FONDATION
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PASC22 Conference

Enabling Industrialized Analysis of Textual Documents in Data Lakes

Pegdwendé Nicolas Sawadogo

pegdwende.sawadogo@univ-lyon2.fr

June 27, 2022

Outline

1. Introduction
2. DL and DWH
3. AUDAL implementation
4. Textual analyses in AUDAL
5. Conclusion

Why Data Lakes?

Welcome to the big data era

Tremendous growth of produced and available data

Big data opportunities

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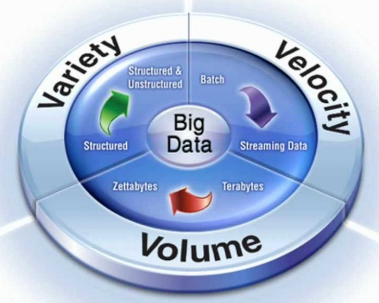
Welcome to the big data era

Tremendous growth of produced and available data

Big data opportunities

Big data challenges

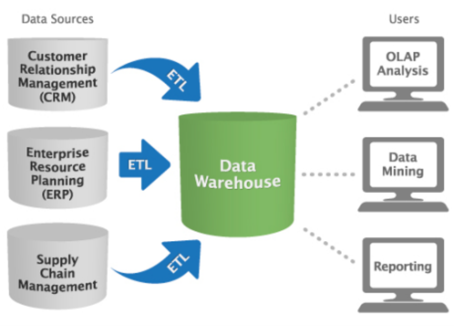


https://www.ibm.com

Why Data Lakes?

From data warehouses to data lakes

- Data warehouses do achieve insights from big data.
- Distributed technologies to tackle **Volume**
- ...but **Variety** and **Velocity** pose great challenges.



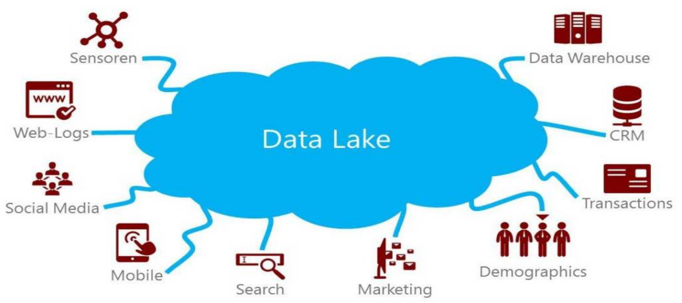
https://intellipaat.com

What is a Data Lake?

Definition

James Dixon (2010)

A data lake is a large **repository** of **raw** and **heterogeneous data**, fed by external sources and allowing users to **explore**, sample and **analyze** the data.



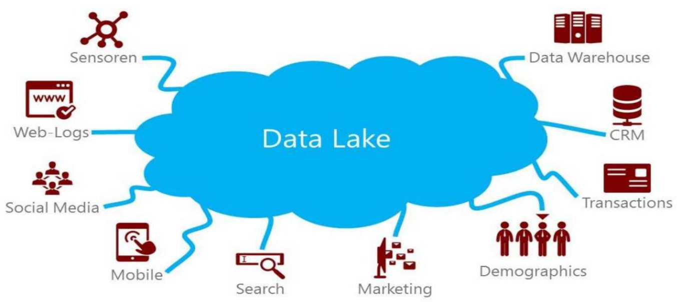
http://dwbimaster.com

What is a Data Lake?

Definition

Sawadogo et al. (2019)

A data lake is a **scalable storage** and **analysis system** for **data** of any type, retained in their **native format** and used *mainly* by data **specialists** (statisticians, data scientists or analysts) for knowledge extraction.

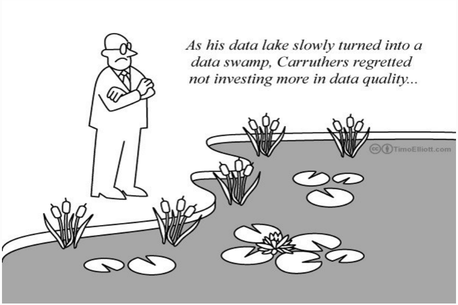


http://dwbimaster.com

Data Lake Issues

Avoiding the data swamp

- **Schema-on-read** approach
- Efficient metadata system *required* for data access and querying
- ...but how to design such a system?

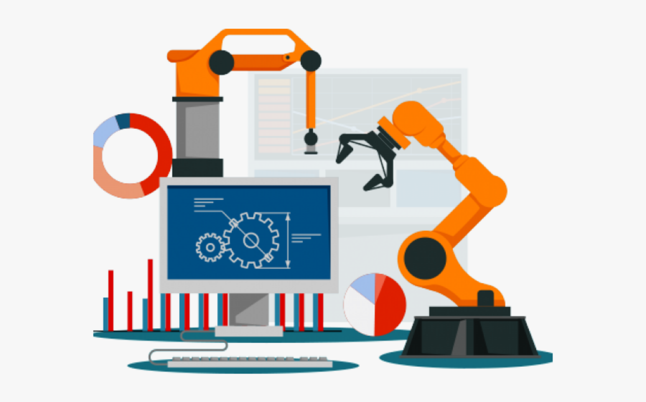

As his data lake slowly turned into a data swamp, Carruthers regretted not investing more in data quality...
TimoElliott.com

https://timoelliott.com

Data Lake Issues

Enabling industrialized analyses

- Open the data lake to business users
- Make easier advanced analyses
- Automate metadata management



https://www.clipartkey.com/

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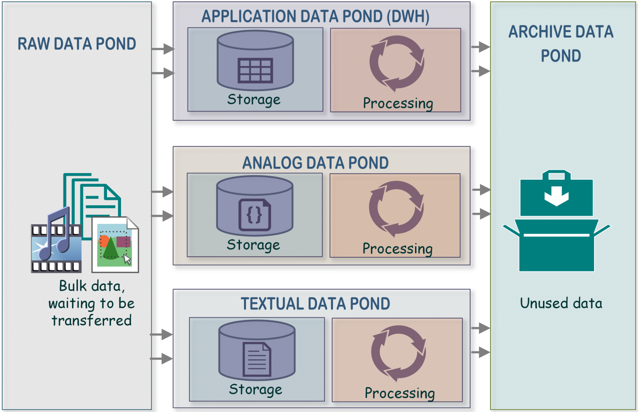
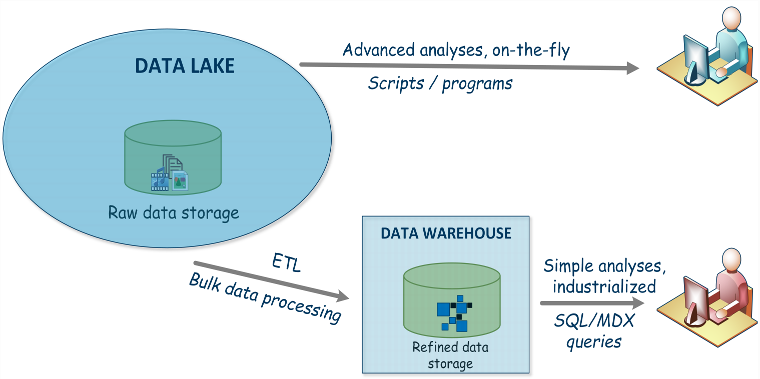
DWH in a DL

- Approach proposed by Inmon
- Induces a data siloing



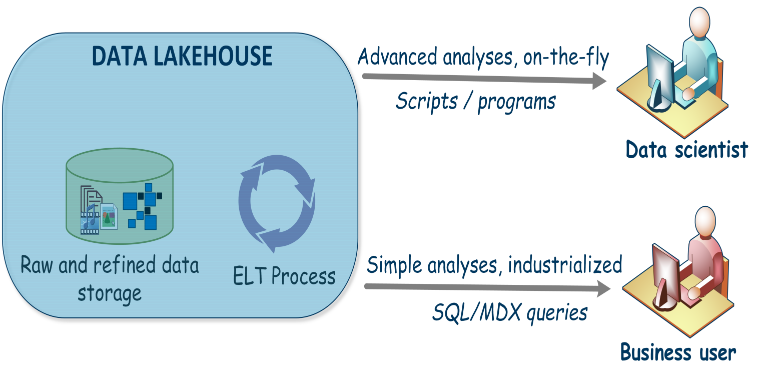
DL ahead of a DWH

- Based on a functional distinction
- DL for ponctual analyses, DWH for industrialized analyses



DL merged with a DWH

- Most recent approach (still maturing)
- Industrialization of analyses in the DL


DATA LAKEHOUSE
Raw and refined data storage
ELT Process
Advanced analyses, on-the-fly
Scripts / programs
Data scientist
Simple analyses, industrialized
SQL/MDX queries
Business user

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AURA-PMI Project

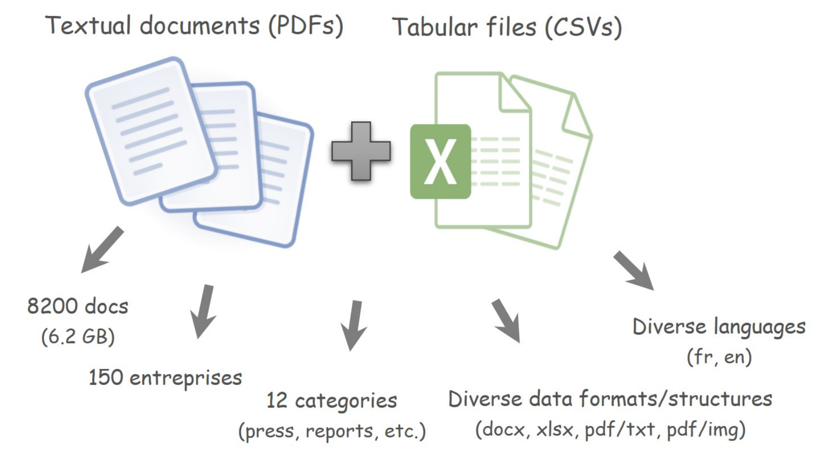
AURA-PMI, a multi-disciplinary project

- Research project in management
- Analysis of the digitization of small enterprises
- Comparison of digitization policies across categories of small enterprises

AURA-PMI Project

Extract insights from data

- Enterprises' characteristics (region, nb. employees, domain, etc.)
- Annual reports, financial reports, etc.



Textual documents (PDFs)

Tabular files (CSVs)

8200 docs
(6.2 GB)

150 entreprises

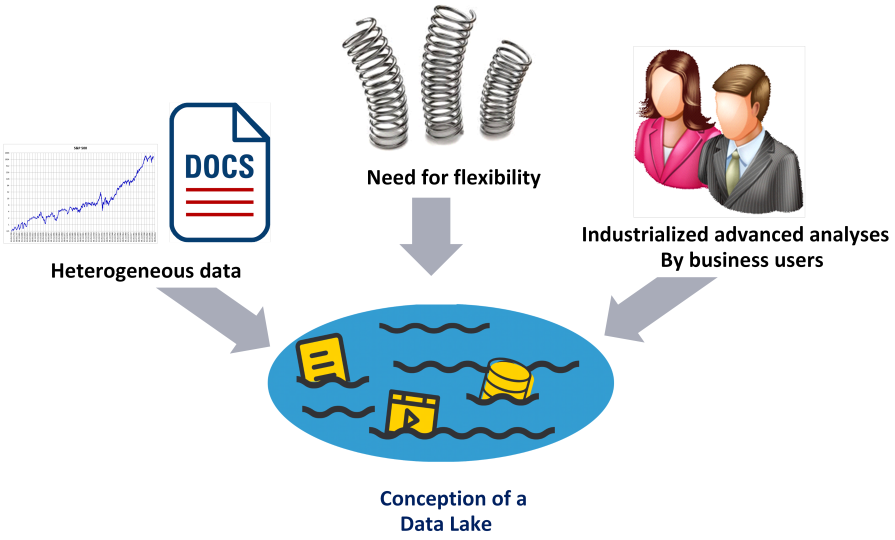
12 categories
(press, reports, etc.)

Diverse data formats/structures
(docx, xlsx, pdf/txt, pdf/img)

Diverse languages
(fr, en)

AURA-PMI Project

Need for a data lake



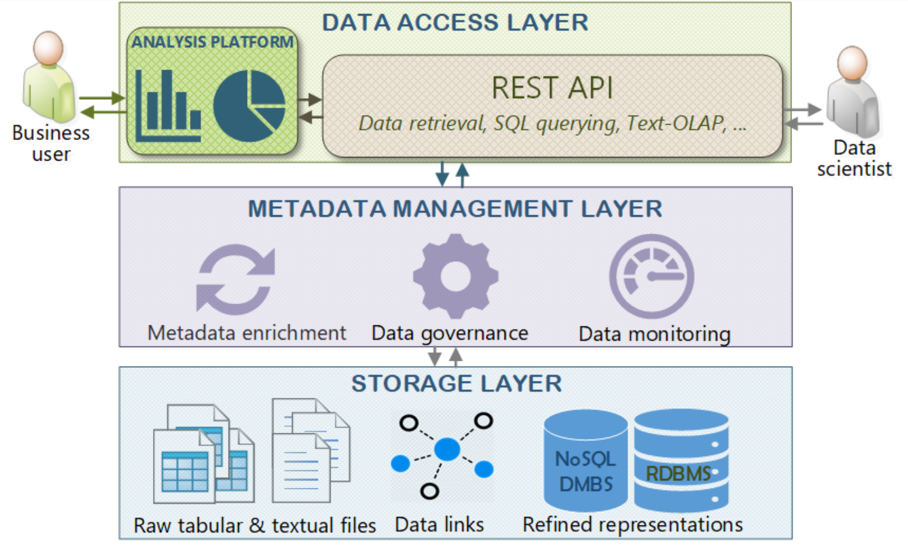
Heterogeneous data

Need for flexibility

Industrialized advanced analyses
By business users

Conception of a
Data Lake

Architecture of AUDAL



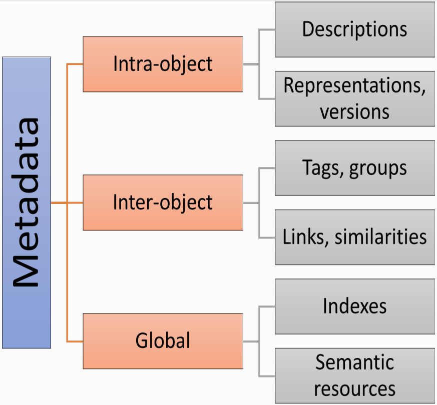
Metadata management

An extensive vision of metadata

Visengeriyeva (2020)

Metadata are **structured information** that **describes**, **explains**, **locates**, or otherwise makes it easier to **retrieve**, **use**, or **manage** information resources.

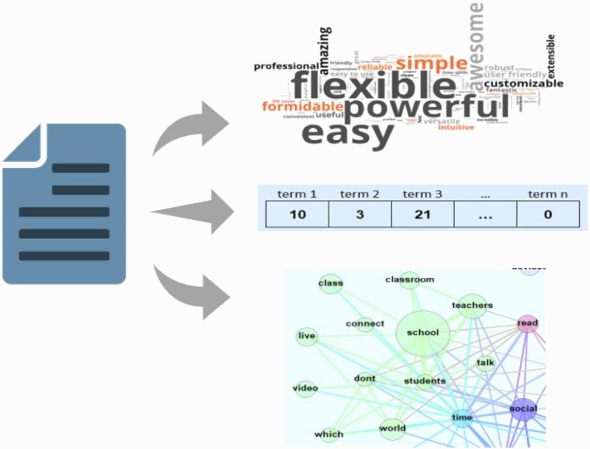
$$DL = \langle \mathscr{D}, \mathscr{M} \rangle$$
$$\mathscr{M} = \langle \mathscr{M}_{intra}, \mathscr{M}_{inter}, \mathscr{M}_{glob} \rangle$$



Metadata management

Data polymorphism

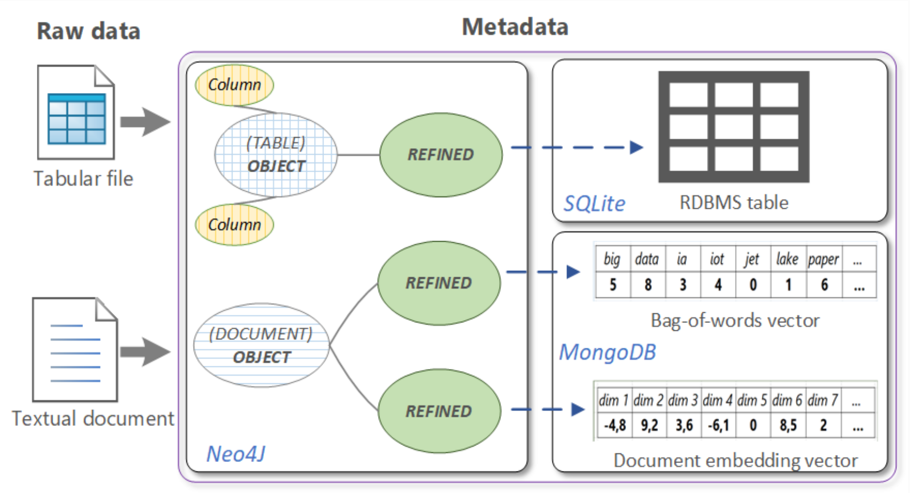
- Simultaneously manage different representations of data
- Such representations are viewed as metadata of raw data



term 1	term 2	term 3	...	term n
10	3	21	...	0

Metadata management in AUDAL (3/3)

Intra-object metadata

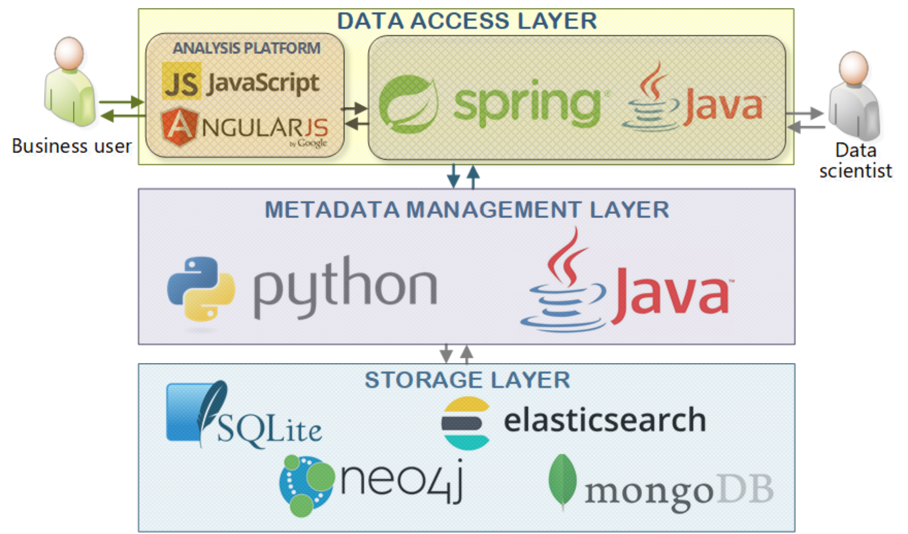


big	data	ia	iot	jet	lake	paper	...
5	8	3	4	0	1	6	...

dim 1	dim 2	dim 3	dim 4	dim 5	dim 6	dim 7	...
-4,8	9,2	3,6	-6,1	0	8,5	2	...

Technologies used in AUDAL

AUDAL = AUra-pmi DAta Lake



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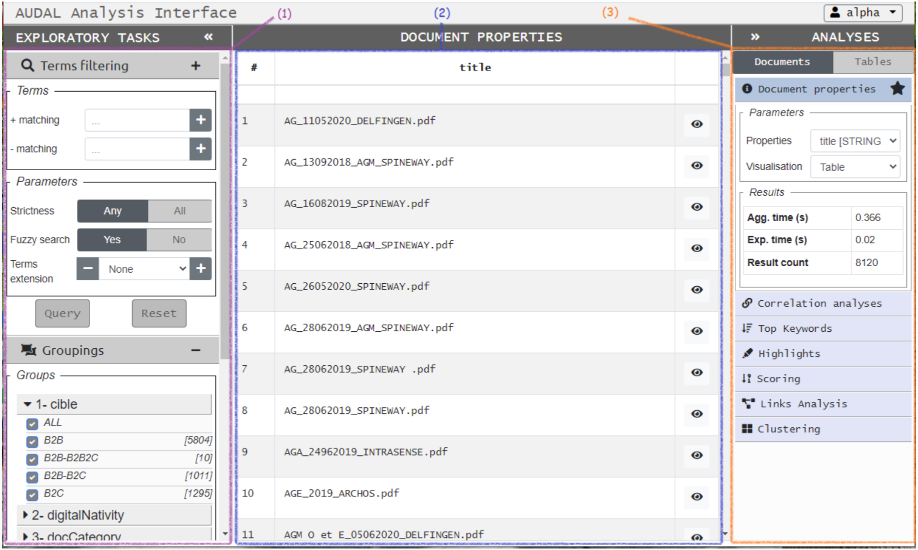
Analyses dans AUDAL



Terms
+ matching ...
- matching ...

Parameters
Strictness: [✓ Any] All
Fuzzy search: [✓ Yes] No
Terms extension: None

Groups
▾ 1- cible
☑ ALL
☑ B2B [5804]
☑ B2B-B2B2C [10]
☑ B2B-B2C [1011]
☑ B2C [1295]
▸ 2- digitalNativity
▸ 3- docCategory

#	title
1	AG_11052020_DELFINGEN.pdf
2	AG_13092018_AGM_SPINEWAY.pdf
3	AG_16082019_SPINEWAY.pdf
4	AG_25062018_AGM_SPINEWAY.pdf
5	AG_26052020_SPINEWAY.pdf
6	AG_28062019_AGM_SPINEWAY.pdf
7	AG_28062019_SPINEWAY .pdf
8	AG_28062019_SPINEWAY.pdf
9	AGA_24962019_INTRASENSE.pdf
10	AGE_2019_ARCHOS.pdf
11	AGM O et E_05062020_DELFINGEN.pdf

Parameters
Properties: title [STRING
Visualisation: Table

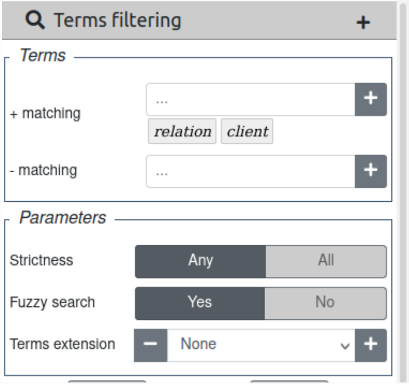
Results

Agg. time (s)	0.366
Exp. time (s)	0.02
Result count	8120

Analyses in AUDAL

Data retrieval

Keyword-based filtering



Terms filtering +

Terms

+ matching ... +

relation *client*

- matching ... +

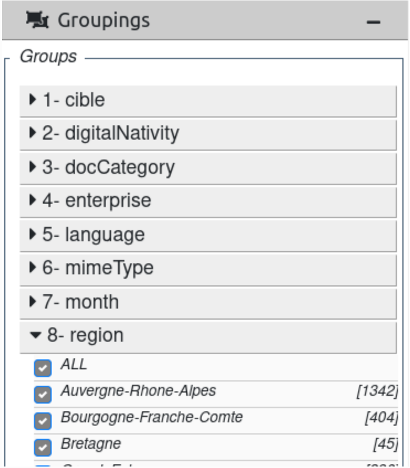
Parameters

Strictness: Any | All (Any selected)

Fuzzy search: Yes | No (Yes selected)

Terms extension: − None +

Category-based filtering



Groupings −

Groups

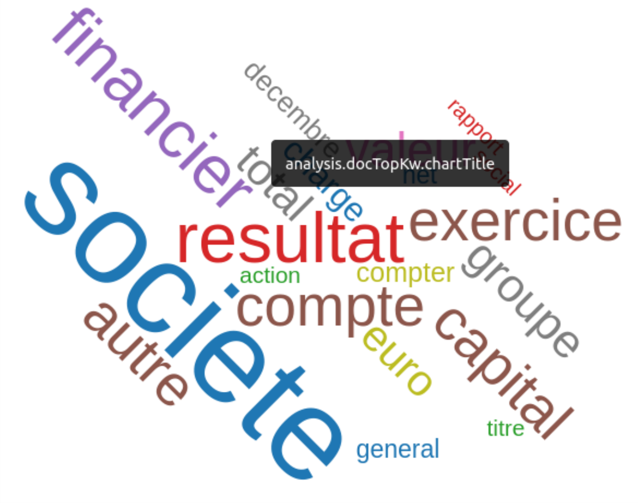
- 1- cible
- 2- digitalNativity
- 3- docCategory
- 4- enterprise
- 5- language
- 6- mimeType
- 7- month
- 8- region

☑ *ALL*	
☑ *Auvergne-Rhone-Alpes*	*[1342]*
☑ *Bourgogne-Franche-Comte*	*[404]*
☑ *Bretagne*	*[45]*

Analyses in AUDAL

Textual data aggregation

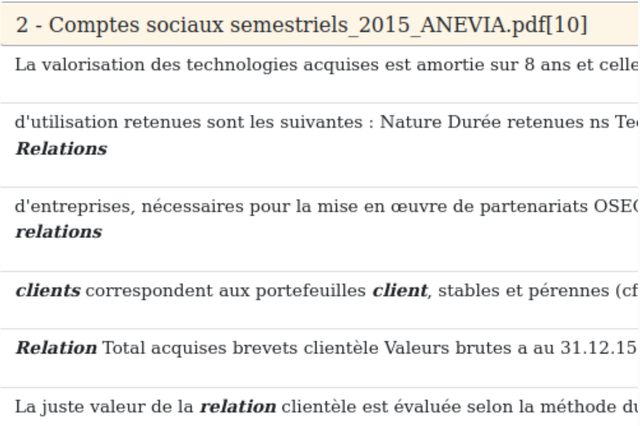
Highlighting documents' content with a wordcloud



Analyses dans AUDAL

Textual data aggregations

Highlighting documents' content with a Concordance



2 - Comptes sociaux semestriels_2015_ANEVIA.pdf[10]

La valorisation des technologies acquises est amortie sur 8 ans et celle

d'utilisation retenues sont les suivantes : Nature Durée retenues ns Te
Relations

d'entreprises, nécessaires pour la mise en œuvre de partenariats OSE
relations

clients correspondent aux portefeuilles ***client***, stables et pérennes (cf

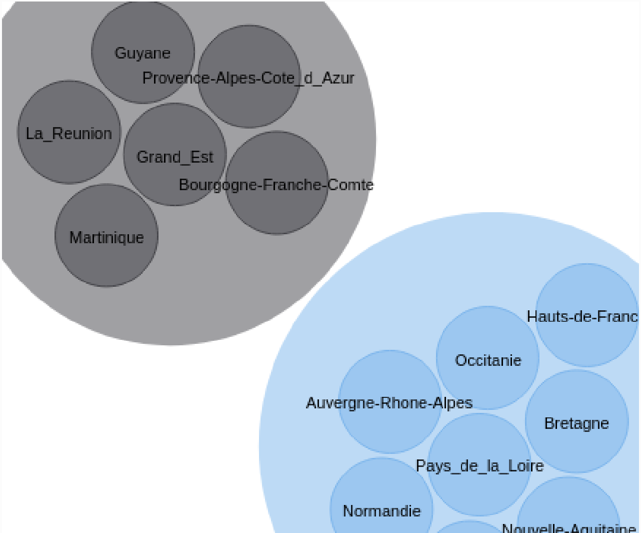
Relation Total acquises brevets clientèle Valeurs brutes a au 31.12.15

La juste valeur de la ***relation*** clientèle est évaluée selon la méthode du

Analyses in AUDAL

Textual data aggregation

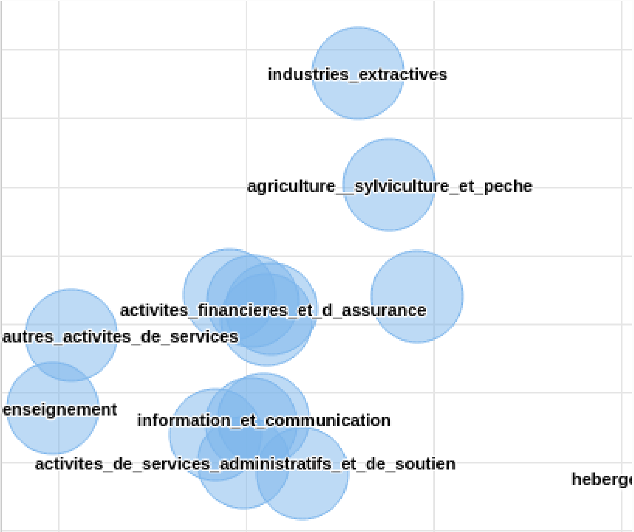
Clustering KMeans of documents by groups



Analyses in AUDAL

Textual data aggregation

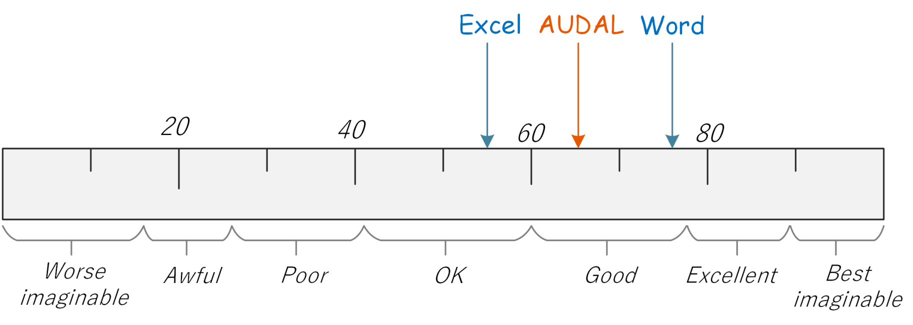
PCA of documents by groups



User experience with AUDAL

Usability

- Method *System Usability Scale* (SUS)
- Protocol based on a feedback from 6 users via a questionnary



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Conclusion

We presented...

★ **How DSS architectures evolved with the DL wave**

- DWH in the DL
- DL ahead of the DWH
- DL merged with the DWH

★ **How to activate industrialized analyses for textual documents in a DL**

- Using an extensive vision of metadata
- Thanks to a principle of data polymorphism
- With a combination of storage technologies

Conclusion

We presented...

★ **How DSS architectures evolved with the DL wave**

- DWH in the DL
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★ **How to activate industrialized analyses for textual documents in a DL**

- Using an extensive vision of metadata
- Thanks to a principle of data polymorphism
- With a combination of storage technologies

What's next ?

► **Activate deeper textual data analyses**

- Sentiment analysis

► **Industrialized analyses for more unstructured data in DLs**

- Images
- Videos

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