

Semantics in Scientific Publishing

Approaches & Case Studies

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7.-8. oktober 2013

Agenda

- ❖ Why „Scientific Publishing“? Isn't that hard?
- ❖ NLP: Where hard things are sometimes easy and easy things often hard
- ❖ Case studies
- ❖ TEMIS: Who we are



Publishers
of Scientific Journals

Source: 2011 study by the Publishing Research Consortium

Observation

NLP is different from many other technology fields

- ❖ NLP (e.g. Semantics) almost mainstream today in scientific publishing
- ❖ But in our everyday life today, there's not a lot NLP yet
- ❖ Often technology uptake is the other way round
 - First, „simple“ requirements can be met
 - Then, as technology advances, sophisticated expert use cases can be handled, too

Examples



First: Simple snapshots only



First: Barely leaving the ground



Today: Complex devices for complex use cases



Today: Broad range of specialized, high-performance machines

NLP is different ...

... because language is different

- ❖ Requirements of the „experts“ are often easier than modelling presumably everyday communication
- ❖ Example I: „Perplexity“ of natural language in speech recognition:
 - Speech recognition of radiology reports: Far easier than everyday communication.
 - Counter-intuitive at first: Isn't the special language of highly trained expert more complex?
 - Taking perplexity as the measure, normal newspaper corpora have a perplexity of >100, radiology reports may be as low as 10
 - (Definition:

$$PP(W) = \sqrt[N]{\frac{1}{P(w_1, w_2, \dots, w_N)}}$$

❖ Example II: Machine translation

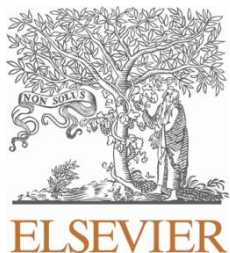
- As early as 1981: System METEO : Fully automatic translation of Canadian weather reports, replacing manual translation
- Narrow, expert domain → useful results, clear business case (reduction of efforts, increase in speed)
- But: Machine translation of average personal letters remains challenging until today.

NLP @ TEMIS:

Structure *unstructured text*
content in business & scientific
contexts to improve how it is
managed and exploited

Key TEMIS customers in Publishing

STM, Legal, B2B, Trade, Media



THOMSON REUTERS

nature publishing group



Springer



DE GRUYTER



Thieme

KARGER



HighWire
Stanford University

HCPro

IOP
Institute of Physics



Science
AAAS

LexisNexis®

Bloomberg
BNA

EDITIONS
FRANCIS
LEFEBVRE
La solution juridique

DALLOZ
EDITIONS
LEGISLATIVES

SOQUIJ



juris®

The McGraw-Hill Companies

McGraw Hill
CONSTRUCTION

AVIATION WEEK

platts

SIMON & SCHUSTER

SAE International



Erdee Media Groep

Trinity Mirror



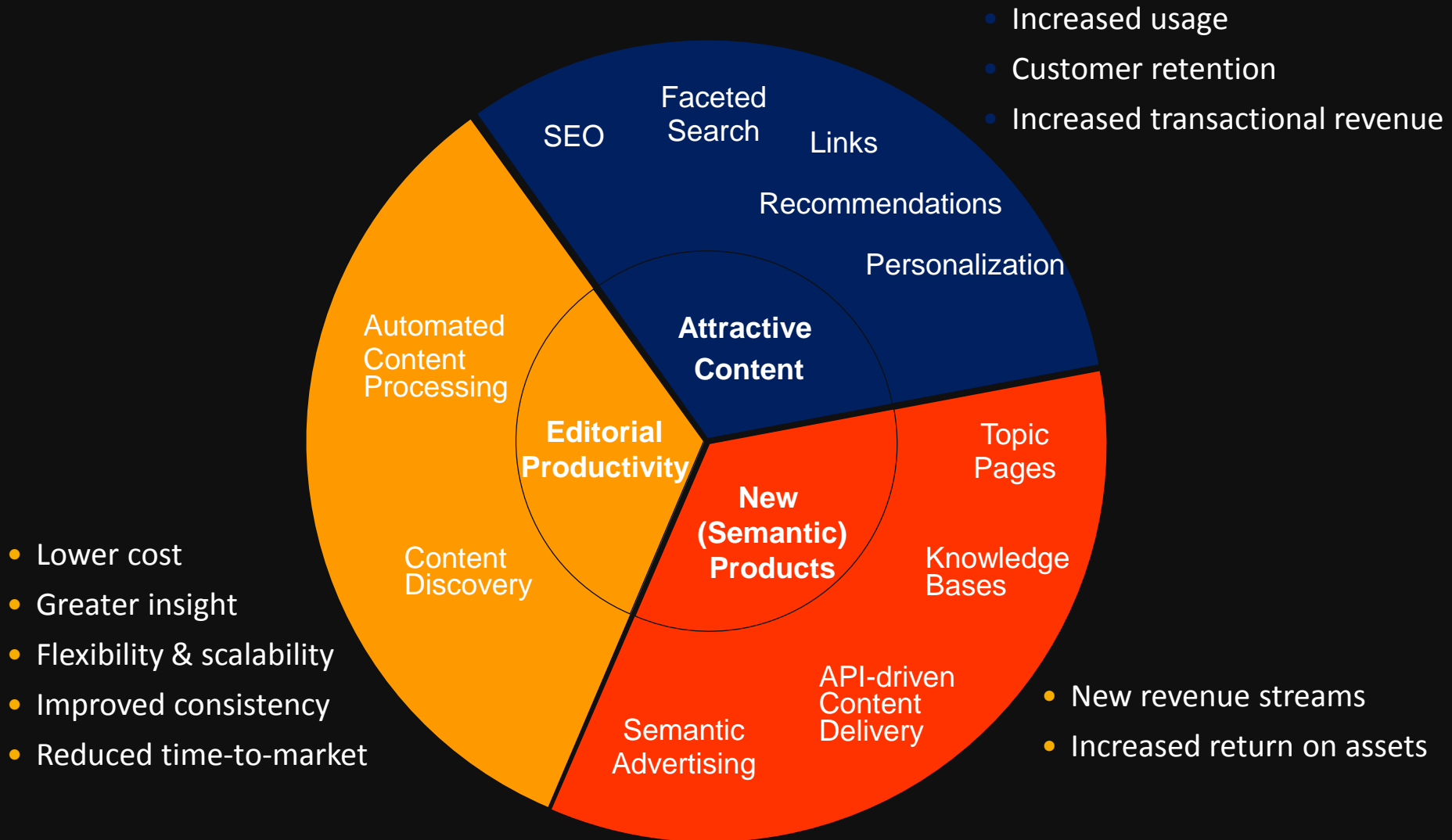
GANNETT

CONDÉ NAST

astral

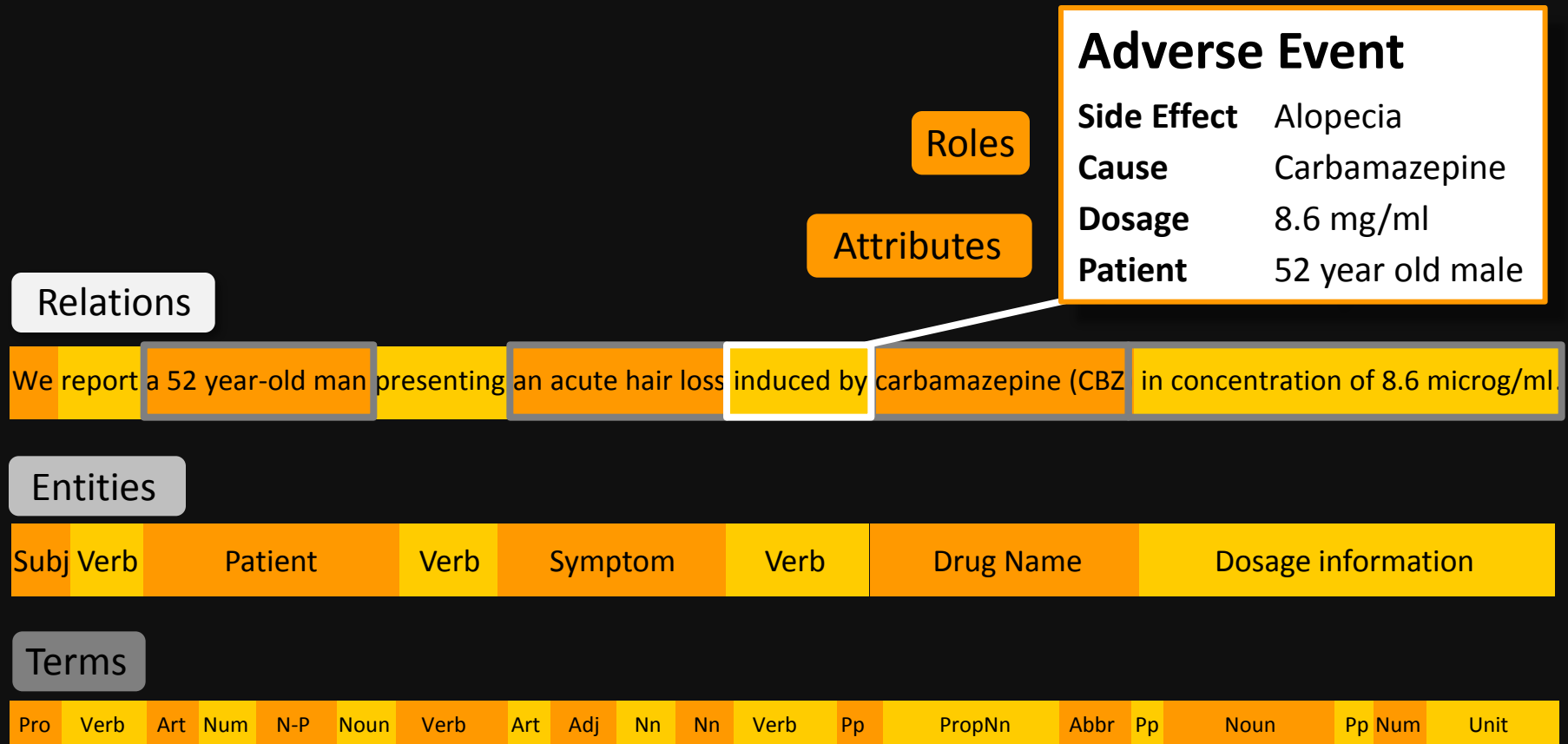
publishers
press

Three Key Areas of Value



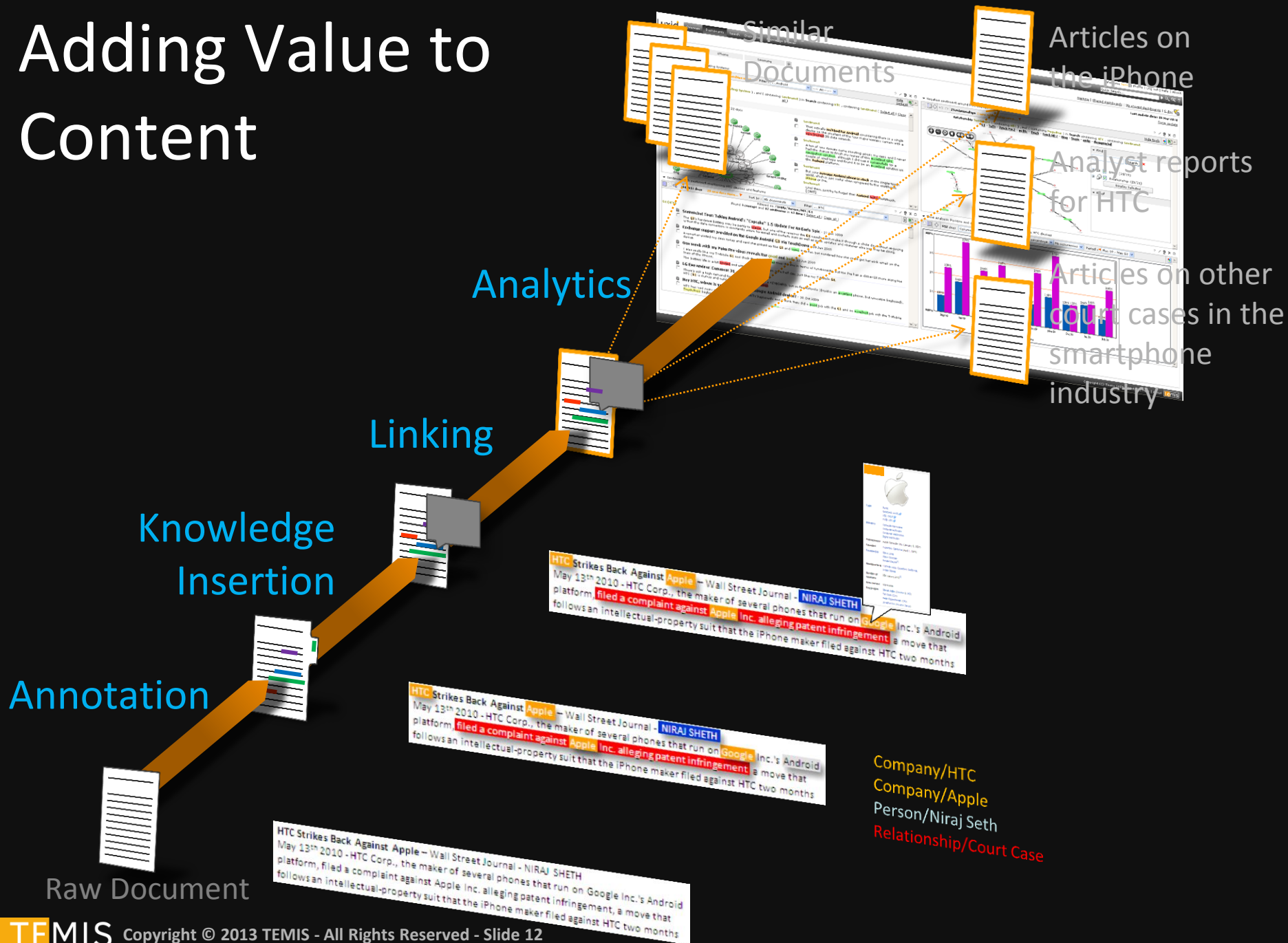
What Is Semantic Content Enrichment?

The automated extraction of domain metadata



We report a 52 year-old man presenting an acute hair loss induced by carbamazepine (CBZ) in concentration of 8.6 microg/ml.

Adding Value to Content



Radbase project at



❖ Program goal : implement semantic navigation

- **Giving radiologists access to high quality content enriched with Semantics: Faceted Search, Topic Pages**
- **Related Document Linking**

❖ Program motivations

- **Add value to existing content**
- **Use Semantics to implement a radiologists workflow (Finding → Diagnosis → Therapy)**

❖ The solution

- Luxid® Content Enrichment Platform and custom Skill Cartridge® based on Thieme Medical Thesaurus (polyhierarchic & bilingual, 53.000 concepts / 340.000 terms / 350+ MB)

Home My RadBase

Suche

Ihre Suche:
Ihre Filter:

Sources/Content Types

Scan Types

Anatomical Regions

Pathologies / Indications

QUELLEN / INHALTE

QUELL

Diagnosen

DD Diff

Pro

E-B

E-J

Rac

Ana

Rac

Ext

ANATOMIE

Atmungssystem

Endokrines Sys

Gewebe

Haut und Hautanhangsge

Herz-Kreislauf-System

Körperregionen

Muskel-Skelett-System

Nervensystem

Sinnesorgane

Stomatognathes System

Tumoren

Urogenitalsystem

Verdauungssystem

PATHOLOGIE

MODALITÄT

MODALITÄT

Angiografie

CT

CTA

DSA

Mamm

MRA

MRT

PET

Röntge

Sonogr

Szintig

ANATOMIE

Atmungssystem

Endok

Gewe

Haut

Herz-

Körpe

Muske

Nerve

Sinne

Stoma

Tumore

Uroge

Verda

PATHOLOGIE

Angeborene, hereditäre und neonatale Krankheiten und Fehlbildungen

Atemwegskrankheiten

Augenkrankheiten

Bakterielle Infektionen und Mykosen

Diagnostik

Endokrine Krankheiten

Ernährungs- und Stoffwechselkrankheiten

Hals-Nasen-Ohren-Krankheiten

Haut- und Bindegewebskrankheiten

Herz-Kreislauf-Krankheiten

Immunologische Krankheiten

Krankheiten des Bewegungsapparates

Krankheiten des Blutes und des lymphatischen Systems

Krankheiten, männliches Urogenitalsystem

Nervensystemkrankheiten

Parasitäre Krankheiten

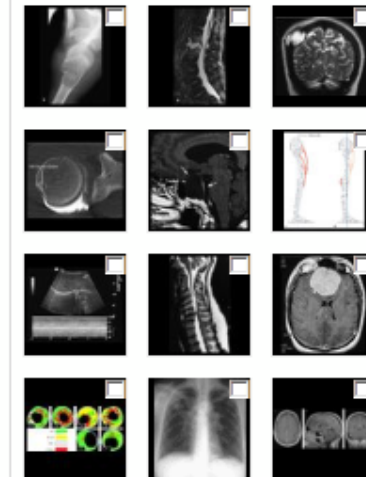
Pathologische Zustände, Symptome

Pathologische Zustände, Symptome

Pathologische Zustände, Symptome

Pathologische Zustände, Symptome

RAD PICTURES (97131)



Ergebnisliste: » RadPictures

BILDER VERGLEICHEN

Case Law in Numbers project

❖ Program goals

- **Create an interactive knowledge base**

by extracting from unstructured legal decisions documents highly relevant information regarding typical amounts in the contexts of:
Labor Law (depending on age, company size, location, industry, region, ...)
Damages (the type of loss, circumstances, region, ...)
Commercial Rent (size, location, facilities, time, region, ...)
Alimony/Child support (income, marriage, children, region, ...)

❖ Program motivations

- **Revenue generation**

❖ The solution

- Luxid[®] Content Enrichment Platform
- **Custom-developed Skill Cartridges[®]**
embedding semantic extraction rules specific to the legal domain

Querying the Knowledge Base

Thème : **Droit social** Sujet : **Accidents du travail**

topic **Labor Law** subtopic **Accidents in the workplace**

Vous pouvez rechercher des documents par un ou plusieurs des critères suivants :

Mots recherchés

Type of disability

Date of decision

Court

Age

Gender

Profession

Type of accident

Cause

Part of body

Damages paid

Severity of the disability

Préjudices

Déficit fonctionnel permanent

Somme entre [] € et [] €

Taux (%)

Préjudice d'agrément

Somme entre [] € et [] €

Taux

Préjudice esthétique

Somme entre [] € et [] €

Taux

Each
extracted
concept
has become a
search
criteria

Navigating Query Results

Thème : Droit social

Sujet : Accidents du travail

Dr Droit social > Accidents du travail > Liste

Age min. : 40 - Age max. : 60 - Sexe : masculin - Fait générateur : acci

Decisions matching the search criteria

Modifier

Affiner cette recherche...

- + Cour d'appel
- + Date
- + Formation
- + Jurisdiction 1er degré
- + Age
- + Barème
- + Partie du corps
- + Fait générateur
- + Profession
- + Sexe
- + Déficit fonctionnel permanent (€)
- + Taux du déficit fonctionnel permanent (%)
- + Indemnité pour préjudice d'agrément (€)
- + Indemnité pour préjudice esthétique (€)
- + Taux du préjudice esthétique

93 documents

indendent à votre recherche

1 2 3 ... 10

Accidents du travail

- Taux du déficit fonctionnel permanent : 5 % - Indemnité pour préjudice d'agrément : 1700 € - Partie du corps : plèvre
CA Douai du 8 juillet 2010 n° 09109388 , ch. 03

Accidents du travail

- Taux du déficit fonctionnel permanent : 14 % - Indemnité pour préjudice d'agrément : 2000 € - Indemnité pour souffrances endurées : 4000 € - Barème : barème de la Gazette du Palais
CA Aix-en-Provence du 7 juillet 2010 n° 08111336 , ch. 10

Accidents du travail - Informaticien

Indemnité pour déficit fonctionnel permanent : 19500 € - Taux du déficit fonctionnel permanent : 15 % - Indemnité pour préjudice d'agrément : 10000 € - Indemnité pour préjudice esthétique : 2500 € - Taux du préjudice esthétique : 2.5 - Indemnité pour souffrances endurées : 8000 € - Taux des souffrances endurées : 4.0 - Partie du corps : sternum front visage crâne pied droit omoplate hanche membre inférieur épaule gauche
CA Nîmes du 29 juin 2010 n° 09101346 , ch. civile 01

Accidents du travail

- Taux du déficit fonctionnel permanent : 5 % - Indemnité pour préjudice d'agrément : 1200 € - Partie du corps : plèvre

Facets based on the same concepts
enable efficient drill-down within the document set

- Taux du déficit fonctionnel permanent : 5 % - Indemnité pour préjudice d'agrément : 1200 € - Partie du corps : poumon plèvre
CA Caen du 11 juin 2010 n° 09100303 , ch. 03 sect. sociale

Navigating within 1 query result

Pointer sur...

- ☐ Indemnité pour préjudice d'agrément (€)
- ☒ Fait générateur
 - [accident du travail](#)
 - [accident de la circulation](#)
- ☐ Déficit fonctionnel permanent (€)
- ☐ Age
- ☐ Taux de souffrances endurées
- ☒ Profession
 - [Technicien](#)
 - [Pompier](#)
- ☐ Sexe
- ☐ Indemnité pour souffrances endurées (€)
- ☐ Taux du déficit fonctionnel permanent (%)
- ☒ Partie du corps
 - [crâne](#)
 - [abdomen](#)
 - [coude gauche](#)
 - [genou droit](#)
 - [fémur](#)
 - [visage](#)
 - [menton](#)
 - [hanche](#)
 - [membre inférieur](#)
 - [cheville](#)
 - [orteil](#)
 - [genou](#)
- ☐ Taux du préjudice esthétique
- ☐ Indemnité pour préjudice esthétique (€)

Attendu que s'agissant des souffrances endurées, l'expert a relevé que le pretium doloris, proposé par lui au taux de 5/7, tenait compte de la longue évolution, de l'atteinte bilatérale au niveau des membres inférieurs avec des difficultés de déambulation importantes, de l'atteinte faciale avec ses conséquences initiales sur l'alimentation et des conséquences psychiques initiales avec des troubles

initialement importants, ayant nécessité une prise en charge ;

Attendu que M. Raphaël B. justifie aux pièces de son dossier avoir suivi deux séances d'entretien avec un psychologue Mme D. , et selon certificats médicaux des 7 mars, 30 avril et 25 mai 2007 du docteur Anne Marie B. son médecin traitant, avoir dû suivre un traitement pour soigner son état dépressif réactionnel ;

Attendu qu'au vu de ces éléments, les souffrances endurées paraissent avoir été assez importantes ; que la cour estime, en fonction des justifications produites et en réformant partiellement le jugement de ce chef, devoir indemniser ce poste de préjudice par l'allocation d'une indemnité de 15 000 € ;

Attendu qu'au titre du déficit fonctionnel permanent, l'expert a retenu un taux d'incapacité permanente partielle de 10 % qui tient compte de la raideur modérée de la cheville droite, avec gêne dans les mouvements du gros orteil des douleurs des hanches et des genoux sans limitation fonctionnelle, de l'hypoesthésie des lèvres en rapport pour l'alimentation au niveau des hémisphères supérieure gauche et inférieure droite et de la gêne à l'ouverture buccale complète ;

Attendu que la victime était âgée de 36 ans au moment de la consolidation (le 11 janvier 2006) ; qu'en lui allouant une indemnité de 11 230 € au titre de ce préjudice, le tribunal a fait une juste appréciation des faits de la cause et qu'il convient de la confirmer ;

Attendu que la Caisse d'allocation familiale n'a fait aucune demande de reconnaissance de l'accident du travail par la Caisse d'allocation familiale de la victime assurée en tout ou partiellement par la Caisse d'allocation familiale de la victime

Attendu que le préjudice d'agrément est constitué d'après l'expert, par le fait que les séquelles de l'accident, conservées par la victime, entraîneront une plus grande pénibilité de la marche prolongée et des difficultés pour pratiquer le VTT de façon intensive, toutefois sans contre indication à la pratique en dilettante de cette activité ;

Attendu qu'en l'état de ces éléments, et sans qu'il soit besoin d'exiger la production de plus amples justificatifs eu égard à la nature du sport pratiqué, en tenant compte également de l'abandon forcé de l'activité de pompier

Enhanced experience with accelerated navigation

- ❖ Semantic shortcuts accelerate navigation
- ❖ Key concepts highlighting

❖ Program goals

- **Make content more compelling**
- **Provision new and evolving products and services**
- **Make publishing more dynamic**

❖ Program motivations

- **Customer retention**
- **Revenue generation**

❖ The solution

- Luxid® Content Enrichment Platform
- Life Sciences Skill Cartridges®: Chemistry, Medicine and Biology



Explore



Validate



Learn

Search

**FMNL3** gene product

DKFZp762B245, MGC45819, WBP3

The protein encoded by this gene contains a formin homology 2 domain and has high sequence identity to the mouse Wbp3 protein. Two alternative transcripts encoding different isoforms have been described. [provided by RefSeq, Jul 2008]

[More gene data](#) ▶

ANTIBODIES

Compare Selected

13 antibodies from 6 providers.

Show Additional Columns ▶

Filters

Application

Reference

Provider

Host

Reactivity

Antibody type

Filter

or Clear

- Supportive data in Antibodypedia
- Data presented on provider website
- Data in Antibodypedia (Inconclusive)
- Recommended by provider



ANTIBODY

REFS

TYPE

WB

EL

IF

IP

IH

FC

Novus Biologicals

[4 antibodies](#) ▶

H00091010-B01

Polyclonal



H00091010-B01P

Polyclonal



Abnova Corporation

[2 antibodies](#)

H00091010-B01

Polyclonal



H00091010-B01P

Polyclonal



Atlas Antibodies

[2 antibodies](#)

HPA002552

Polyclonal



HPA023201

Polyclonal



Towards data-centric

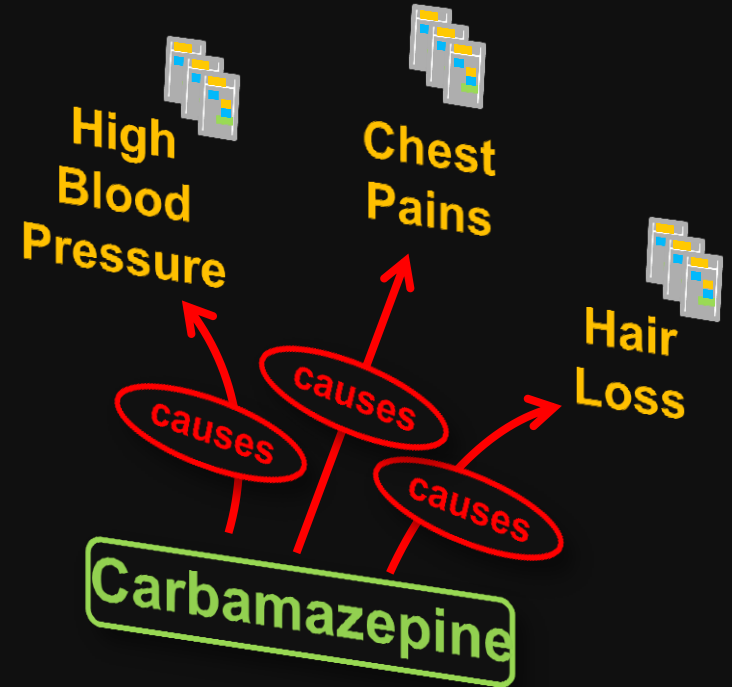
In addition to Content-centric



Symptom/Alopecia
Drug/Carbamazepine
Patient information/Man/52-year old/
Side-effect/Drug-induced Alopecia

Content-Centric

“which documents could you show me that discuss side effects of carbamazepine ?”



Data-Centric

“what are the side effects of carbamazepine ?”

Workflow Productivity

Example metrics

x?

Automated indexing of 2M abstracts
5 months vs. 2,000 man months (manual)

x4

Volume of indexed documents
(stable indexing team size)

95%

Automated linking of legal citations
Anonymization of case law

/4

Resources required for legal consolidation
Daily vs weekly update of the law

Luxid : The TEMIS Approach to Semantics

Platform approach

Annotation Factory



Skill Cartridge® Library



Content Enrichment Studio



Generic Analysis Engine: Multilingual Part of Speech Tagging, Scalability, REST Web Service API, UIMA, Rules Engine, Document Categorization, Clustering, ...

Collection of generic or domain- / client specific analysis components implementing vocabularies, rules, statistical models to extract specific types of information from text

Integrated development environment to develop, test, evaluate, maintain and extend analysis components, syntax-aware, one-click compilation, deployment, collaboration, ...



Luxid

Skill Cartridge[®] Library



TM360°
People
Companies
Locations



BER
Biological
Entities
Relationships



Events
Military
Political
Strategic



Competitive Intelligence
Business
Relationships



MER
Medical
Entities
Relationships



Opinion Mining
Opinions
Sentiment



IPTC
News
Categories



CER
Chemical
Entities
Recognition



RTF
STF
...



One Skill Cartridge Example: Terminology Matching



❖ Thesaurus of Agricultural terms, used at the US National

```
<skos:Concept rdf:about="#29126">
  <skos:prefLabel xml:lang="en">corn</skos:prefLabel>
  <skos:prefLabel xml:lang="es">maíz</skos:prefLabel>
  <skos:scopeNote xml:lang="en">Use for corn as a grain; For corn as a vegetable USE sweetcorn; For the corn plant USE Zea mays.</skos:scopeNote>
  <skos:scopeNote xml:lang="es">Usar para maíz en grano; USAR "maíz dextrinoso" para referirse al maíz como hortaliza; USAR "Zea mays" para designar la planta.</skos:scopeNote>
  <skos:altLabel xml:lang="en">feed corn</skos:altLabel>
  <skos:altLabel xml:lang="en">field corn</skos:altLabel>
  <skos:altLabel xml:lang="en">maize</skos:altLabel>
  <skos:altLabel xml:lang="es">maíz</skos:altLabel>
  <skos:related rdf:resource="#29135" />
  <skos:related rdf:resource="#6414" />
</skos:Concept>
<skos:Concept rdf:about="#19818">
  <skos:prefLabel xml:lang="en">grains</skos:prefLabel>
</skos:Concept>
<skos:Concept rdf:about="#6414">
  <skos:prefLabel xml:lang="en">nixtamalization</skos:prefLabel>
  <skos:prefLabel xml:lang="es">nixtamalización</skos:prefLabel>
  <skos:definition xml:lang="en">Nixtamalization involves cooking and steeping corn in a lime solution, then washing and grinding the corn to form masa, a dough used to make tortillas, taco shells, corn chips, etc.</skos:definition>
  <skos:definition xml:lang="es">La nixtamalización consiste en cocer y remojar maíz en una solución de cal, luego el maíz se lava y muele para formar una masa con la que se hacen tortillas, hojarazcas para tacos, chips de maíz, etc.</skos:definition>
  <skos:altLabel xml:lang="en">nixtamalisation</skos:altLabel>
  <skos:altLabel xml:lang="en">nixtamalising</skos:altLabel>
  <skos:altLabel xml:lang="en">nixtamalizing</skos:altLabel>
  <skos:hiddenLabel xml:lang="en">nixtamalised</skos:hiddenLabel>
  <skos:hiddenLabel xml:lang="en">nixtamalized</skos:hiddenLabel>
  <skos:altLabel xml:lang="es">nixtamalización</skos:altLabel>
  <skos:related rdf:resource="#6413" />
  <skos:related rdf:resource="#29126" />
  <skos:related rdf:resource="#29149" />
  <skos:related rdf:resource="#29173" />
  <skos:broader rdf:resource="#2132" />
```

Related term

One Skill Cartridge Example: Terminology Matching



❖ Indexing

- Build a specific Skill Cartridge® for thesaurus indexing, based on the NAL thesaurus
- Increased precision by computing the relevance of terms

based on position, frequencies (document, reference corpus), measure of connectedness with other terms, length, depth ...

The screenshot displays a Skill Cartridge interface with a tree view on the left and a text area on the right. The tree view shows a hierarchy of terms, with 'Genomic instability' selected. A callout box highlights the score and frequency for this term: **Score: 0.47 / Frequency: 35**. Another callout box highlights the score and frequency for 'cancer': **Score: 0.76 / Frequency: 1**. The text area on the right contains a paragraph about cancer, with several terms highlighted in blue boxes: 'cancer', 'genomic instability', 'mutations', and 'evolution'.

Extraction result

- /Entity/NNN-Ontology: Mutation
- /Entity/NNN-Ontology: Genomic instability
 - /OA/label: Genomic instability
 - /OA/\$score\$: 0.7639056
 - /OA/\$features\$: [tf: 1, idf: 5.60]
 - /EA/Id: 631/208/211
 - /OA/\$score\$: 0.7639056
 - /EA/broader: 631/208
 - /EA/hierarchy: Biological sciences/Ge
- /Entity/NNN-Ontology: DNA replication
- /Entity/NNN-Ontology: DNA replication

Score: 0.47 / Frequency: 35

Score: 0.76 / Frequency: 1

Genomic instability in **cancer** was hypothesized by Boveri on the basis of the effects of aneuploidy on the growth of sea urchin embryos. Foulds further observed that malignant characteristics appeared to occur in a stepwise fashion, and Nowell suggested that **genomic instability**, a collection of **mutations**, contributes to a process — a recapitulation of Darwinian evolution and mutagenesis and Darwinian **evolution** are not mutually exclusive.

Gene rearrangements. The heterogeneity and complexity of the **cancer** genome was documented initially by techniques that analysed gene rearrangements. Rearrangements and large deletions occur at a much lower frequency in **cancer** genomes than do single-base substitutions, but they have the potential to inactivate multiple contiguous genes. Using comparative genomic hybridization (CGH), oligonucleotide arrays or PCR

One Skill Cartridge Example: Terminology Matching



❖ Indexing

- Build a STF-based (Smart Taxonomy Facilitator) Skill Cartridge®
- Increased precision by computing the relevance of terms
based on position, frequencies (document, reference corpus), measure of connectedness with other terms, length, depth ...
- Increased recall by applying fuzzy term matching techniques
Identifies and scores lexical variations of thesaurus terms

	Term	Score
Preferred form	Acousto-optical deflector	1.0000
Permutation	Optic and acoustic deflector	0.8677
Insertions	Acousto-optic based deflector	0.8339
Spelling alternatives	Acousto-optical deflecter	0.9259

Skill Cartridges

Flexible approach to address many use cases

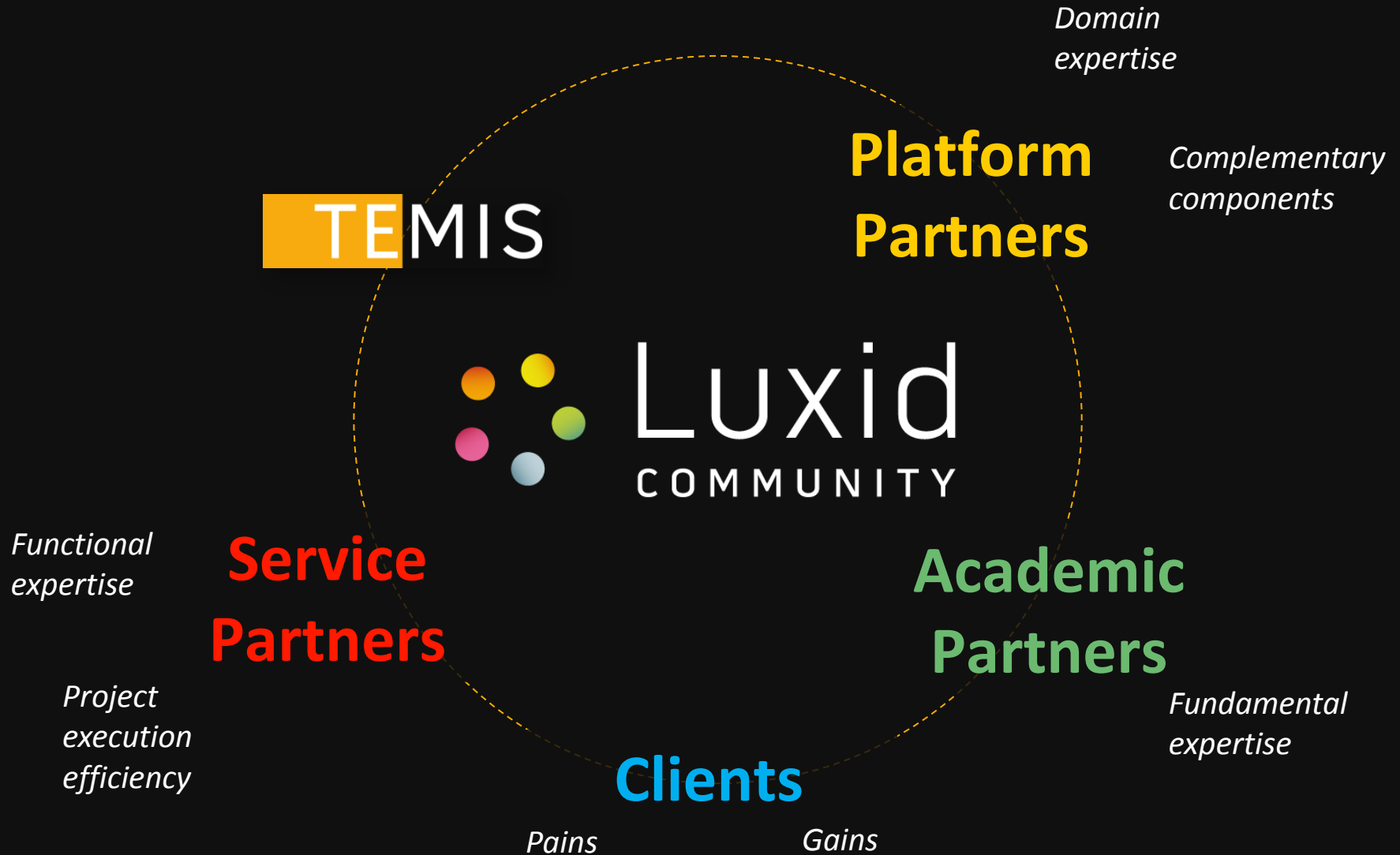
- ❖ Generic software platform Luxid + specific Skill Cartridge
 - Allows addressing many different use cases
indexing scientific documents in life sciences, legal, engineering,
... sentiment analysis, patent analysis, ...
 - There are more opportunities than TEMIS can address alone
- ❖ Invite 3rd parties to participate
 - Define new, additional Skill Cartridges
 - Open license or commercial?
- ❖ A marketplace to suggest a technical and formal framework: The “Luxid Community”
 - An “AppStore” for Semantic components
 - Development tools, teaching material, access to existing install base, discuss, learn, exchange



community.temis.com

Luxid[®] Community



Building, using, exchanging resources for Semantic Content Enrichment



The Luxid Community


An „App Store“ for Semantic components

[WHY A COMMUNITY](#) [MEET](#) [DISCUSS](#) [LEARN](#) [EVENTS](#) [IMPROVE](#) [MARKETPLACE](#)

  [Stefan Geibler](#)
[Sign Out](#)

Marketplace

[Download the Marketplace Toolkit!](#) [Feedback](#)







Marketplace











38 entries found

[Suggest a component](#) [Publish on marketplace](#)

Category



-  Skill cartridge (35)
-  Taxonomy (1)
-  Script (1)
-  Other (2)

Sector

-  Bio / Medical (8)
-  News / Media (6)
-  Chemistry (4)
-  Agronomics (2)
-  Social sciences (2)
-  Legal (2)
-  Security (2)
-  Document management (1)
-  Energy (1)
-  Generic (14)

[TEMIS Starters] Machine learning Skill Cartridge®

TEMIS

Material produced during the tutorial "Create a machine-learning Skill Cartridge®"



LANGUAGE(S): EN

BUSINESS MODEL: Community

[Learn More](#)

[TEMIS Starters] Premier League STF Skill Cartridge®

TEMIS

Material produced during the tutorial "Create a Skill Cartridge® based on DBPedia".



LANGUAGE(S): Generic

BUSINESS MODEL: Community

[Learn More](#)

[TEMIS Starters] Skill Cartridge Project for SCB tutorial

TEMIS

Skill Cartridge Builder Project created during the tutorial "[TEMIS Starters] Create your first rule-based Skill Cartridge®".



LANGUAGE(S): Generic

BUSINESS MODEL: Community

[Learn More](#)

Acronyms Skill Cartridge®

TEMIS

Generic Skill Cartridge® that identifies acronyms and their expanded forms in text. Based on simple heuristic patterns, this provides a fast and light-weight addition to terminology identification.



LANGUAGE(S): EN

BUSINESS MODEL: Community

[Learn More](#)

Affiliation Skill Cartridge®

TEMIS

Extracts and normalizes Organization names (e.g. Academia, Hospitals, Medical centers, Institutes, Companies,...) and Locations in the Affiliation text zone of scientific literature (PubMed, Embase, Scopus).



LANGUAGE(S): EN

BUSINESS MODEL: Community

[Learn More](#)

Agricultural Organisms Entities & Relationships Cartridge®

INRA


 

Extracts 11 key types of agricultural organisms entities and 1 relationship binding them, including Attack of plants by pests.

LANGUAGE(S): EN

BUSINESS MODEL: Community

[Learn More](#)



TEMIS

Semantic Content Enrichment software vendor since 2000



2010 Montréal
New York



2010
London



2000



Paris
Grenoble



Heidelberg

Content
Enrichment

26 patents

Luxid



Closing thoughts

❖ Semantics in Scientific Publishing

- **Faster & simpler process** in internal editorial workflows
- **Additional insight & perspective** beyond the raw content
- **New types of products**, possible only with automated semantics

❖ TEMIS approach

- **Luxid Platform:** One software core, many components
- **Multilinguality, scalability, APIs, rule-based, thesaurus-based, machine-learning, ...**

❖ Luxid Community: Meeting the interests of different stakeholders

- **Luxid user:** More existing, ready-made domain-specific components
- **Domain expert** (“App Developer”): Access to industry clients
- **TEMIS:** Increased reach of the Luxid approach



Takk for oppmerksomheten!

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