Efficient Handover Protocol in Cellular Networks: a MADDPG-controlled Multi-Agent Learning Approach

Master's Thesis

Project

As cellular networks continue to advance, new challenges emerge in the communication between User Equipments (UEs) and Base Stations (BS). This master's thesis focuses on utilizing multi-agent reinforcement learning, specifically MAAC/MADDPG, to develop an efficient handover protocol. The goal is to optimize handovers, minimizing packet loss and resource utilization, thereby enhancing network efficiency.

The thesis aims to create a system where UEs can communicate with multiple base stations. The exchanged messages are intended to represent handover protocols. The dynamic simulation of the connection between UE and BS requires the UE to switch between BS during handovers. The challenge lies in learning a handover protocol to minimize packet loss and resource utilization, ensuring successful handovers.

The primary task involves the realization of a multi-agent reinforcement learning system where UEs efficiently communicate with base stations using MAAC. The objective is the representation of the handover process by learning a time-varying handover protocol. In addition to functional goals such as maximizing network efficiency, the focus is on researching the learned protocol and its structures.

Tasks

1. Familiarization with the reinforcement learning, MADDPG
2. Implementation of the system in Python using PyTorch
3. Comprehensive literature review, on existing handover protocols
4. Validation of learned protocols through simulations & statistical methods
5. Thorough analysis of results, concluding with recommendations

Requirements

✔ Basic knowledge in machine learning & reinforcement learning.

✔ Programming skills, preferably in Python and experience with PyTorch

✔ Familiarity with network protocols and wireless communication technology

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