



Hauptseminar Winter 2024/2025

## “ Machine Learning with Graphs ”

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### Target Group.

This seminar targets students interested in learning how machine learning can be applied to graphs. Participants are expected to have completed the course “Machine Learning” or a related course in the field of machine learning. Familiarity with knowledge graphs is a plus.

### The Topic

There are many types of data that can naturally be represented by graphs, e.g. computer networks, disease pathways, social networks, knowledge graphs, and citation networks. Recently, machine learning with graphs attracted great attention both in industries and in academia for several applications, e.g. link prediction, recommender systems, and question answering.

However, the majority of current machine learning techniques are designed for simple data types like tables, sequences, and grids. Machine learning and deep learning methodology have been very good at processing these types of data. On the other hand, graphs are much harder to process because they are more complex. First, they have an arbitrary size and complex topology, and there is also no spatial locality (orientation between nodes) nor reference point (fixed ordering) as in grids or as in text. Thus, it's not possible to directly apply existing machine learning approaches to graphs. Machine learning with graphs addresses these problems by proposing approaches such as graph representation learning, graph kernels, etc to process graphs directly.

In this English-speaking Hauptseminar (presentations and seminar reports will have to be delivered in English) we will survey current approaches for applying machine learning on graphs. Particularly, we explore current attempts to learn the representation of relational graphs via machine learning and deep learning models. We will also explore a few downstream graph learning tasks such as node classification and link prediction.

### Procedure

After an introduction on the topic, participants will work on a technical report about a chosen topic. The report will be peer-reviewed by other participants. Students will give a talk about their topic and hand in their technical report.

