Machine Learning Developed Tools

luigi.serio@cern.ch

CASO

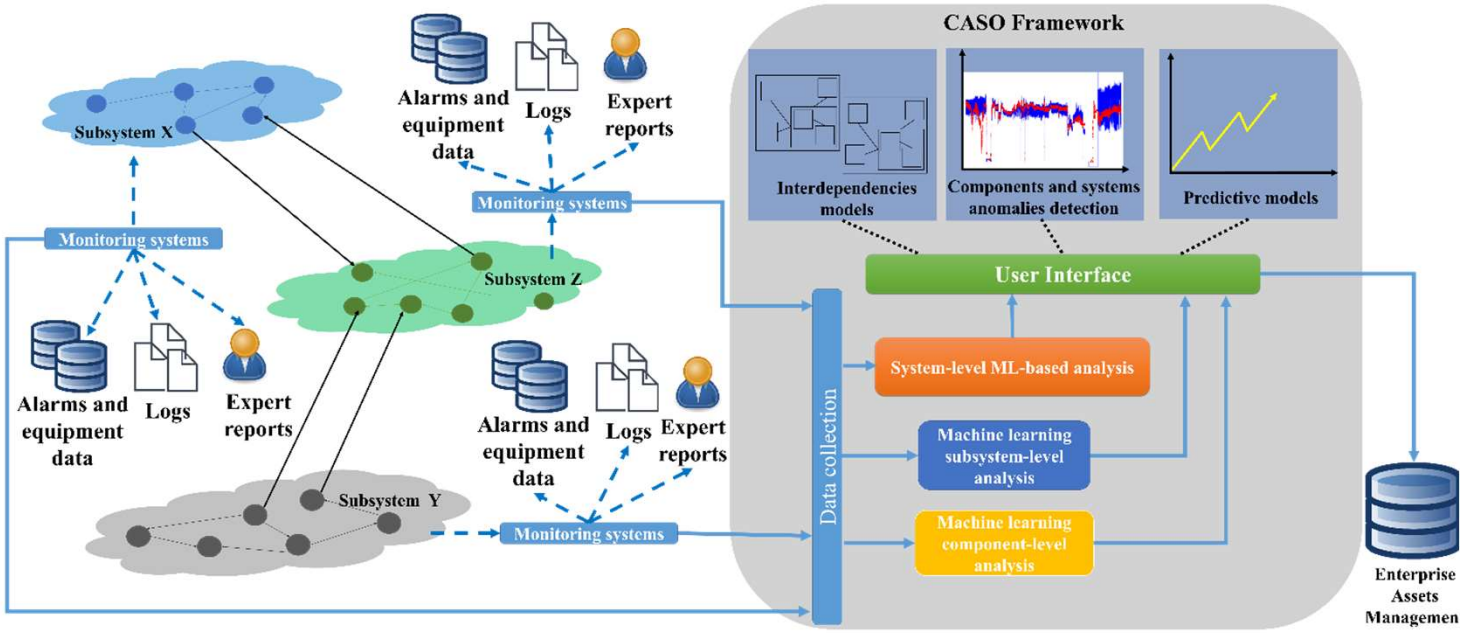
- *Deployed*
  - Predictive/ Preventive /Condition based maintenance
  - Failure analysis and dependencies modelling

CAFEIN IND and MED

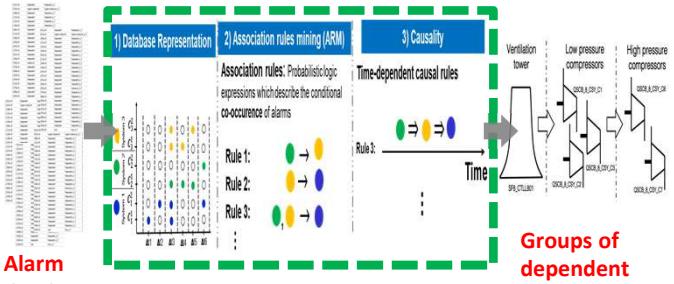
- *Deployed*
  - Federated learning platform
- *Under clinical evaluation on brain pathologies*
  - Full screening platform for brain abnormalities
- *Under development*
  - Tool to extract features, patterns and models for risk prediction and prevention based on digital images and clinical, therapies and genetic data

CASO

Computer Aided System for critical infrastructures Operation



- Data-driven tools capable of discovering dependencies and abnormal behaviours:

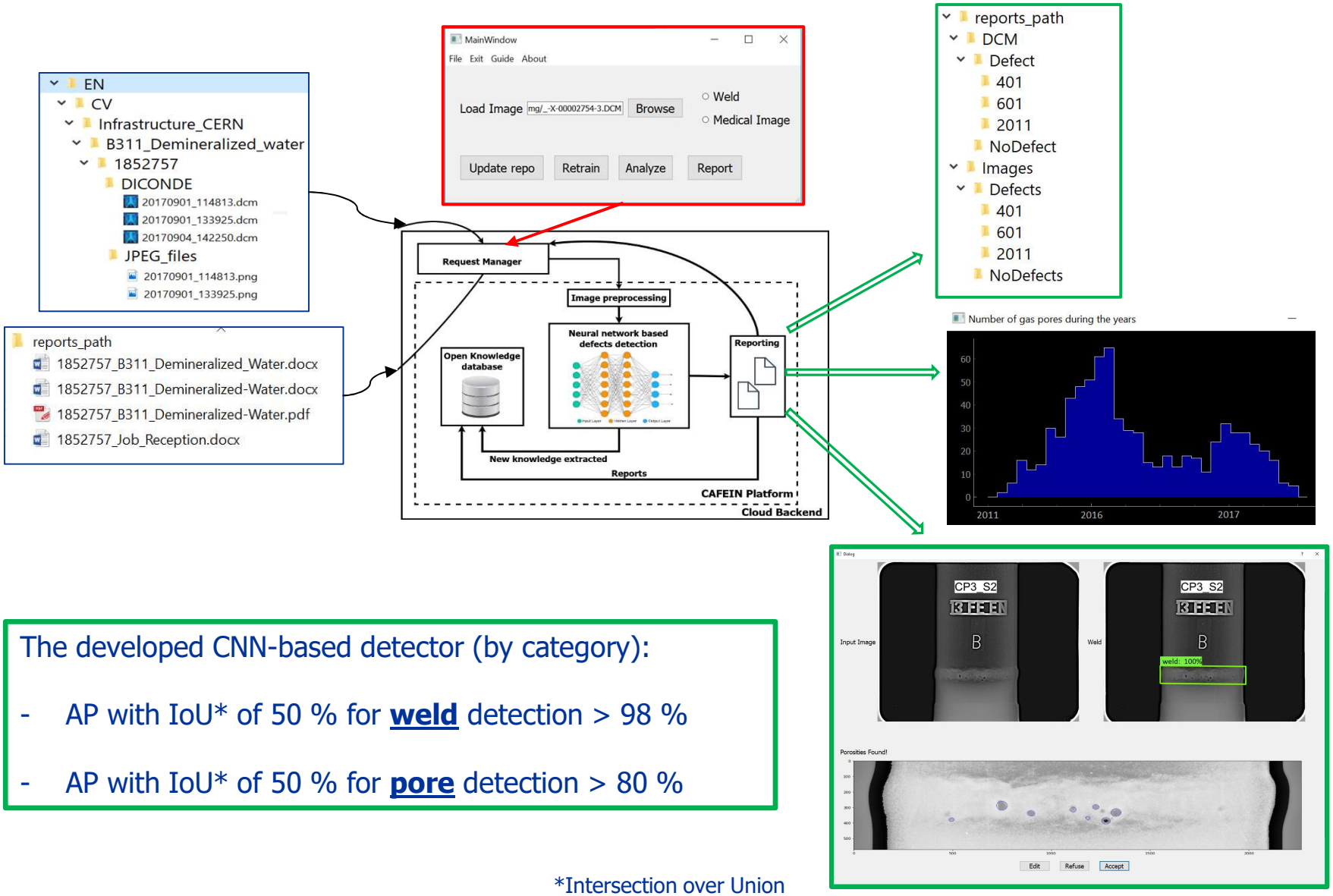


Alarm databases 20 millions of messages

Groups of dependent abnormal behavior components

- Capable of inferring and interpreting data coming from different and heterogeneous sources and systems
- A machine-learning core, composed of bricks of algorithms developed for
  - the component-level and high-level system dependencies analysis and predict equipment failures
- Linked to an enterprise asset management system to guide maintenance and consolidation programs as well as track dependencies and draw fault trees

CAFEIN IND



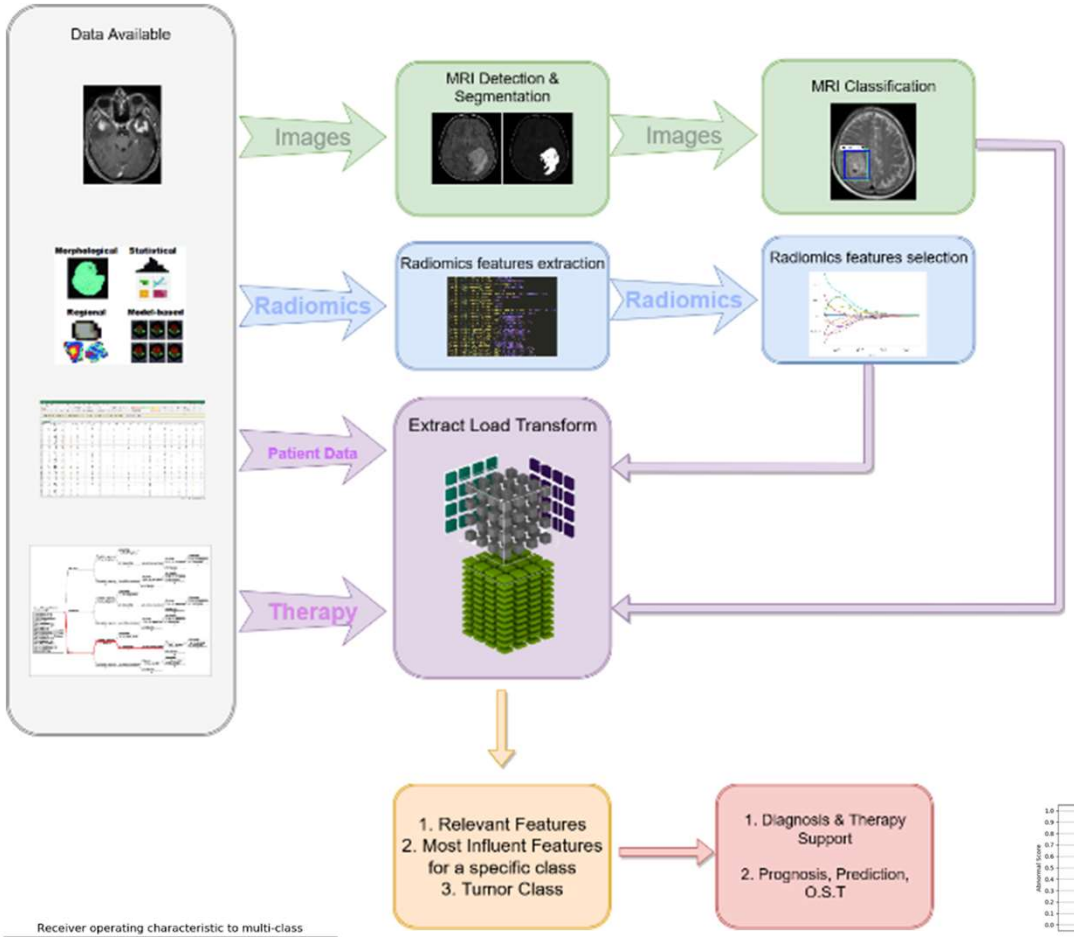
The developed CNN-based detector (by category):

- AP with IoU* of 50 % for **weld** detection > 98 %
- AP with IoU* of 50 % for **pore** detection > 80 %

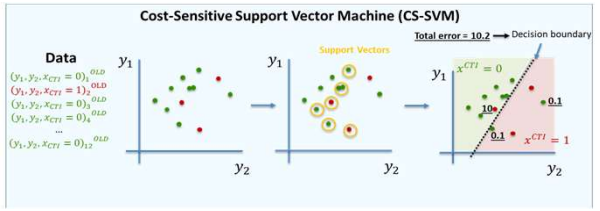
*Intersection over Union

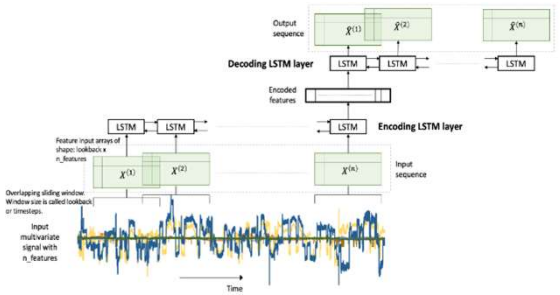
CAFEIN MED: Architecture

Computer-Aided Defects and Anomalies Detection, Identification and Classification system for Digital Images and Medical Data

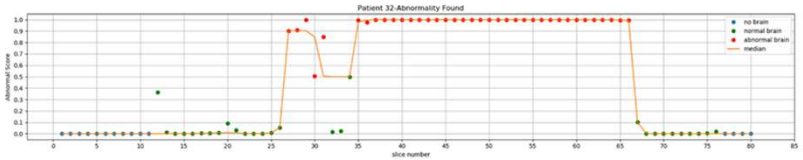


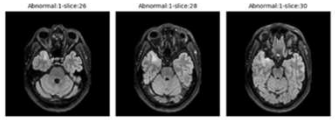
AI algorithms to extract features, patterns and develop models for risk prediction and prevention based on digital images and clinical, therapies and genetic data

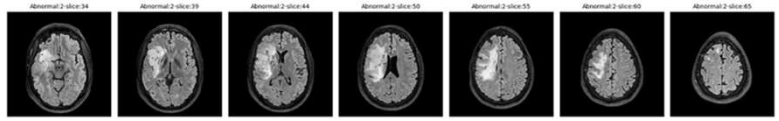


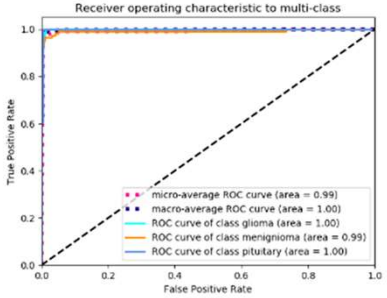


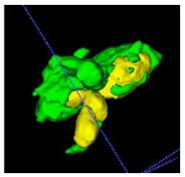
5 class (MS, WMH, tumor, stroke, other)
Classification per pathology and per component







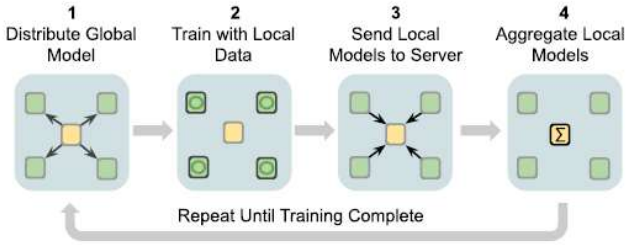




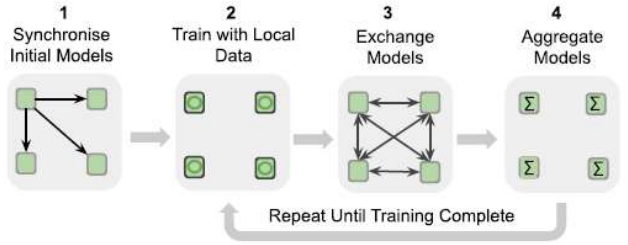
Per slice accuracy > 98 %
Dice coefficient > 90 %, avg area coverage 90 %

Distributed learning of models without sharing data

- Privacy-preservation
- Increase (federate) datasets
- Implement on edge devices and in remote location



(a) FL - Aggregation Server



(b) FL - Peer to Peer