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Machine learning based image processing technology for longitudinal phase space analysis in a compact THz-FEL

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The longitudinal phase space characterization of electron bunches plays a crucial role in operational optimization of accelerator facilities. Currently, the terahertz free-electron laser (THz-FEL) facility at Huazhong University of Science and Technology (HUST) uses a combined deflecting cavity and dipole magnet system for longitudinal phase space measurements of bunches. In order to achieve non-intercepting measurements and also for automated parameter optimization, we developed an image-based virtual diagnostic system utilizing convolutional neural networks trained on simulated bunch data. Our preliminary results demonstrate successful longitudinal phase space reconstruction of the injector output bunch with prediction accuracy exceeding 85%.

Footnotes

Funding Agency

I have read and accept the Conference Policies

Yes

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