tinyML® EMEA

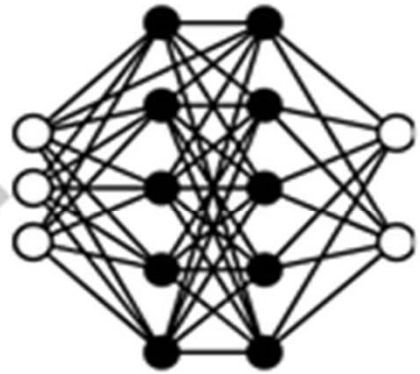
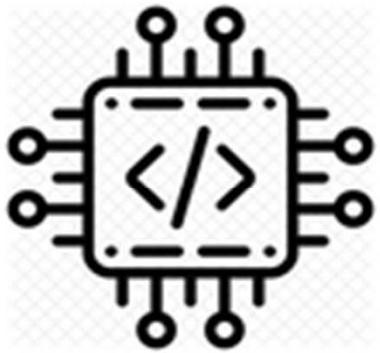
Enabling Ultra-low Power Machine Learning at the Edge

tinyML EMEA Technical Forum 2021 Proceedings

June 7 – 10, 2021

Virtual Event

www.tinyML.org


Offline Prediction of Cholera in Rural Communal Tap Waters Using Edge AI inference

TINY ML

tinyML® EMEA

Enabling Ultra-low Power Machine Learning at the Edge

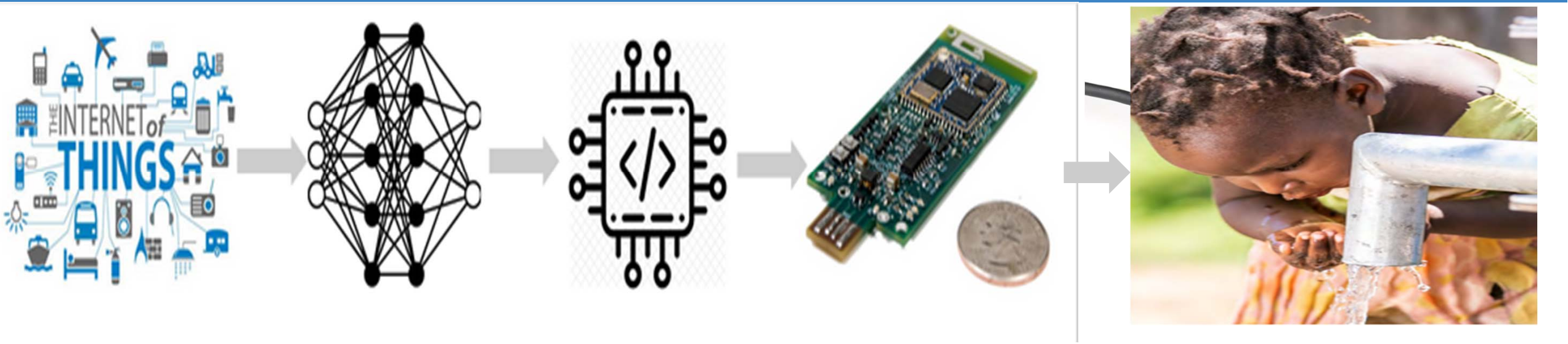
Marvin Muyonga Ogore, Dr. NSENGA Jimmy, Dr. NKURIKIYEYEZU Kizito

ACEIoT

AFRICAN CENTER OF EXCELLENCE IN INTERNET OF THINGS

UNIVERSITY of RWANDA
College of Science and Technology

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



Outline

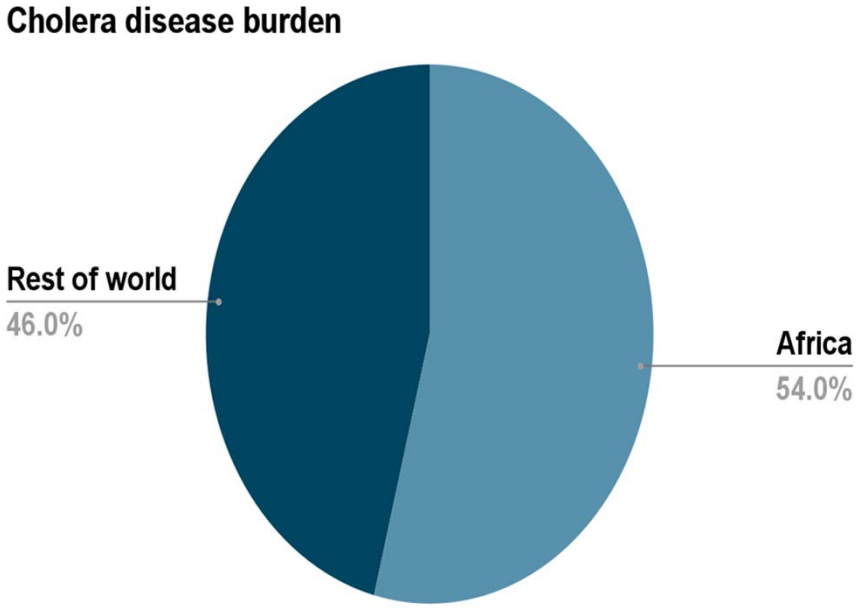
- Introduction
- State of the Art
- Methodology and set-up
- Simulation layout
- Results
- Achievements

Dr Ir Jimmy Nsenga
jimmy.nsenga@gmail.com | +32 486 942 504

Use Case 1: **Cholera Warning on Communal Rural Water Taps**

Motivation for the study

Societal Challenge



- Cholera is a Water borne disease
- Kill up to 200K persons yearly

Existing Detection Technology

Are not Cost effective

Not scalable for mass Deployment

Long detection time e.g APW takes upto 24h

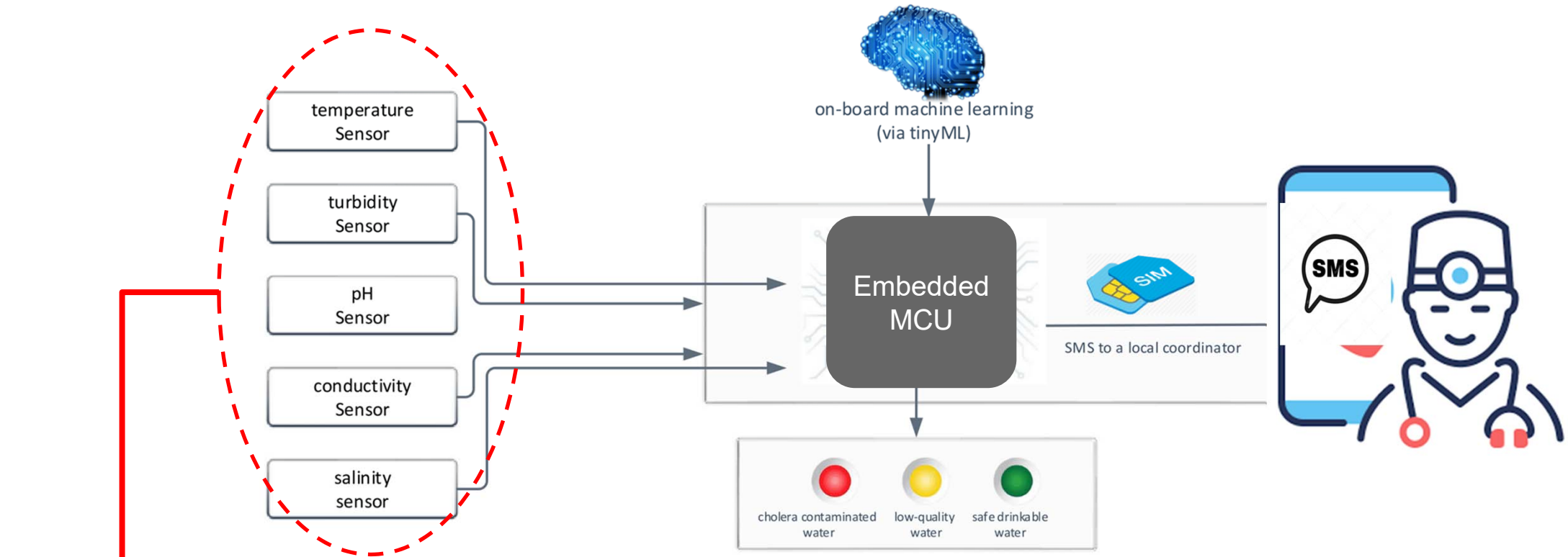
Require lab settings e.g use of APW

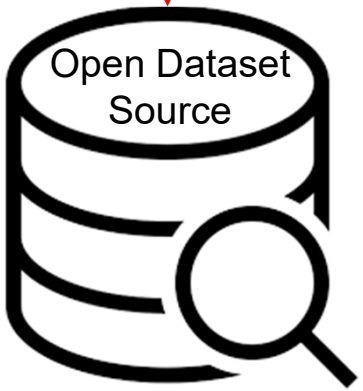
Our research basis

Edge AI Cholera pluggable detection device

Target: Communal rural water taps
Data: Water PhysicoChemical parameters
Cheap for mass deployment
Edge AI because
- Poor rural internet connectivity
- Fast response time

Implementation of our research approach



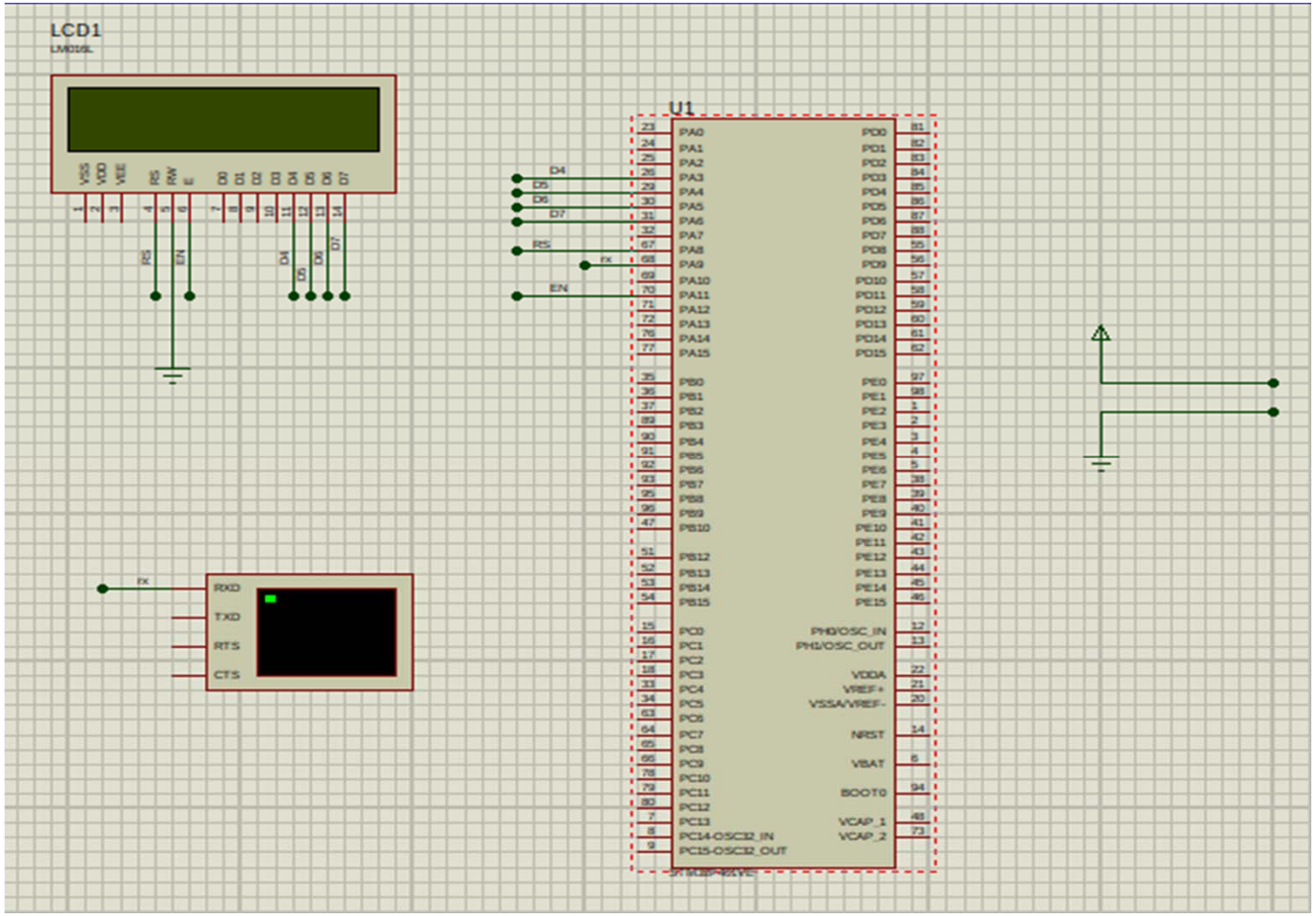


Physicochemical properties of water of observed cholera cases in the Katana health zone

Edge AI Tool Stack
(Training + TinyML generation + Embedded Simulator)

Cholera safe or not?

Simulation layout



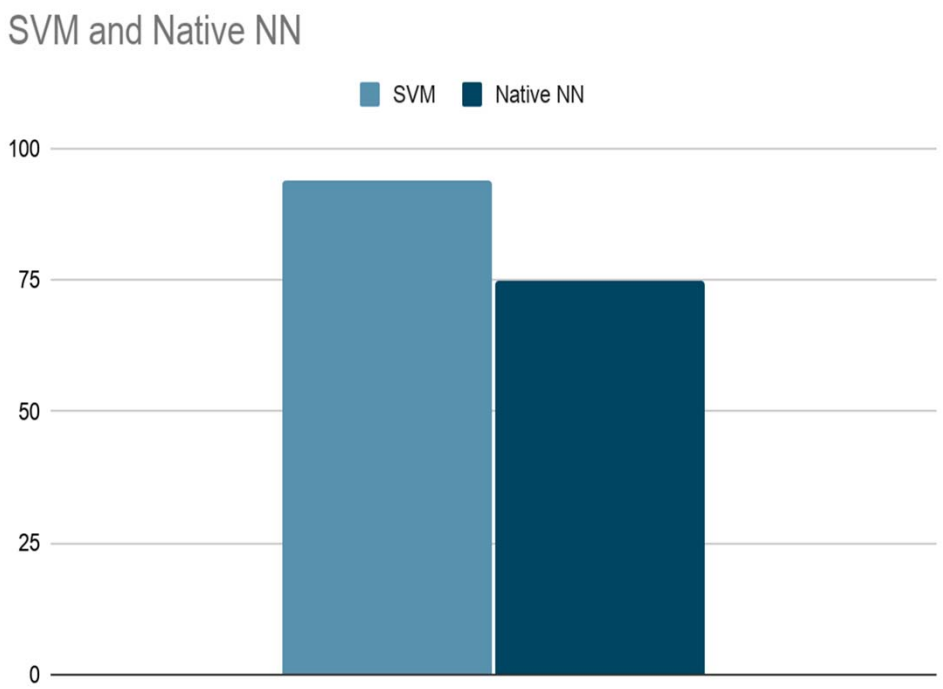
Proteus PCB layout components
LCD
Virtual terminal
Target ARM cortex M4 MCU

SVM outperforms native Neural Networks for small datasets

Model Inference Performance

ACCURACY

94.03%



Model optimization

RAM USA

1.6K

LATENCY

1 ms

ROM USA

15.1K

ACCURAC

94.03%

CONFUSION MATRIX

100	0	0	0
0	87.5	0	12.5
0	0	100	0

On device real-time performance

Inference Time

1 Ms

RAM

1.5K

ROM

14.9K

Achievements

Simulation of an edge impulse generated model on proteus

AI Model for prediction of cholera on Embedded devices / Edge devices

Cheap real time detection of Cholera in water away from the Labs

Synthetic data generation

Thank you

TINY ML EMEA
Virtual
JUNE 7-10,2021

Premier Sponsor

Intelligent Agent
Neuton

Automated TinyML

Zero-code SaaS solution

Create tiny models, ready for embedding, in just a few clicks!

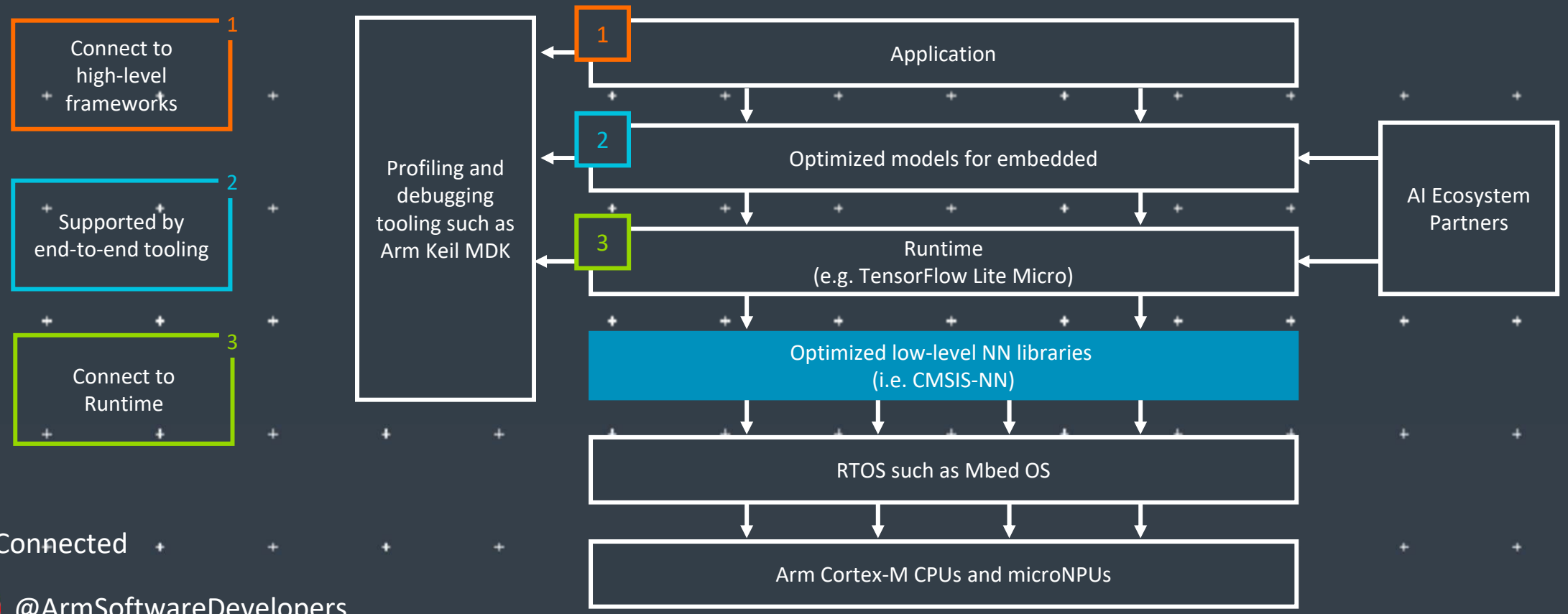
Compare the benchmarks of our compact models to those of TensorFlow and other leading neural network frameworks.

Build Fast. Build Once. Never Compromise.

TINY ML EMEA
Virtual
JUNE 7-10,2021

Executive Sponsors

Arm: The Software and Hardware Foundation for tinyML



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

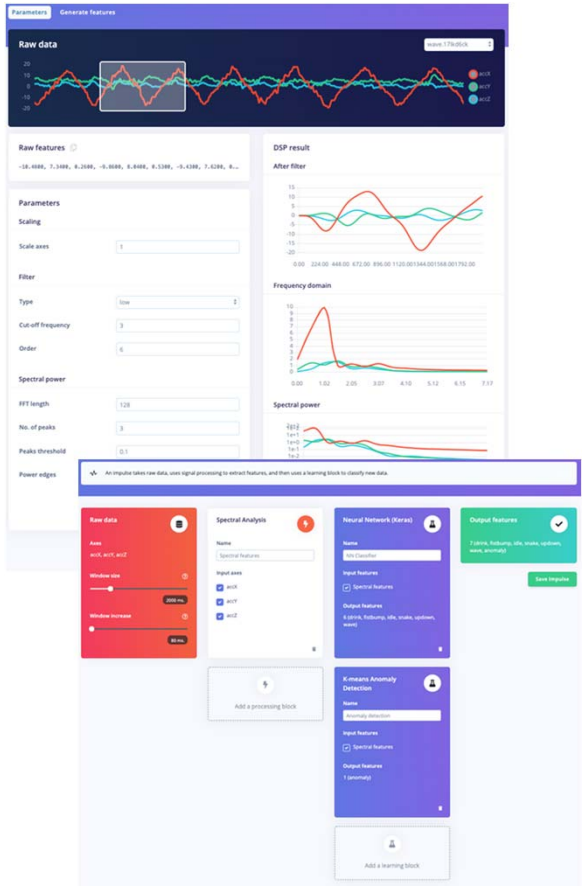
Open source SDK

Impulse

Embedded and edge compute deployment options

Test impulse with real-time device data flows

Test



www.edgeimpulse.com

Qualcomm
AI research

Advancing AI research to make efficient AI ubiquitous

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

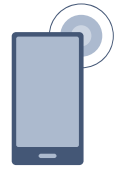
Reinforcement learning for decision making

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.

www.syntiant.com

@Syntiantcorp

TINY ML EMEA
Virtual
JUNE 7-10,2021

Platinum Sponsors

Part of your life. Part of tomorrow.

www.infineon.com

Reality AI®

Add Advanced Sensing to your Product with Edge AI / TinyML

https://reality.ai info@reality.ai @SensorAI Reality AI

Pre-built Edge AI sensing modules, plus tools to build your own

Reality AI solutions

Prebuilt sound recognition models for indoor and outdoor use cases

Solution for industrial anomaly detection

Pre-built automotive solution that lets cars "see with sound"

Reality AI Tools® software

Build prototypes, then turn them into real products

Explain ML models and relate the function to the physics

Optimize the hardware, including sensor selection and placement

TINY ML EMEA
Virtual
JUNE 7-10,2021

Gold Sponsors

LatentAI

Adaptive AI for the Intelligent Edge

Latentai.com

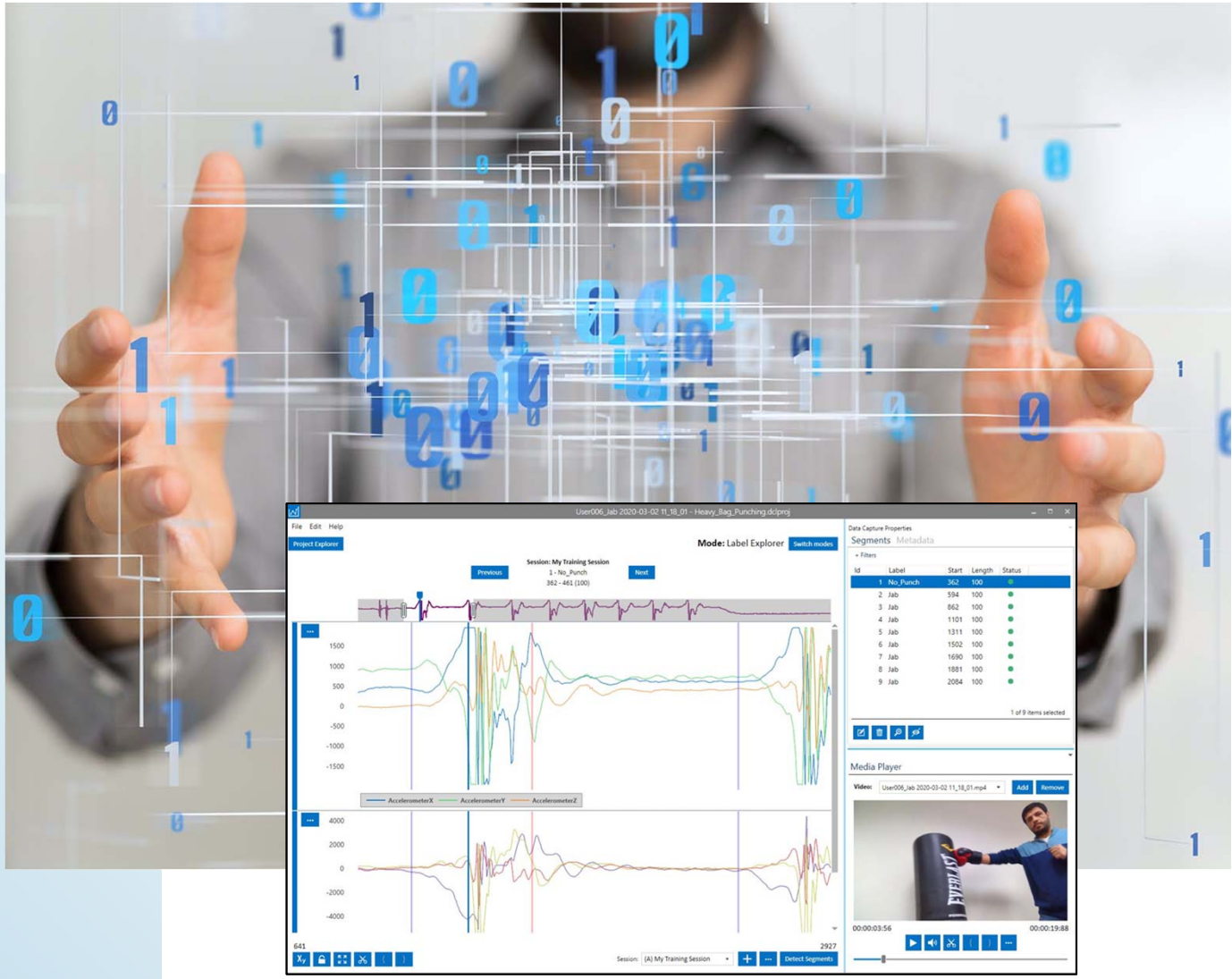
SensiML™

Build Smart IoT Sensor Devices From Data

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

- End-to-end AI workflow
- Multi-user auto-labeling of time-series data
- Code transparency and customization at each step in the pipeline

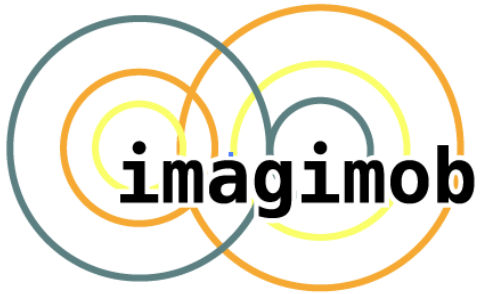
We enable the creation of production-grade smart sensor devices.



sensiml.com

TINY ML EMEA Virtual JUNE 7-10,2021

Silver Sponsors



Copyright Notice