Eidgenössische Technische Hochschule Zürich
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Distributed Computing

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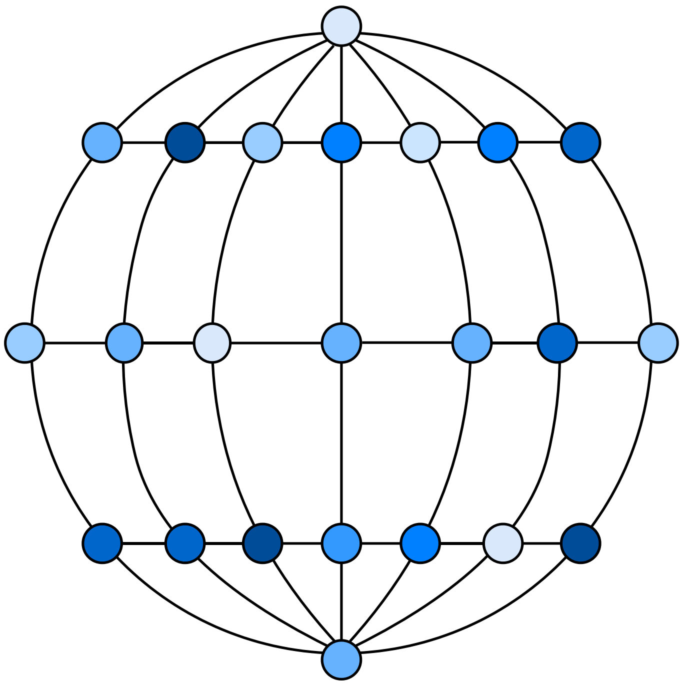
Graph Drawing with GNNs

Computational methods for drawing graphs try to find embeddings of graphs (for example in the plane) that optimize certain criteria. These criteria could be crossing count, crossing angles, stress of the embedding or neighborhood preservation. While gradient descent methods based on minimizing loss functions for finding such embeddings already exist and perform very well on small graphs, they become costly and non-viable on big graphs as the computation of the loss functions scales badly.

In this thesis, we want to explore the capabilites of Graph Neural Networks (GNNs) for graph drawing. GNNs work in synchronous message passing rounds where information between neighboring nodes is exchanged. The network is then trained to minimize a loss function, similar in idea to what the aforementioned Gradient Descent methods are doing. Our goal is to train a GNN on small graphs, where the loss function is still tractable and extrapolate to bigger graphs after the model has been trained. We hope that we still get embeddings that optimize the defined loss function to a certain degree while being more computationally efficient as it does not have to be computed repeatedly. To do so, we will have to use recent architecture advances of GNNs and come up with supporting graph structures to enable better information exchange between nodes, even if they are far away in the input graph.



Requirements: Strong motivation, knowledge in graph theory and machine learning, as well as good coding skills. Prior experience with GNNs or Machine Learning is a big advantage. We will have weekly meetings to discuss open questions and determine the next steps.

Interested? Please contact us for more details!

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