Karlsruhe Institute of Technology

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Distributed Reinforcement Learning for Handover Management in Mobile Cellular Networks

Master's Thesis

Project

Changing mobile devices between different cells in mobile communication networks (handover) is an error-prone process. When handing over user equipment (UEs) to the downstream base station (BS), errors sometimes occur because the handover process is initiated too early or too late. Furthermore, changing the cell too frequently leads to unnecessary communication overhead in the system, called the ping-pong effect.
The aim of this work is to investigate whether a distributed reinforcement learning model can be used in cellular networks to replace a rigid handover protocol. For this purpose, a simple scenario should first be designed, based on which the UEs or the DRL agents can learn handover management. In the first step, this can be based, for example, on parameters such as the SINR and the speed of the UE measured in fixed-time intervals. In order to also optimize the energy consumption of the mobile devices, the time interval between the measurements can be included in the model in a second step. An exchange of the models between the UEs/BS in the event of a cell change should support the optimization of the BS-specific models and also ensure the ability to adapt to new scenarios.
In order to be able to compare developed methods with each other and also with existing protocols, the models should be evaluated using various key performance indicators.

Tasks

1. Solid understanding of mobile cellular networks and the handover process.
2. Modeling of a simple cellular network with multiple base stations and mowing u
3. Implementation of the 5G event-based handover protocol as a benchmark.

Requirements

- ✔ Knowledge of mobile communications
- ✔ Ideally, knowledge/experience with reinforcement learning
- ✔ Programming skills in Python/MATLAB or C++

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