## 5th ICFA Beam Dynamics Mini-Workshop on Machine Learning for Particle Accelerators



Contribution ID: 5

Type: Invited talks

## Application of boosted decision trees in beam anomaly detection with high throughput data streaming system - 10'+5'

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The National Synchrotron Radiation Centre SOLARIS is a third generation light source. SOLARIS, as a big science facility with seven fully operational beamlines, is obligated to provide the best possible conditions for conducting research. One of the ways to create favorable environment is delivering precise tools for teams working across many different fields in SOLARIS. The general problem that still remains alive and it is not fully covered is the detection of beam anomalies. The challenge we faced was to find common points among all of synchrotron's fields and combine them into comprehensive, reliable system which aims to provide continuous operation and improve quality of beam shared for synchrotron users. Solution we would like to present is a system which gathers diagnostics signals (e.g. from BPMs, magnets system, vibration detecting system and other sensors) and ingest them in real-time into machine learning (ML) unit. The current system consists of two parts. The first one is high capable data streaming layer which handles high frequency signal (fast acquisition). The second one is ML unit which uses boosted decision trees (BDT) to perform real-time classification whether beam parameters are good or not and predict future beam dump at the early stage. At this moment the main data source for ML model are signals from Beam Position Monitors. Moreover, algorithms such as Fast Fourier Transform (FFT), Probability Density Function (PDF) or Principal Component Analysis (PCA) are working simultaneously in background and gives diagnostic team factors to make a proper evaluation and take actions before automatic beam dump mechanism will be activated. Additionally, PDF and PCA algorithms give ability to detect exact location of issues.

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