tinyML® EMEA

Enabling Ultra-low Power Machine Learning at the Edge

tinyML EMEA Technical Forum 2021 Proceedings

June 7 – 10, 2021

Virtual Event

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June 7-10, 2021

TOD: Transprecise Object Detection to Maximise Real-Time Accuracy on the Edge

Presented by: JunKyu Lee, Research Fellow, Queen's University Belfast, UK

Acknowledgement

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The CHIST-ERA No. CHIST-ERA-18-SDCDN-002 (**DiPET**)

DiPET Website : https://dipet.eeecs.qub.ac.uk

June 10, 2021

- Edge for Real-Time Video Analytics (RTVA)

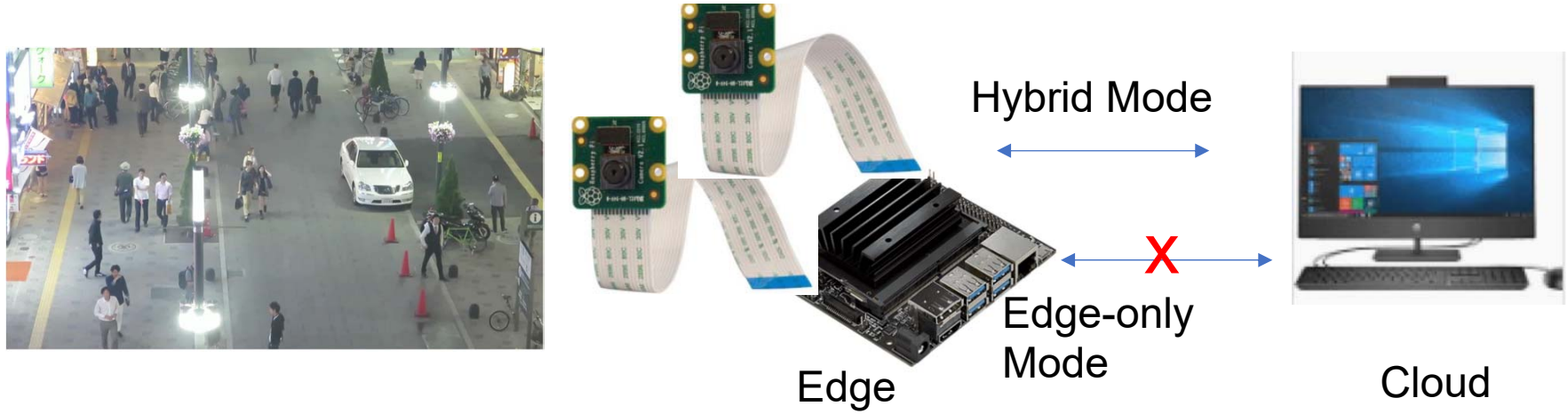

Figure Source: Multi Object Tracking 17 Dataset (https://motchallenge.net)

- Challenges in RTVA on the Edge: Limited Computational Power → Longer Inference Latency from Deep Neural Network (DNN) → More Dropped Frames → *Limited Object Detection Accuracy*

TOD: Transprecise Object Detection (to maximise RTVA accuracy on the Edge)

- Initialization: Preloading 4 different YOLOv4 detectors into GPU RAM
- Runtime Scheduler (RS) Selects a DNN on the Fly according to Dynamic Object Sizes Detected.
- TOD Demonstration when objects are fading away from camera (i.e., objects are getting smaller.)

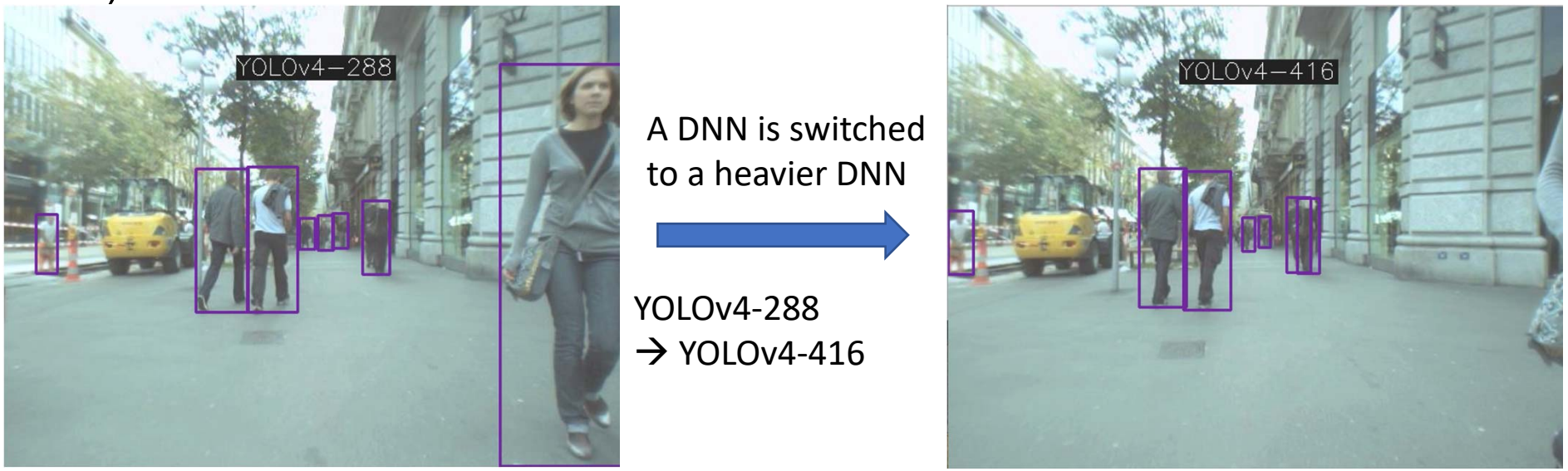

Figure Source: Multi Object Tracking 17 Dataset (https://motchallenge.net)

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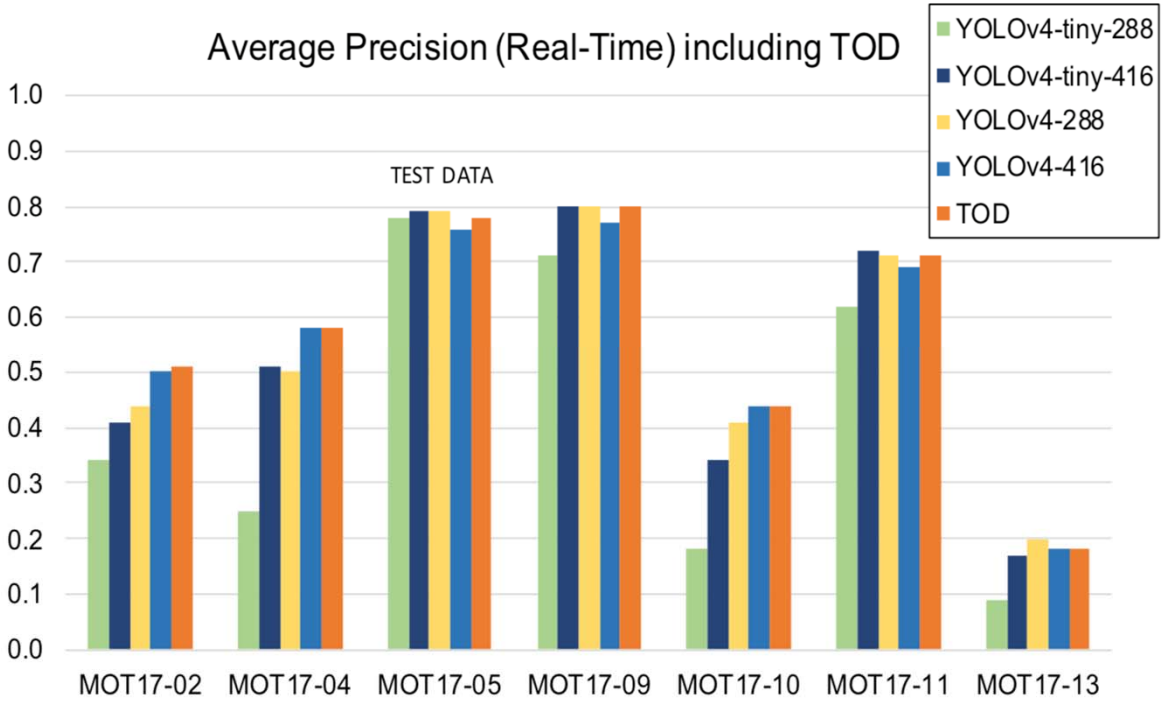
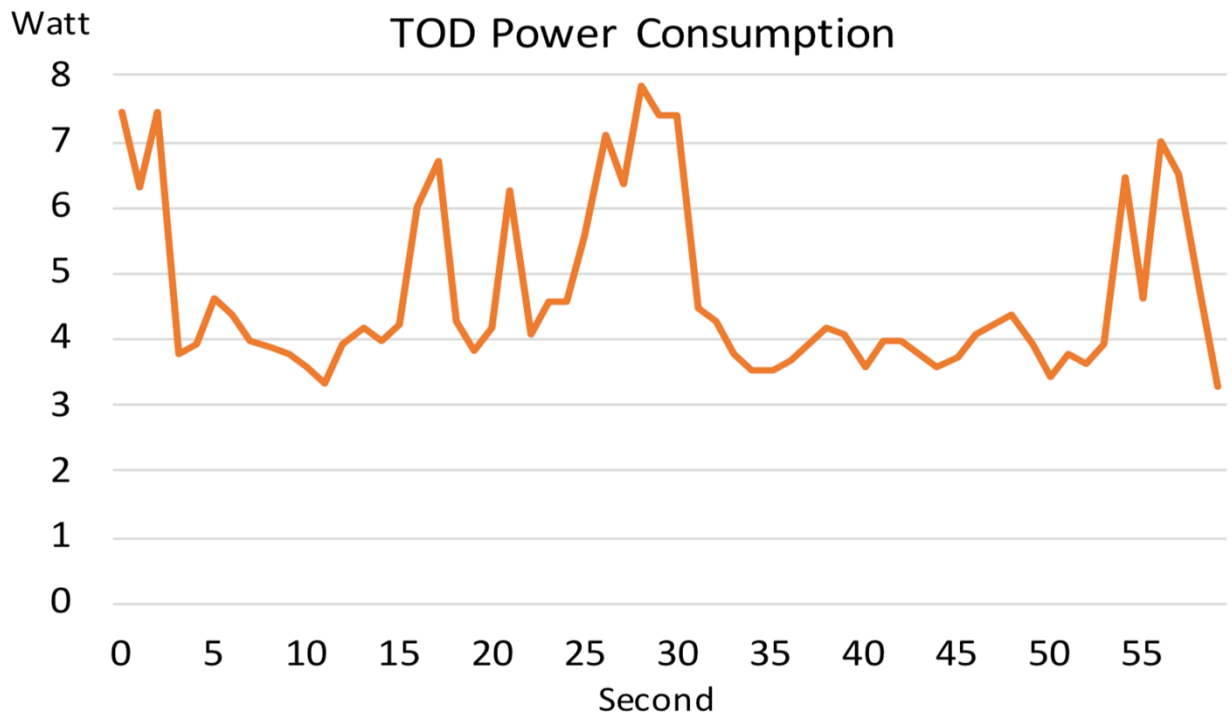
Experimental Evaluation with a NVidia Jetson Nano Board with MAX power mode





Best (or equivalently good) accuracy for all cases
- 35% gain over YOLOv4-tiny-288.

With MOT17-05 data, TOD requires 63% of the power without losing accuracy compared to YOLOv4-416. (TOD: 5.7W, YOLOv4-416: 7.5W)

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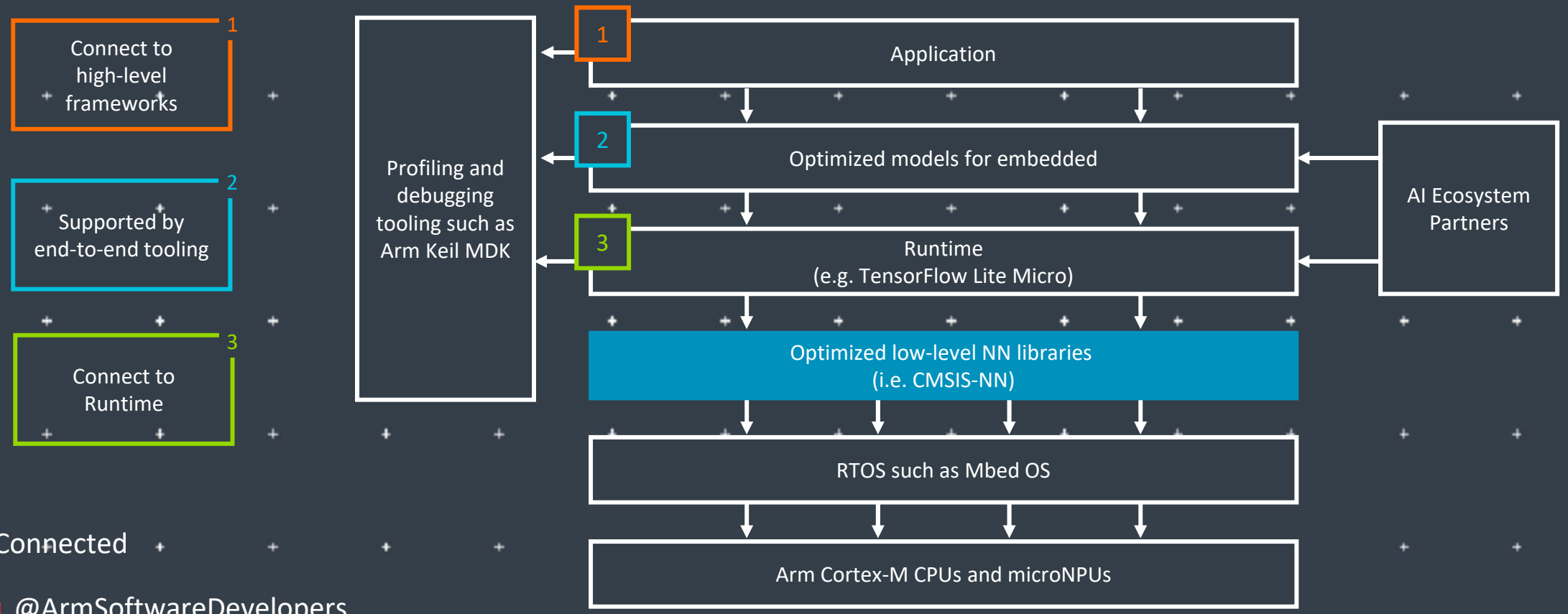

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Resources: developer.arm.com/solutions/machine-learning-on-arm

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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

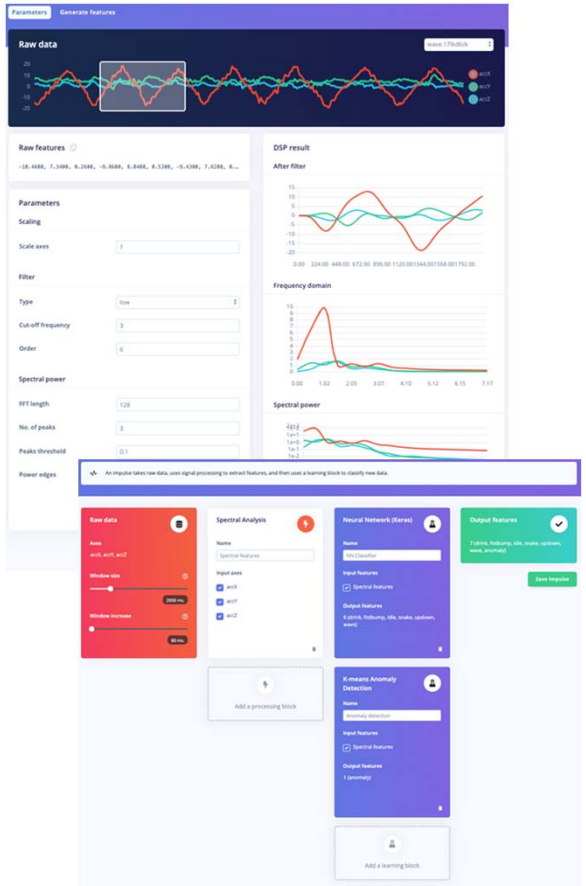
Open source SDK

Impulse

Embedded and edge compute deployment options

Test impulse with real-time device data flows

Test



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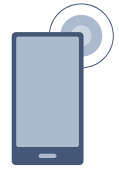

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Founded in 2017 and headquartered in Irvine, California, the company is backed by Amazon, Applied Materials, Atlantic Bridge Capital, Bosch, Intel Capital, Microsoft, Motorola, and others. Syntiant was recently named a CES® 2021 Best of Innovation 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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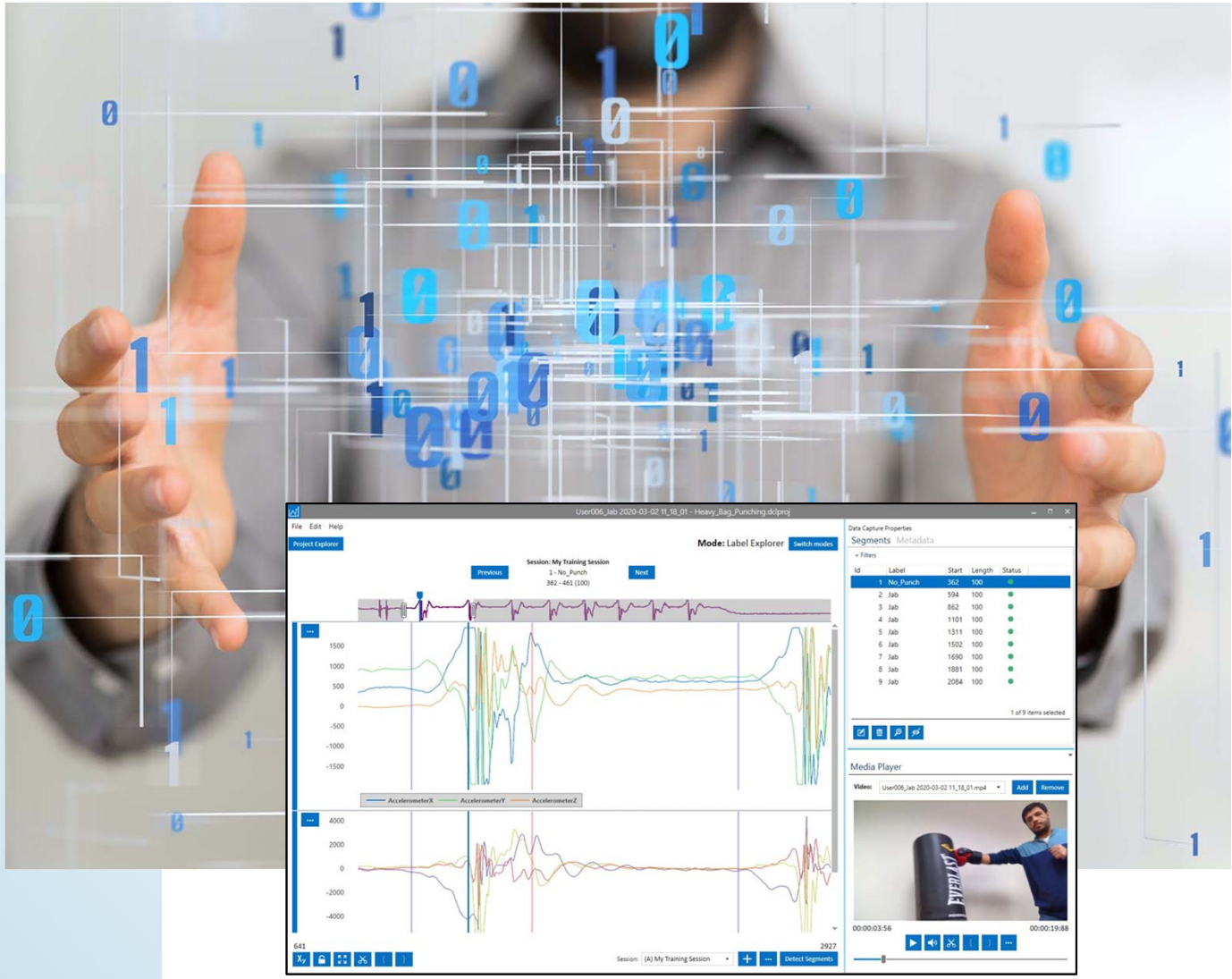

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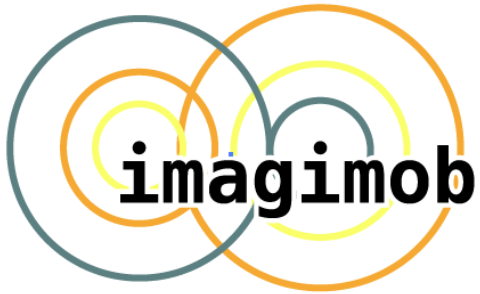

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