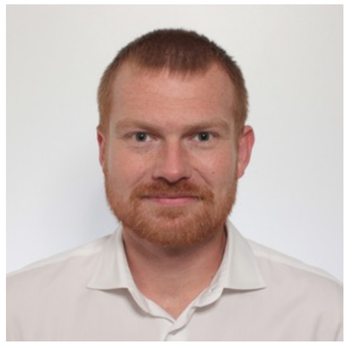
EDUCATION & CAREER PATHS IN DATA SYSTEMS & INFORMATION MANAGEMENT

WELCOME TO THE DATA SYSTEMS LAB

Dear Students,

The **Big Data Engineering (DAMS)** Group and the **Database Systems and Information Management (DIMA)** Group at TU Berlin offer numerous opportunities for you to learn, grow, and develop. Incidentally, DAMS and DIMA are members of the Data Systems Lab (DASL) in the Berlin Institute for the Foundations of Learning and Data (BIFOLD), a German National Center for Artificial Intelligence. This poster was created to inform you about our educational programs, course offerings, thesis opportunities, and prospective career paths. It is particularly informative for those interested in pursuing a Master's or PhD with a concentration in data management, big data engineering or technologies and systems for data science. Our curriculum is specially designed to ensure sound theoretical knowledge, supplemented with hands-on lab sessions, development projects, and seminars to deepen understanding. Furthermore, our colloquia (Bachelor's/Master's Colloquium and DIMA Research Colloquium) expose you to the current research being undertaken by our scientists and guest speakers from academia and industry. Upon completing our courses, you will possess the foundational, technological, and systems skills you will need to pursue a career in database systems, information management, big data engineering, and technologies and systems for data science. We encourage you to visit and learn more about us.



Prof. Dr. Matthias Böhm
Head of DAMS

Prof. Dr. Volker Markl
Head of DIMA

DATA SCIENCE AND ENGINEERING TRACK

The Data Science and Engineering Track enables students pursing a Master's Degree in Computer Science, Computer Engineering, or Information Systems Management to specialze and develop expertise in data analytics. In order to fulfill the requirements of this specialization area, students from these aforementioned programs will need to select from an approved set of courses in three core competencies, namely, (1) data analytics, (2) scalable data management, and (3) an application area.

https://www.tu.berlin/en/dima/analytics/data-science-and-engineering-track

BACHELOR'S & MASTER'S THESIS OPPORTUNITIES

Students interested in pursuing a thesis in data systems should possess outstanding programming skills in C++, Java, or Scala, deep knowledge in database systems (e.g., IBM DB2, Oracle) or big data analytics systems (e.g., Flink, Spark), basic knowledge in the use of an IDE (e.g., Eclipse, Intellij), and basic knowledge in the use of a distributed version control system (e.g., SVN, Git).

Furthermore, to conduct a:

BACHELOR'S THESIS

Students should have successfully completed ISDA and DBPRA (at a minimum) with a grade of good or better and advanced Bachelor's courses offered by the chairs of the Data Systems Lab, in particular, a seminar and a project.

Examples of recent theses include:

- Investigating Kernel Invocation Approaches for GPU-Accelerated Stream Processing
- Order Preserving Encryption with Trusted Execution Environment Client
- Adaptive Active Standby for IoT-Based Data Management Systems
- Investigating the Semi-join Operator for Black-box Cross-database Environments
- An Investigation of Temporal and Non-temporal Synopses
- End-to-End Feature Engineering for Multimodal Machine Learning
- DAG Visualizer for Machine Learning Workload

MASTER'S THESIS

Students must have successfully completed DBT and DBTLAB (at a minimum) with a grade of good or better and advanced Master's courses offered by the chairs of the Data Systems Lab, in particular, a seminar and a project.

Examples of recent theses include:

- Towards the Fast and Secure Execution of User-Defined Functions in Stream Processing Engines
- A Comparative Benchmark for Join Operations between Raster and Vector Data
- Query Containment for Structurally Distinct Stream Queries using Satisfiability Modulo Theory
- Optimizing Physical Data Layouts in Stream Processing Systems
- Failure Detection in Distributed Stream Processing Systems
- End-to-End Feature Engineering for Multimodal Machine Learning

Moreover, depending on the thesis topic, additional knowledge may be required (e.g., compiler technology, distributed systems, networking, operating systems, systems programming, machine learning).

For more information refer to the QR codes below

DIMA

DAMS

CAREER PATHS

PATH 1: JOIN THE DATA SYSTEMS LAB AS A PHD STUDENT

- Experience the research process from idea generation, prototype design and implementation to experimental and analytical evaluation
- Gain deep knowledge in your specialization area
- Identify open research questions, devise novel solutions, and validate them
- Make an impact with your own scientific contributions
- Learn proven techniques to disseminate and publish your findings at top-tier venues (e.g., VLDB, SIGMOD, ICDE, EDBT)
- Contribute to large-scale & open-source software projects
- Identify and critically read leading scientific works
- Possibility for excellent PhD students to participate in Software Campus
- Gain technical expertise in database systems, data analysis, data mining, and related topics
- Enhance business and networking skills and interface with researchers and business leaders
- Gain professional work experience by engaging in summer internships

PATH 2: JOIN OR FOUND A STARTUP

Founded by the original creators of Apache Flink in 2014, dataArtisans sought to offer an innovative large-scale data processing technology rooted in sound database and distributed systems principles and architectures. Acquired by Alibaba in 2019, dataArtisans is known as Ververica today. At dataArtisans, DIMA alumni were employed as a CEO, CTO, or software engineer.

ParStream introduced the industry's first fully integrated, tested, fast and low-latency big-data analytics platform built for the Internet of Things. In 2015, ParStream was acquired by Cisco. At ParStream, DIMA alumni were employed as software engineers.

Comprised of an interdisciplinary team of AI scientists, pathologists, software engineers and business professionals, Aignostics is dedicated to taking explainable AI from their research lab to the world. At Aignostics, a DIMA alumnus is employed as the Chief Data Officer.

PATH 3: JOIN INDUSTRY

Representative examples of positions and employers of Data Systems Lab alumni:

- Applied Scientist
- Software Engineer
- Senior Member Technical Staff
- Postdoctoral Researcher
- Researcher
- Senior Research Scientist

BACHELOR'S COURSES

ISDA Information Systems and Data Analysis

Learn the concepts of information management using (relational) database systems from the perspective of an application developer.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
6	SS	IV	INTRO	GER

DBPRA Database Practical Hands-on Training

Intensify practical skills in designing, implementing, and administrating relational databases using concrete application examples.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
6	WS / SS	PR	INTRO	GER/ENG

PPDS Programming Project: Data Systems

Work on a given project in the context of implementing database systems. Learn how to prototype development, the systematic handling of version management, test-driven development, design documentation, and runtime experiments and improvements.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
6	WS / SS	PR	ADV	GER

DBPRO Database Project

Develop an information system jointly with a team along a classical development process, including the functional specification, modeling, implementation and demonstration of the system.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
6	WS / SS	PJ	ADV	GER

LDE Large-scale Data Engineering

In this combined seminar/project module, you will learn about scientific reading and writing and create prototypes of programming projects in data and ML systems, in the context of big data engineering.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
12	WS / SS	PJ + SE	ADV	ENG

DBSEM Seminar on Advanced Topics in Database and Information Systems

Learn about the core elements of a technical presentation, learn how to properly present an advanced scientific topic drawn from the database systems or technologies and systems for big data management and data science literature, and sharpen critical thinking skills.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
3	WS / SS	SE	ADV	ENG

BC Bachelor's Colloquium

Covers a presentation on open thesis topics at DIMA, a presentation and discussion on the expectations and evaluation criteria of Bachelor's Theses, topic selection, structuring and writing a thesis proposal, including problem statement, solution approach, experimentaldesign, evaluation, and implementation plan as well as project and time management over the course of a Bachelor's Thesis.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
3	WS / SS	CO	ADV	ENG

BT Bachelor's Thesis

Create a scientific work that solves a data management, big data engineering, or technologies and systems problem: (i) surveying related work, (ii) stating the research problem, (iii) defining the scope, (iv) specifying a solution approach and methodology, (v) differentiating the solution from the state-of-the-art, and (vi) showing the effectiveness and efficiency of your solution.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
12	WS / SS	THESIS	ADV	GER/ENG

MASTER'S COURSES

DBT Database Technology

Learn both the fundamentals of data processing in traditional single-node database systems and how to scale out these techniques to huge amounts of data in large-scale, distributed environments.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
6	WS	IV	INTRO	ENG

DBTLAB Database Technology Lab

Learn how to implement components of a database system. You will create a working SQL query processor that can answer a set of basic queries.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
6	WS	PR	INTRO	ENG

MDS Management of Data Streams

Develop deep skills in conventional, methodical and the practical processing of continuous data streams using various application examples.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
6	WS	IV	ADV	ENG

DMH Data Management on Modern Hardware

Learn the fundamentals of cache-efficient storage and processing models and the basics of parallel data processing on modern CPUs and co-processors for typical database operators.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
6	SS	IV	ADV	ENG

DIA Data Integration and Large-Scale Analysis

Learn about major data integration architectures, key techniques for data integration and cleaning, as well as methods for large-scale, i.e., distributed, data storage and analysis.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
6	WS	VL + UE	ADV	ENG

AMLS Architecture of Machine Learning Systems

Learn about the architecture and essential concepts of modern ML systems for both local and large-scale machine learning, including systems for data-parallel execution, parameter servers, ML lifecycle systems, and the integration of ML into database systems.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
6	SS	VL + UE	ADV	ENG

BDSPRO Big Data Systems Project

Solve a current research problem in the field of technologies and systems for big data analytics / data science.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
9	WS / SS	PJ	ADV	ENG

LDE Large-Scale Data Engineering

In this combined seminar/project module, you will learn about scientific reading and writing and create prototypes of programming projects in data and ML systems, in the context of big data engineering.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
12	WS / SS	PJ + SE	ADV	ENG

BDASEM Big Data Analytics Seminar

Learn how to critically read state-of-the-art publications on technologies and systems for big data management and data science as well as learn how to offer an effective presentation, all under the guidance of an assigned mentor.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
3	WS / SS	SE	ADV	ENG

IMSEM Seminar Hot Topics in Information Management

Learn how to critically read state-of-the-art publications on technologies and systems for big data management and data science. In addition, learn how to offer an effective presentation and write a scientific/technical report, all under the guidance of an assigned mentor.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
3	WS / SS	SE	ADV	ENG

MLDMS Joint Seminar on Machine Learning and Data Management Systems

In this research-oriented seminar you will learn about and present a selected machine learning and data management topic.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
3	WS / SS	SE	ADV	ENG

ROC Foundations for Graduate Research in Data Management and Machine Learning Systems

Learn contemporary research methodology, gain both theoretical and practical skills in data management and big data technologies, and be attuned to today's major research challenges in scalable data management and processing.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
6	WS	PR + SE	ADV	ENG

MC Master's Thesis Colloquium in Data Management Systems

Covers a presentation on open thesis topics at DIMA, a presentation and discussion on the expectations and evaluation criteria of Master's Theses, topic selection, structuring and writing a thesis proposal, including problem statement, solution approach, experimental design, evaluation, and implementation plan as well as project and time management over the course of a Master's Thesis.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
3	WS / SS	CO	ADV	ENG

MT Master's Thesis

Create a scientific work that solves a data management, big data engineering, or technologies and systems problem: (i) surveying related work, (ii) stating the research problem, (iii) defining the scope, (iv) specifying a solution approach and methodology, (v) differentiating the solution from the state-of-the-art, and (vi) showing the effectiveness and efficiency of your solution.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
30	WS / SS	THESIS	ADV	GER/ENG

RC DIMA Research Colloquium

Learn about the latest research results from prominent academic or industry guest speakers.

ECTS	TERM	TYPE	LEVEL	LANGUAGE
0	WS / SS	CO	ADV	ENG

LEGEND

INTRO introduction
ADV advanced

COURSE DESIGNATION

CO colloquium
IV integrated course
PJ project
PR practical training
SE seminar
UE tutorial
VL lecture

www.tu.berlin/en/dima

www.tu.berlin/en/dams