| 03-IMS-COML | Combinatorical Optimization and Machine Learning |
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**Lehrform** *(teaching format)* / **SWS** *(hours per week)*: 2SE

**Kreditpunkte** *(credit points)*: 3

**Turnus** *(frequency)*: offered once (summer term 2024)

**Inhaltliche Voraussetzungen** *(content-related prior knowledge/skills)*:

**Sprache** *(language)*: English

**Lehrende** *(teaching staff)*: AG Kombinatorische Optimierung und Logistik (Dr. Felix Hommelsheim)

| Studiengang *(degree program)* | Module | Semester |
|---|---|---|
| Informatik (Master) | IMS | ab 1.Sem. |
| Informatik (Bachelor VF) | (nur *Freie Wahl*) | ab 4.Sem. |

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**Lernergebnisse** / *Learning Outcome*:

Students learn how machine-learned advice/predictions can be incorporated to improve well-established solution methods for NP-hard discrete optimization methods. Furthermore, they learn which combinatorial optimization problems are key for establishing machine-learning tools and how to solve these. The main goals are to understand, design, and analyze algorithms for solving such problems.

Furthermore, the students will learn how to read and thoroughly understand original research papers. They learn how to prepare slides for these papers and give an oral presentation to other students who have no prior knowledge about the paper.

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**Inhalte** / *Contents*:

This seminar focusses on recent research at the interplay of combinatorial optimization and machine learning. Both fields provide important methods for solving various real-world problems.

On the one hand, we study how machine learning techniques can improve well-established solution methods for NP-hard discrete optimization problems. How can untrusted prediction, e.g., machine-learned, be used to derived provable guarantees for the performance of online algorithms? How can machine learning accelerate existing optimization methods?

On the other hand, combinatorial optimization problems are increasingly important in machine learning. We will study particular relevant problems such as clustering, feature selection and submodular function optimization.

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**Hinweise** *(remarks)*: The table lists only the primary / most specific modules to which this course is assigned.