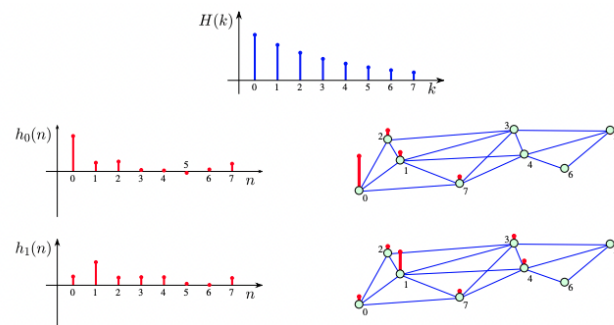


## Call for Master Thesis / Hiwi Job / Praktikum “Performance Analysis of Graph Neural Diffusion via Fourier Decomposition”

### What is the goal?

Graph neural networks (GNNs) have been increasingly used as a prevailing framework for machine vision, atomic simulation, drug discovery, and recommender systems. They have achieved increasingly impressive results without loss of generality. At the same time, some theories suggest that GNNs are not effective in counting subgraphs, lacks effective representation of knowledge graphs, and its approximation performance is limited by over-smoothing.



The goal of this work is (1) to analyze the difference in performance between the new generation and the universal GNN using traditional Fourier decomposition and (2) to propose an upper bound on the approximation error. In addition, (3) its ability to characterize hierarchical data will be investigated and practically evaluated on a knowledge graph benchmarks.

The contents of the master's thesis/research intern are already well defined.

The student will get the chance to publish the work as a research paper and to provide the knowledge graph on the web in collaboration with industry partners. In this way, the student can gain insights into the scientific communities and practices of IT companies.

### What are the prerequisites?

- Master student in techno-mathematics or electronic and information engineering with interest in signal processing
- Good understanding of mathematics, data analysing, machine learning, and Fourier decomposition
- General interest in knowledge graphs and data mining
- Solid programming skills in Python, matlab, or C++

- [1] <https://arxiv.org/abs/2006.10739>  
[2] <https://arxiv.org/abs/2104.12840>  
[3] <https://arxiv.org/pdf/2204.04661.pdf>

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