2nd ABCD Workshop on
Algorithms and Mathematical Optimization: New Trends

Date: July 14, 2025
Location: Seminargebäude (106), Universitätsstr. 37, University of Cologne

The goal of this afternoon workshop is to bring together researchers at all levels — from professors to PhD students — from the Aachen-Bonn-Cologne-Dortmund area (and beyond!) who are working on algorithms and mathematical optimization. The aim is to exchange ideas and challenges and to initiate possible future collaborations.

Participation is free of charge, but please register in advance (by **Sunday, June 29, 2025**) by sending an email to Annette Koenen.

Schedule

- **13:00** – Check-in

- **13:15–15:00** – Talks

  - **Nithin Varma (Cologne)**
    Sublinear Nearest Neighbor Data Structures in the Ultra High Dimensional Setting

    Abstract: In high-dimensional machine learning and data-analysis settings, the sheer dimensionality d often surpasses the dataset size n, making traditional nearest-neighbor structures impractical due to their linear or superlinear dependence on d.
    This talk presents a data structure that achieves sublinear dependence on d both in space and query complexity. Specifically, we construct a nearly optimal $(1 + \varepsilon)$-approximate nearest neighbor data structure for ultra-high dimensions ($d \gg n$) under the ℓ_1 and ℓ_2 metrics, using only $\mathcal{O}(n \log d/\text{poly}(\varepsilon))$ space and supporting queries in $\tilde{\mathcal{O}}(n/\text{poly}(\varepsilon))$ time.
    Joint work with: Martin Herold, Danupon Na Nongkai, Joachim Spoerhase, and Zihang Wu (SoCG 2025).

  - **Kevin Buchin (Dortmund)**
    Recent Advances in Geometric TSP Variants and Spanner Construction

    Abstract: We give an overview of recent work on two types of optimization problems on geometric graphs: route planning and network construction.
    First, we present results on the geometric TSP and the orienteering problem with time windows: selecting a maximum-profit walk under a length budget, subject to visiting points within specified time intervals. We survey tractable cases when the underlying graph is simple (e.g., a path or cycle), including polynomial-time algorithms and approximation schemes.
    Then, we shift to geometric spanners: sparse graphs that approximately preserve dis-

tances. We highlight results on oriented spanners, including the first algorithm to build sparse oriented spanners of constant dilation in fixed dimensions.

- **Petra Mutzel (Bonn)**
  tba

- **15:00–15:30** – Coffee Break

- **15:30–17:15** – Talks

  - **Anne Driemel (Bonn)**
    Finding Complex Patterns in Trajectory Data

  - **Martin Hoefer (Aachen)**
    Designing Exploration Contracts

    Abstract: We propose a model for contract design in which a principal delegates a sequential search task to an agent. The agent explores n options (e.g., boxes with unknown prizes), pays a cost per inspection, and selects one prize. Both agent and principal derive value from the selected prize.
    The principal influences the agent's decisions by offering contracts — payments based on discovered outcomes. This problem generalizes the Pandora's Box model. We present algorithms for optimal linear contracts (in polynomial time), and also for optimal general contracts in special cases: when agents have no individual value, prizes are aligned in value, or distributions are i.i.d.

  - **Kevin Schewior (Cologne)**
    Recent Advances on Stochastic Boolean Function Evaluation

    Abstract: The Stochastic Boolean Function Evaluation (SBFE) problem involves evaluating a Boolean function defined on independent Boolean random variables with known distributions and inspection costs.
    This talk surveys recent approximation algorithms for computing optimal adaptive and non-adaptive policies for SBFE, and discusses remaining open questions in this area of stochastic combinatorial optimization.

- **17:15** – Check-out

- **18:00** – Biergarten / Restaurant (self-organized)

Organizers

Anja Fischer (Dortmund), Britta Peis (Aachen), Heiko Röglin (Bonn), Frank Vallentin (Cologne)

Link to 1st ABCD Workshop