



Workshop of WLCG research projects for HL-LHC era experiments
July 10-12, 2017

Machine Learning session highlights

Mikhail TITOV (NRC KI)

July 11, 2017



ATLAS Data Management

- Data distribution can be seen as a distance quantification problem
 - Idea: Estimate Transfer Time-To-Complete (TTC) as dynamic “closeness”
- Modeling transfer TTC
 - Dummy model (based on mean network rate)
 - Improved model (non linear fit)
 - Full model, including queuing time (based on window-size of previous transfers)
- Advanced Use Cases
 - Task / Data Allocation
 - Input drop-off (find the drop-off point to ensure optimum throughput)
 - Anomaly detection

ATLAS Production System

- *Anomalies* are instances of *ProdSys2* that do not conform to an acceptable notion of normal behavior;
- *ProdSys2 anomalies* may occur due to reasons such as :
 - *overload in the system,*
 - *malfunctioning of computing resources,*
 - *ProdSys2 components misconfiguration,*
 - *malicious activities;*

from: Analytics and Machine Learning
in ATLAS Distributed Computing
August 2016

- Delay in task brokerage or/and in execution
- Far from optimal resources utilization
- Abnormal number of failures or/and errors
- Tasks Time-To-Complete (TTC) under expectation

Task TTC / current state

- ML technology and methods
 - Spark.MLlib / Ensemble methods (ensemble of decision trees)
 - Gradient-Boosted Trees regression method
 - Random Forests regression method
 - Approaches based on set of parameters and run time
 - Cold / warm / hot prediction
- Workflow automation
 - Model management system prototype

Results

```
Training data - 3 months
Test data     - 1 month
Absolute error (days):
  Mean = 0.63
  Std  = 2.57
  Min, Max = -15.95, 34.04
  3 sigma = 7.72
RMSE = 2.65 days
```

Task TTC / near-term plans

- Distribution of the execution (wall) time
 - Grid “classic” tasks (*not Event Service tasks*)
 - For tasks - grouped by project / productionStep
 - For task chains (evgen-simul-recon) - grouped by project
 - Tasks on Titan (*same approach as for previous problem*)
- Sources for time checkpoints
 - JEDI (dynamic job definition)
 - Use tool from Deep Anomaly project (developed by Vyom Sharma) to extract/process data from ElasticSearch cluster at CERN for archived jobs
 - PanDA Pilot