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A Bayesian multi-objective framework for optimizing an electron injector linac

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This study introduces a multi-objective Bayesian optimization framework to enhance the performance of electron linear accelerators in Fourth Generation Synchrotron Radiation facilities. By focusing on minimizing horizontal and vertical emittances and energy spread at the linac exit, the approach targets improved beam quality essential for advanced synchrotron applications. Traditional methods face challenges balancing these competing objectives due to system complexity and nonlinearity. Bayesian optimization addresses this by combining probabilistic modeling and sequential sampling to efficiently navigate the high-dimensional parameter space, balancing exploration and exploitation while iteratively refining predictions. Results demonstrate the framework's ability to reduce emittances and energy spread effectively and efficiently. This scalable, adaptive method offers a robust optimization strategy for improving performance across accelerator systems in multi-objectives

Footnotes

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Author: PARK, Chong Shik (Korea University Sejong Campus)

Presenter: PARK, Chong Shik (Korea University Sejong Campus)

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