SKILL-LEVEL DETECTION FOR WELDERS

GUIDE – Guidance and Assistance Machine Learning on IMU Data

Markus Laube¹, Michael Haslgrübler¹, Alois Ferscha¹²

Pro2Future GmbH¹, JKU-IPC (Institute of Pervasive Computing)²

¹ Science Park 3, Altenberger Straße 69, 4040 Linz, Austria ² Science Park 3, Altenberger Straße 69, 4040 Linz, Austria

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.

Project Name GUIDE Project ID DP1.6 Duration 33 Months

Project FactBox

Perception and Aware Systems **Project Lead** Prof. Dr. Alois Ferscha

Area 1

DATA TRANSFORMATION

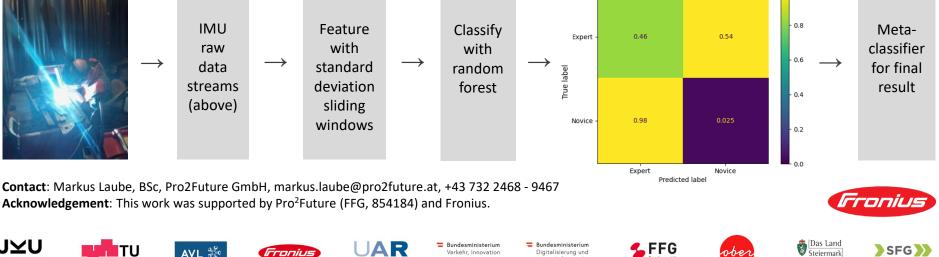
These IMU data streams include all axis of both accelerometer and gyroscope, voltage, current, pitch and roll with distance of 20ms. To distinguish between an expert and novice welder, the raw data streams were not sufficient (left diagrams). Thus, sliding windows compute new features via standard deviation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

	Raw data		Featured data
		Roll	month war March Manuth march war where where the second seco
Expert		Pitch	man in station and reached and a second and a
	put the manufacture and a second and the second and	Current	and have a proper a proper and the second
	many water and the second and the second s	Voltage	har market with the second she have been and the control of the second control of the second and the second s
	Mar	accX	and where a show the second with a second with a second show a second second second second second second second
	many have a second and the second an	accY	June Margarette
	man Mar Mar Mar Mar Mar	accZ	man when Mondor Monard or men a reason and a superior
	man white the second se	gyrX	การสาวและเหลาไหวและสินาและได้รัฐไฟสายสามหาวามสาวและสาว เมตา และ และ เมตรีการและ และ สามารถ และ และสินาส์และเร
		gyrY	an an an and the carry and that the transmission and the second second statements and the second second second
	ment for the second sec	gyrZ	senterendellen des sandtheigenselseten en anderen anderen anderen anderen det anderenderen anderen service ander
Novice		Roll	Mr. M. Marcul
		Pitch	manual when a when the second
	man Mer and manufacture and a second and a	Current	
	- M M M	Voltage	and down and down when a second second second and the second and the second dependence of the second s
		accX	man in which we man which the her Man and the
	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	accY	White many with the second sec
	Man Aran Man Aran Aran Aran Aran Aran Aran Aran Ar	accZ	an man and star man and Marken allow an and
	Market Marke	gyrX	person attraction wave and attraction wave and an an announce a survey on the State of the second or the person wave and a survey of the second or the survey of the surve
		gyrY	without a second of the the the second and the second second second with the Atomas and the second the second

## **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.

gyrZ







**Pro²Future** 





