Artificial Intelligence at NSRC Solaris

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Abstract:In the past decade Deep Learning (DL) proved to be very successful in tasks which involve image, signal and text analysis and recognition. Due to the complexity of the synchrotron control system and the physical phenomena occurring in such an infrastructure, it can benefit from novel deep learning techniques. Currently at Solaris two projects that involve the machine learning techniques are realised. The goal of the first project is to develop a Neural Network which controls electron beam position in Solaris storage ring. As an input data feeding Neural Network BPMs readouts, current applied on main and corrector magnets and, optionally, beam profile from camera will be used. Since performance of Neural Network controlling only the beam position is easy to compare with standard methods, it was decided to implement a simple Neural Network as a starting point for a more advanced deep learning project at NSRC Solaris. Beam position RMS value below 1μm will serve as quantitative indicator of neural network quality. The main goal of the second project is to improve the signal analysis and anomaly detection in HD datasets with the use of advanced deep neural networks. An End-To-End anomaly score learning method for the early classification of occuring anomalies will be proposed. The interpretability analysis will allow us to locate the features that are responsible for large anomaly scores and therefore evaluate which features have the greatest influence on the electron beam.