

COIL

Cognitive Laser

Matej Vukovic¹, Michael Haslgrübler¹, Stefan Thalmann², Belgin Mutlu¹

Pro2Future GmbH¹, BANDAS-Center (University of Graz)²

¹ Sandgasse 34, 8010 Graz, Austria

² Universitätsstraße 15, 8010 Graz, Austria



MOTIVATION & GOALS

Industrial CO₂ lasers are widely used in modern manufacturing, enabling **precision cutting, marking, engraving, and converting** applications across various industries, including food and beverage, automotive, and aerospace.

This project leverages **Machine- and Deep Learning** methods to analyze **laser performance data** from standardized tests (12-hour and 30-minute protocols) to identify differences in test **characteristics between laser types, components, and defect sources**. Additionally, the project analyzes how **continuous operational information** can be **stored and transmitted** using classical and machine-learning protocols and utilized by the hardware capable of **real-time operation** and **embedded AI** capabilities.

Project FactBox

Project Name COIL
Project ID MFP A.1
Duration 36 Months

Area 3
Area Analytics

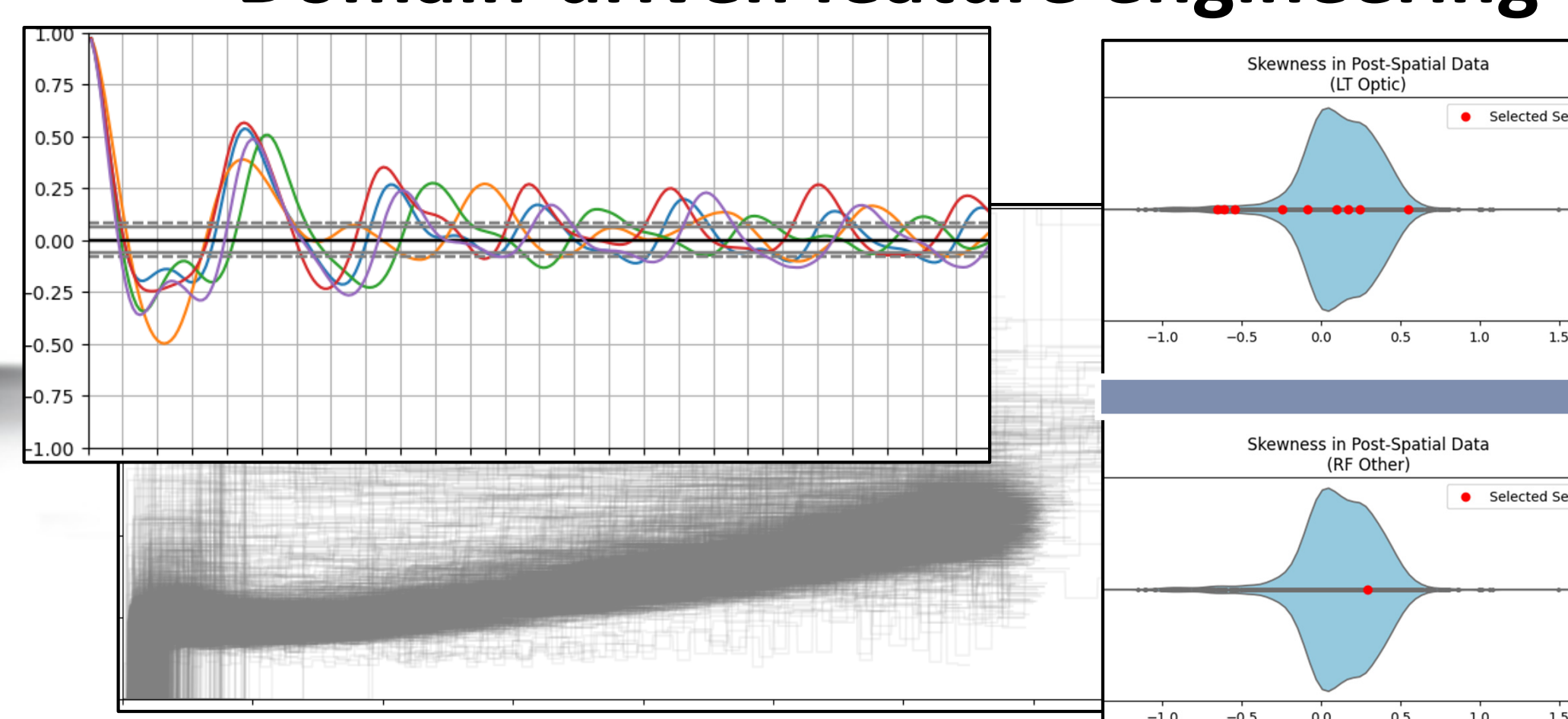
Project Lead
DI Dr. Belgin Mutlu

APPROACH & SYSTEM ARCHITECTURE

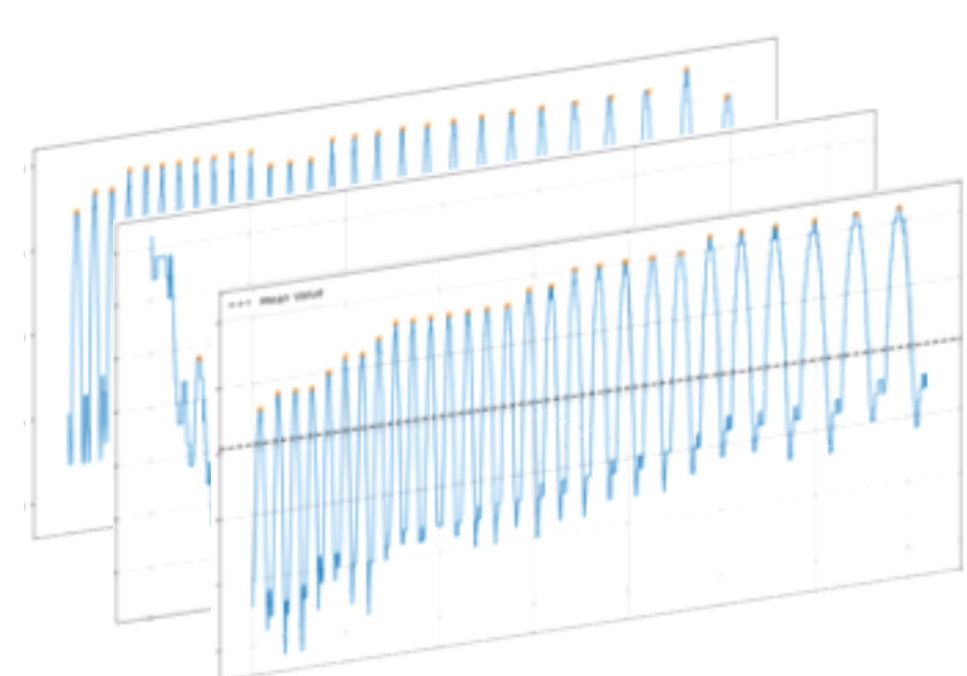
Manufacturing data, Components,
Production Line and Assembly



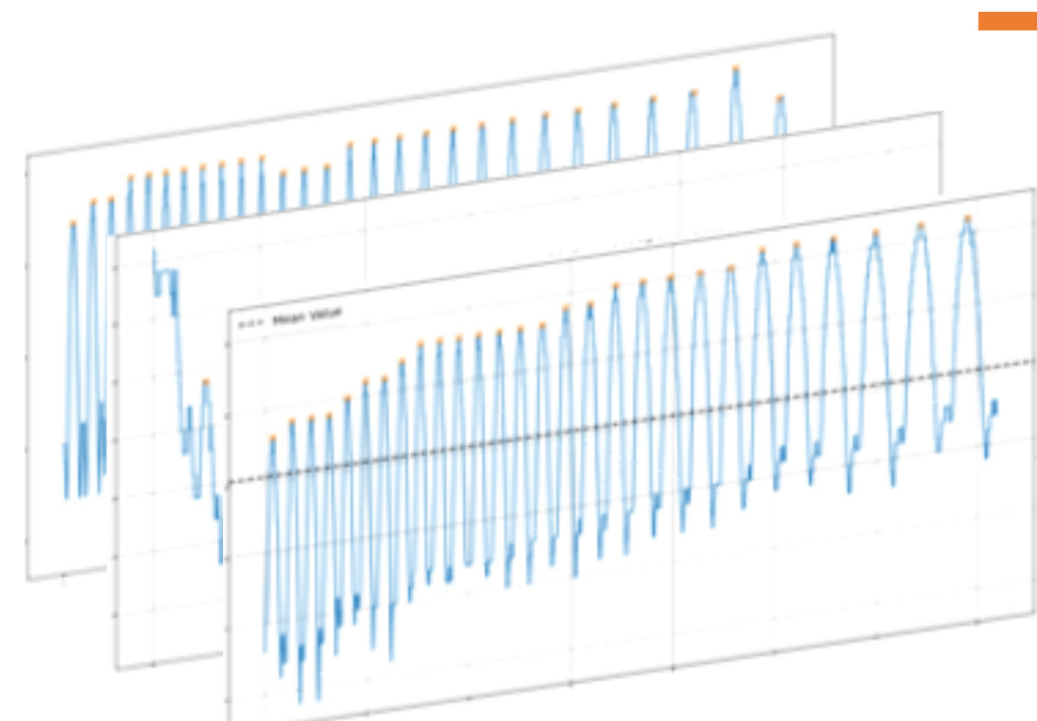
Domain-driven feature engineering



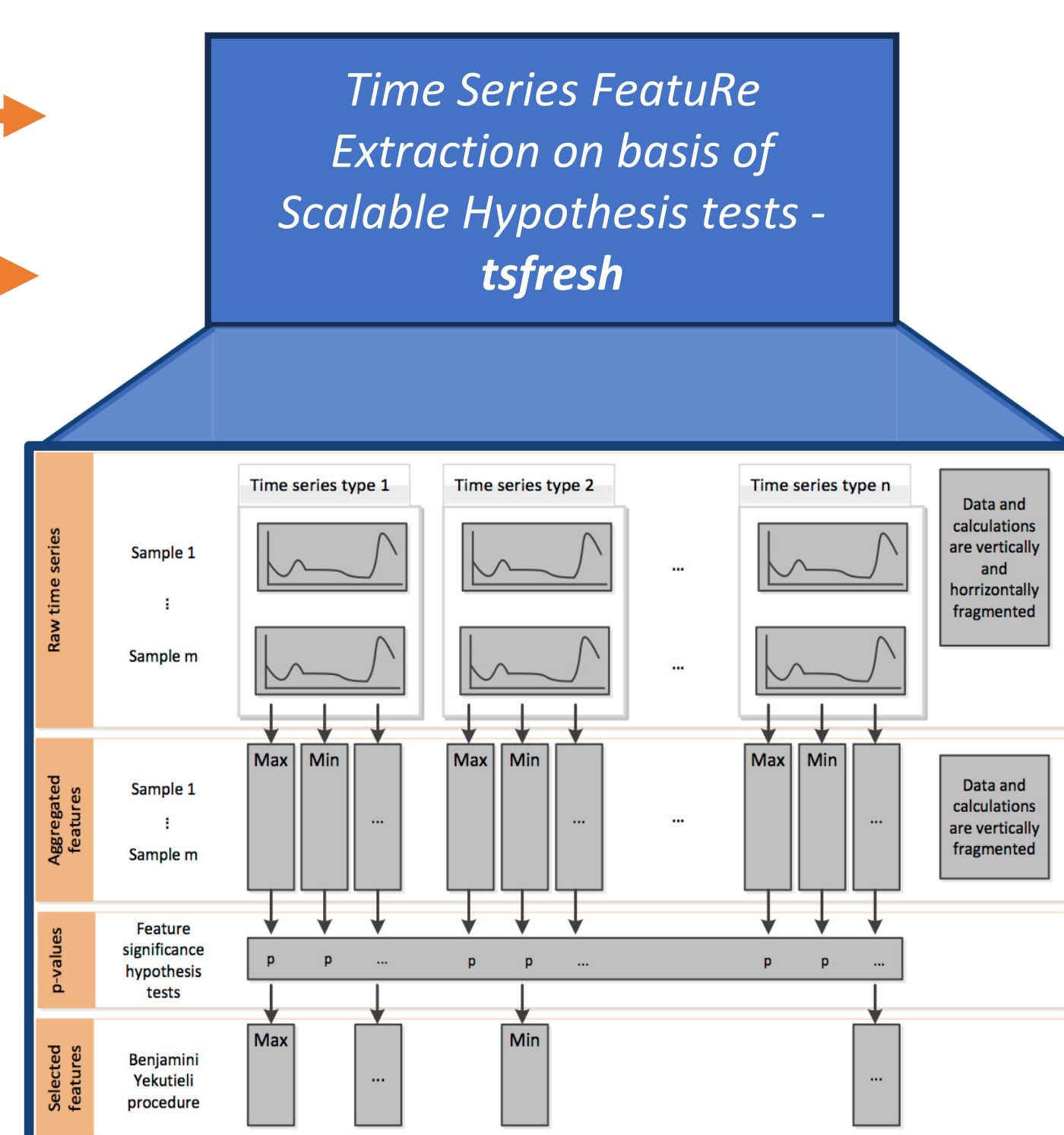
Post-spatial Raw Data



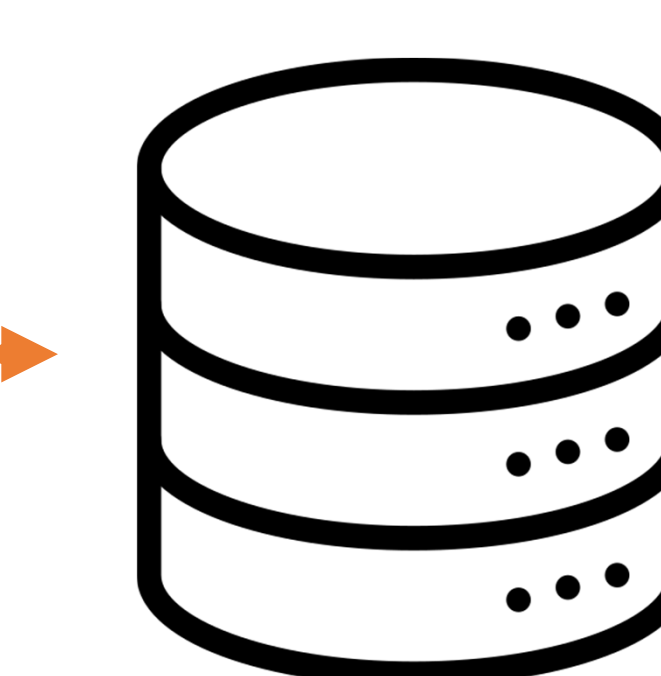
Pre-spatial Raw Data



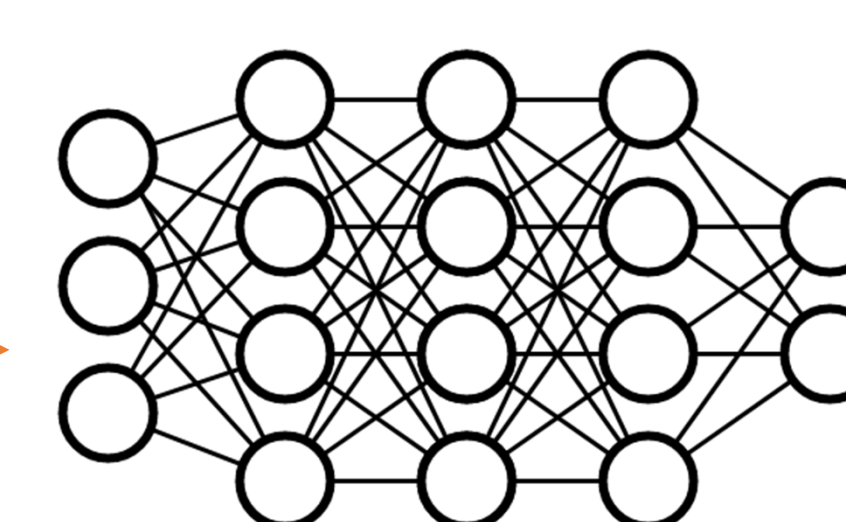
Statistical Feature extraction



Feature set



ML Model (supervised)



Failure probability and characteristics

xAI / Knowledge Discovery



Contact: Dr. Matej Vukovic, Pro2Future GmbH, matej.vukovic@pro2future.at

Acknowledgement: This work was supported by Pro²Future II (FFG, 911655) and Iradion LASER HOLDING GmbH.

IRADION
CORE LASER TECHNOLOGY