

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

PERFECT COFFEE ROASTING WITH TINYML SOUND SENSING

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tinyML EMEA 2021



ROEST

ROEST



Audio Machine Learning

Sound Event Detection

Acoustic Anomaly Detection

Data Platform



Hardware



Noise Monitoring

Noise and Acoustics Rating

S C 61 dB

Safety Very good Hearing protection not necessary

Concentration Not so good Recommend reducing by 10 dB for increased productivity and satisfaction

Acoustic Anomaly Detected

78 dB

Details High frequency sounds 40% above normal

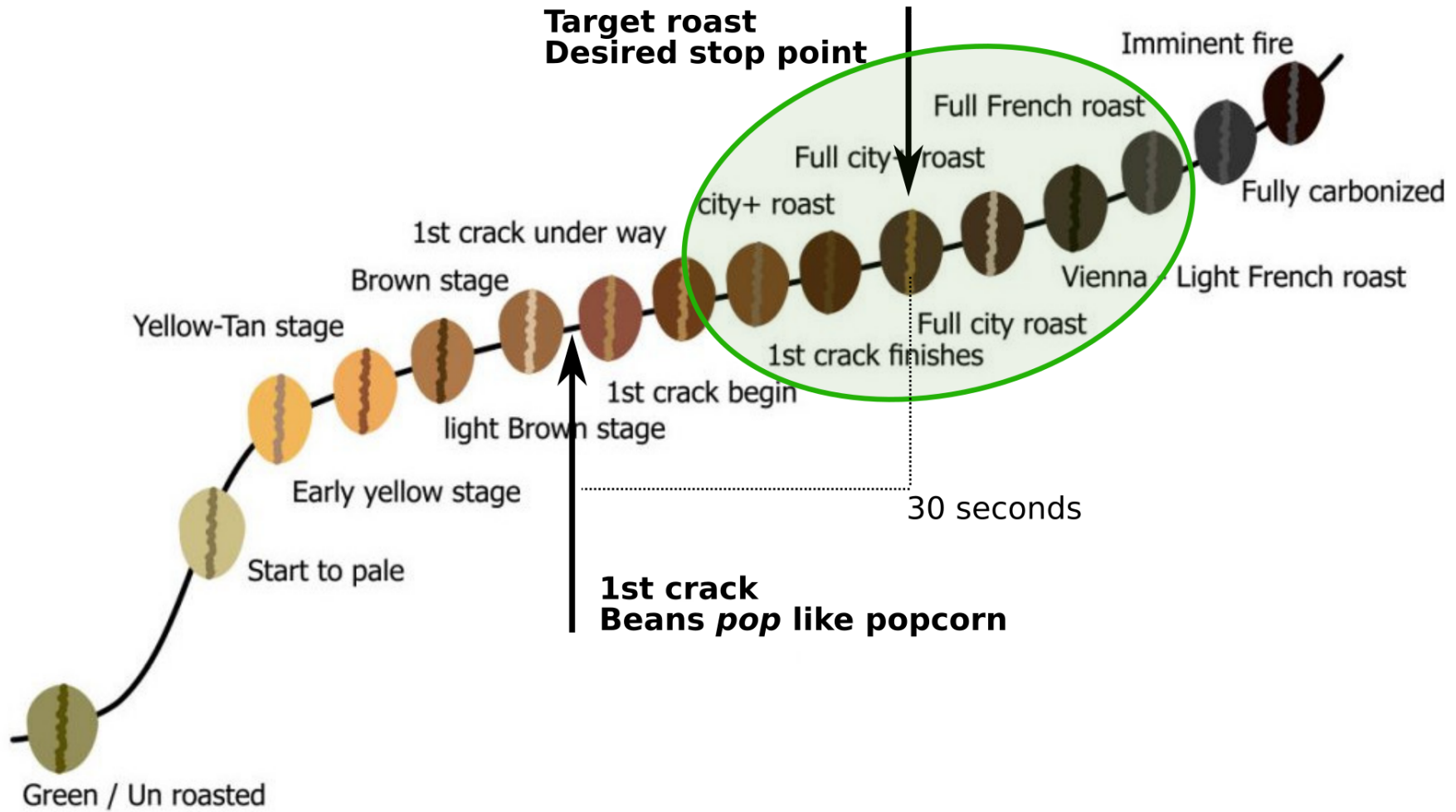
Cause Unknown

Inspection scheduled Work order #4397



Machine Monitoring

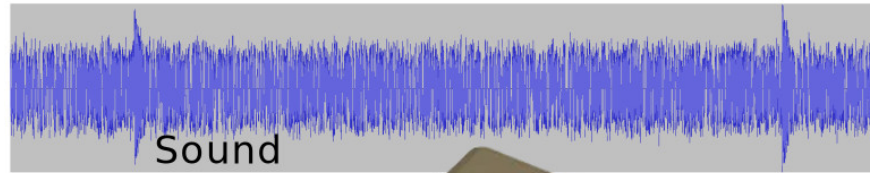
ROASTING COFFEE



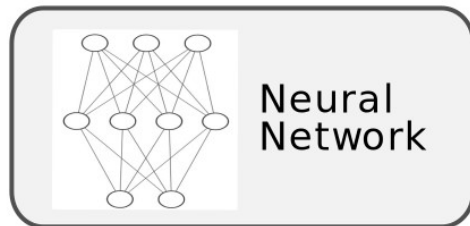
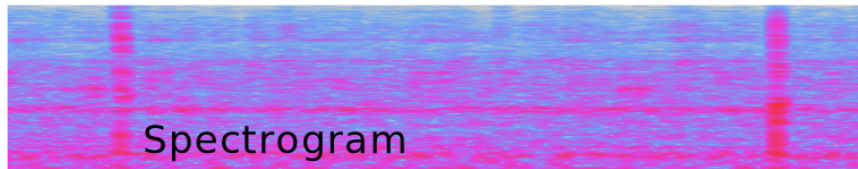
DOING IT MANUALLY



AUTOMATIC FIRST CRACK DETECTION



Preprocessing



Deep-learning framework



TinyML Inference Engine

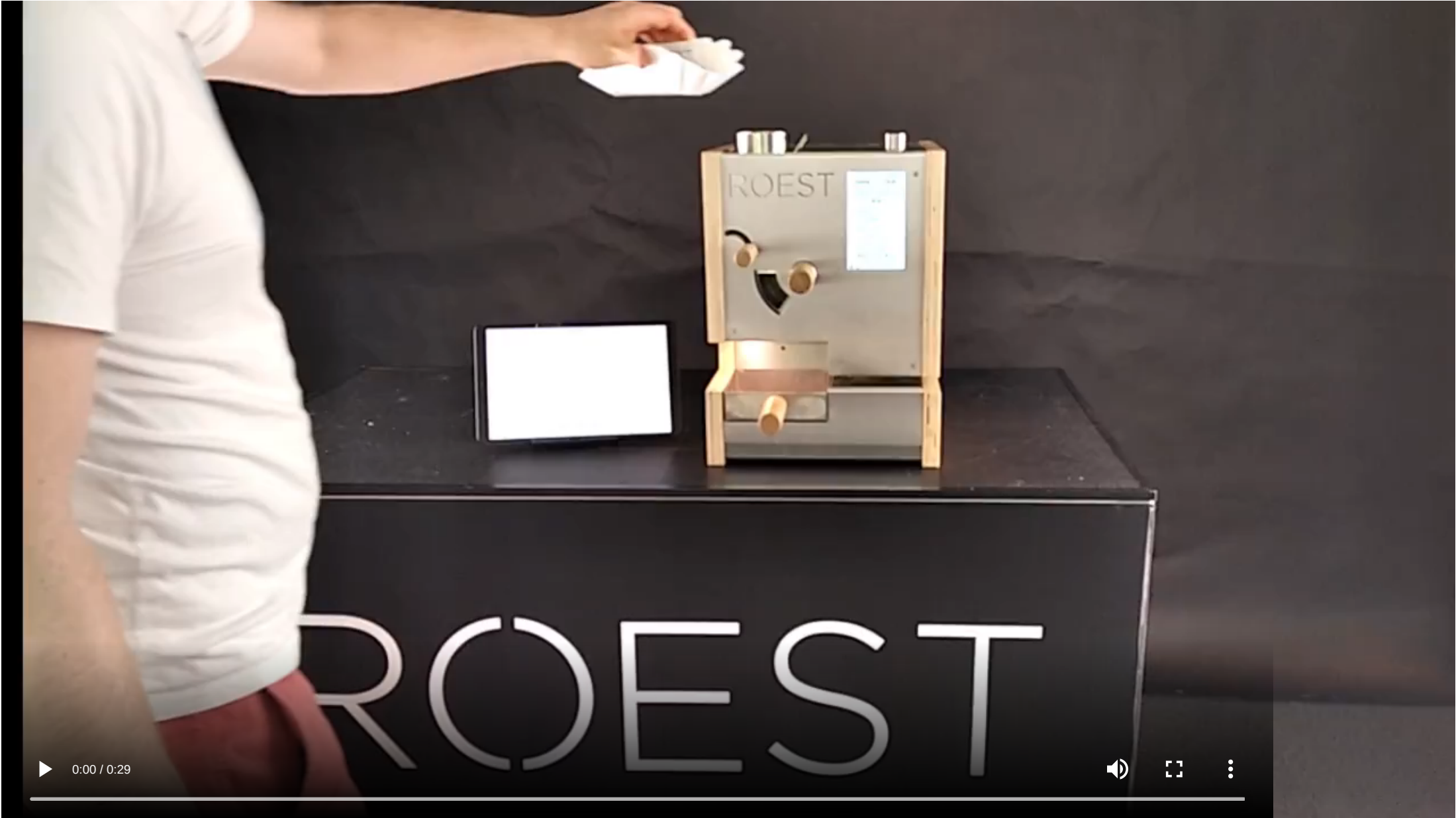


Microcontroller



Models for Sound Event Detection
Customized firmware
Custom PCB hardware

DEMO VIDEO



Benefits of fully automated roasting

- Operator can do other things while machine runs
- Improved consistency
- Works well regardless of operator skill level

Summary

- Acoustic detection of first crack
- Shipping on Roest coffee roasters since 2020
- Using TinyML solution developed by Soundsensing

WANT TO SENSE ACTIVITIES OR MONITOR MACHINERY USING SOUND AND MACHINE LEARNING?

contact@soundsensing.no

TinyML EMEA 2021: Perfect coffee roasting with TinyML sound sensing

Jon Nordby
jon@soundsensing.no



ROEST

BONUS

Bonus slides after this point

MORE RESOURCES

Machine Hearing. ML on Audio

- github.com/jonnor/machinehearing

Machine Learning for Embedded / IoT

- github.com/jonnor/embeddedml

Thesis Report & Code

- github.com/jonnor/ESC-CNN-microcontroller

WANT THE WORLDS BEST COFFEE ROASTER?

sales@roestcoffee.com

 soundsensing

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Premier Sponsor



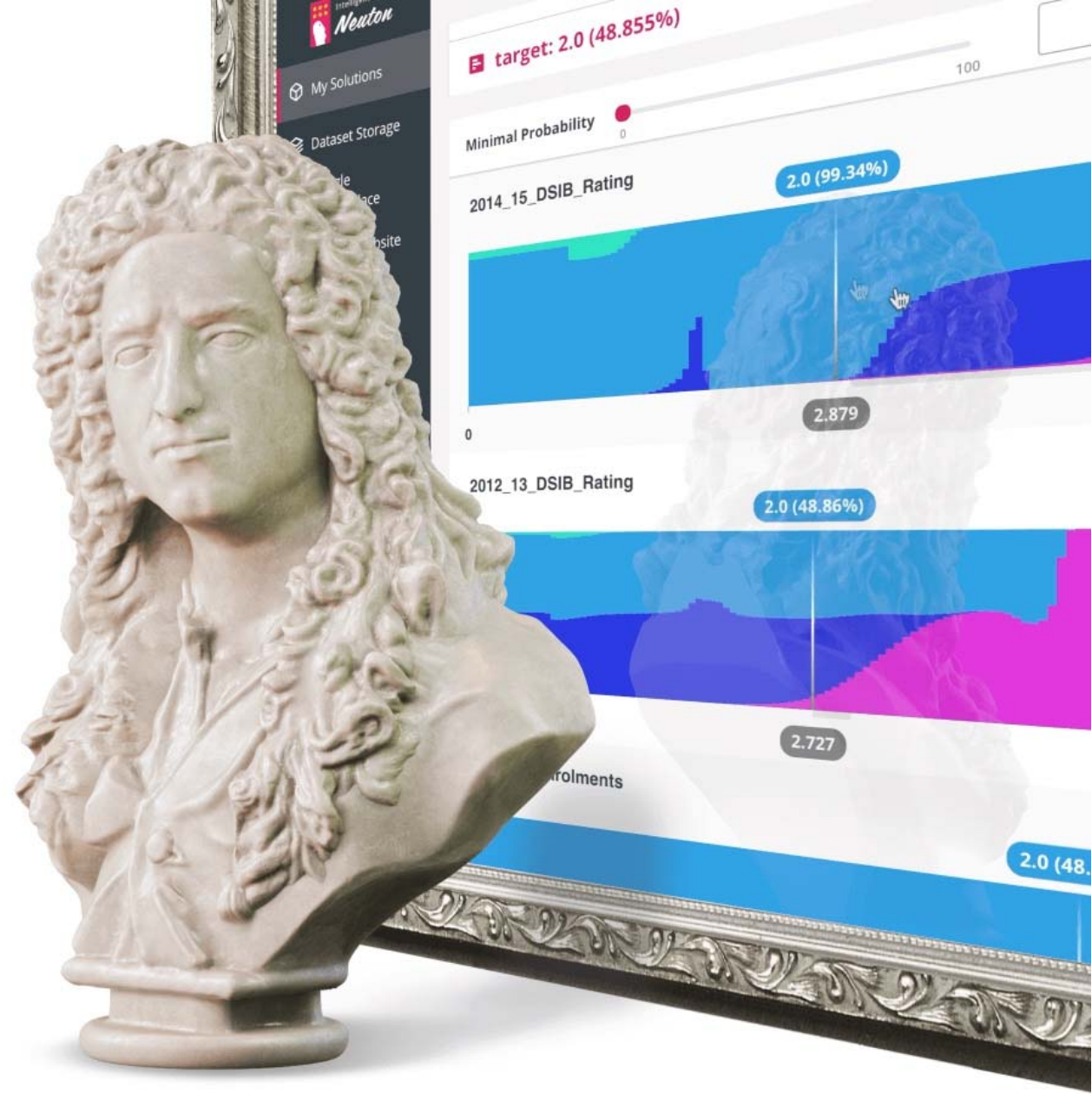
Automated TinyML

Zero-code SaaS solution

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

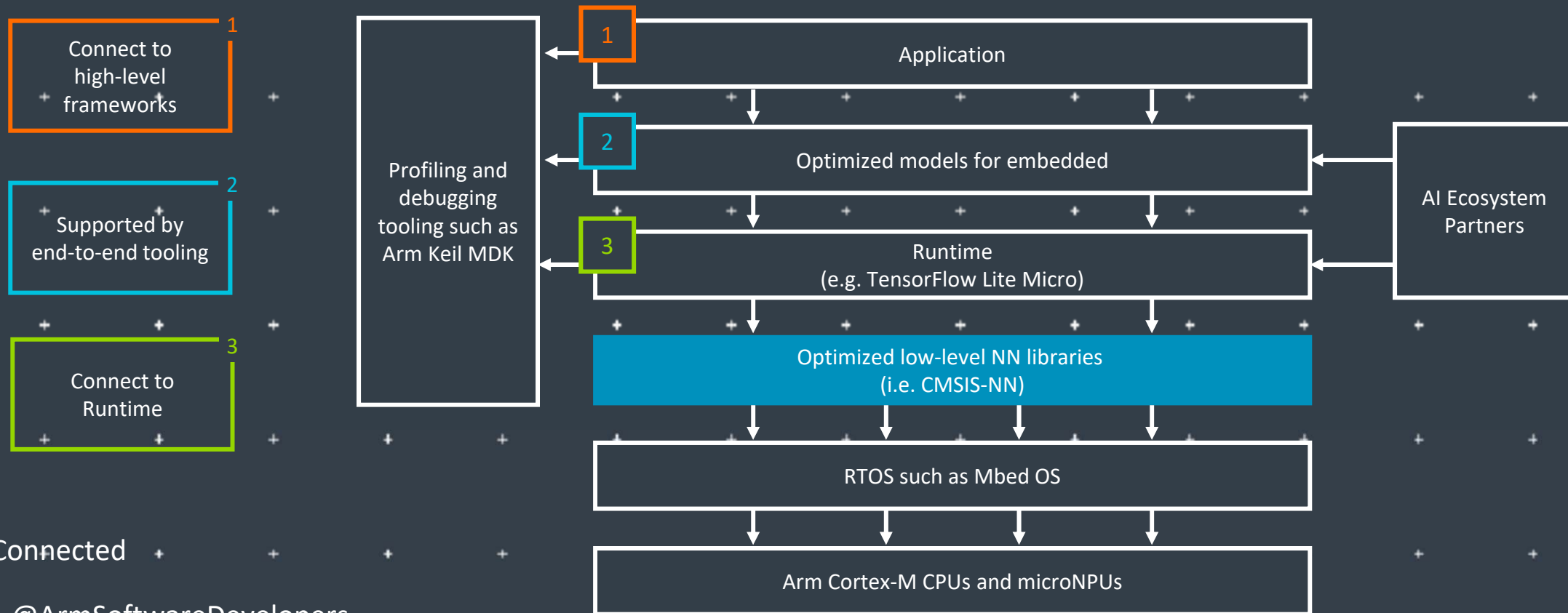
Compare the benchmarks of our compact models to those of TensorFlow and other leading neural network frameworks.

Build Fast. Build Once. Never Compromise.



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Arm: The Software and Hardware Foundation for tinyML



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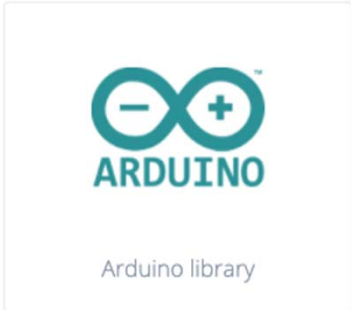
 @ArmSoftwareDev

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

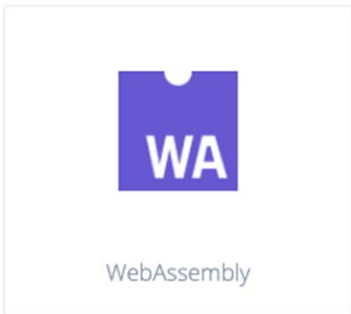
TinyML for all developers



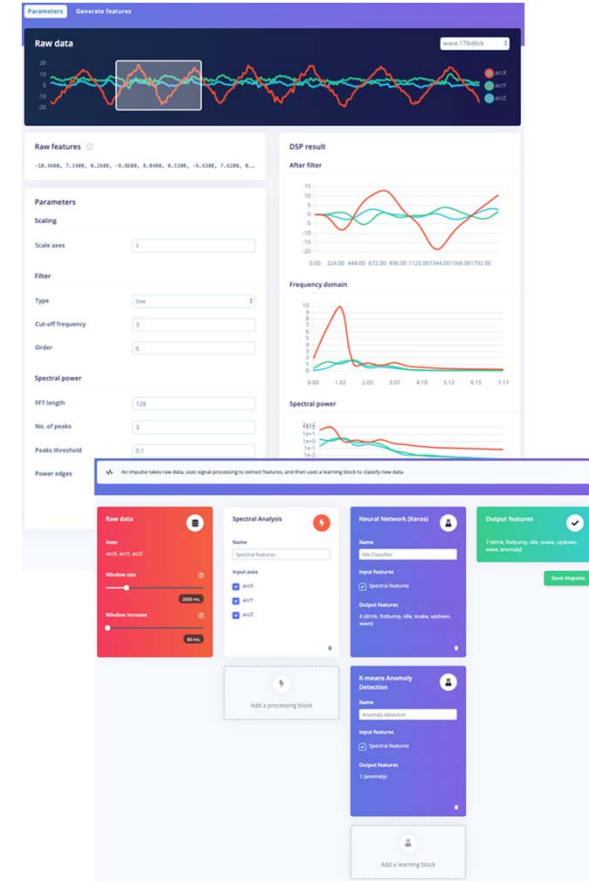
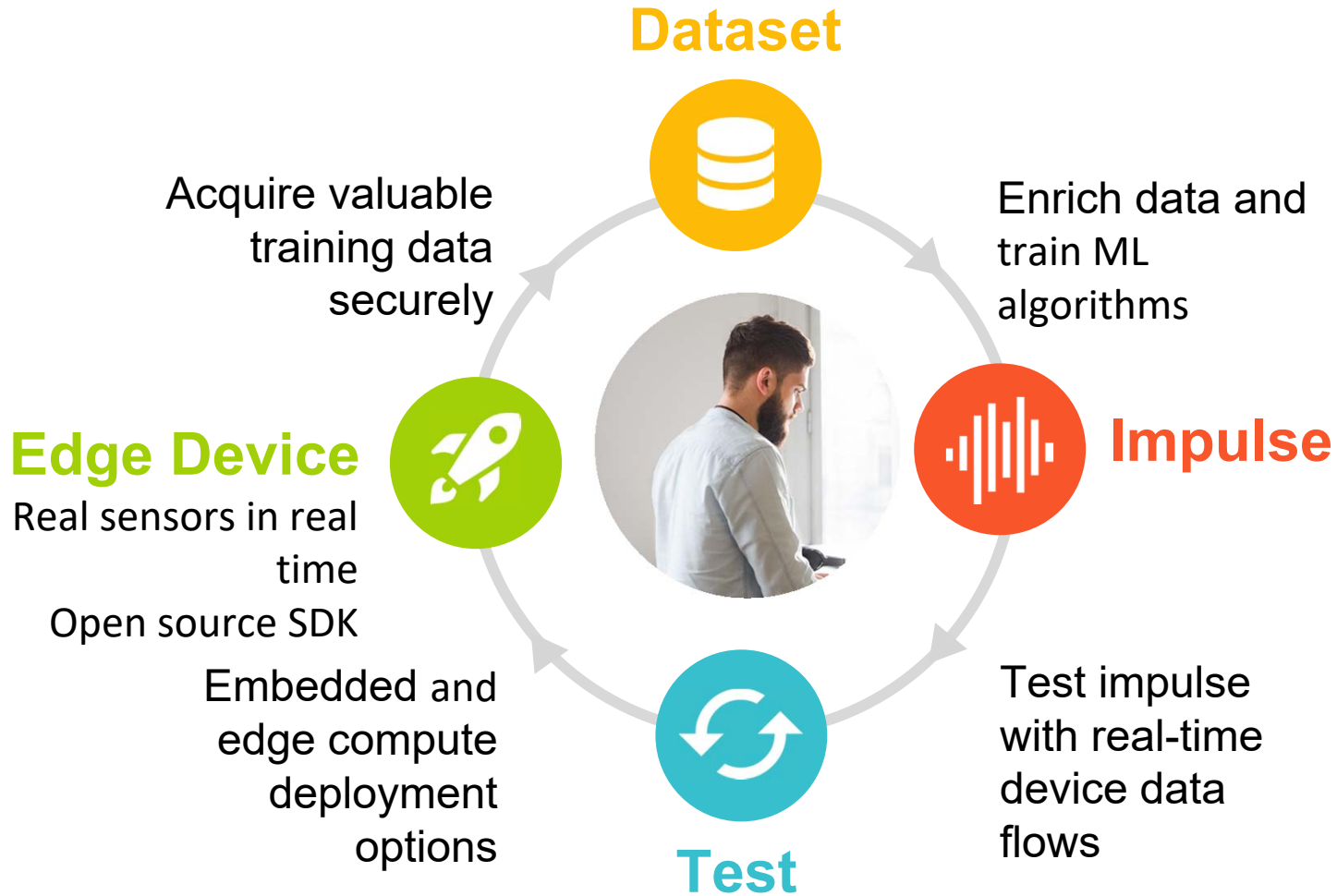
C++ library



Arduino library



WebAssembly



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



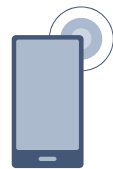
Cloud



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.

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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



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LatentAI

Adaptive AI for the Intelligent Edge

latent.ai



Build Smart IoT Sensor Devices From Data

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

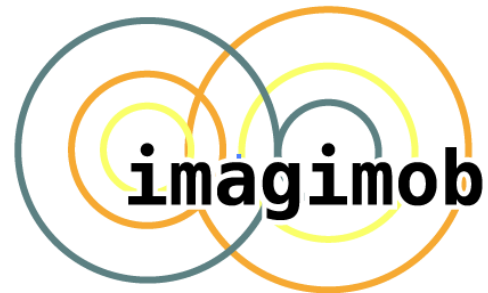
- End-to-end AI workflow
- Multi-user auto-labeling of time-series data
- Code transparency and customization at each step in the pipeline

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