synset. Thus, “hurricane” is added to the query.*

**Table 1. Mean Average Precision (MAP) Results by Different Algorithms**

Algorithm	Query Set (Collection)									
	TREC9 (WT10G)		TREC10 (WT10G)		TREC12 old (disk4&5)		TREC12 new (disk4&5)		TREC12 overall (disk4&5)	
SO	0.1872	n/a	0.1834	n/a	0.1009	n/a	0.2779	n/a	0.1894	n/a
NO	0.2096	12%	0.2130	16%	0.1061	5%	0.2860	3%	0.1961	3.5%
NO+P	0.2347	12%	0.2358	11%	0.1228	16%	0.2939	3%	0.2103	7%
NO+P+D	0.2434	4%	0.2574	9%	0.1641	34%	0.3346	14%	0.2494	19%
NO+P+D+F	<b>0.2613</b>	7%	<b>0.2752</b>	7%	<b>0.1729</b>	5%	<b>0.3641</b>	9%	<b>0.2685</b>	7.6%

# Conclusion

- Des résultats positifs mais... parfois décevants
- Quels types de ressources pour quelles applications ?
- Quand utiliser des ressources et quand ne pas les utiliser ?
- Quelles interfaces et quel niveau d'interaction ?
- Ressources génériques vs. ressources spécialisées vs. ressources personnalisées
- ... dépasser le signe en gardant la forme

*Le signe et la forme*

