Deep-learning applications to the multi-objective optimisation of IACT array layouts

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Executive Summary

In this work we use Deep Reinforcement Learning methods to optimise an array of Imaging Atmospheric Cherenkov Telescopes (IACTs), using a heuristic model.

Usually, the telescope arrangement for an array is calculated using computationally intensive Monte Carlo simulations, taking into account the detailed development of the shower and technical specifications of the telescope. For larger arrays this is a very challenging task due to the complexity of parameter space to be explored.

Here, we use Reinforcement Learning algorithms with a heuristic model of the array to optimise the layout using the effective area as metric: a Neural Network learns to position the telescopes in a way that maximises the detection area, and therefore, the event detection rate.

Since any single telescope has already a high effective area, the detection would be improved by placing all telescopes very close. To address this issue, we also include the internal area of the configuration in our approach. We see a tendency of two telescopes to be placed together for low multiplicity, which is broken for larger values of the multiplicity.