

Interfacing AI algorithms with a 5G network simulator

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AIMM

Bath Maths4DL 2022-04-22 1000–1030

The AIMM project

Title: AIMM (AI-enabled Massive MIMO)

Project Coordinator: Arman Shojaeifard (InterDigital)

Project Status: Running

Clusters: UK, Germany, France, Canada

Duration: 2 years

Start Date: Oct 2020

End Date: Sep 2022

Budget (total): 4,732 K€

Effort: 44.83 PY

Partners: 10

Work-Packages: 6

Project-ID: C2019/2-5

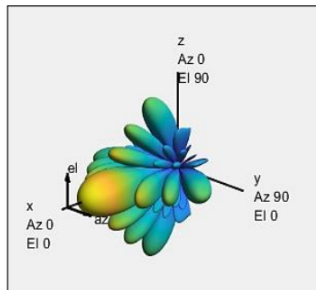
Website: <https://www.celticnext.eu/project-aimm/>

Twitter: @AIMM_project



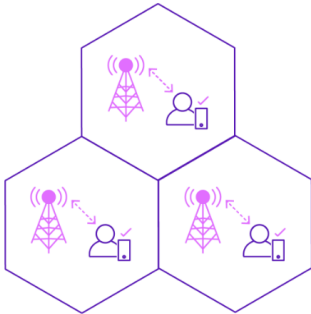
MIMO

64T64R Massive MIMO (5G)

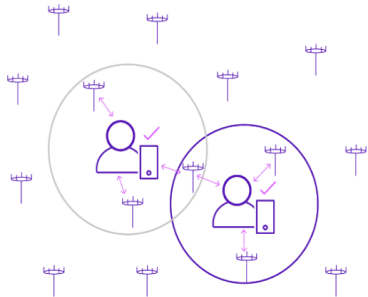


Cellular networks

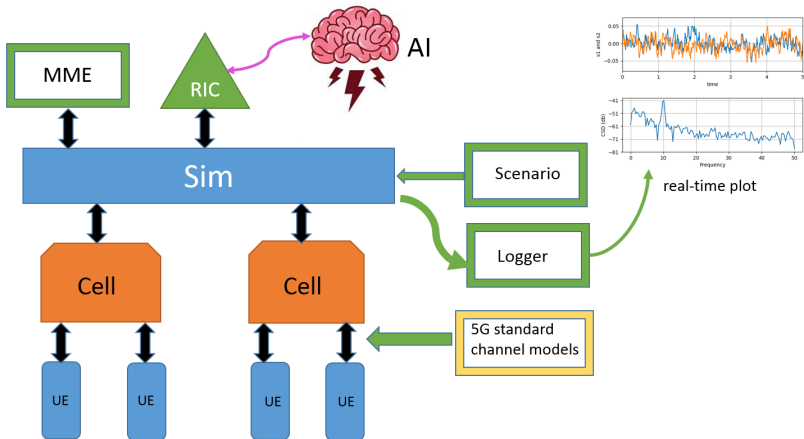
Centralised Massive MIMO



Cell-less Massive MIMO



The AIMM simulator <https://aimm.celticnext.eu/simulator/>



Where is the maths?

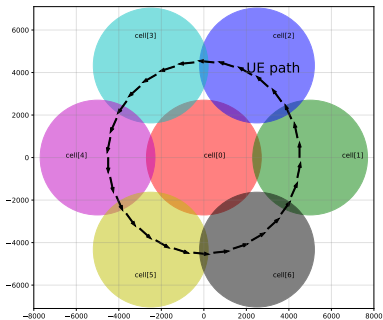
- Channel models, fading.
- Channel estimation, precoding.
- Modulation schemes.
- Dynamic spectrum allocation (sub-banding).
- Handover algorithms.
- Traffic models.
- Mobility models.
- Mapping physical metrics to subjective quality-of-experience.

Radio channel modelling

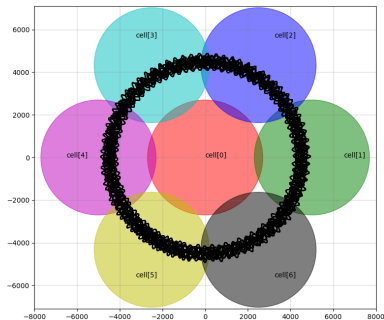
A trade-off is required: simulation accuracy vs. speed.

- Most important parameter is signal-to-noise ratio.
- To a first approximation, signal strength at distance d is $d^{-\alpha}$, where α is typically in the range 3 to 4.
- Adding to this is a stochastic term, e.g. Rayleigh distributed, and possibly correlated.
- Our approach: use a standardized model to pre-compute lookup tables, and code these tables into the simulator.
- In a real system, signal quality is measured by UEs, and reported to the cells. All decisions have to be based on these reports.

Example 1: handover of devices between cells

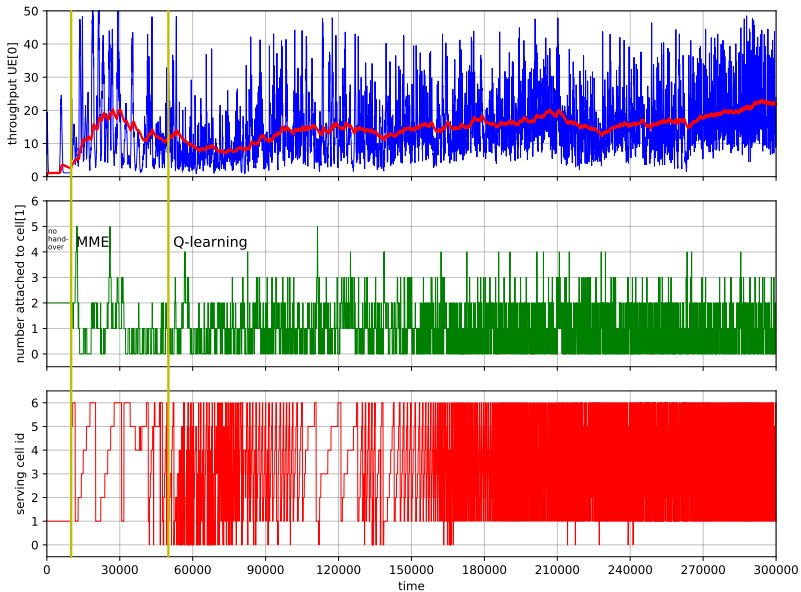


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Reinforcement learning for handover



Example 2: Reinforcement learning for sub-band allocation

