SKILL-LEVEL DETECTION FOR WELDERS

GUIDE – Guidance and Assistance
Machine Learning on IMU Data

Pro²Future

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MOTIVATION & GOALS

Our partner Fronius is working with IMU expanded welding machines, enabling to collect different data streams during welding. Based on this data a new developed workflow reveals the skill level of the welder. For Fronius this result enables them to adapt their machines for the expertise of the user.
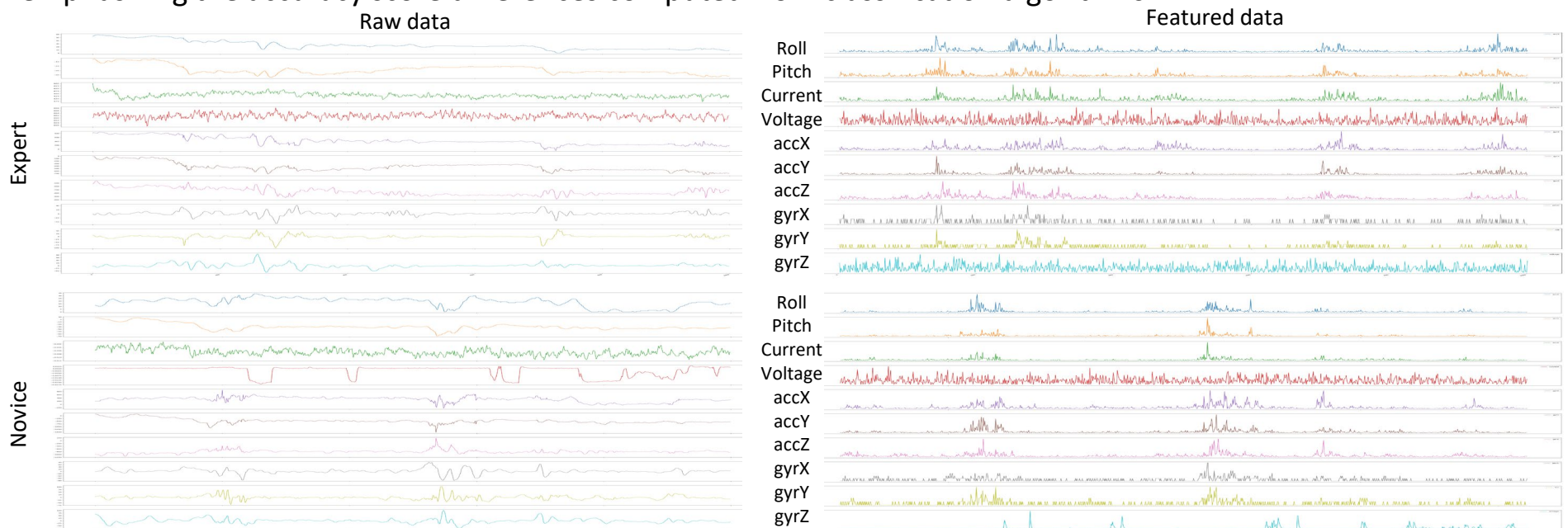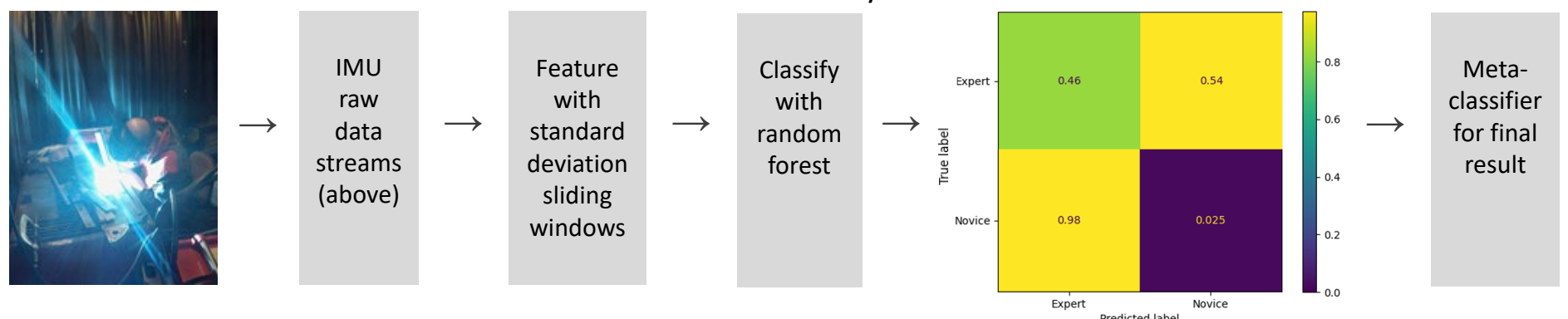
DATA TRANSFORMATION

These IMU data streams include all axis of both accelerometer and gyroscope, voltage, current, pitch and roll with distance of 20ms. To distinguish between an expert and novice welder, the raw data streams were not sufficient (left diagrams). Thus, sliding windows compute new features via standard deviation (right diagrams) or variance, emphasizing the accuracy score differences computed from classification algorithms.

Project FactBox

Project Name GUIDE
Project ID DP1.6
Duration 33 Months

Area 1
Perception and Aware Systems

Project Lead
Prof. Dr. Alois Ferscha

Raw data — Featured data (Expert / Novice): Roll, Pitch, Current, Voltage, accX, accY, accZ, gyrX, gyrY, gyrZ

APPROACH

Evinced by experiments, a window with size of 2 (independent of offsets 1, 2 and 5) in combination with an applied random forest results in the most decisive model so far. This model reaches accuracy scores for experts around 45 to 55% (upper confusion matrix) and for novice welders under 10% (lower confusion matrix). Last a meta-classifier makes the final decision based on these accuracy scores.

IMU raw data streams (above) → Feature with standard deviation sliding windows → Classify with random forest → [confusion matrix: Expert 0.46 / 0.54, Novice 0.98 / 0.025] → Meta-classifier for final result

Fronius

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