

# **Expert System**

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**Who, What, When, Where and How:  
Semantics helps connect the dots**

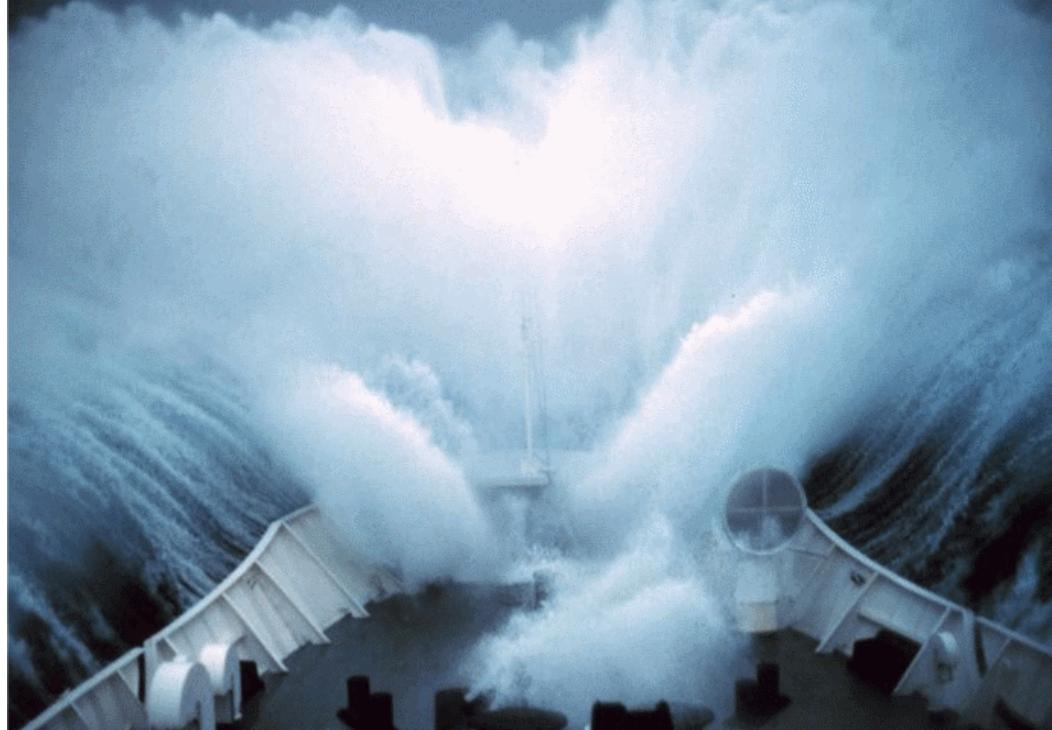
**Gian Piero Oggero  
Director Strategic Accounts, Intelligence Division**

**Andrea Melegari  
COO, Intelligence Division**



# A flood of unstructured data & information

More than 80% of the knowledge on which our daily jobs are based is **unstructured** (emails, documents, web pages, articles, information from social media, etc.).



# Every 60 seconds on the Internet



Source: GO Globe July 2011

# The limits of traditional approaches

## Keyword Technology or Statistics

Breaks text into single words without considering the context, like reading a language that we don't understand:

*Az IBM szokásosan nagy hangsúlyt helyez a továbbképzésre, így munkatársai évente számos szakmai tanfolyamon vesznek részt.*

**Neither understands the *meaning* of words.**

## Shallow Linguistic Technology

Recognizes words and identifies their most basic forms (lemmas), but cannot distinguish between different meanings.

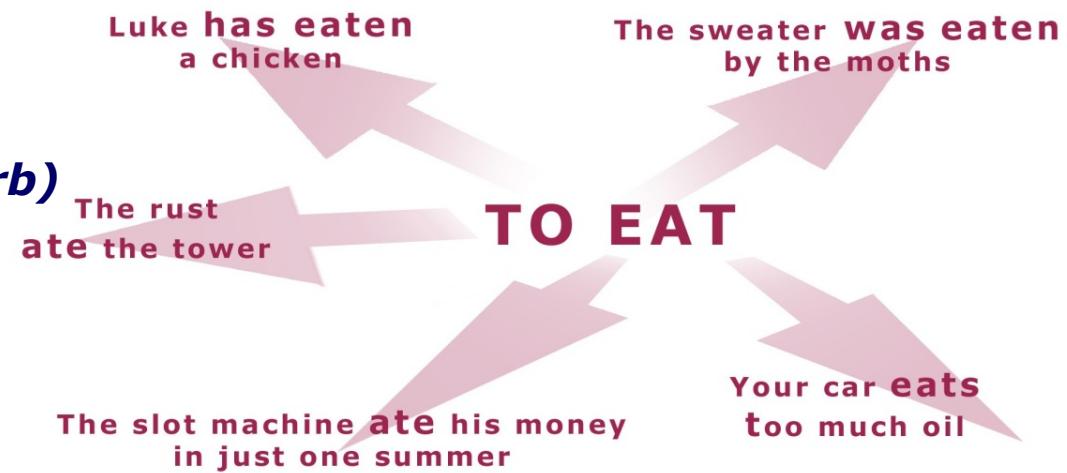
***Sell -> Selling -> Sold***

# Why we are different

**Semantic technology understands the meaning of words in the same way you learned to read.**

- It understands the relationships between words.

**Luke (subject) has eaten (verb) a chicken (object).**



- It understands the meaning of words.

**To eat (chicken); to consume (oil); to destroy (sweater); to spend (money); to rust (the tower), etc.**

# Where semantic technology excels



cafe

About 223,000,000 results (0.18 seconds) **Search** Advanced search

**Café - Wikipedia, the free encyclopedia**  
A **café** (pronounced /kəfē/ or /kæfē/), also spelled **cafe**, may in the United States mean an informal restaurant, offering a range of hot meals and ...  
[en.wikipedia.org/wiki/Café](http://en.wikipedia.org/wiki/Café) - Cached - Similar

**Corporate Average Fuel Economy - Wikipedia, the free encyclopedia**  
The **Corporate Average Fuel Economy (CAFE)** are regulations in the United States, first enacted by US Congress in 1975, and intended to improve the average ...  
[en.wikipedia.org/wiki/Corporate\\_Average\\_Fuel\\_Economy](http://en.wikipedia.org/wiki/Corporate_Average_Fuel_Economy) - Cached - Similar

**CaFÉ - CallForEntry.org**  
divider; About Us; divider; Calendar; divider; **Cafe** Chat; divider; How To Apply; divider; Image Prep; divider; **Cafe** Help; divider ...  
[www.callforentry.org/](http://www.callforentry.org/) - Cached - Similar

**Free online games. Play new single and multiplayer games online ...**  
Play the best FREE online games with your friends in the fastest growing online games community. Win Real Prizes!  
[www.cafe.com/](http://www.cafe.com/) - Cached - Similar

**CAFE Overview**  
18 Dec 2001 ... Congress specified that **CAFE** standards must be set at the "maximum feasible level." Congress provided that the Department's determinations ...  
[www.nhtsa.gov/cars/rules/cafe/overview.htm](http://www.nhtsa.gov/cars/rules/cafe/overview.htm) - Cached

**Custom T-Shirts, Unique Gifts, Posters, & Personalized Mugs ...**  
CafePress has the best selection of custom t-shirts, personalized gifts, posters & art, mugs, and much more. Get your unique or funny gift, t shirt, ...  
[www.cafepress.com/](http://www.cafepress.com/) - Cached - Similar

**Canadian Association of Family Enterprise**  
10-7-2010 **CAFE** Edmonton and ABFI present the 2010 Family Enterprise Forum 07-27-2010  
Check out the Events Calendar for a sneak peak at what Manitoba has ...  
[www.cafecanada.ca/](http://www.cafecanada.ca/) - Cached - Similar

**Starbucks Coffee Company**  
Since 1971, Starbucks has been committed to ethically sourcing and roasting the highest quality arabica coffee in the world. Today, with stores around the

Sponsored links

One keyword,  
many  
different meanings.

Over 231 million  
results  
for a single query.

# The problem of text analysis

Same word,  
different  
meanings



Jaguar (animal)  
Jaguar (car)

Different words,  
but the same  
meanings



Disability Legislation  
Equal Opportunity Law

Different words,  
related  
meanings

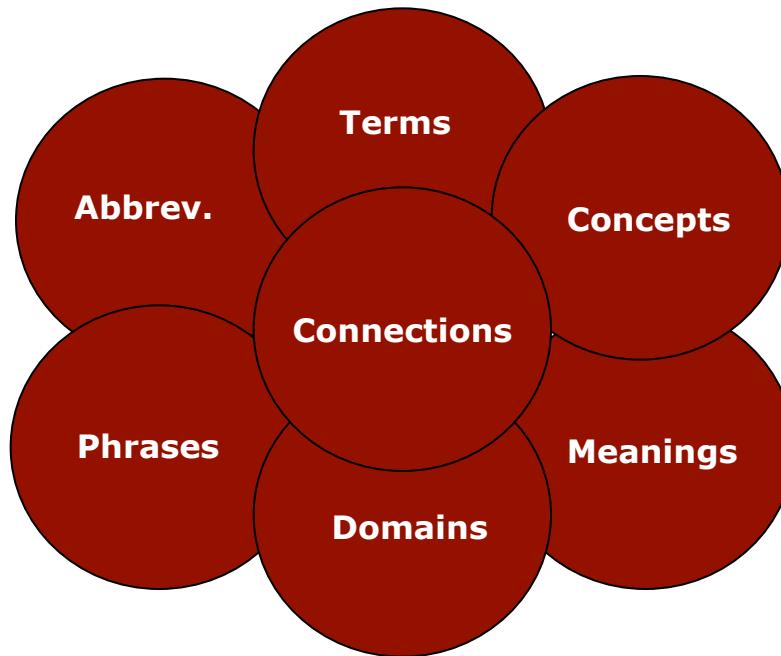


Organization → Company  
Organization → Charity  
Organization → Trade Union

# The semantic net, the heart of Cogito

Traditional technologies can only guess the meaning of words using keywords, shallow linguistics and statistics.

Instead, semantic networks can identify:



***"San Jose is an American city."***

***"San Jose is a geographic part of California."***

# Disambiguation example

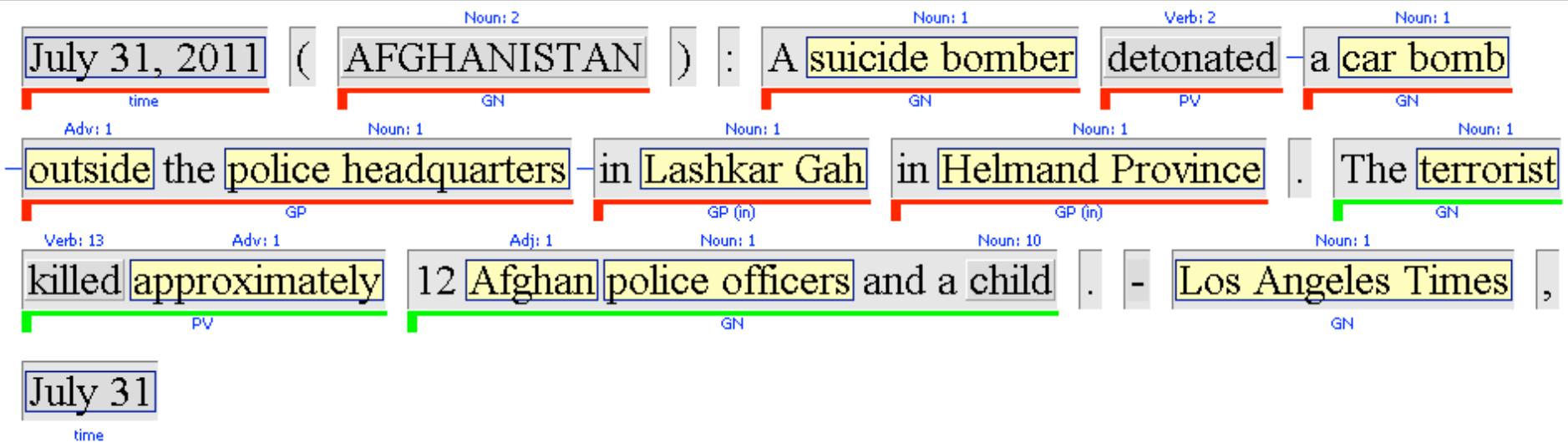
## The original text:

July 31, 2011 (AFGHANISTAN): A suicide bomber detonated an explosives-laden vehicle outside the police headquarters in Lashkar Gah in Helmand Province. The terrorist killed approximately 12 Afghan police officers and a child.

- *Los Angeles Times, July 31*

# Disambiguation: Grammar analysis

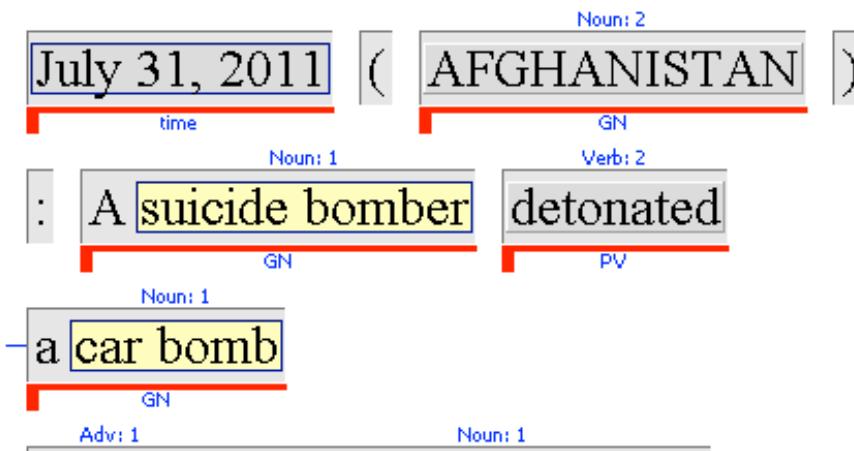
July 31, 2011 (AFGHANISTAN): A suicide bomber detonated a car bomb outside the police headquarters in Lashkar Gah in Helmand Province. The terrorist killed approximately 12 Afghan police officers and a child. - Los Angeles Times, July 31



# Disambiguation: Logical analysis

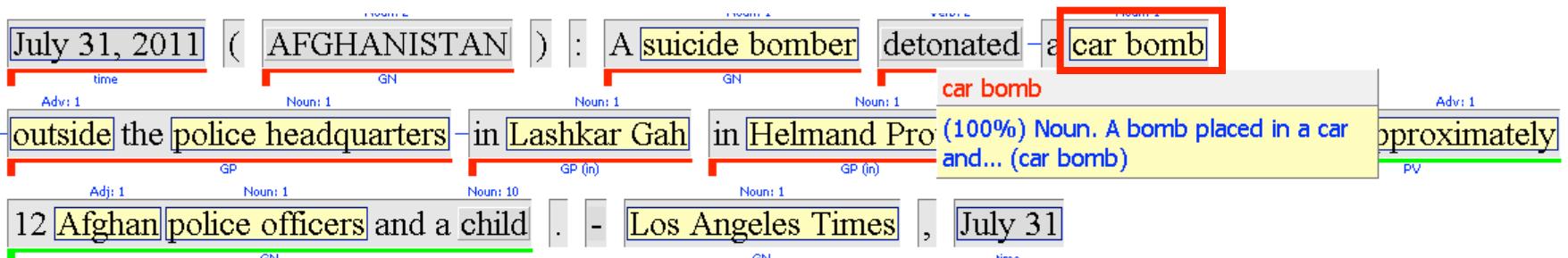
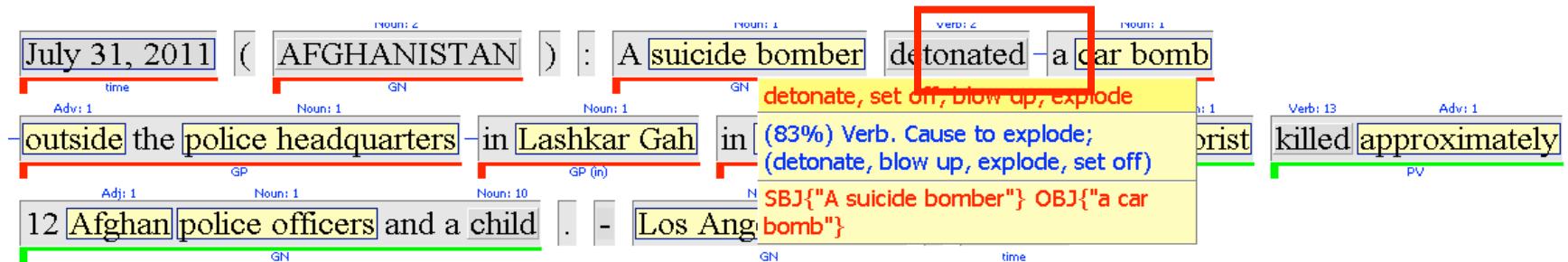
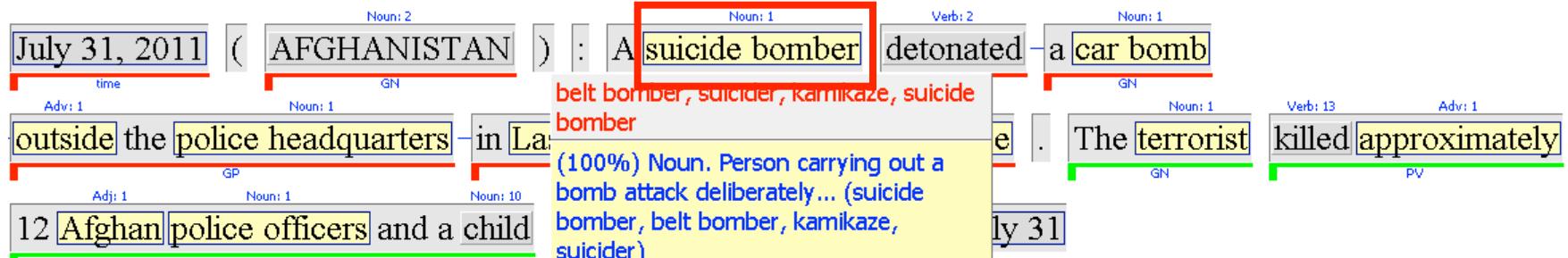
July 31, 2011 (AFGHANISTAN): A suicide bomber detonated a car bomb outside the police headquarters in Lashkar Gah in Helmand Province. The terrorist killed approximately 12 Afghan police officers and a child. - Los Angeles Times, July 31

- crime 16.3% (2)
  - suicide bomber #198700#
  - car bomb #14226#
- police 9.2% (2)
  - police headquarters #19280#
  - police officer #46692#

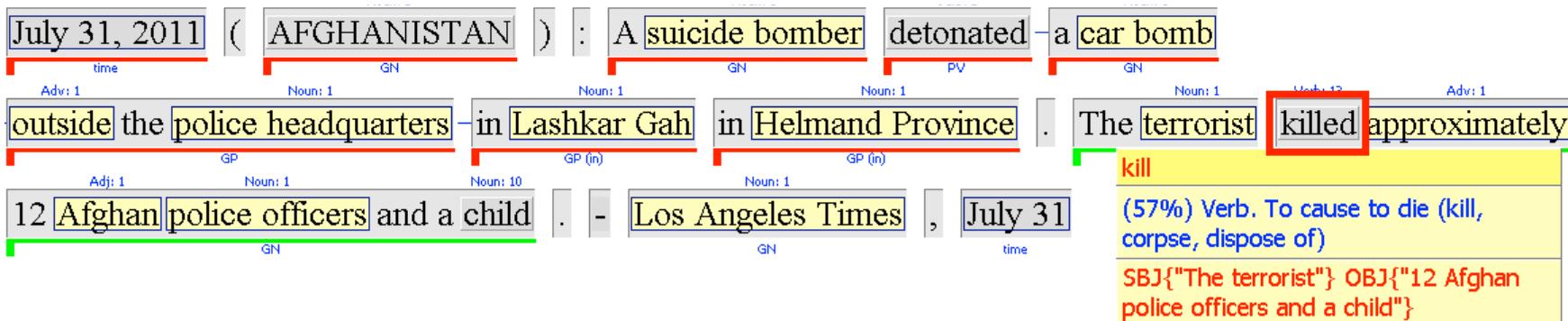
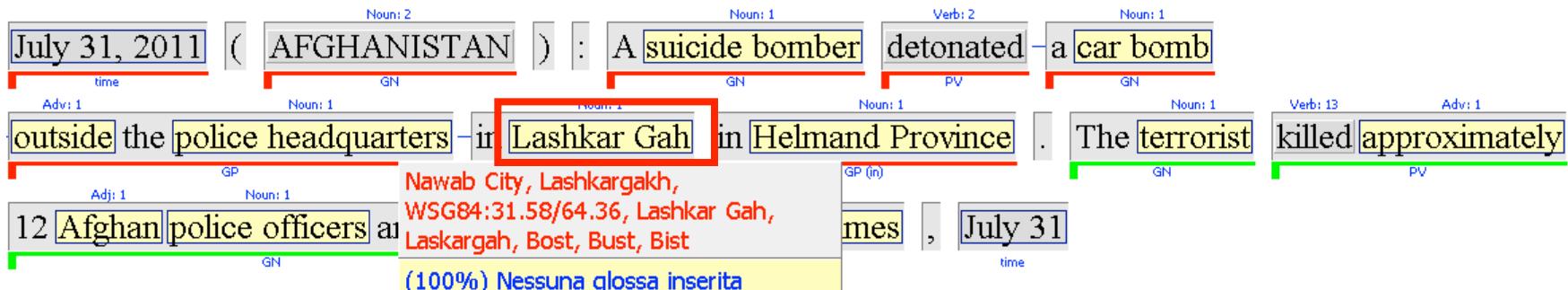


- detonate
  - SBJ:"A suicide bomber"
  - OBJ:"a car bomb"
- kill
  - SBJ:"The terrorist"
  - OBJ:"12 Afghan police officers and a child"

# Disambiguation: Semantic analysis



# Disambiguation: Semantic analysis



# The Cogito semantic network

20110731 ctc afghanistan.rtf - COGITO - Semantic Disambiguator

File Edit Commands Show Flags View Help

July 31, 2011  
headquart  
officers ar

July 3  
Verb: 2  
detona  
PV  
in Las  
Verb: 13  
killed

Lemma available meanings: lemmaID:481853 - pos:149 - tkn:24 - key:10 - grp:13

2	13	Sort	superverb/subverbum
v. of general action, v. di azione generica	[1] kill, "corpse", "off", "dispose of" Score: 768229 No domain Verb. To cause to die (kill, corpse, dispose of)	v	
No domain Verb. V. DI AZIONE GENERICA (v. of general action, v. di azione generica)	[2] "kill" Score: 69530 No domain Verb. To cause severe physical pain or discomfort...	v	
v. of action, v. di azione	[3] kill, stamp out Score: 63598 No domain Verb. To cause something to end or be... (stamp out, kill)	v	
No domain Verb. V. DI AZIONE (v. of action, v. di azione)	[10] "kill" Score: 57241 No domain Verb. To exhaust somebody completely	v	
	#68462 WNET[ #71775 ] Attr: Transitivo Sbj: [shot, shooting], [contacting, contact], [burst, explosion, deflagration], [attack, attempt, assault], [military action, cat. azioni militari, action], [fire, firing], [emanation, emission], [python], [carnivore], [beast of prey, predatory animal, predator], [bomb],	v	
	drown No domain Verb. Kill by submerging in water; (drown)	v	
	slaughter, mow down, "	v	

# What is a semantic network?

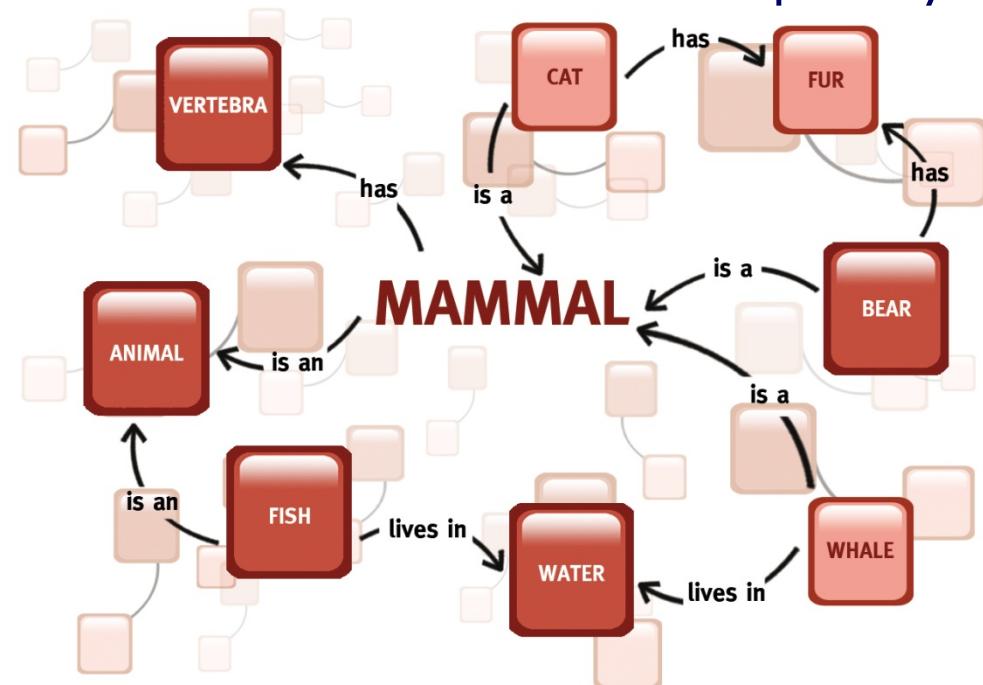
A rich map of associations and meanings of words.

- Includes all definitions of all words.
- Includes relationships between all words.

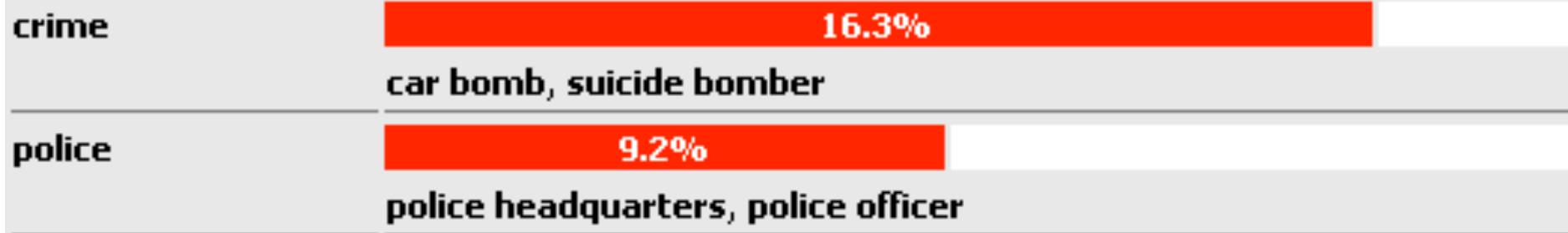
The quality of results is derived from the richness and complexity of the semantic network.

## COGITO® English Semantic Network:

- 350,000 words
- 2.8M relationships



# Disambiguation: Categorization

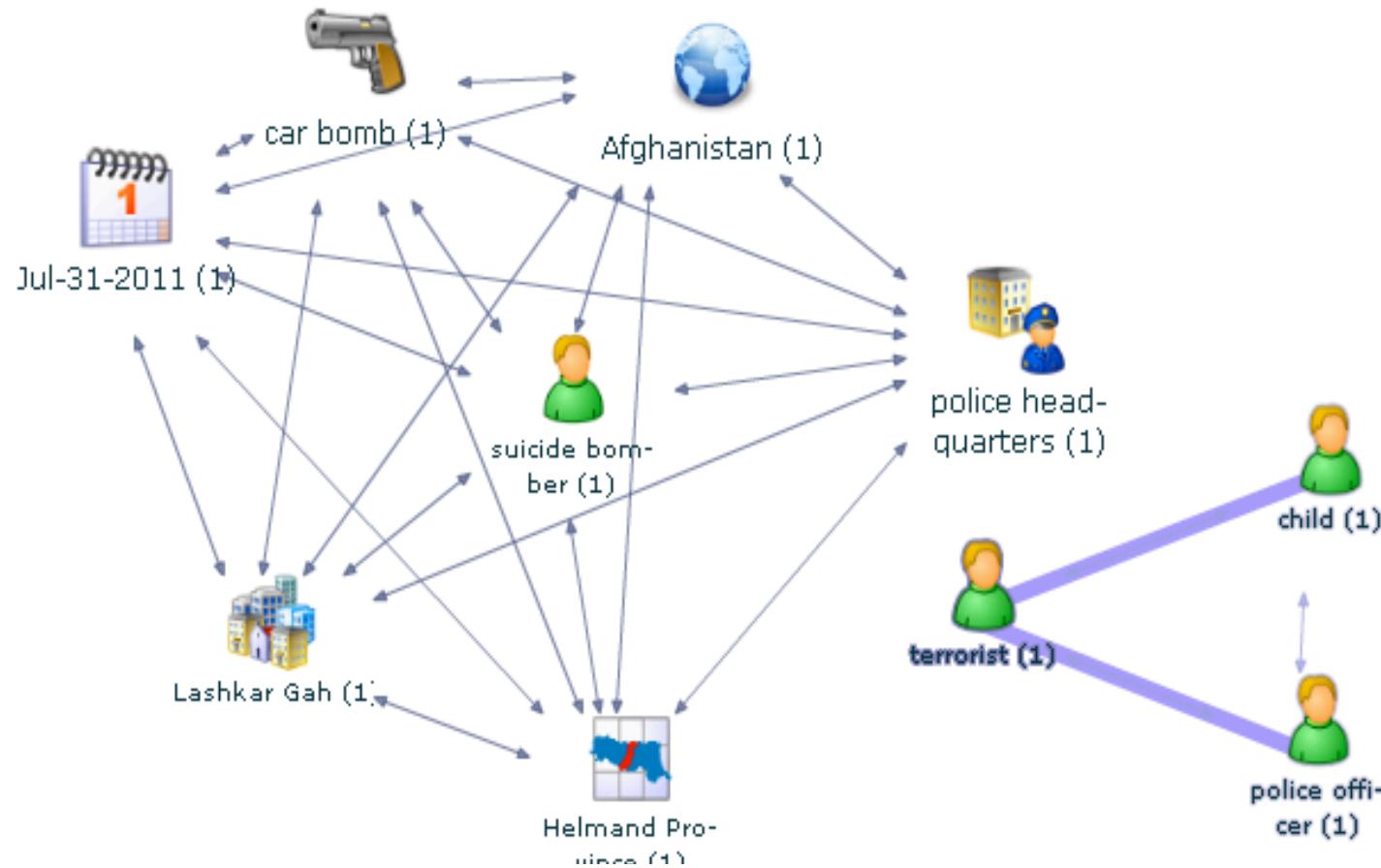


## Cogito features:

- Classification using taxonomies.
- Custom taxonomy building.



# WHO: Relationships between entities



# WHAT: Context and concepts of interest

## What's happening?



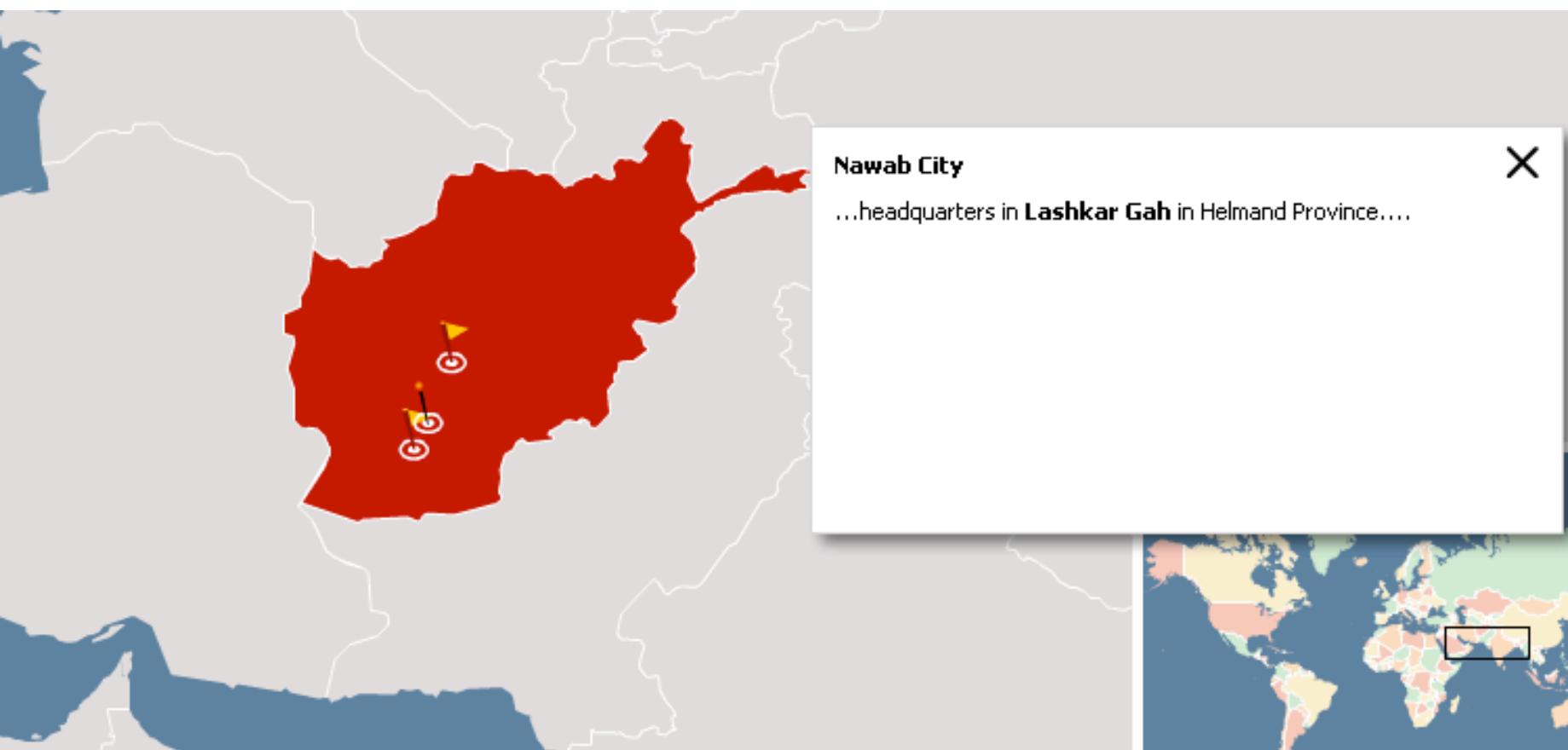
## Main concepts

45.7%	suicide bomber
39.9%	car bomb
14.3%	police headquarters

## Concepts of interest

July 31, 2011 (AFGHANISTAN): A suicide bomber <b>detonated</b> a <b>car bomb</b> outside the police headquarters in Lashkar Gah	
	<b>Elements</b>
car bomb (#14226)	<b>Weapon</b>
Lashkar Gah (#11134720)	<b>City</b>
suicide bomber (#198700)	<b>People</b>
child (#45047)	
police officer (#46692)	
terrorist (#47776)	
police headquarters (#19280)	<b>PoliceStation</b>
Helmand Province (#6000060)	<b>Province</b>
Afghanistan (#39770)	<b>Country</b>
Jul-31 (#65454)	<b>Date</b>
Jul-31-2011 (#65454)	

# WHERE: Integration with maps



# WHEN and HOW

Automatic identification of the *timeline of events* and *how* the different entities were involved (type of entities, role in the event, etc.).

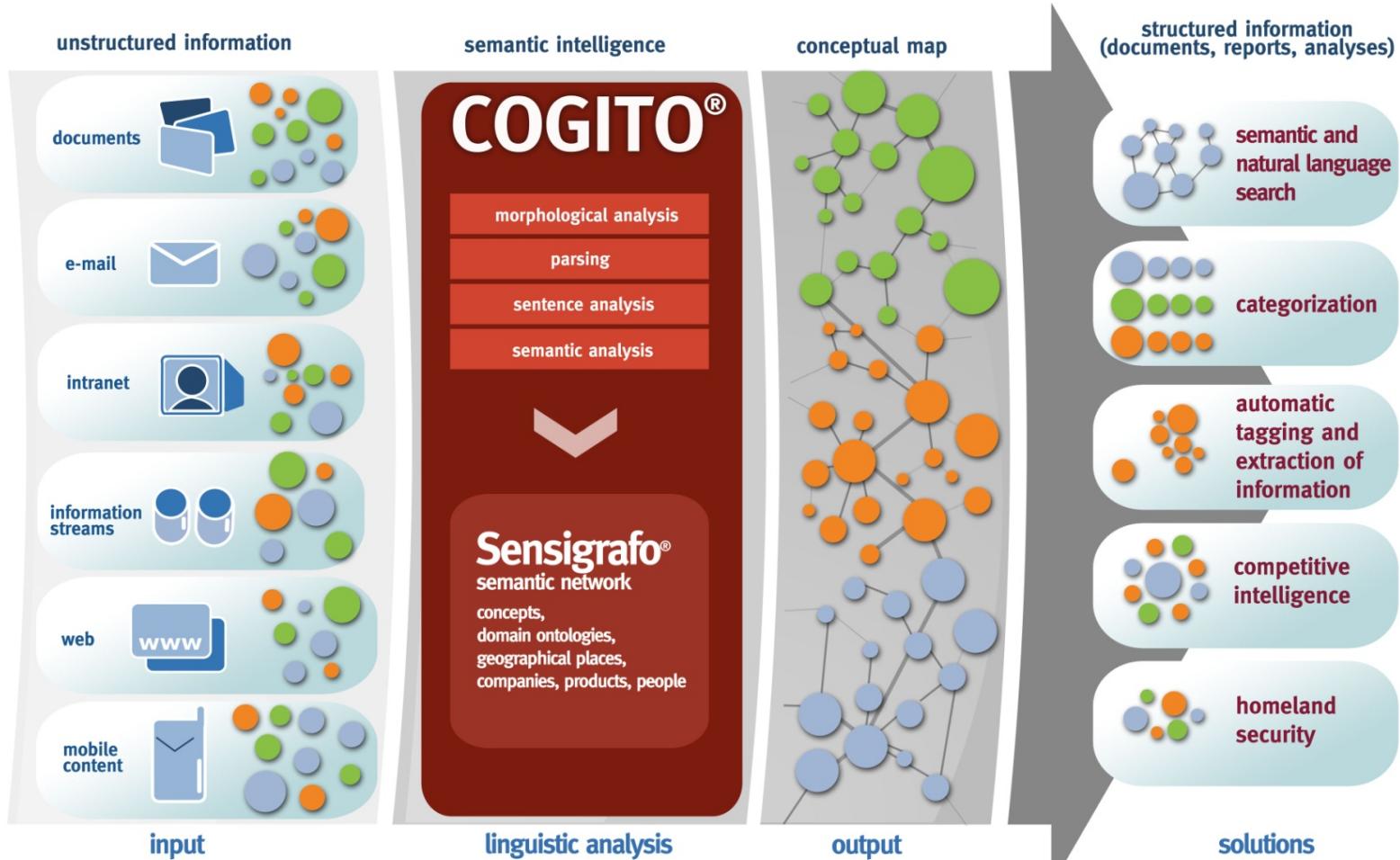
**detonate** (#67338)

+ sbj	<i>People</i>	<b>suicide bomber</b> (#198700)
+ obj	<i>Weapon</i>	<b>car bomb</b> (#14226)
+ time	<i>Date</i>	<b>Jul-31-2011</b> (#v370659)
+ other	<i>Country</i>	<b>Afghanistan</b> (#39770)
+ other	<i>PoliceStation</i>	<b>police headquarters</b> (#19280)
+ other	<i>City</i>	<b>Lashkar Gah</b> (#11134720)
+ other	<i>Province</i>	<b>Helmand Province</b> (#6000060)

**kill** (#71775)

+ sbj	<i>People</i>	<b>terrorist</b> (#17776)
+ obj	<i>People</i>	<b>police officer</b> (#46692)
+ obj	<i>People</i>	<b>child</b> (#45047)

# How Cogito works



# Next generation technology

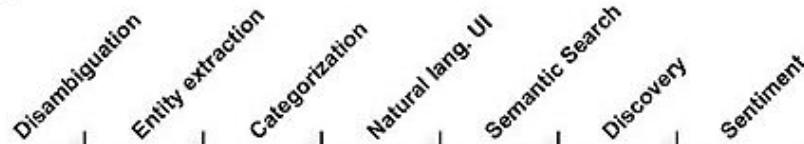
100% semantic technology for  
next-gen text analysis

Excels in the areas where  
traditional technologies fall short

# COGITO®

## Semantic Intelligence

- Linguistic rules
- Sentence analysis
- Semantic Network

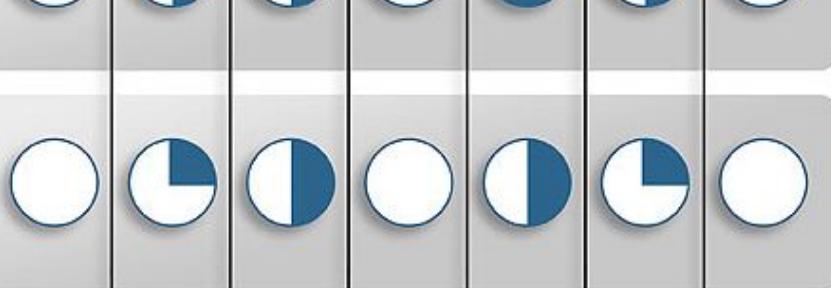


## Shallow text analytics

- Statistics
- Heuristic rules
- Morphological recognition



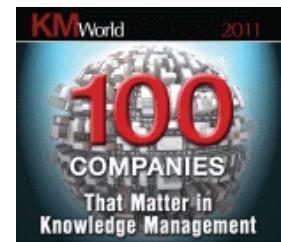
## Keyword-based technologies



# Who we are

**Expert System is the largest, fastest growing semantic software company in the world.**

**We develop technology, applications and solutions to extract, understand and share information more effectively.**



# Established market presence

- Expert System was established in Modena, Italy by three young programmers with an idea. A few months later, Expert System's software was integrated into the Microsoft Office suite.
- Private and Profitable with Revenue doubled in the last three years to over \$15 million in 2010 and EBITDA above 20%.
- 30% of resources devoted to R&D and over \$14 million invested in the last 3 years, with \$5M more planned for the next 2 years.
- More than 100 employees and offices in Italy, London, Washington, D.C. and Chicago.

# Recognized for mature and proven technology



Identified among the world's leading information access technology developers.

Selected one of the “Innovative Information Access Companies Under \$100M to Watch.”

Recognized for text analytics and superior SharePoint integration capabilities.

One of the few non-Microsoft technologies in the MS Office suite.

# Contact us

**Thank You!**

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**Gian Piero Oggero**  
[goggero@expertsystem.net](mailto:goggero@expertsystem.net)

**[www.expertsystem.net](http://www.expertsystem.net)**

# COGITO® Intelligence Platform

# What we do

**The Cogito Intelligence Platform supports analysts in all phases of the intelligence cycle:**

- **Acquisition:** Crawler to acquire data from different sources
- **Exploitation:** Interact with data using semantic analysis
- **Evaluation:** Easily produce reports using the exploited data
- **Distribution:** Sharing data with other authorized users

# Cogito Intelligence Platform

Combines superior text analytics and domain ontology capabilities with the ability to search and manage large quantities of data from:

- **Documents**
- **Multimedia**
- **Audio streams**
- **Web pages**
- **Social networks**

Incorporates a proven approach for intelligence data management, and features the best software components for:

- **Speech analysis**
- **GEO mapping**
- **Deductive algorithms**
- **Advanced visualization systems**

# Working with concepts, keywords and lemmas

CIP COGITO® Intelligence Platform | mdinanni 8:41 AM

IPTC Taxonomy

- Economy, Business and Finance (2)
  - Media (1)
    - News Agency (1)
  - Politics (2)
    - Nuclear Policy (2)
  - Health (1)
    - Disease (1)
      - Virus Diseases (1)
- View more

Geo Taxonomy [3]

- United States (2)
  - Texas (1)
- Iran (2)
- Israel (2)

worm ▾ X Insert text noun

Did you mean...

- worm as noun   
A computer program that invades computers on...
- worm as keyword
- worm as lemma
- worm as noun   
Any of numerous relatively small elongated soft-bodied...
- worm as noun   
Threads gear with the teeth of a...
- worm as noun   
Somebody regarded as contemptible, especially somebody who...
- worm as noun   
The larva of an insect, for example,...
- worm as noun   
An animal that looks or moves like...

Available corpora

- Public for All Users (11037)
- Uncategorized (11037)
  - English (10158)
  - Italian (879)

Available sources

- Public for All Users (11037)
- RSS Feeds (11036)
  - Feeds Bbc Co Uk News (1469)
    - Europe (304)
    - US and Canada

EXPERT SYSTEM SEMANTIC INTELLIGENCE

30

# Working with taxonomies and categories

CIP COGITO® Intelligence Platform mdinanni 8:43 AM

IPTC Taxonomy   

- Politics (19)
  - Diplomacy (19)
    - Summit (3)
    - Peace
    - Negotiations (2)
    - Alliances (1)
  - Defence (19)
    - Armed Forces (2)
    - Military Equipment (2)
  - Government (5)
    - Heads of State (3)
    - Government Departments (2)
    - National Government (1)
  - Election (3)
    - Voting (1)
    - Political Campaigns (1)
  - Espionage and Intelligence (3)
  - Foreign Aid (2)
  - Parliament (1)
    - Upper House (1)

National Security  International Relations   Insert text.

Search Clear Sensigrafo

Results Geo Map Google Map Google Earth Tag Cloud

1-10 of 19 results sorted by Creation date (0.625 seconds)  

 <http://www.bbc.co.uk/go/rss/int/news/-/news/world-south-asia-13263270>

Creation date [3 May 2011 12:17:37] - Acquisition date [3 May 2011 10:58:59]  
Corpus [English] - Source [http://newsrss\_bbc\_co\_uk\_rss\_newsonline\_uk\_edition\_front\_page\_rss\_xml]  
But in his opinion piece, Mr Zardari said Pakistan had "never been and never will be the hotbed of fanaticism that is often described by the media".

Key Groups (23%) - Counter Terrorism (6%) - 9 People 2 Countries 2 Places  
International Relations (4%) - War (2%) - 8 Organizations 6 Cities 0 URLs



 <http://feedproxy.google.com/~r/TheGlobeAndMail-International/~3/Fz2Rj1zM77A/>

Creation date [3 May 2011 12:12:49] - Acquisition date [3 May 2011]

Available corpora   

- Public for All Users (11037)
  - Uncategorized (11037)
    - English (10158)
    - Italian (879)

Available sources   

  - Public for All Users (11037)
    - RSS Feeds (11036)
      - Feeds Bbc Co Uk News (1469)
        - Europe (304)
        - US and Canada (295)
        - Africa (236)
        - Asia pacific (233)
        - Middle East (154)
        - Latin America (132)
        - South Asia (115)
      - Feeds (2)

# Using entities for interacting with data

CIP

COGITO Intelligence Platform | mdinanni 8:52 AM

IPTC Taxonomy  
Geo Taxonomy [16]  
Places [10]  
People [32+1]

Leon Panetta person  
Pentagon organization

Insert text..

Search Clear Sensigrafo

Results Tag Cloud

1-6 of 6 results sorted by Creation date (desc)  
(0.452 seconds)

<http://www.bbc.co.uk/go/rss/int/news/-/news/world-us-canada-13261064>  
· Creation date [3 May 2011 12:17:36] - · Acquisition date [3 May 2011 11:14:36]  
· Corpus [English] - · Source [[http://newsrss.bbc.co.uk/rss\\_newsonline\\_uk\\_edition\\_front\\_page\\_rss\\_xml](http://newsrss.bbc.co.uk/rss_newsonline_uk_edition_front_page_rss_xml)]  
US President Barack Obama has hailed the death of Al-Qaeda leader Osama Bin Laden as a "good day for America", saying the world is now a safer and a better place.

Unrest, Conflicts and War (25%) - Key Groups (21%) - Counter Terrorism (7%) - Death and Dying (3%) - Counter Terrorist Attack (3%)

8 People 3 Countries 3 Places  
9 Organizations 6 Cities 0 URLs

Available corpora   
 Public for All Users (11037)  
 Uncategorized (11037)  
 English (10158)  
 Italian (879)

Available sources   
 Public for All Users (11037)  
 RSS Feeds (11036)  
 Feeds Bbc Co Uk News (1469)  
     Europe (304)  
     US and Canada (295)  
     Africa (236)  
     Asia pacific (233)  
     Middle East (154)  
     Latin

# Creating queries using the semantic tag cloud

COGITO® Intelligence Platform | amelegari 9:10 AM

IPTC Taxonomy  
Geo Taxonomy [49]  
Places [44]  
People [100]  
Organizations [80]

Facebook X Insert text..  
fairet item

Search Clear Sensigrafo

Results Google Map Tag Cloud Entity Map

Available corpora

Public for All Users (11037)  
 Uncategorized (11037)  
 English (10158)  
 Italian (879)

Available sources

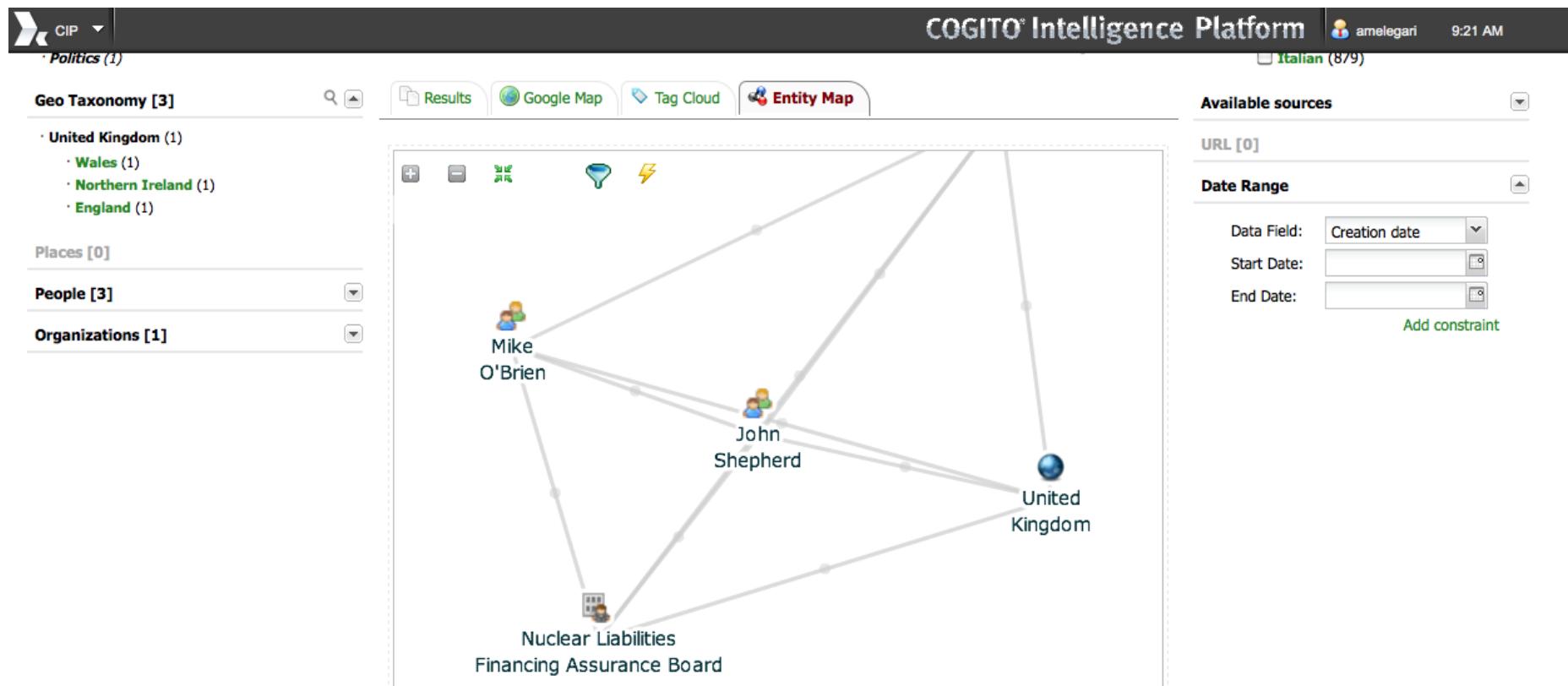
URL [22]

Date Range

Data Field: Creation date  
Start Date:   
End Date:  Add constraint

account, act, airship, alert, American, analyst, anniversary, announcement, **Barack**  
**Obama**, Cameron Reilly, candidate, Central Intelligence Agency, Chernobyl Anniversary  
Projection, China, coal, comment, company, damage, data, **data center**, **data centre**,  
deficit, disaster, Don Graham, Earth Day, Earth Day Network, economy, **election**, employee,  
**energy**, event, **experience**, fan, firm, Fukushima, Google, **Greenpeace**,  
Hatton Promotions, Hosni Mubarak, incident, information, **internet**, **Internet**, intifada,  
**intro**, Israel, IT, Joe Chen, Karl Hopwood, **Kate Middleton**, Kent Conservative, kid, Larry  
Klayman, **latest**, litigation, Manchester, Manchester United, **Mark Zuckerberg**, meaning,  
media, medium, memory, **message**, Mount Sinai, Muhamafazat Shamal Sina', name, Neil Lennon, New York

# View entities using E-R diagram



# Using Google Maps to georeference and interact

CIP ▾

Geo Taxonomy [98]

- United States (5098)
  - Washington (1765)
  - New York (738)
  - District of Columbia (606)
  - California (521)
  - Texas (253)
  - Florida (246)
  - Virginia (215)
  - Massachusetts (183)
  - Michigan (174)
  - Colorado (171)
  - Ohio (151)
  - North Carolina (147)
  - Maryland (132)
  - Wisconsin (112)
  - Missouri (110)
  - Nevada (103)
  - Hawaii (98)
  - Arizona (94)
  - Pennsylvania (91)
  - Illinois (90)
  - Alabama (88)
  - Alaska (81)
  - New Jersey (72)
- United Kingdom (2315)
  - England (1351)
  - Wales (171)
  - Scotland (164)

COGITO Intelligence Platform | amelegari 9:06 AM

Public for All Users (11037)  
 Uncategorized (11037)  
 English (10158)  
 Italian (879)

Search Clear Sensigrafo

Results Google Map Tag Cloud Entity Map

EXPERT SYSTEM EXPERT SYSTEM Mappa Satellite

Alaska  
Geoname Id: 5879092  
Show Documents (67)  
Add Constraint  
Powered by Cogito Intelligence Platform  
Expert System S.p.A.

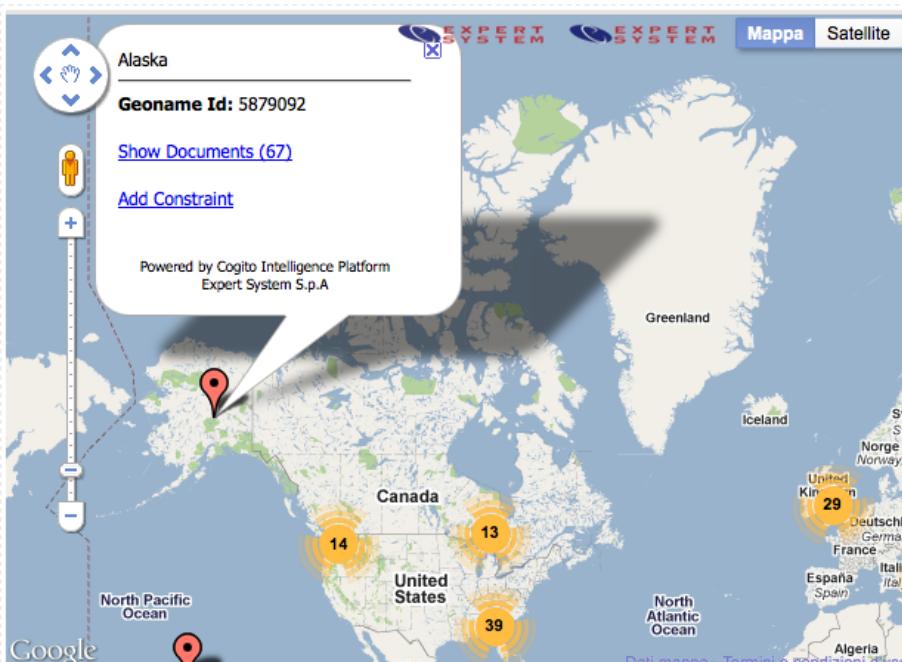
Available sources

URL [100]

Date Range

Data Field: Creation date  
Start Date: End Date:

Add constraint



# Key targets are highlighted in each document

SIP RSS Feed [ED531E7EBA79487EA078694FD6E68FE0] COGITO® Intelligence Platform amelegari 9:24 AM

IPTC Taxonomy Available corpora

RSS Feed [ED531E7EBA79487EA078694FD6E68FE0] - Detail

People Organizations URLs Countries Places

[http://www.worldnuclear.org/\\_news\\_database/rss\\_detail\\_features.cfm?objID=85DDAF72-89A7-488E-8FDA93D3A335A3A](http://www.worldnuclear.org/_news_database/rss_detail_features.cfm?objID=85DDAF72-89A7-488E-8FDA93D3A335A3A)

Creation date [29 Apr 2011 20:33:01] - Acquisition date [26 Apr 2011 01:13:01]  
Corpus [English] - Source [[http://www.worldnuclear.org/\\_rss\\_publicnews\\_xml](http://www.worldnuclear.org/_rss_publicnews_xml)]  
Language [ENG]

Nuclear Power (16%) - Waste Management and Pollution Control (14%) - Nuclear Policy (6%)

Available highlight layers:  Search constraints  People  Organizations  URLs  Countries  Cities  Places

Energy and Climate Change Minister Mike O'Brien said the new Nuclear Liabilities Financing Assurance Board (NLFAB) would be chaired by Lady Balfour of Burleigh.

As part of any application to build a new nuclear power plant in England, Wales and Northern Ireland, operators must submit plans for decommissioning and waste management which will include arrangements for financing those plans.

The NLFAB will provide independent scrutiny and advice on the financing arrangements of the plans, which will have to be approved by the government. The first meeting of the NLFAB is expected to be held in January 2009.

Mr O'Brien said: Nuclear energy is an affordable, low carbon, dependable and safe technology that is important for our low carbon future. But we've always said the taxpayer should be protected from the costs of decommissioning and waste disposal arising from new nuclear power stations. The NLFAB will be another piece of armour to help ensure they get that protection".

The UK's Office for Nuclear Development also issued the first of three discussion papers yesterday to hear the views of the general public on estimates of the costs of decommissioning and waste management.

The UK government gave the go-ahead for the possible construction of a new generation of nuclear power plants in the country in January 2008.

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# Integration with GIS systems

Critical infrastructures categories [5]

IPTC categories [3]

- Economy, Business and Finance
- Energy and Resource
  - Oil and Gas - Upstream Activities (3)
  - Energy (general) (1)
- Macro Economics
  - Imports (1)
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- Disaster and Accident
  - Fire (1)
- Environmental Issue
  - Environmental Pollution (2)

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Countries categories [36]

- Russia (3)
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Showing results in the GEO map

1-7 of 7 results sorted by Custom (0.804 seconds)

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# Using Google Earth to visualize global phenomena

COGITO Intelligence Platform pgallo 2:12 PM

IPTC Taxonomy

- Unrest, Conflicts and War (29)
  - Act of Terror (16)
    - Key Groups (12)
    - Counter Terrorism (6)
      - Counter Terrorist Attack (4)
    - Terrorist Attacks (1)
  - Civil Unrest (8)
    - Religious Conflict (4)
    - Revolutions (4)
  - War (6)
  - Crisis (3)
  - Demonstration (1)
  - Armed Conflict (1)
- Crime, Law and Justice (15)
  - Judiciary (System of Justice) (7)
    - Judge (1)
  - Corporate Crime (4)
    - Corruption (4)
  - Tribunal (2)
  - Prosecution (2)
    - Defendant (1)
  - Police (2)
    - Arrest (1)
  - Trials (2)
  - Crime (2)
  - Punishment (1)

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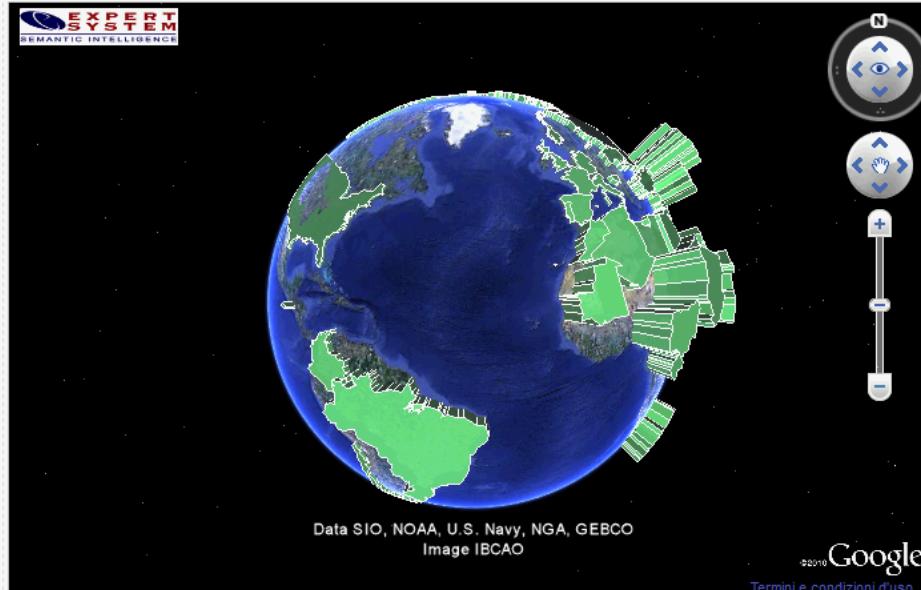
Geo Taxonomy [62]

- Egypt (31)
- United States (30)

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A 3D rendering of the Earth from space, showing landmasses and bodies of water. The globe is overlaid with a network of green lines and shapes, representing global phenomena. A legend in the top left corner identifies these as 'EXPERT SYSTEM SEMANTIC INTELLIGENCE'. A copyright notice at the bottom reads 'Data SIO, NOAA, U.S. Navy, NGA, GEBCO Image IBCAO'. The Google logo is in the bottom right corner.

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