VRIJE
UNIVERSITEIT
BRUSSEL

Data Management and Analytics

InfoGroep Seminar 2022

Prof. Dr. Beat Signer

Prof. Dr. Bas Ketsman

Prof. Dr. Pieter Libin

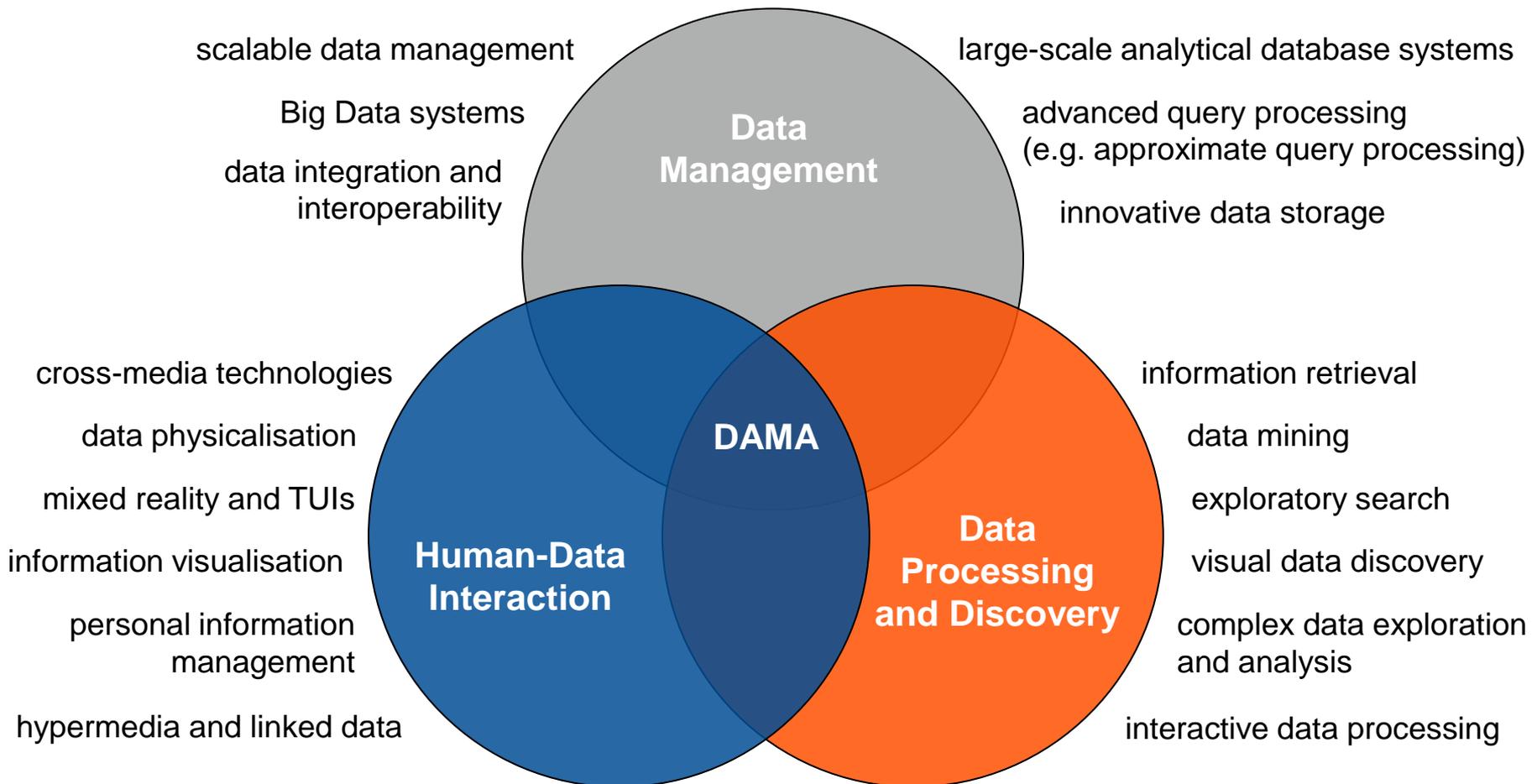https://www.vub.be/en/computer-science-specialisations#data-management-&-analytics

Data Management and Analytics (DAMA)

"Our goal is to *prepare students for the future challenges in managing and analysing the rapidly growing amounts of data* *that is produced manually by humans as well as automatically generated by, for example, sensors in emerging Internet of Things solutions, data capturing on the Web or as an outcome of scientific experiments. Thereby, we focus on the scientific aspects and concepts for* *scalable data management solutions, information retrieval and data mining* *as well as different* *information visualisation and interaction techniques* *rather than on existing mainstream technologies, and provide students the necessary education for a* *future career as data scientists and data engineers**."*

Data Management and Analytics (DAMA) …

scalable data management

Big Data systems

data integration and interoperability

large-scale analytical database systems

advanced query processing
(e.g. approximate query processing)

innovative data storage

Data Management

cross-media technologies

data physicalisation

mixed reality and TUIs

information visualisation

personal information management

hypermedia and linked data

Human-Data Interaction

DAMA

Data Processing and Discovery

information retrieval

data mining

exploratory search

visual data discovery

complex data exploration and analysis

interactive data processing

DAMA Semester 1 (Example)

Methods for Scientific Research (3 ECTS) – *Prof. Bart De Boer*
understanding of the scientific method and the process of doing research
Scientific Integrity (3 ECTS) – *Prof. Gustaaf Cornelis*
understanding of science ethics
Software Architectures (6 ECTS) – *Prof. Coen De Roover*
architecture definition, architectural patterns, micro-service architectures, ...
Data and Information Management (6 ECTS) – *Prof. Bas Ketsman*
data models, data integration, generic architectures of information systems, ontologies
Information Theory (3 ECTS) – *Prof. Leo Van Biesen*
signal theory and the study of communication channels
Declarative Programming (6 ECTS) – *Prof. Geraint Wiggins*
syntax, semantics and proof theory of clausal logic, advanced reasoning techniques, …
Theory of Computation (3 ECTS) – *Prof. Bart Bogaerts*
Church-Turing thesis, decidability, halting problem, NP-completeness, …

■ mandatory core (30 ECTS)   ■ elective DAMA (min 6 ECTS)

■ mandatory DAMA + thesis (24 + 30 ECTS)   ■ elective (rest) + free elective (max 6 ECTS)

DAMA Semester 2 (Example)

Scalable Analytics (6 ECTS) – *Prof. Pieter Libin*
scalable machine learning, recommender systems, large graph analysis, scalable deep learning
Information Visualisation (6 ECTS) – *Prof. Beat Signer*
data representation, data presentation, visualisation techniques, dashboards, perception and colour theory
Advanced Topics in Big Data (6 ECTS) – *Prof. Beat Signer* and *Prof. Bas Ketsman*
seminar about recent developments in big data (data management, retrieval and human-data interaction)
Next Generation User Interfaces (6 ECTS) – *Prof. Beat Signer*
interaction design, multimodal interaction, tangible user interfaces, augmented reality, gesture-based interaction
Computational Creativity (6 ECTS) – *Prof. Geraint Wiggins*
computational creativity theory, engineering computational creativity

🟧 mandatory core (30 ECTS)   🟦 elective DAMA (min 6 ECTS)

🟦 mandatory DAMA + thesis (24 + 30 ECTS)   ⬜ elective (rest) + free elective (max 6 ECTS)

DAMA Semester 3 (Example)

Research Training & Master's Thesis (30 ECTS over semester 3&4)
thesis promoted by the research labs
Scalable Data Management Systems (6 ECTS) – *Prof. Bas Ketsman*
distributed databases, MapReduce, data partitioning, distributed query planning, scalable transaction management
Cloud Computing and Big Data Processing (6 ECTS) – *Prof. Jens Nicolay and Joeri De Koster*
properties of big data, MapReduce and other Hadoop-related technologies, cluster-computing with Spark, ...
Natural Language Processing (6 ETCS) – *Dr. Paul Van Eecke*
visual question answering, database querying and robot instructions

- 🟧 mandatory core (30 ECTS)
- 🟦 mandatory DAMA + thesis (24 + 30 ECTS)
- 🟦 elective DAMA (min 6 ECTS)
- ⬜ elective (rest) + free elective (max 6 ECTS)

DAMA Semester 4 (Example)

Research Training & Master's Thesis (30 ECTS over semester 3&4)
thesis promoted by Prof. Beat Signer, Prof. Bas Ketsman or Prof. Pieter Libin
Statistical Foundations of Machine Learning (6 ECTS) – *Prof. Pieter Libin*
linear model, error and noise, neural networks, overfitting, support vector machines, kernel methods, …

■ mandatory core (30 ECTS) ■ elective DAMA (min 6 ECTS)

■ mandatory DAMA + thesis (24 + 30 ECTS) ■ elective (rest) + free elective (max 6 ECTS)

Other Courses

Database Systems Architecture (5 ECTS) – *Prof. Mahmoud Sakr*
query optimisation, physical design, secondary memory indexes, cost-based plan estimation, …
Advanced Databases (5 ECTS) – *Prof. Esteban Zimanyi*
deductive databases, multimedia databases, temporal databases, data warehouses, ...
Computational Game Theory (6 ECTS) – *Prof. Ann Nowé* and *Prof. Tom Lenaerts*
multi-agent learning, evolutionary game theory, learning by imitation, evolutionary dynamics
Software Quality Analysis (6 ECTS) – *Prof. Coen De Roover*
data flow analysis, control flow analysis, pointer analysis, abstract interpretation of higher-order programs
Computer Vision (4 ECTS) – *Prof. Hichem Sali*
fundamental mathematical and computational computer vision techniques
Virtual Reality (5 ECTS) – *Prof. Gauthier Lafruit*
3D meshes, 3D point clouds, OpenGL, realistic shading, 3D input devices, physics engines, 3D modelling
…

🟧 mandatory core (30 ECTS)   🟦 elective DAMA (min 6 ECTS)

🟦 mandatory DAMA + thesis (24 + 30 ECTS)   ⬜ elective (rest) + free elective (max 6 ECTS)

Repair Courses (from Bachelor)

Human-Computer Interaction (3 ECTS) – *Prof. Beat Signer*
UI design principles, usability, user-centred design, mobile user interfaces
Web Technologies (6 ETCS) – *Prof. Beat Signer*
HTTP, Web 2.0, RIAs, Web Services, REST, HTML5, JavaScript, CSS, Web 3.0, XML, RDF, web search, security, …
Databanken (Databases) (6 ECTS) – *Prof. Bas Ketsman*
ER model, relational model & algebra, SQL, transactions, concurrency control, storage & access structures, …

Up to a maximum of 12 ECTS can be taken from these Bachelor courses in case of lacking knowledge
(*conditional to the agreement of the exam commission*)

DAMA: https://www.vub.be/en/computer-science-specialisations#data-management-&-analytics
Detailed course catalogue: https://we.vub.ac.be/caliweb/ma/cs/dama

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- ⬜ elective (rest) + free elective (max 6 ECTS)

Exchange Semester Abroad

University of Warwick, United Kingdom

University of Potsdam, Germany

CY Cergy Paris University, France

Technische Universität München, Germany

Universitat Politécnica de Catalunya (UPC), Spain

- **Possibility to <u>study a semester abroad</u>**
  - best during 3rd semester of Master studies
    - follow most of the mandatory courses at the VUB during first year
  - top European universities via Erasmus+ programme
    - University of Warwick, UPC, CY Cergy Paris University, TU Munich, University of Konstanz, Bauhaus University Weimar, Potsdam University, Chalmers University of Technology, University of Gothenburg, …
  - non-EEA destinations
    - Brazil, China, Canada, Japan, Mexico, South Korea, Chile, Morocco and South Africa