

Developing a Minor Embedding Algorithm for Oscillator based Ising Machines using Reinforcement Learning



TECHNISCHE
UNIVERSITÄT
DARMSTADT

Supervisor: M.Sc. Maximilian Naneder
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Description

Oscillator based Ising Machines (OIMs) are a promising metaheuristic intended for solving NP-hard or NP-complete combinatorial optimization problems (e.g. the famous Traveling Salesman problem (TSP)). The advantage of an OIM compared to other approaches is speed and energy efficiency. Our OIM consists of a network of 1440 oscillators. In the context of ising machines an optimization problem can be reformulated in the ising model and therefore be represented as a graph. The vertices of the graph are mapped to the oscillators and the edgeweights of the graph determine the coupling strength between the oscillators. The system will then evolve toward a state of minimum energy. The phases of the oscillators in the energy minimum state constitute the solution.

However, to actually make use of an OIM one needs to map the graph of the optimization problem to the oscillator network of the hardware. This process of embedding the graph of the optimization problem into our hardware topology is referred to as **minor embedding**. In general minor embedding is **NP-complete**.

Fachgebiet Integrierte
Elektronische Systeme



M.Sc. Maximilian Naneder
Room S306|345a
maximilian.naneder@ies.tu-
darmstadt.de

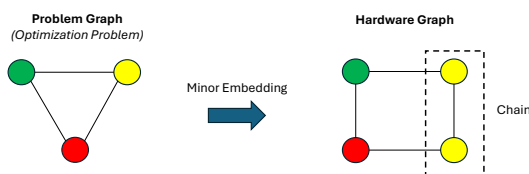


Figure 1: Embedding Example

Task

The goal of this thesis is to approach the embedding problem with **reinforcement learning**.

Requirements

- Ability to solve problems and work independently
- Good programming skills (python)
- Background / Strong Interest in reinforcement learning
- Interest in optimization problems (...and a little bit of graph theory)

Language

German or English

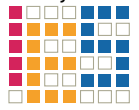
Thesis Type

This project can be offered as seminar, bachelor- or master thesis.

Contact

If you are intersted in this topic, please write an email to
maximilian.naneder@ies.tu-darmstadt.de

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