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# Reinforcement Learning for Radio Interferometry Data Processing

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Data gathered by an interferometer requires substantial processing before astronomers can extract the scientific information from it. The selection and sequencing of calibration and analysis actions is a complex decision-making task. This decision process depends on the expertise of astronomers, who consider data characteristics, instrument knowledge, compute cost, and best practices to guide each choice.

We apply reinforcement learning (RL) to this task, where an agent can autonomously explore and identify optimal decisions based on an objective function with metrics that quantify best practices. By framing data processing as a pathfinding and cost minimization problem, we can use this data-driven approach to learn effective sequences and settings of algorithms for variable input data. This has implications for pipeline development and for improving the quality and efficiency of automated data processing.

Why RL? RL is ideal for tasks where hard-coding every situation is not feasible. Unlike supervised learning, RL does not require labeled data; instead, it relies on a feedback loop from an objective function to improve its decision-making.

Our research involves developing a training environment aligned to real-world applications where an RL agent learns the optimal action based on the input data. In the training environment different states are presented, action sequences explored, and different outcomes evaluated. In this talk I will present where we are in this process and recent results.

When scaled, such methods are expected to learn the breadth of our high-dimensional, continuous, problem space and generalize the knowledge for inference. Our vision is that this generalized knowledge will be able to optimally calibrate and image datasets on its own without following a predetermined recipe.

1. Brian M. Kirk, Urvashi Rau, and Ramyaa Ramyaa, “Reinforcement Learning for Data-driven Workflows in Radio Interferometry. I. Principal Demonstration in Calibration,” *The Astronomical Journal*, Volume 169, Number 1, December 2024, DOI 10.3847/1538-3881/ad88f6