



Gelördert durch:



# TechWatch

# Technology and Market Observation powered by SMILA

PD Dr. Günter Neumann DFKI, Deutsches Forschungszentrum für Künstliche Intelligenz GmbH, Juni 2011



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# Goal - Observation of Innovations and Trends



### » Technologies:

DO

» Combine methods from Bibliometrics, Information Wrapping, Text Mining, Information Extraction, Semantic Search and Knowledge Management.

### » Applications:

- » Search for publications and patents
- » The analysis of extracted relationships between themes, authors, time behavior and organizations.
- » Search for Key-Players of innovations.
- » Web-based search for trend statements.
- » Presentation of a knowledge domain as ontology, which can be used in further functionalities that improve the search and analysis



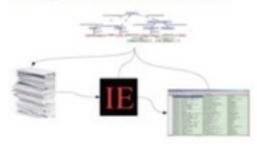


- » Cooperation between DFKI and TKS since 2006
- » Ontology-based search for key players in the area of welding and joining technologies
  - » Authors, inventors, companies, institutes, technologies
    - » Advanced patent search (EPO)
    - » Publications (Google Scholar)
  - » Visualization of the created innovation network and of new trends
- » Software development "TechWatchTool"
- » In Theseus-Ordo
  - » SMILA-fication of the system architecture
  - » Ontology-based information extraction
  - » Trend-Monitoring and analysis (new technologies, innovation pushers)





**Ontology-based Information Extraction** 



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- Extraction of relations through linguistic analysis
  - e.g., dependency analysis
- Information that change over time
  - e.g., "Increase of publications about lithium batteries"
- Near-Synonyms
  - "Approach"; "Method"
- Collocations
  - "come to a decision", "make a picture"
- Co-reference
  - "dependency analysis", "this method"
- Hyponyms, Part-of Relationship
  - "is a", "consists of"
- Meta data
  - "is author of ", "is owner of the patent"

# Search and Analysis of Innovation Indicators



- » Relevant Key Phrases
  - » "Technology of tomorrow", "Future", "Development"
- » Sentence patterns
  - » "Lithium-ion batteries will power cars in the future."
  - » "Lithium-ion technology is the future for hybrid and electric cars."
  - » "The laser will always be good for a surprise also in the future", predicts Peter Leibinger.

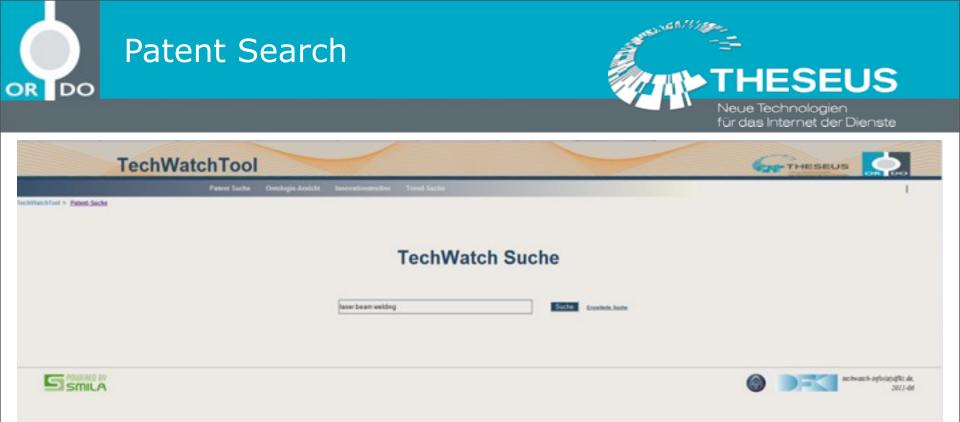
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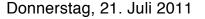
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### Trend analysis

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**TechWatchTool** 



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Analyse Information	12	haddead had - had hade	e - Seter Schedul + Secer @-
Suchanfrage: Ithium-ion	Sprache:	Trends innerhalb von Sätzen ( Number: 134 )	
Innovationstreiber: Algomoin	Muster: (/	Tau Manufan	
Gespeicherte Dateien: 85	Trends in	1. The Ithium-ion befory offers energy density and power density higher than the nickel-metal-hydride battery , and demand for Ithium-ion batteries is there	tore
Personen-Suchergebnisse: 604	Abfrage n	expected to grow in the future as the ballery of choice for hybrid vehicles URL Cache	
Organisationen-Suchergebnisse : 1376	Abfrage n	<ol> <li>However, Otiver Nazimeh, Director and head of the global e-Nobility Practice al PRIM, a global management consulting frm, suggests that lotal lithium-to cest reductions exceeding 50% by 2009 are leasible without technology breakthroughs, primarily through operational gams, assuming EV adoption of appr 10% of new vehicles sold by 2009 to support velume manufacturing <u>Littic Caster</u></li> </ol>	
DOWNLOAD		3. Decidron , a manufacturing company , will apply the new technology to the development of a new generation of tithium ion totheries . URL Cache	
www.ths.zig		<ol> <li>Secondary lithium-ion cells are currently used as batteries in virtually all portable electronic devices such as cell phones and notebook PCs , and are also e be applied practically as large power supply batteries in the future , for example , in that cell vehicles and hybrid automobiles <u>URY</u>. <u>Cache</u></li> </ol>	spected to
Frends innerhalb von Sätzen ( M	Number: 13		
lop 50 anzeigen		<ol> <li>Mass -based A123 Systems is now worth nearly \$2 billion—indicating huge investor confidence in the future of electric care , plug-in hybrids , and the bat make them go <u>URL</u> Castle</li> </ol>	terres that
dik ananiano		6. And next year at least two motorcycles powered by advanced lithium-ion batteries will be sold in the United States . URL Capter	
Abfrage relevanter Personen ( N		<ol> <li>Bosch and Samsung expect a market volume of some three million hybrid volucies by 2016.          4 We are the first and only automotive supplier with a port w develop tithium-lon batteries for the complex requirements of the automotive , " says Wolf Henning Scheider , president of Besch's Gasoline Systems divis LFEL</li></ol>	
		8 Mercedes-Benz will sunch an S-Class hybrid equipped with a lithium ion battery next year Littl. Cathe	
		<ol> <li>The part verture partners are partners are partners are partners between \$300 and \$400 million in the next five years and 58 LiMotve plans to start series manufacturing of the battery systems customized to automotive requirements and to market them workbuilde in 2011. URL Cascher</li> </ol>	thium-ion
		10 Toyota to Start Sales of Utblam-ion Plug-in Hybrids by 2010 (1991) Cache	
		11. Lithsum iron phosphale is an alternative to the lithsum cobalt oxide used in most lithium-ion batteries in laptop computers . <u>LITL</u> Captor	
		12 Lithium-ion batteries are used in lipitops because they 're small and light compared with the alternatives <u>LHSL</u> <u>Cache</u>	
		13. Other companies have developed afternative approaches to making ithium-ion batteries safer, including using different electrode materials or nonflammab	6 (4 • 5,05 •

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### Trend analysis



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echWatchTool > <u>Trend-Sur</u>	24 > Erpebnisse		
0	Organizations (Number: 69)		
	1. Johnson Controls (Property: 15.)		
<ul> <li>Analyse I</li> </ul>	1. Johanne Controls Lithium-ion Butteries Johanne Controls is a full-service supplier capable of essenting the entire battery system, from	n design to manufacturing. LURL Cache	S · D · C · · · · · · · · · · · · · · · ·
Suchanfra	2. Johnson Controls Lithium-ion Batteries Johnson Controls is a full-service supplier capable of executing the entire battery system, from	n design to manufacturing. LURL Cache	
Innovation	3. Johnson Controls Lithium-ion Chemistry Our Li-Ion chemistry is available in a cell pertfolio ranging in amp-hour capacity from six a	il the way up to 43 amp-hours. 1081. Cache	
Gespeiche	4. Johnson Controls Libbium-ion Battery Safety Measures Johnson Controls has purposefully built four layers of redundancy into each B	ithium-ion battery system to ensure safety. LIKL Cache	union batteries is therefore
Personen-	5. Johnson Controls Lithdum-ion Battery Safety Measures Johanon Controls has purposefully built four layers of redundancy into each 10		
Organisati	<ol> <li>Lithium-ion Autometive Benery Manufacturing: Nersec, France and Holland, Michigan, US Johnson Controls-Saft joint venture open 31, 2008 in Nersec, France. LIEZ. Cache</li> </ol>	nol the world's first manufacturing facility for likkiom-ion hybrid applications,	ppents that total lithium-ion battery ming EV adoption of approximately
	7. The 2009 Mercedes Bene S class mild hybrid, the first serial production HEV to utilize lithdum ion technology, is powered by Juhanan	Controls cell and bettery system technology. LIML Cache	
· DOWNLO	8. Lithium-ion for the Development of PHEVs Johnson Controls Suft is the exclusive supplier of Ford's first Phys-In Hybrid, to be available	able to consumers in 2012. LWL Cache	es LIRL Cache
results.zig	9. Johanne Controls Li-los PHEV battery modules on bench testing at SCE accumulated the equivalent of 180,000 road miles before falls	ing below the minimum required peak power. LRL Cache	
	10. © 2011 Johnson Controls. URL Cache		LINC Cache
<ul> <li>Trends in</li> </ul>	11. Johnson Controls CEO: Hybrid and EV Battery Market Is Instatute CRL Cache		g-in hybrids, and the batteries that
Top 50 anzeiges	12. Johanne Controls is also making a play in the hybrid barroy market. CRL Cache		gree reportions, and the basisment that
alle ananisen	13. In 2002, Johanne Controls acquired Varia, a major European automotive battery manufactures. URL Cache		Cathe
	14. Johnson Controls could emerge as the only major U.Sbased hybrid battery maker. URL Cache		
<ul> <li>Abfrage r</li> </ul>	15. If Johnson Controls develops lithium expertise, they will be even better positioned. [JR] Cache		two supplier with a port venture to 's Gasoline Systems division"
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-69	1. Toyota: Nickel Burneries for Hybrids, Lithium for Electric Cars URL Gache		and the second second second
	2. Tayata Will Buy Lithian Bataries from Sarpo CIRL Cache		series manufacturing of Ithium-Ion
	3. On Dec. 16, 2005, Treysta announced that they would accelerate development of lithium batteries for use in their hybrids.	de	
	4. For Toyota to achieve its goals of selling our million hybrids globally per your and offering hybrid versions of all their popular vehicles.	, they'll need to reduce the incremental cost of their hybrids. [IR] Cache	
	5. Earlier this year, Kansuski Watanabe, Teysta's president, articulated that goal as reducing 'the cost difference of hybrids to one-half the	e current levels." <u>URL</u> Cache	L Cathe
	6. According to Dave Hermanor, exacutive engineer of environmental engineering at Toyota, batteries are the single most expensive elems	ent in the hybrid system. LBL Cache	
	7. Toyota became the first to use lithium ion batteries in a production vehicle when it placed a four-cell lithium pack in its Viz CVT4, a Sc	cion-looking small boxy vehicle-only available in Japan. 682. Cache	Contraction and the second
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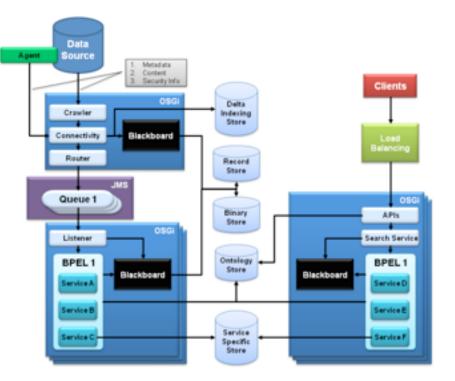
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# TechWatch - SMILA Integration

THESEUS Neue Technologien für das Internet der Dienste

- The core components are integrated via wrapper methods
  - » Patent search
    - » Google Scholar
    - » DepatisNet
    - » Persistence
    - » Trend search
      - » Google Custom Search
      - » Document processing
      - » Trend patterns
      - » Relation extraction
      - » Named Entity recognition
      - » Persistence



### TechWatch - DFKI Language Technology software



#### LanguageID

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- Automatic language identification
- 23 languages
- Speed: ~6ms
- Accuracy: 99,8%
- Implementation: Java, OSGi

#### **MDParser**

- Extraction of the dependency relations of sentences
- Languages: DE, EN & more!
- Speed: 40 Sent./Sec.
- Accuracy: 86% 88%
- Implementation: Java, OSGi

### NE-Hub

- Extraction of Named Entities: Persons, Organizations, Locations, etc.
- Integrates the result of different NE-recognizers (Sprout, OpenNLP, Stanford, LingPipe, etc.)
- Languages: DE, EN
- Implementation: Java, OSGi

#### DARE

- Semi-supervised extraction of relations
- Languages: DE, EN
- Implementation: Java, OSGi

### Example - NE-Hub



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### Example - NE-Hub



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- A fine-grained extraction and search for entities and relations demands for a structural analysis of free text.
- Recently, dependency relations between words are getting more and more important for root semantic applications The dependency relationships uncover a ist flat semantic predicate argument Lithium-Ionen-Technik structure.
- Our current R&D focus
  - Automatic learning of dependency grammars and parsers from corpora
  - Multilingual dependency parsing
  - Solution: MDParser





	Parsing Time	Sentences per Second	
MDParser	73.188s	46.128	1015.55
MaltParser	1954.684s	1.73	38.02

A fine-grained extraction and search for entries and relations

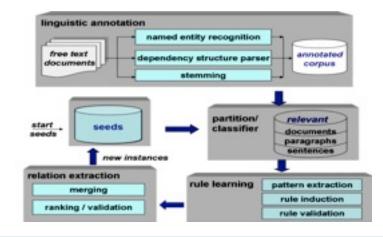
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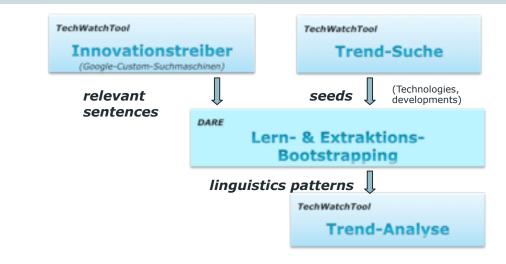




- Extraction of relations of different complexities.
- Automatic learning of linguistic patterns for the extraction of new instances and their projections.
- Bootstrapping between pattern learning and relation extraction which is initialized by means of a small set of seed instances



### Integration into TechWatchTool



- Learning of linguistic patterns for the automatic recognition of new technologies and developments for a future trend analysis.
- Use of the found results (technologies & developments) of the trend analysis as new seeds
- Search of relevant sentences by means of innovation indicators.

# TechWatchTool – DFKI advanced LT components

Neue Technologien für das Internet der Dienste

**IESEUS** 

#### uKeyWe

- Unsupervised Machine Learning algorithm for the extraction of key phrases
- Languages: language independent
- Implementation: Java, OSGi

#### ConExt

- Extraction of concept hierarchies from free texts
- Languages: DE, EN
- Implementation: Java, OSGi

#### TERA (Textual Entailment)

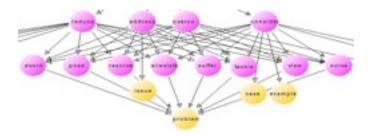
- Decides for two text fragments (phrases, sentences, paragraphs), whether the one semantically entails the other
- Languages: DE, EN
- Accuracy: best results at international competitions (cf. Text Analysis Conference - TAC)
- Implementation: Java, OSGi

# Example - ConExt

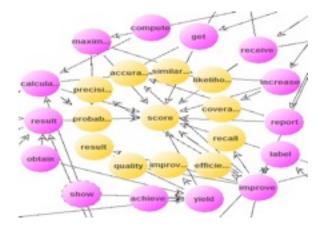


- **Extraction of concept hierarchies** (based on Cimiano, Hotho, Staab; 2005)
- a method for extracting domain specific concept hierarchies from free text which has been syntactically analysed
- **Core idea:** words, which occur with same syntactic functions and context are semantically related.
- Can also be used to determine the terminology of a domain.
- semantically related words can be easier identified.
- Information extraction can benefit (e.g., by means of Query Expansion, Clustering)
- The strategy has been tested with several corpora:
  - business reports (3.964.925 sentences)
  - scientific publications (884.904 sentences)
  - Wikipedia, technical articles (628.560 Sentences)

### Query expansion



### Clutsering



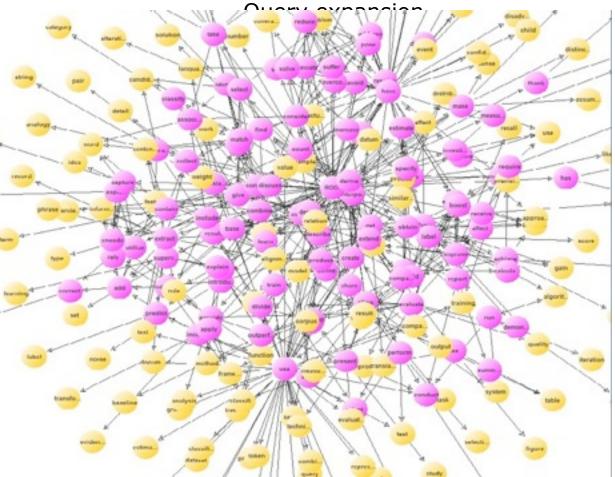
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OR DO

## Example - ConExt



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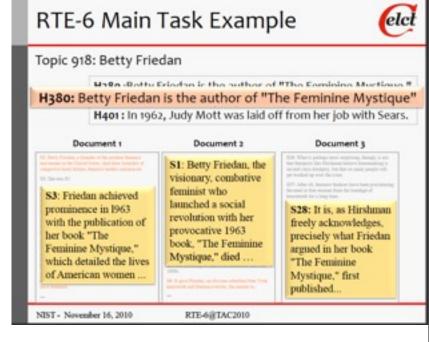


- Textual Inference
  - Determine semantic inference relationships between texts (Recognition of text variants/paraphrases)
  - Entailment: Does Text T entails Text H ?
  - Needed in many text analytics applications (e.g., information extraction, question answering, text summarization)
  - Q: "Wo acquired Overture?"
     A: "Googles buying of Overture supports …"
     ⇒: "X buys Y" ≃ "X acquire Y"

# Example - Textual Inference



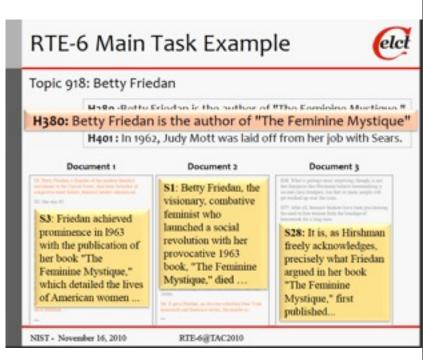
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- semantic search
- concept extraction/ontology learning
- Textual inference (Entailment) is still a very young and dynamic R&D area !
- Progress through international competitions (NIST, USA)
- DFKI with very good results
- EU project Excitement -> prob. from 2012 -> ~ 3.4 million EUR funding (DFKI is one of the 4 core scientific partners, 3 industrial partners; analysis of customer interaction data)

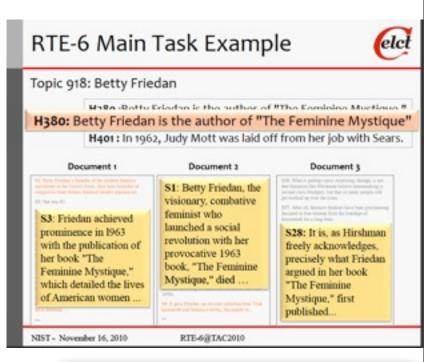


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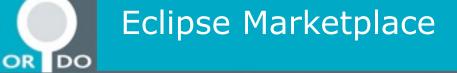


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#### Focus:

- robustness, scalability
- organized by NIST, USA
- 2010: 19 Unis/Institute (world wide), DFKI, 4. best result in Novelty Subtask (with new team) (2009: 2. best result in Main Task.)





marketplace	• • • • • • • • • • • • • • • • • • • •	6	
Home My Marketplace A	dd Content	Log	
Markets 3	1,148 Solutions and counting.	n	
Sort by	SMILA O All Solutions Categories		
Belevator	All Markets Search		
Title Tuten Author Date	Advanced Search * Found 5 results matching your query.		
	Language Identification - a tool for language identification in		
Filter by Status Production/Stable.(4)	SMILA 0.7     The Language identifier provides as main functionality the automatic language identification of any text     provided as input. It is based on an n-gram approach to language		
Filter by License Type	EclipseRT Target Platform Components   language Last Updated on 14 June 2011 by Begdan Secaleacy identification   SMILA   Tools		
Commercial (4)	MDParser - a tool for dependency parsing in SMILA 0.7		
Filter by Categories	MDParser stands for multilingual dependency parser and is a data-driven system, which can be used to parse text of an arbitrary language for which training data is available		
Components (2)	dependency parsing   dependency relations   Last Updated on 14 June 2011 by Bogden Sections EcloseRT Target Platform Components   Inguistic acatholis   SMILA   Tools	•	

### Current

- Implementation: SMILA Piplets (Java-OSGi web service)
- Direct integration into SMILA-process
- License: Research & commercial

### Planned

•

NE-Hub – Multilingual architecture for NE recognition

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The Parts (1)





### **Experience of our SMILA developers**

### Pros

- Rapid entry point for End-User by means of:
  - detailed documentation
  - many good examples
  - Out-of-the-box runnable system
- Parallelism of workflow through BPEL
- Fast composition of new apps by means of existing components and BPEL
- Rapid and competent support by means of the forum

### Cons

- Complicated data structures
   Version 0.7 solved in Version
   0.8
- Restricted extendability of the index algorithms in order to support several dynamically changing indices per user (a very specific requierement)