tinyML® EMEA

Enabling Ultra-low Power Machine Learning at the Edge

tinyML EMEA Technical Forum 2021 Proceedings

June 7 – 10, 2021

Virtual Event

www.tinyML.org

tinyML EMEA Technical Forum 2021
June 7-10, 2021

Exhaled Breath Edge AI Inference for Early Prediction of Chronic Obstructive Pulmonary Diseases (COPD)

Presented by:

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June 09, 2021

Project Overview

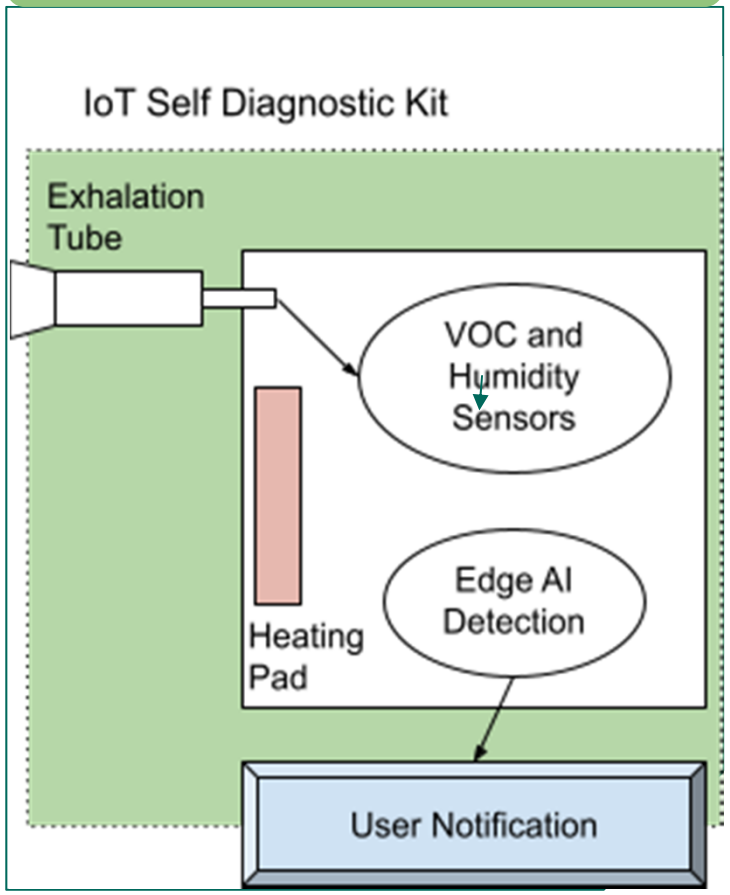
Motivation for the study

> **4 million people die** prematurely from respiratory diseases **annually** (WHO).

Hospital Diagnosis involves use **expensive** equipment in the lab and consultation of few and busy medical experts.

Lack of data to enable reliance on AI solutions

Proposed Solution



Reasons for Edge AI

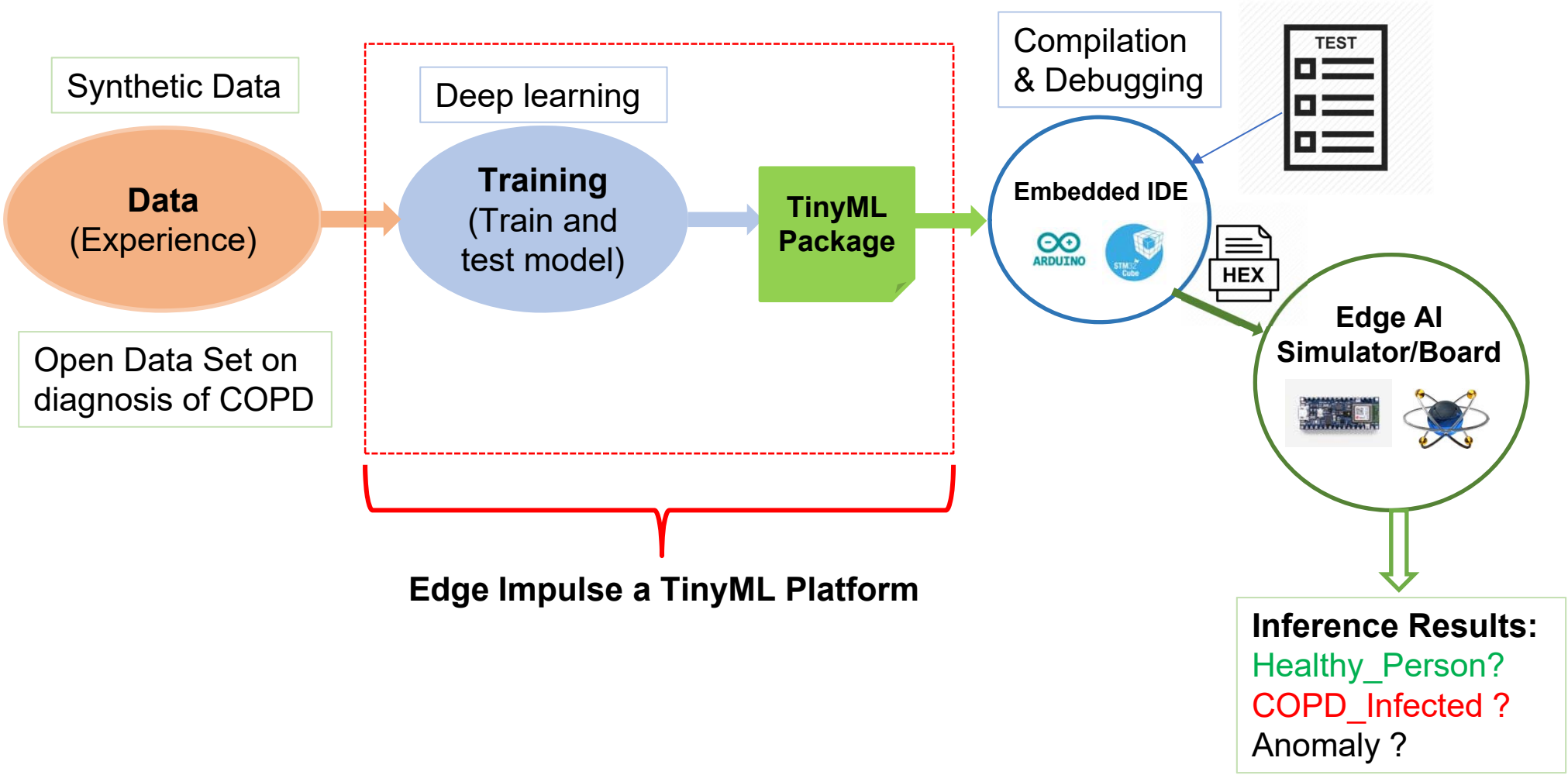

Connectivity


Privacy


Costs


Response time

Edge AI Process Flow



No. of sensors and data processing affect model accuracy

Training Outputs

ACCURACY 95.3%	**Flattened model**
ACCURACY 96.9%	**Raw data model**
ACCURACY 92.0%	**PCA based model**

Real-time Metrics

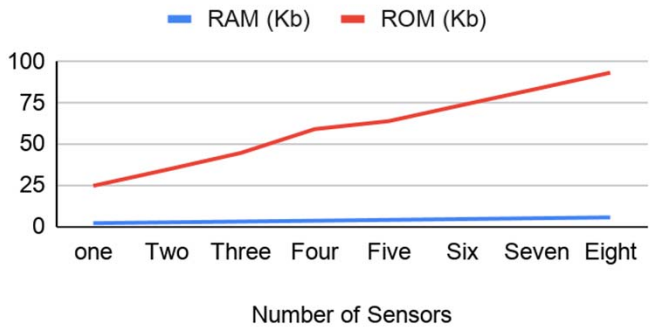
Estimated (Edge Impulse)

INFERENCING ...	PEAK RAM USA...	ROM USAGE
12 ms.	5.4K	92.9K

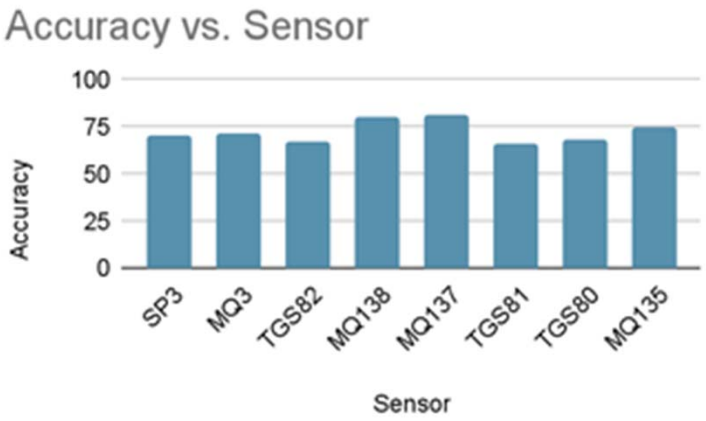
Actual (in STM32 IDE)

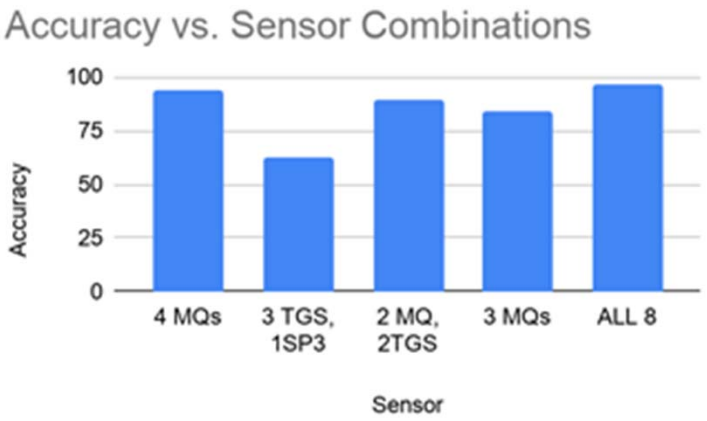
Region	Size	Free	Used	Usage (%)
RAM	96 KB	77.25 KB	18.75 KB	19.53%
FLASH	512 KB	361.28 KB	150.72 KB	29.44%

Sensor Number Impact



Sensor Performance





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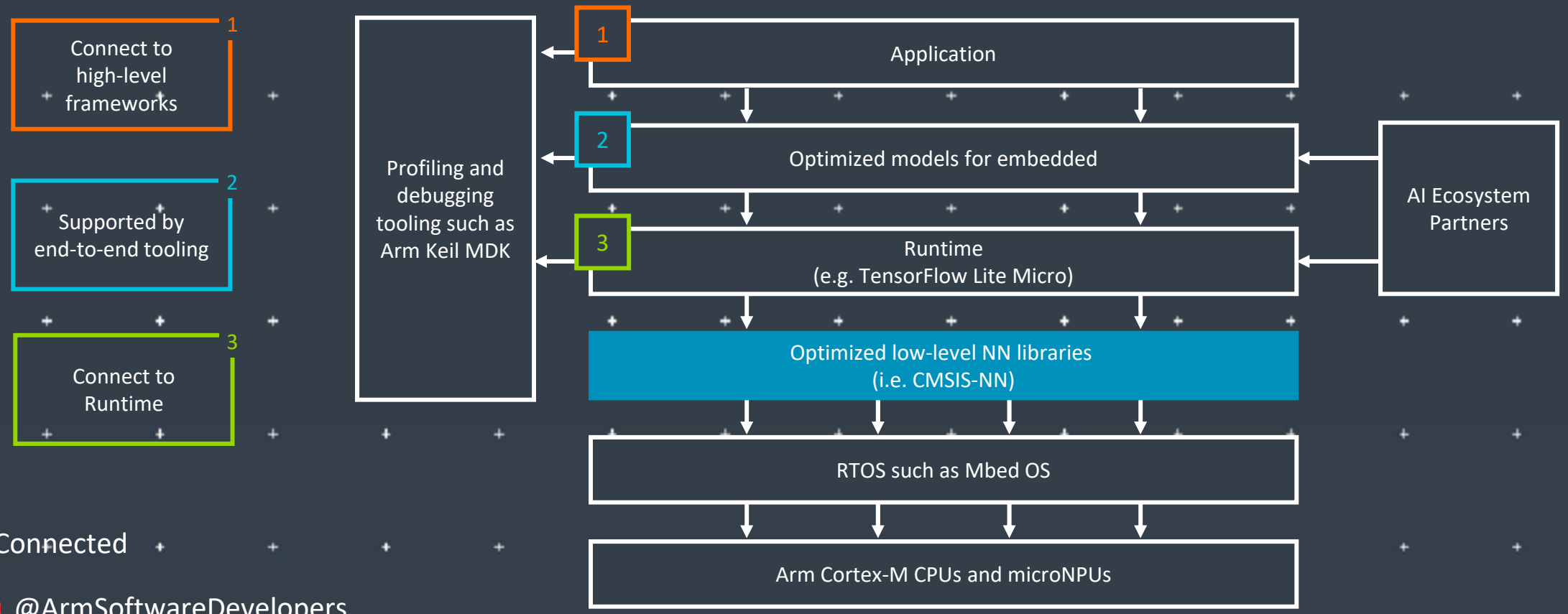


Stay Connected

@ArmSoftwareDevelopers

@ArmSoftwareDev

Resources: developer.arm.com/solutions/machine-learning-on-arm

arm

TinyML for all developers

C++ library

Arduino library

WebAssembly

Dataset

Acquire valuable training data securely

Enrich data and train ML algorithms

Edge Device

Real sensors in real time

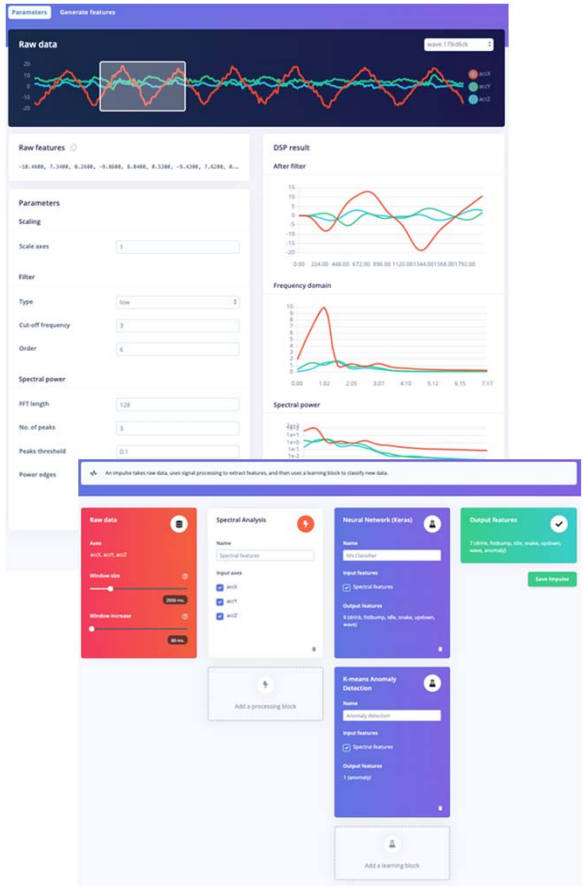
Open source SDK

Impulse

Embedded and edge compute deployment options

Test impulse with real-time device data flows

Test



www.edgeimpulse.com

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Power efficiency

Model design, compression, quantization, algorithms, efficient hardware, software tool

Personalization

Continuous learning, contextual, always-on, privacy-preserved, distributed learning

Efficient learning

Robust learning through minimal data, unsupervised learning, on-device learning

A platform to scale AI across the industry

Perception

Object detection, speech recognition, contextual fusion

Reasoning

Scene understanding, language understanding, behavior prediction

Action

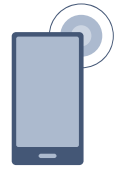
Reinforcement learning for decision making

Edge cloud

Cloud

IoT/IIoT

Automotive



Mobile

SYNTIANT

Syntiant Corp. is moving artificial intelligence and machine learning from the cloud to edge devices. Syntiant's chip solutions merge deep learning with semiconductor design to produce ultra-low-power, high performance, deep neural network processors. These network processors enable always-on applications in battery-powered devices, such as smartphones, smart speakers, earbuds, hearing aids, and laptops. Syntiant's Neural Decision Processors™ offer wake word, command word, and event detection in a chip for always-on voice and sensor applications.

Founded in 2017 and headquartered in Irvine, California, the company is backed by Amazon, Applied Materials, Atlantic Bridge Capital, Bosch, Intel Capital, Microsoft, Motorola, and others. Syntiant was recently named a CES® 2021 Best of Innovation Awards Honoree, shipped over 10M units worldwide, and unveiled the NDP120 part of the NDP10x family of inference engines for low-power applications.

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SensiML pioneered TinyML software tools that auto generate AI code for the intelligent edge.

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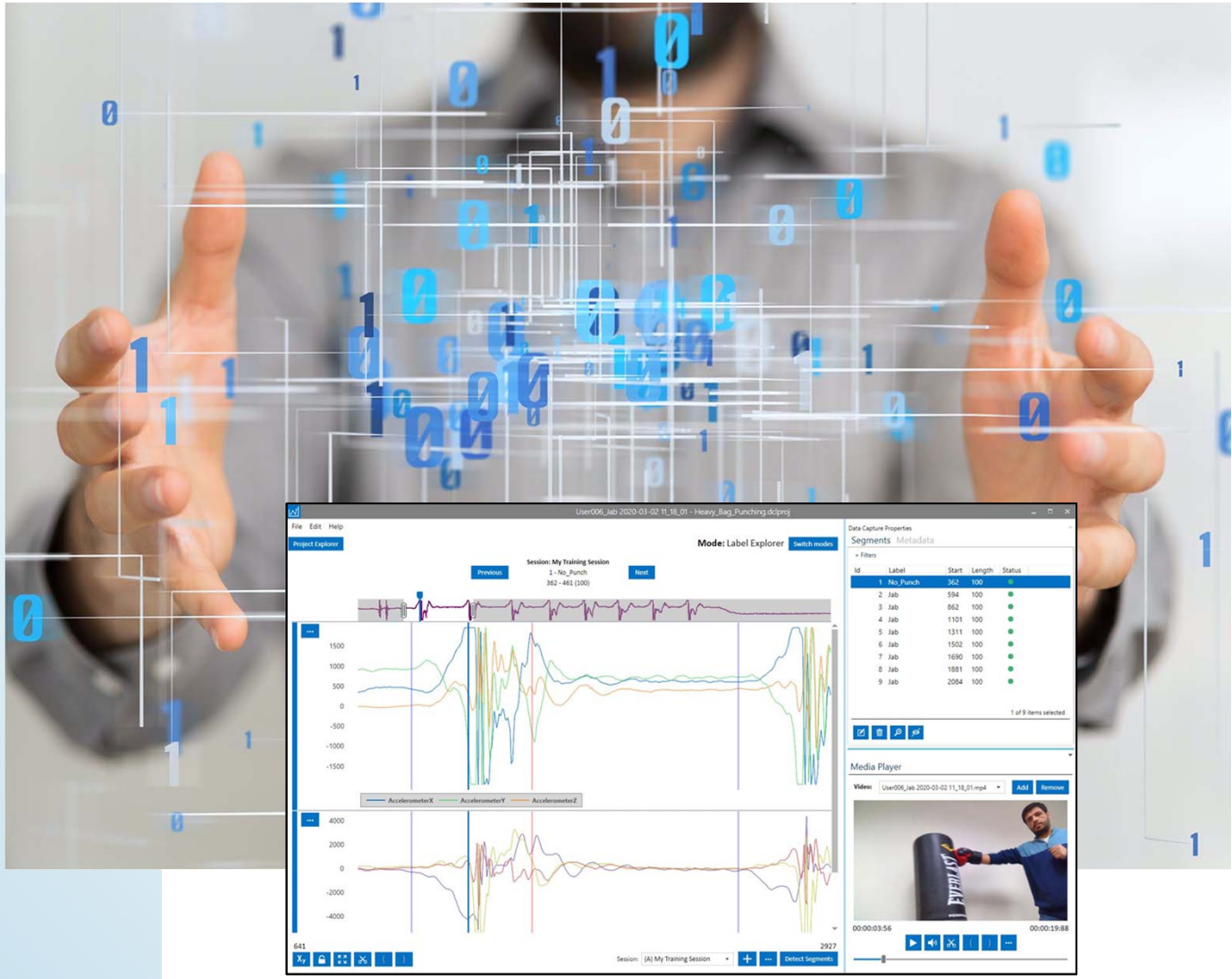
- Multi-user auto-labeling of time-series data
- Code transparency and customization at each step in the pipeline

We enable the creation of production-grade smart sensor devices.



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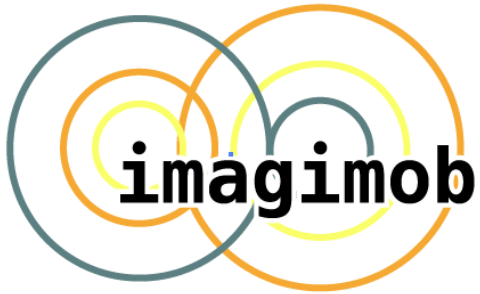

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