Zürcher Hochschule
für Angewandte Wissenschaften

Colloquium of University of Mannheim's School of Business Informatics & Mathematics

CHOCOLATE FLAVOURED DATA SCIENCE

datalab
dlab.zhaw.ch

Zürcher Fachhochschule

Thilo Stadelmann
28.04.2014

UNIVERSITY OF MANNHEIM

Zurich University
of Applied Sciences

ZHAW Zurich University of Applied Sciences – School of Engineering

Switzerland’s biggest fully-featured university of applied sciences

- >10’000 students
- >2’600 employees
- >1’000 (associate) professors

School of Engineering emanates from «Technikum Winterthur» (est. 1874)

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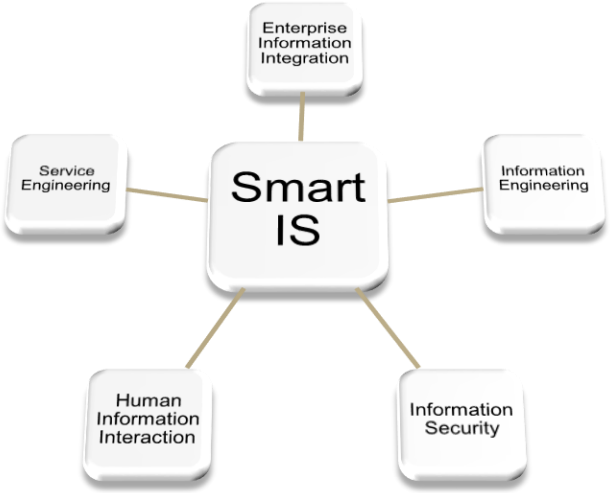
InIT Institute of Applied Information Technology

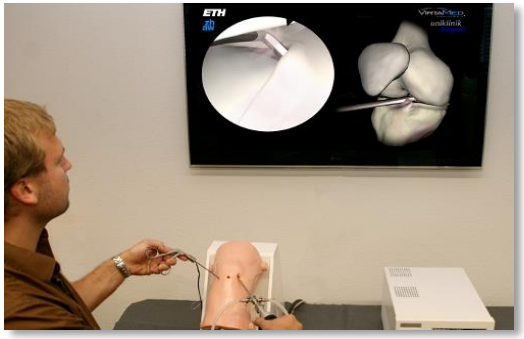
Smart Information Systems since 2005

- 5 Focus areas, one vision: Smart IS
- Undergraduate, graduate & continuing eductation in computer science
- Associated labs: Cloud Computing Lab, Data Science Lab, Visual Computing Lab, Services Lab, …



Facts & Figures

- >70 employees, >35 (associated) professors
- >6 MCHF business volume in 2013



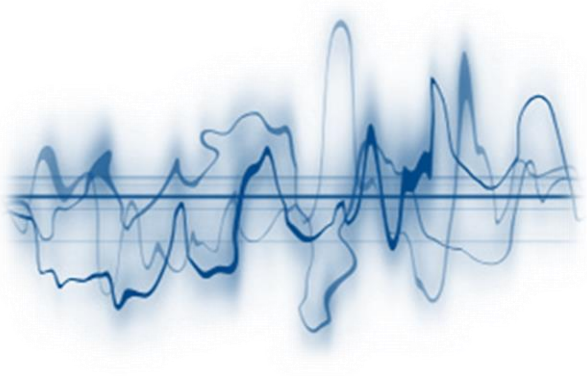
Information Engineering Research Group

Zurich University of Applied Sciences

zh aw

Combining structured and unstructured data analysis

- Information Retrieval and Data Warehousing
- Integration of heterogeneous and unstructured data
- Topic- and Trend-Detection (finding w/o search)
- Data- and Text-Mining
- Machine Learning and Artificial Intelligence
- Benchmarking of search engines
- Data Science within ZHAW Datalab



expert-match

promise

squirro

Information Engineering

Information Retrieval	Data Warehousing
Data Mining	Machine Learning

A Personal Story

- Fascinated by AI
- Studied computer science
- Applied ML & IR during Ph.D.
- Used DWH & DM professionally

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- Difficult to briefly explain professional interests

➔ Excited about term «Data Scientist»

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➔ Excited about term «Data Scientist»

Agenda: 1. Definition → 2. Projects → 3. State of the Union

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What is a Data Scientist, what is Data Science?

Definition & Classification

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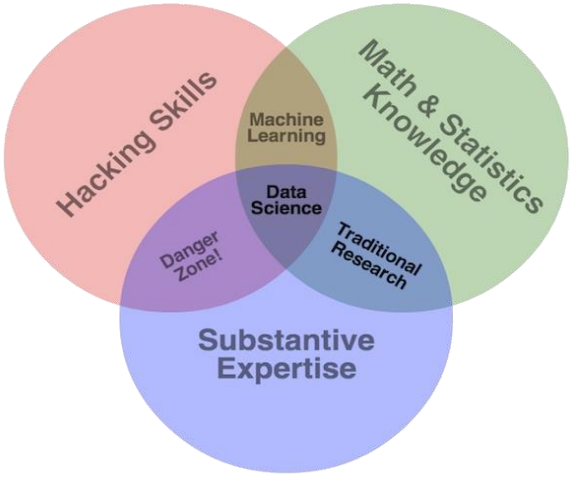
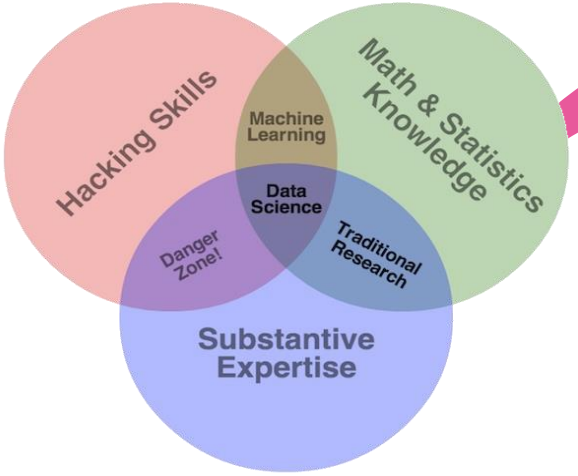
Data Science?



Data Science?



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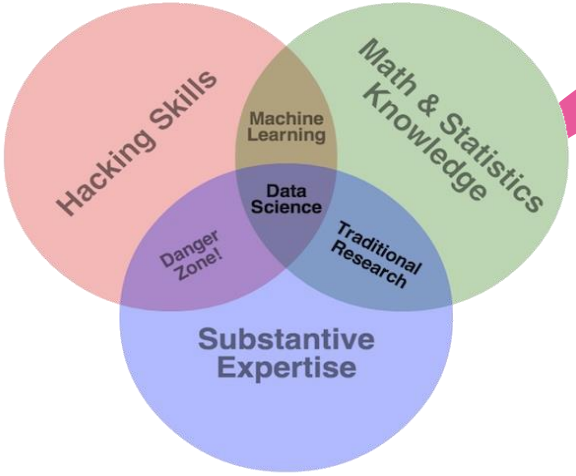

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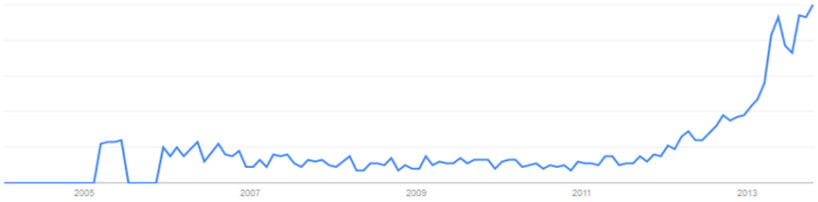

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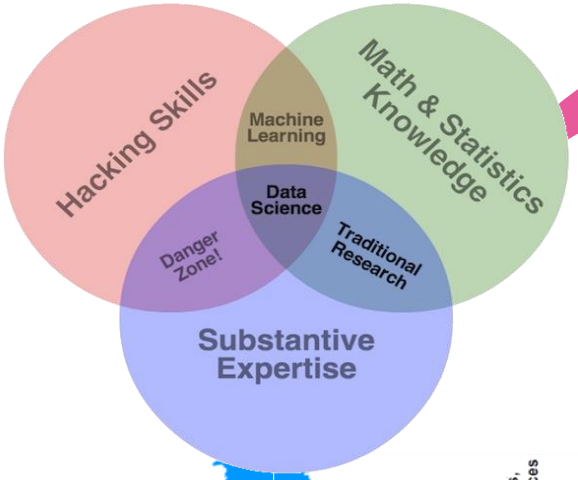

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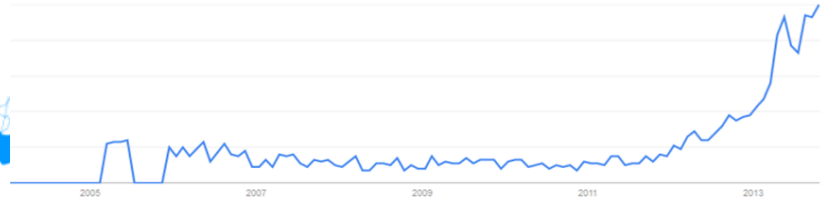

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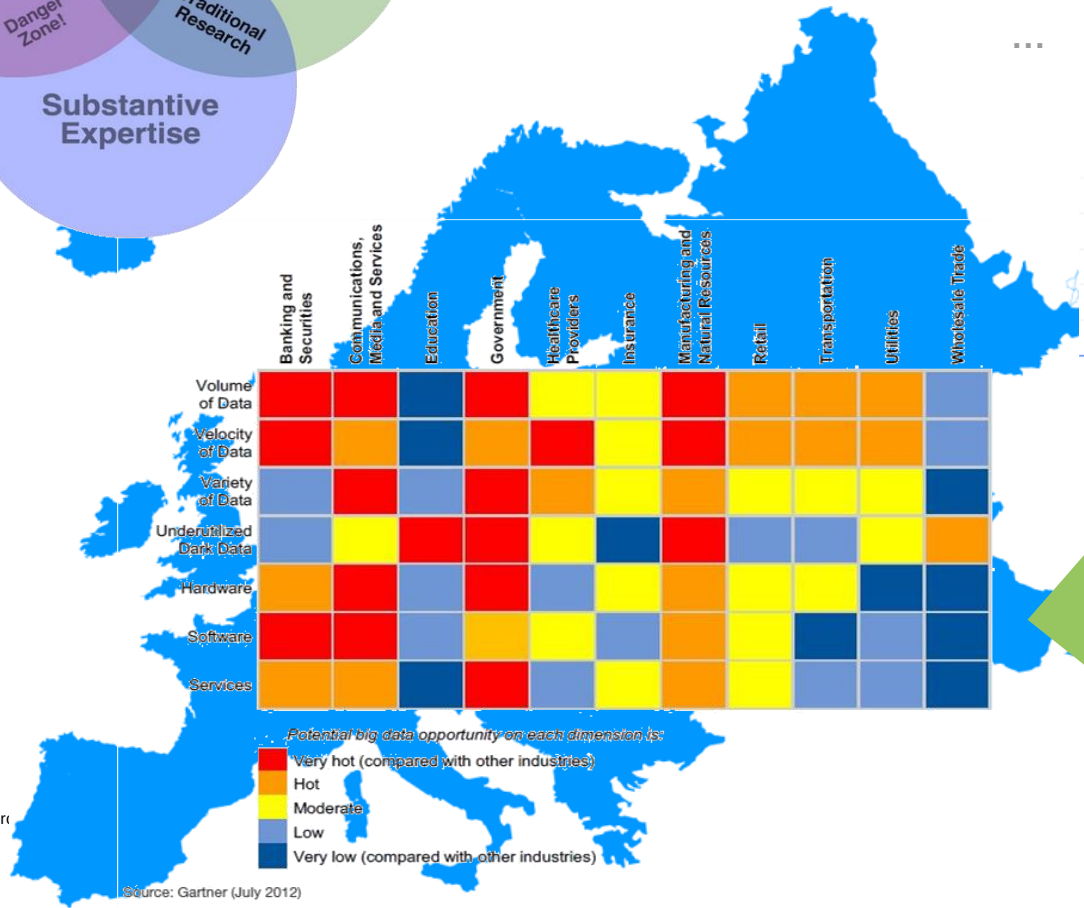

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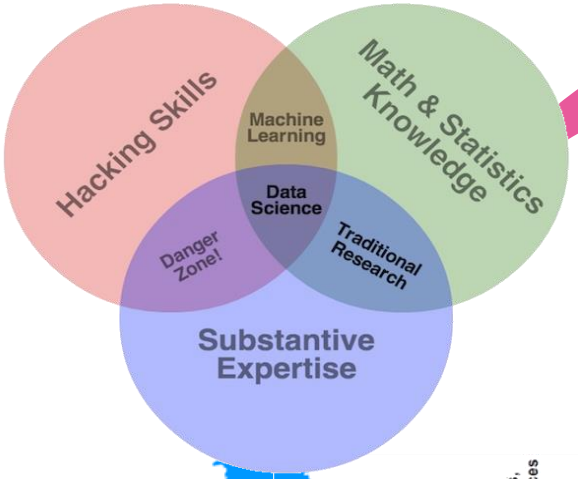

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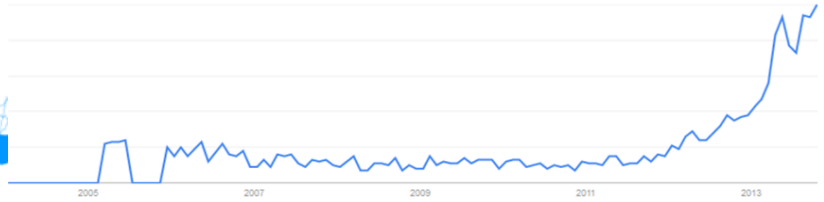

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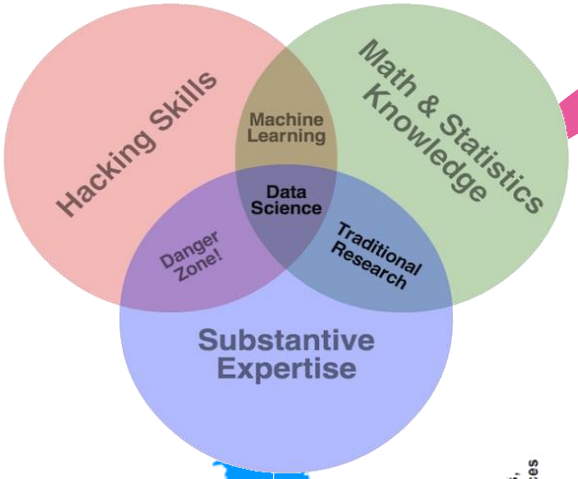

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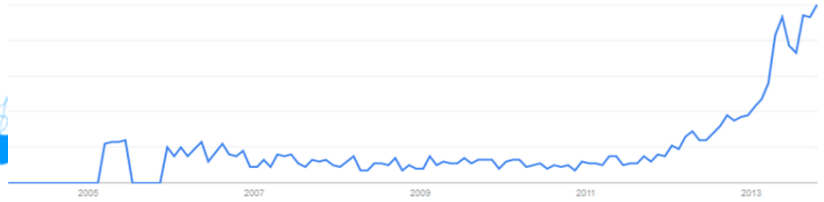

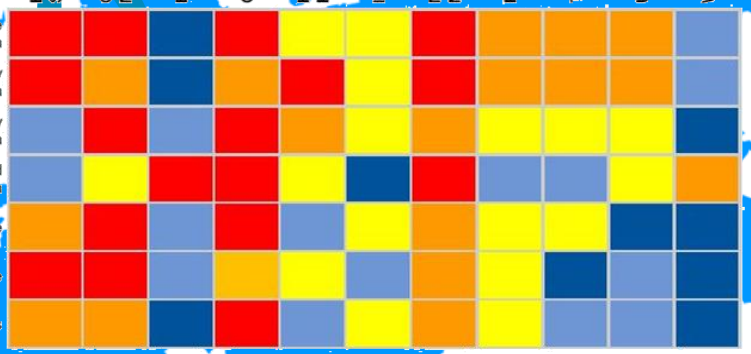

Source: Gartner (July 2012)

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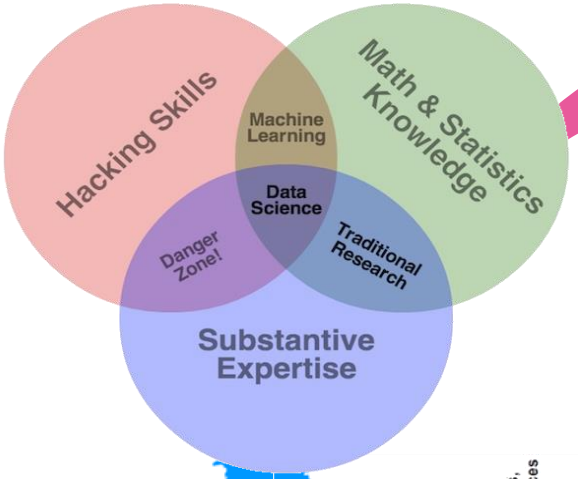
Data Science?



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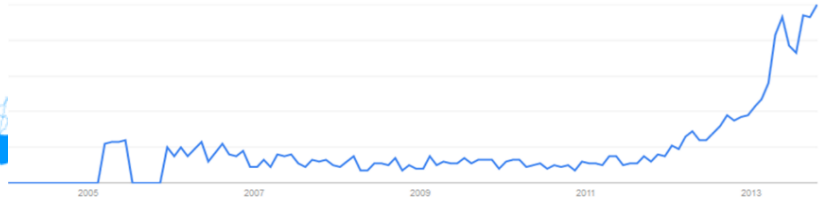

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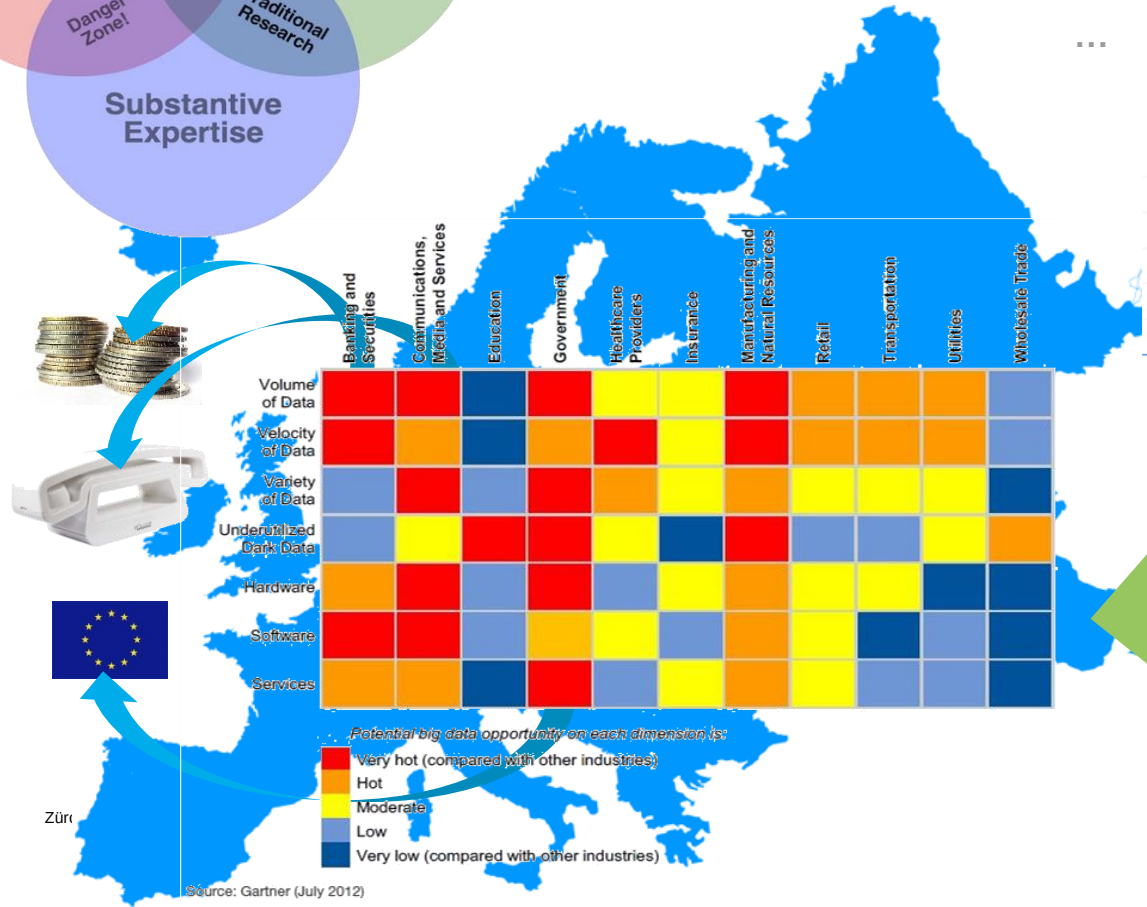

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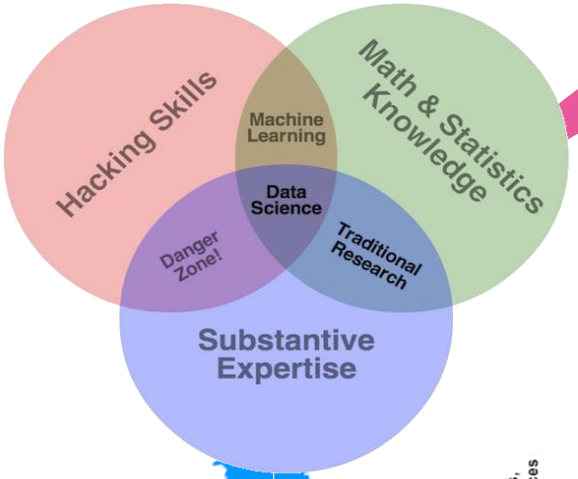

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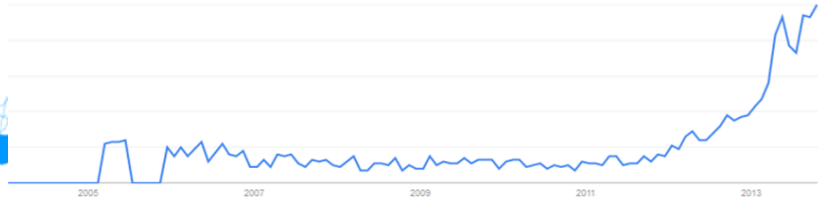

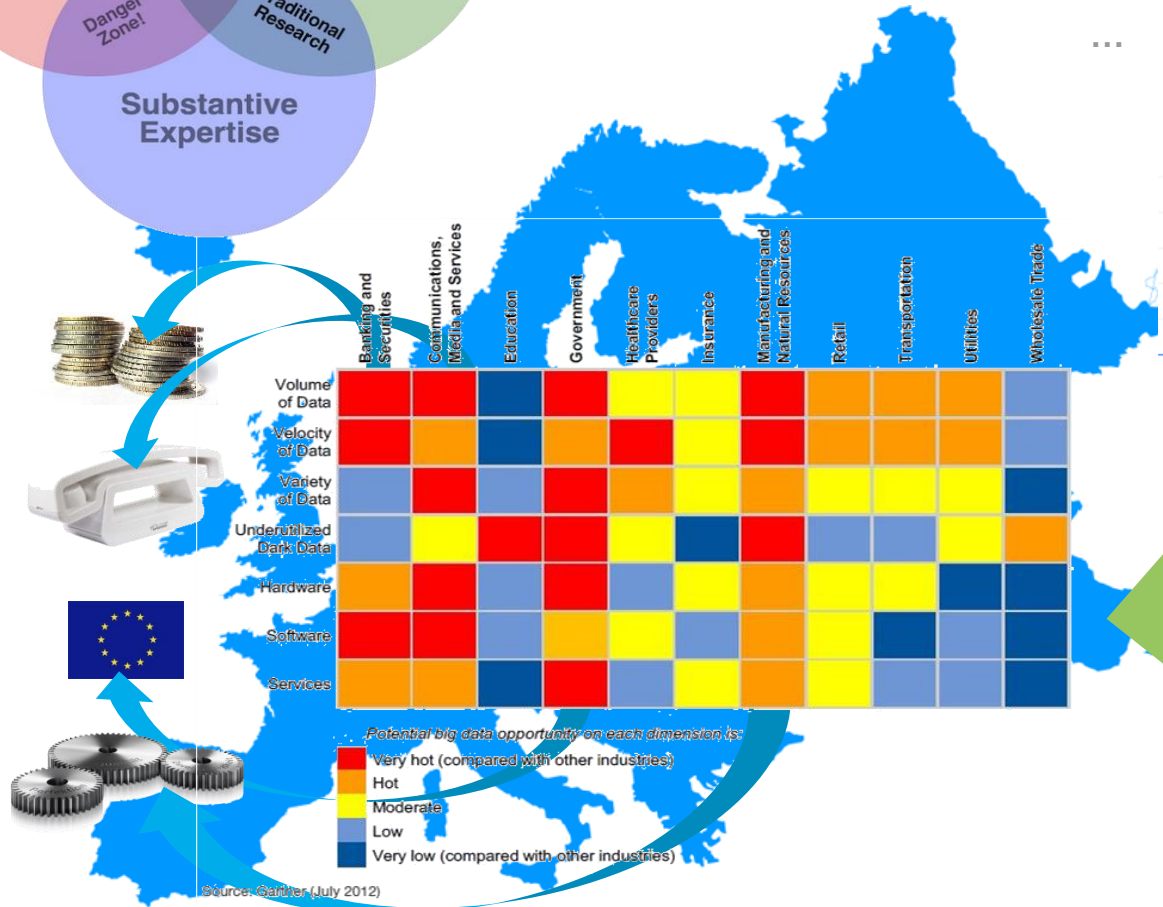

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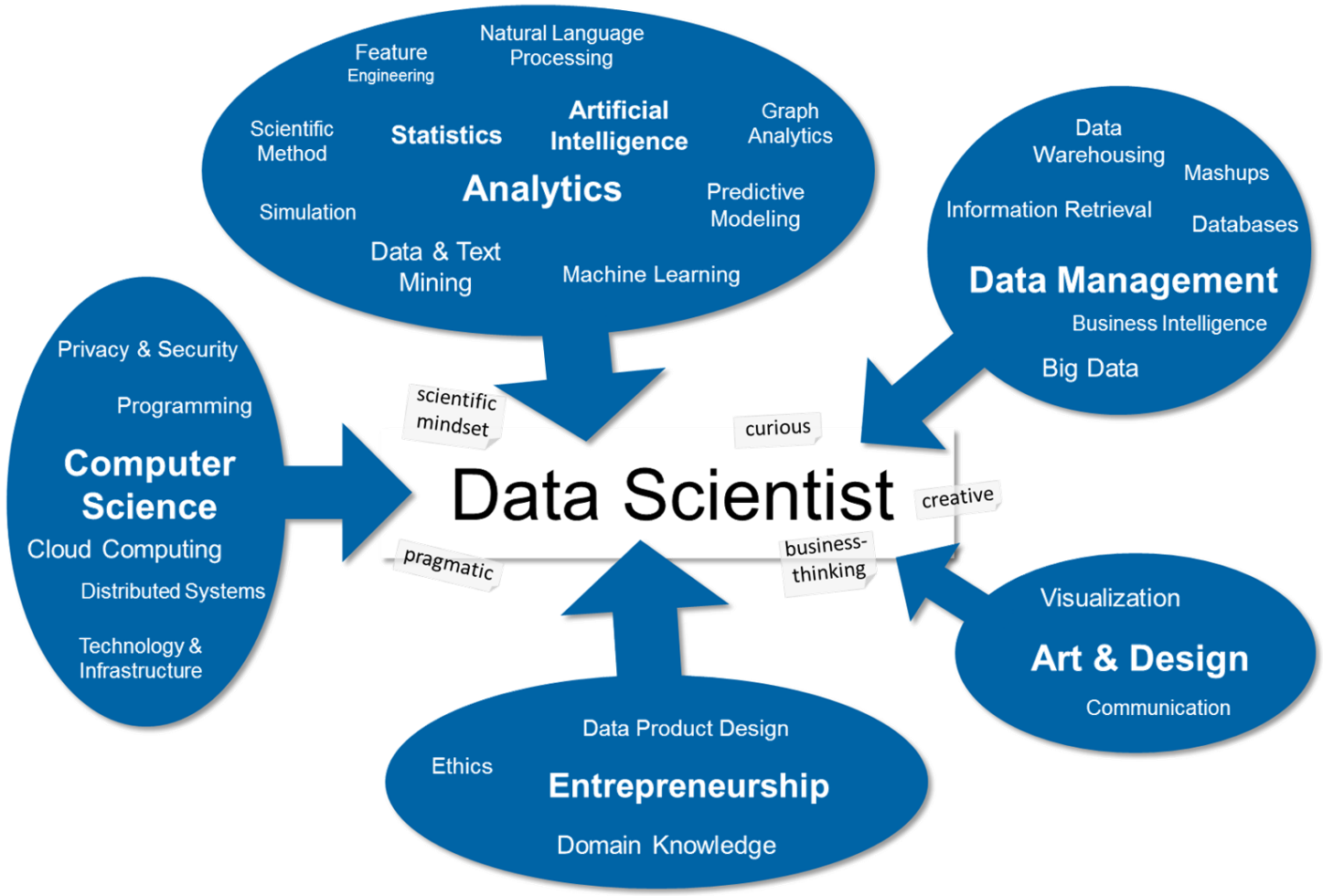

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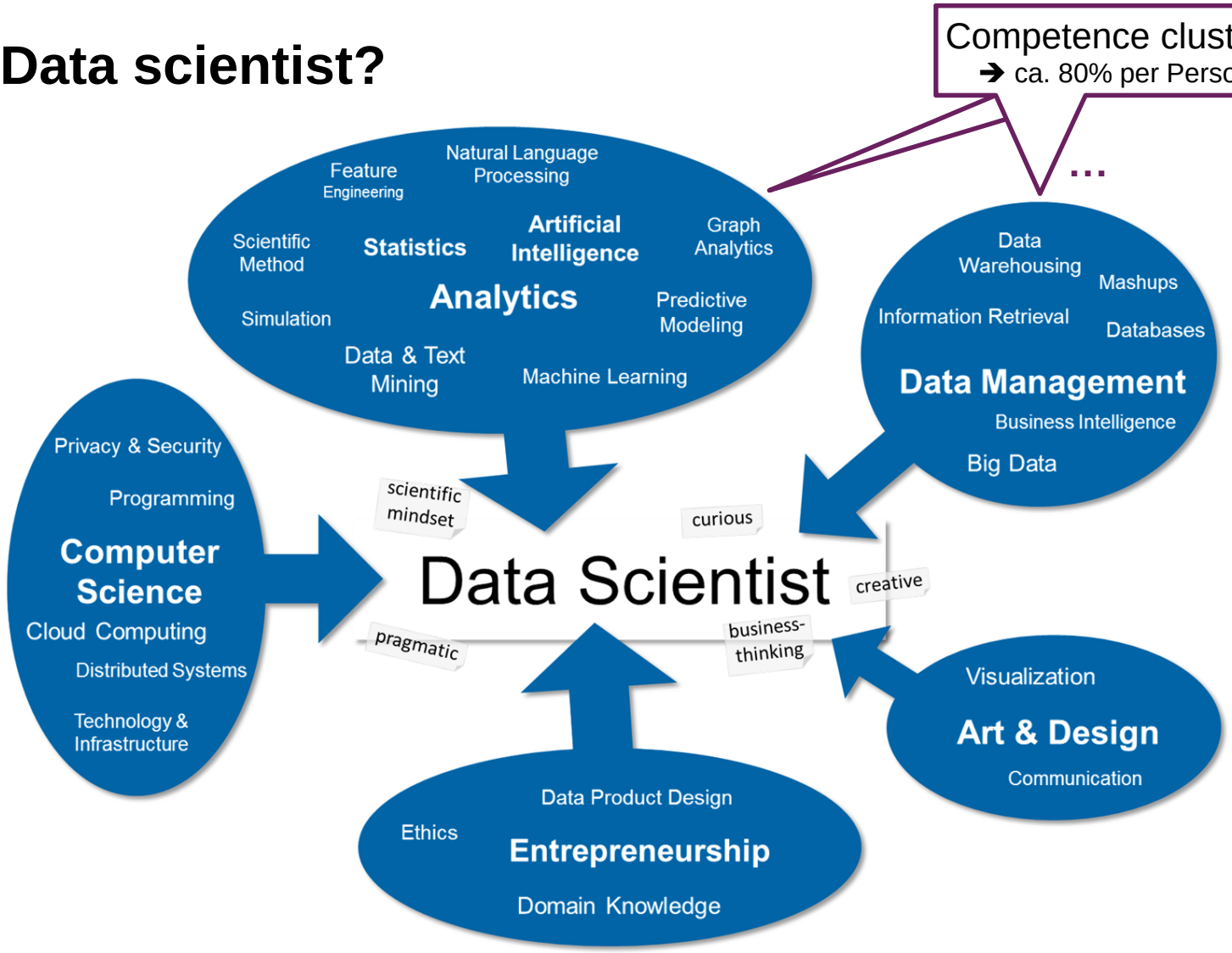

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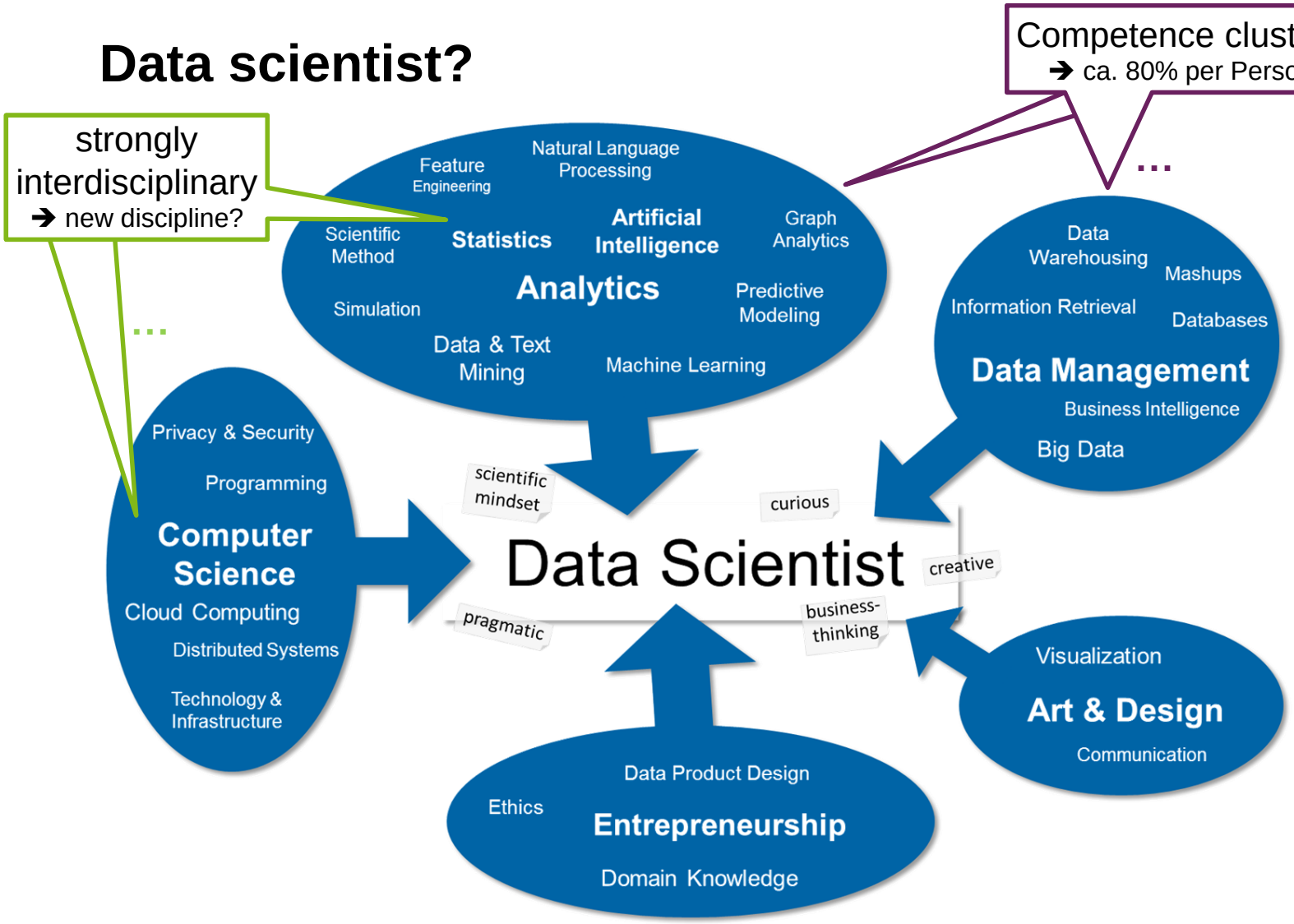

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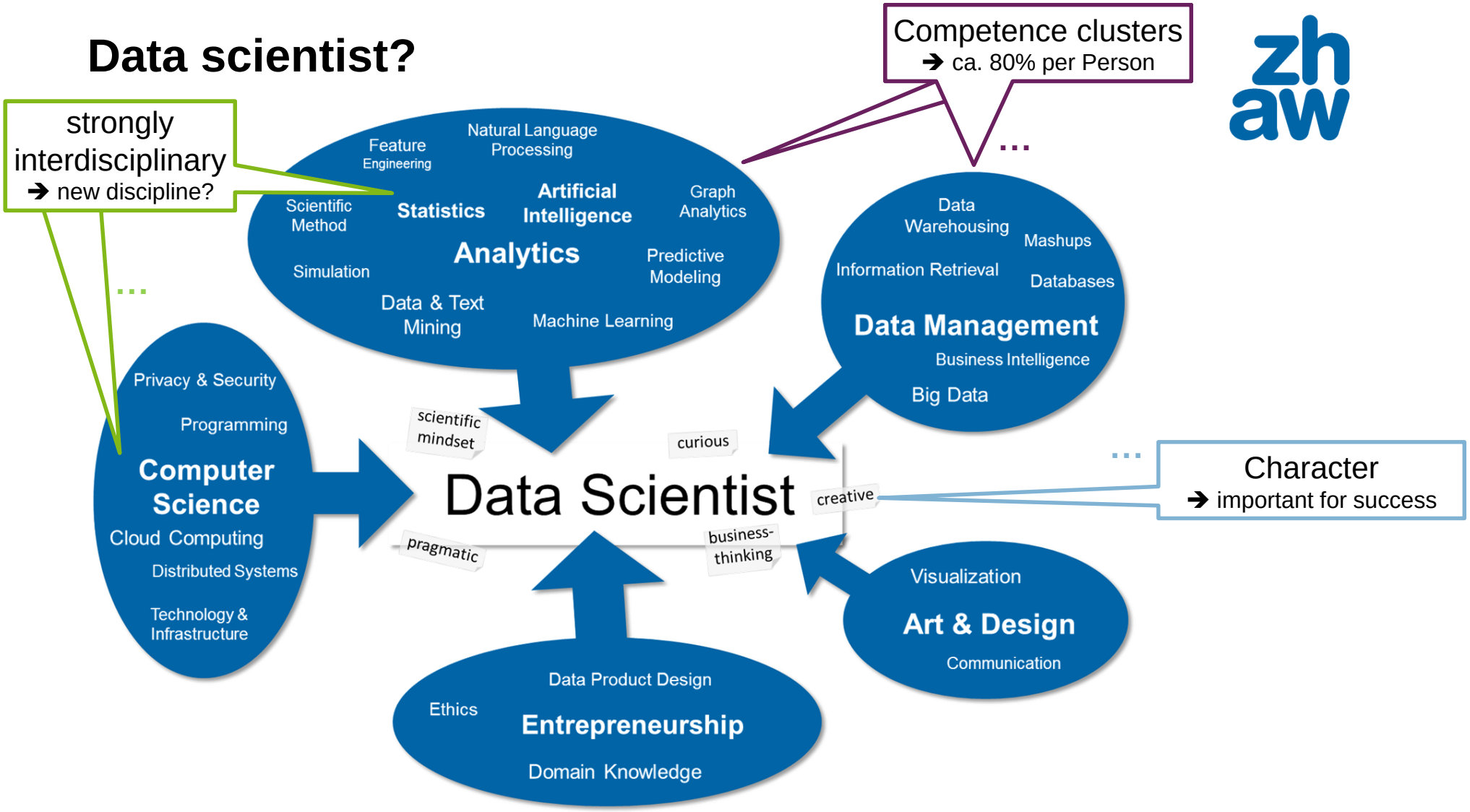

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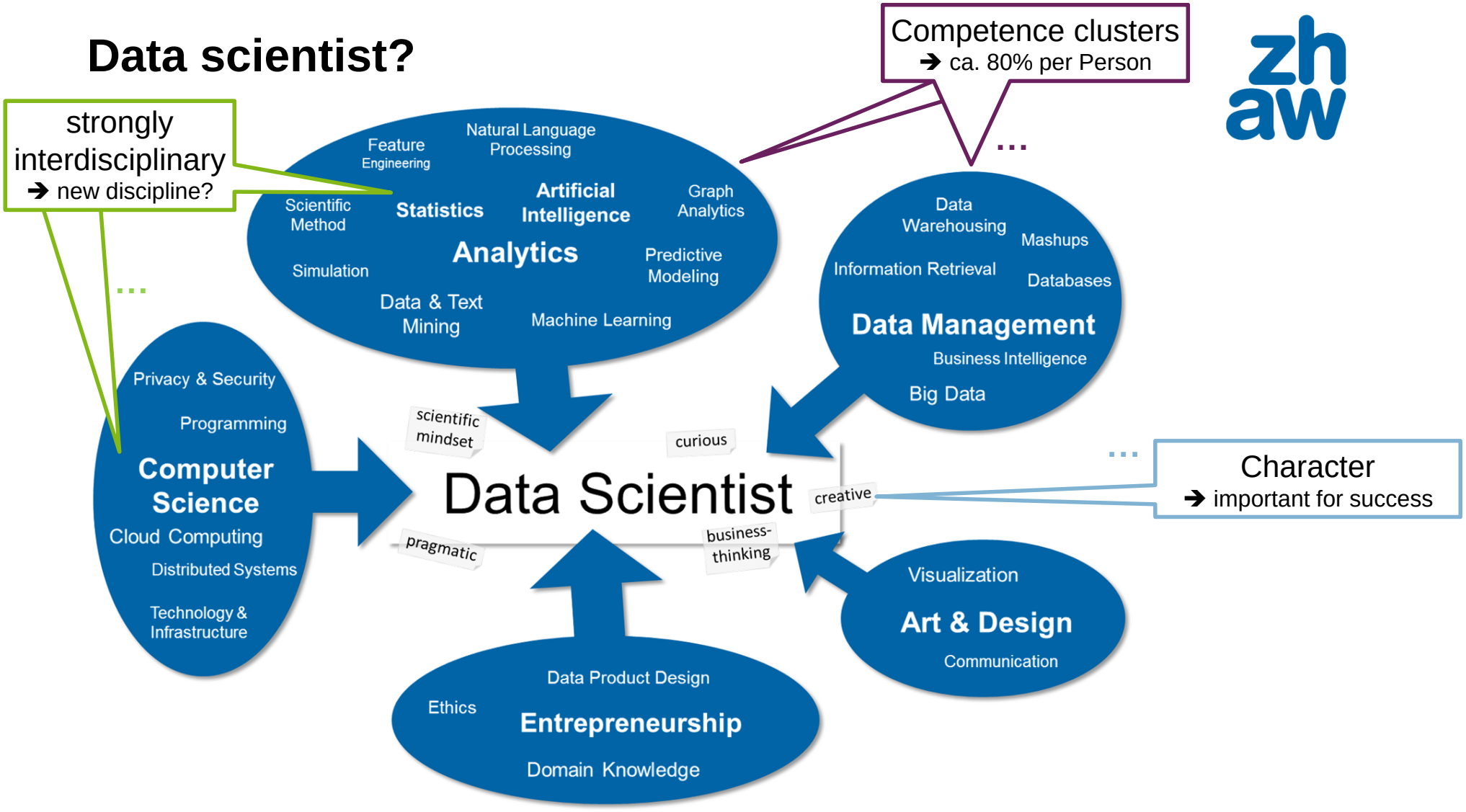

➔ **Unique blend of skills** from AI, engineering & communication aiming at generating **value from the data**

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Project Examples

The ZHAW Data Science Laboratory

Zurich University of Applied Sciences

The ZHAW Data Science Laboratory

- One of the first European centers for Data Science R&D and teaching
- Interdisciplinary virtual organization spanning several instituts
- Core competency: Data Product design with structured and unstructured data

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Projects

- Many years of successful collaborations between academia and business
- Focused on Swiss SMEs as well as European programmes

Teaching

- Undergraduate and Graduate Courses
- One of the first European professional education programmes for Data Scientists
- Seminars and Workshops for idea exchange with industry

MSE

Foundation Register 2.0

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stiftungschweiz.ch

NonproCons
Neue Wege für Nonprofit-Organisationen

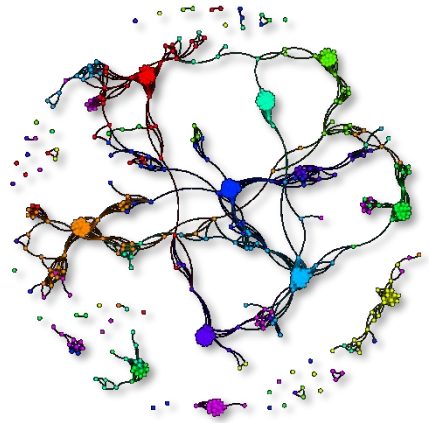
Situation: Ca. 7’500 foundations in Switzerland

Goal: Simple visual search by project proposal should yield most probable sponsor

Challenges: Quantify and visualize content-based similarity of foundation’s missions

Solution:

- Develop multilingual retrieval system
- Search on very small document collection (7.5k foundation’s mission statements)
  ➔ Extremely recall-oriented search
- High amount of data for intuitive visualizations
  ➔ “Forced Directed Layout” of similarities from term-document matrix and topic modeling



Foundation Register 2.0
Technical Aspect: Multilingual IR System

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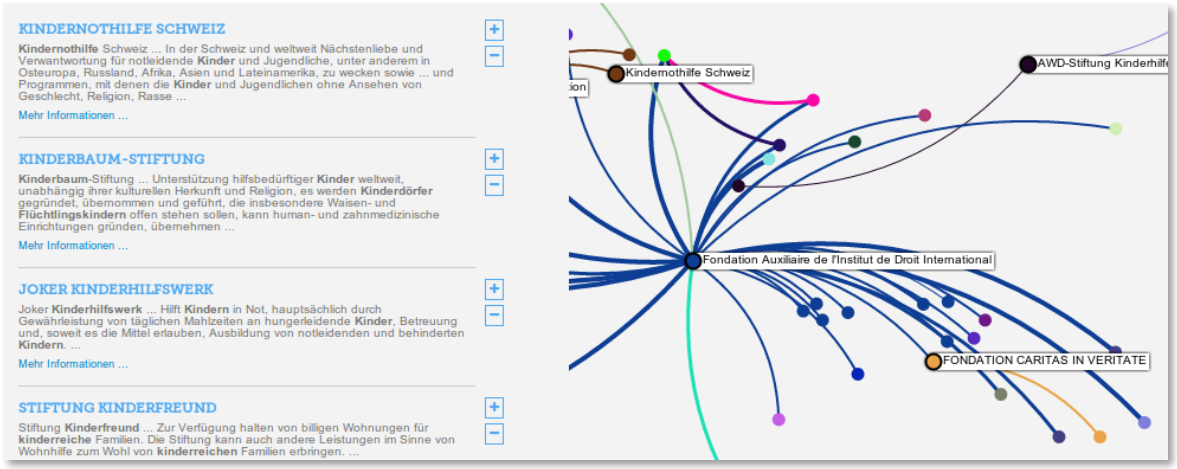
Solution:

- Different index fields for search (DE, FR, IT) and network similarity calculation (CROSS)
- Dual iterative search process:
  - search in own language → relevance feedback on visual neighborhood → foreign language docs appear in search results
- CROSS field construction:
  - Aggressive stop word elimination (outlier removal according to Zipf distribution)
  - No stemming (to retain precision)
  - Machine translation to main language ➔ drop words that couldn't be translated
- Visualization generation:
  - Build similarity matrix of docs in translated CROSS field for network generation
  - Use QuadTree algorithm for large collections



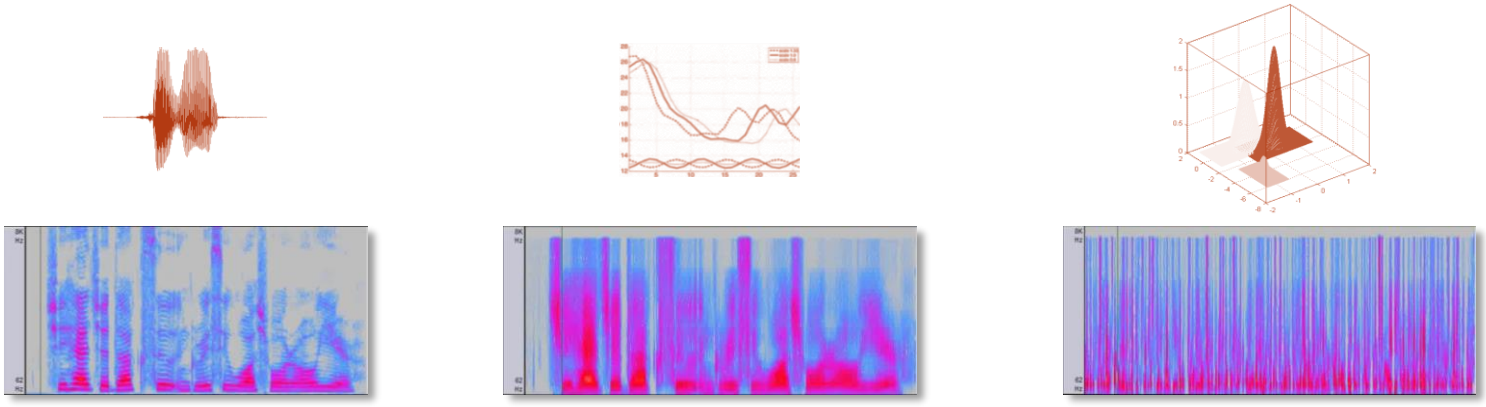
Talkalyzer

Goal: Speaker Recognition in meetings on mobile devices

Challenge: Build reliable speaker models

Approach:

- Loosen i.i.d. assumption on feature vectors
- Use Viola&Jones' face detection approach on audio features
  ➔ find typical sounds of a speaker in a spectrogram



Enterprise Knowledge Curation

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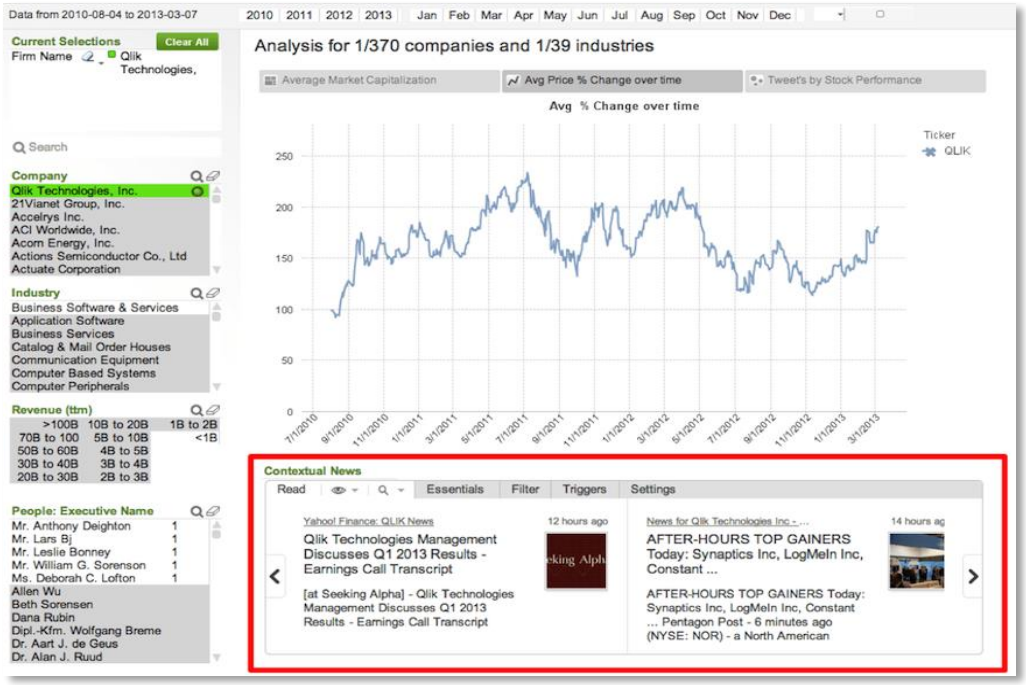
Goal: Contextual News for Structured Data
Challenge: Bridging the sematic gap

squirro

Solution:

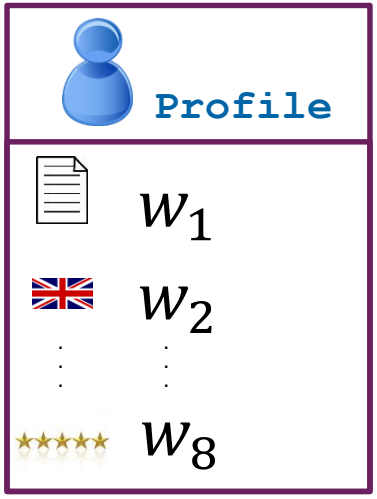
- IR Pipeline with implicit relevance feedback
- Learning user profiles from structured and unstructured data



Enterprise Knowledge Curation (contd.)
Technical Aspect: Data Fusion

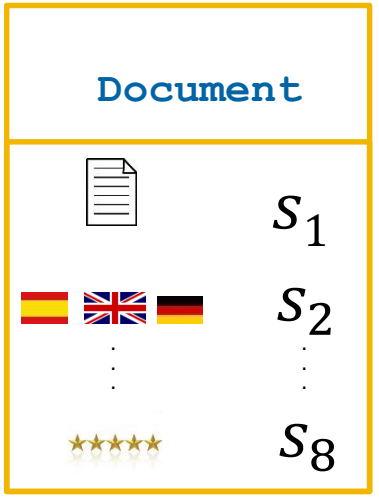
Subgoal: Find relevant news documents per user (document = text & metadata)
Challenge: How to combine information on text and metadata

Solution:
- Score Fusion: Fusion of separate score using a weighted average
- Learning to Rank: Learn weights with logistic regression
- Training data: Click-based implicit user feedback



$$s(d,q) = \sum_i w_i \cdot s_i$$

➔ Next challenge: overcome cold-start by avoiding learning on training data

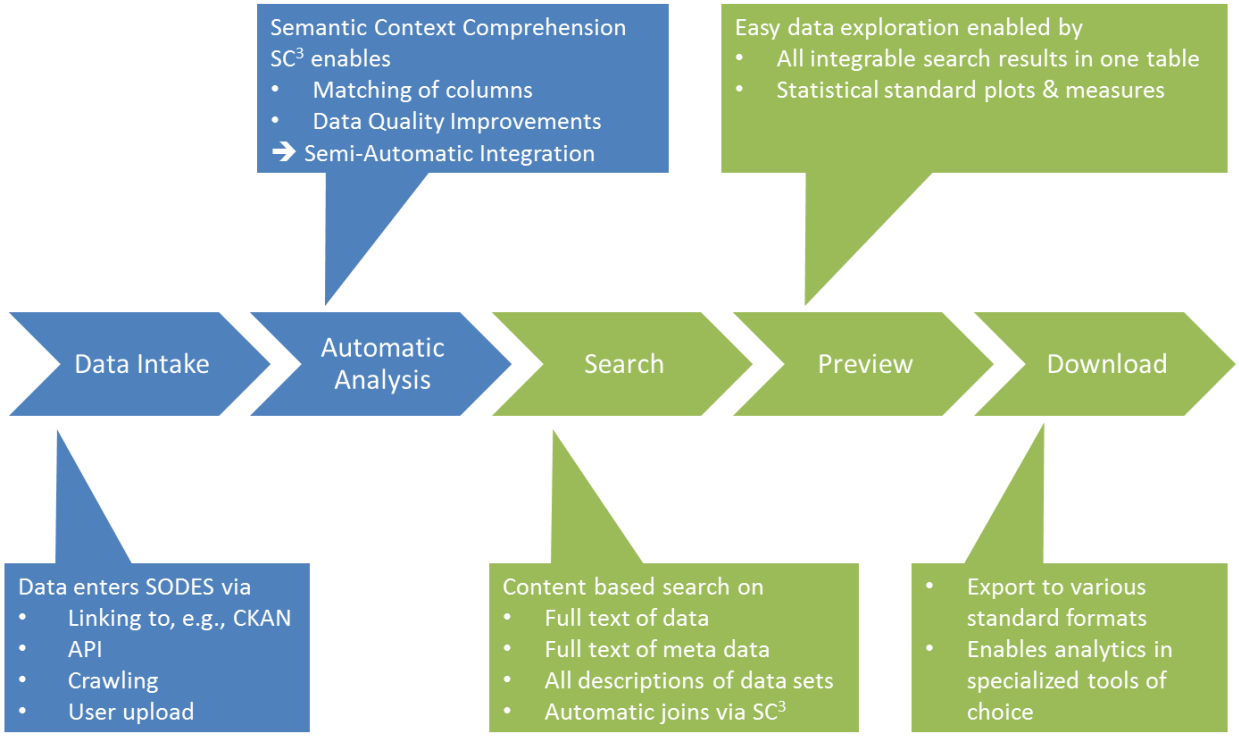


SODES – Swiss Open Data Exploration System

Challenge: Open Data promises to be a gold mine – but accessing and combining data from different data sources turns out to be non-trivial and very time consuming

Goal: A platform that enables easy and intuitive access, integration and exploration of different data sources

Solution:



The State of the Union

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Summary of challenges faced so far

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Transition US → Switzerland

- We don't have internet behemoths
- But we have banks/telcos, industry, retailers, smart*, societal challenges

Uphold quality standard

- It's Data *Science!*
- ➔ Develop curricula

«Evaluation»: DAS in Data Science

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Diploma of Advanced Studies (DAS) professional education programme

- Start: this fall
- Three modules (part time, one afternoon + evening per week)

CAS Data Science Applications

Machine Learning, Big Data Visualization, Design & Development of Data Products, Data Protection & Security

CAS Information Engineering

Scripting inPython, Information Retrieval & Text Analytics, Databases & SQL, Data Warehousing, Big Data

CAS Data Analytics

Data Description & Visualization, Statistical Foundations of Analytics, Multiple Regression, Time Series & Forecasting, Clustering & Classification

➔ Strong demand from industry (CAS Data Analytics already overbooked)

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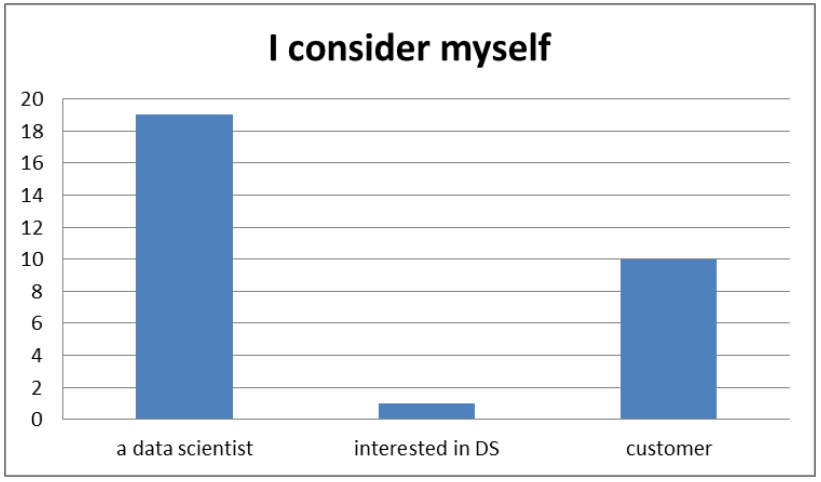
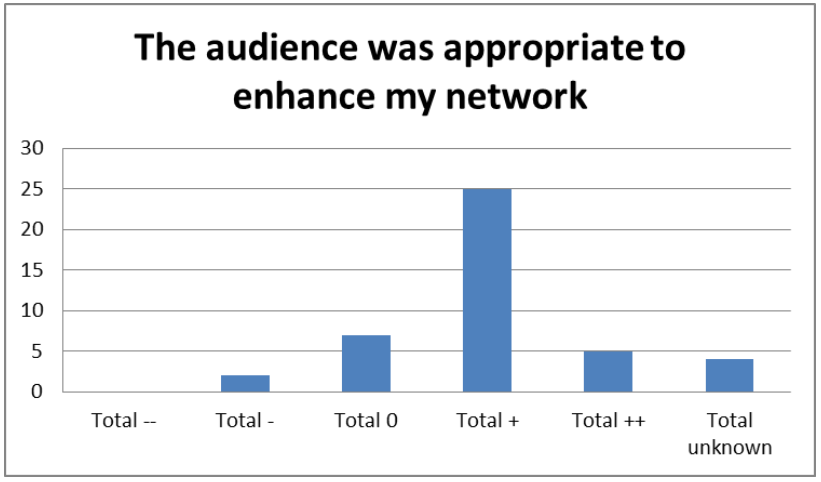
Evaluation: 1st Swiss Workshop on Data Science

Impressions

Evaluation: 1st Swiss Workshop on Data Science

- Expected 60 participants → got 120 plus 7 sponsors
- Ca. ¾ opted in to build a community of Swiss Data Scientists
- Two groups of participants: Data Scientists / Managers needing Data Scientists





Conclusions

- Big **demand** from **industry** regarding Data Science related topics
  - Partly due to routing of requests for formerly diverse topics to central institution
  - More inquiries than actual projects…
  - …but typically more projects than researchers
- Data Science has **different Application** areas in Switzerland
  - But marketing / customer analytics is still a big one
- Chance for academia
  - Bring together diverse expertise from many disciplines
  - **Coin a field**