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Exploring AI-based models in accelerators: a case study of the SOLARIS synchrotron

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The National Synchrotron Radiation Center SOLARIS, third generation light source, is the only synchrotron located in Central-Eastern Europe, in Poland. The SOLARIS Center, with seven fully operational beamlines, serves as a hub for research across a diverse range of disciplines. The most important aspect of such research infrastructure is to provide stable working conditions for the users, operators and the conducted projects. Due to its unique properties, problem complexities, and challenges that require advanced approaches, the problem of anomaly detection and automatic analysis of signals for the beam stability assessment is still a huge challenge that has not been fully developed. To address this problem, different AI-based projects are under discussion and development, i.e. automatic analysis of diagnostic signals on the example of transverse beam profiles or beam position FFT windows classification. The best proposed solution, based on the InceptionV3 architecture, can assess beam quality automatically, based solely on the image itself with 94.1% accuracy and 96.6% precision. Discussion on the current developments and deployments in SOLARIS on that field, both for the accelerator and beamlines, will be covered.

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Footnotes

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