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## Application of Machine Learning in Longitudinal Phase Space Prediction at the European XFEL

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For a free-electron laser facility, the longitudinal phase space of the beam is essential to the FEL lasing performance. However, the commonly-used diagnostics device such as the transverse deflecting cavity provides a destructive way to measure the beam longitudinal properties, which is not available during beam delivery. Thus, the convolutional neural network is introduced to construct a virtual diagnostic tool that facilitates bunch-to-bunch nondestructive measurement of the longitudinal phase space distribution.

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