

tinyML[®] Trailblazers

Ultra-low power machine learning at the edge success stories

tinyML Success Stories

with Mouna Elkhatib

CEO, CTO, and Co-Founder, AONDevices Inc.

INSPIRE-EDUCATE-ILLUMINATE



www.tinyML.org



Thank you, **tinyML Strategic Partners***,
for committing to take tinyML to the next Level, together



* as of March 28, 2022; several more under final reviews



Executive Strategic Partners

arm AI



Powering tinyML Innovation

Arm AI Virtual Tech Talks

The latest in AI trends, technologies & best practices from Arm and our Ecosystem Partners.

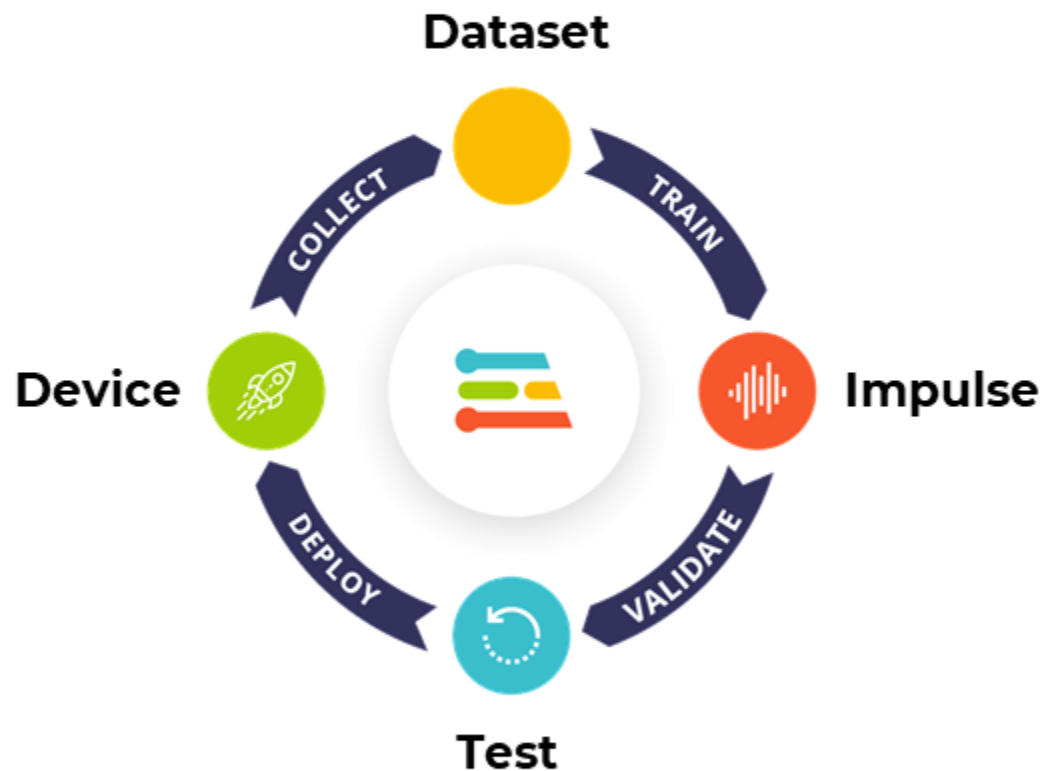
Demos, code examples, workshops, panel sessions and much more!

Fortnightly Tuesday @ 4pm GMT/8am PT

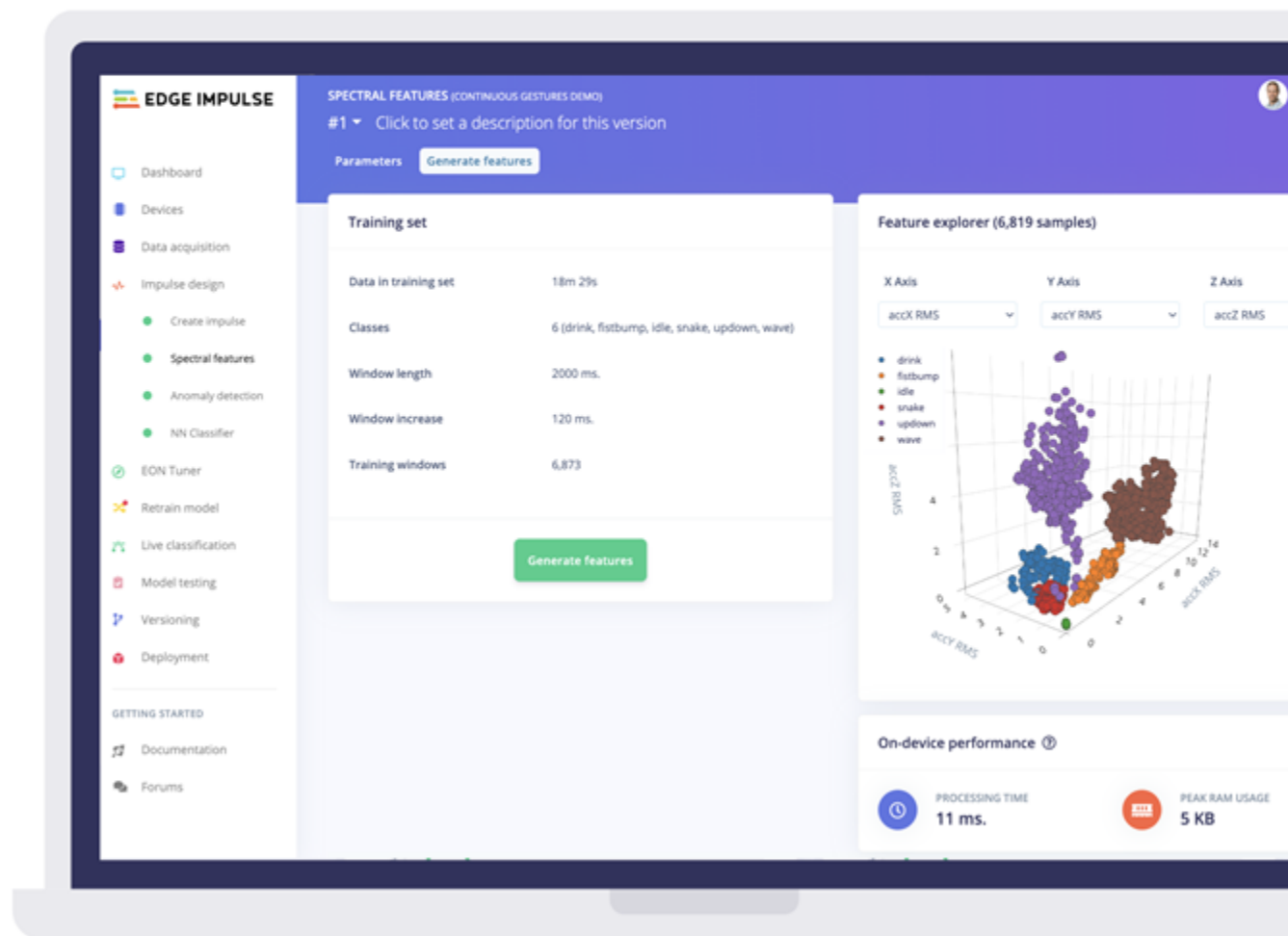
Find out more:

www.arm.com/techtalks

EDGE IMPULSE The leading edge ML platform



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

End-to-End
Deep Learning
Solutions
for
TinyML & Edge AI



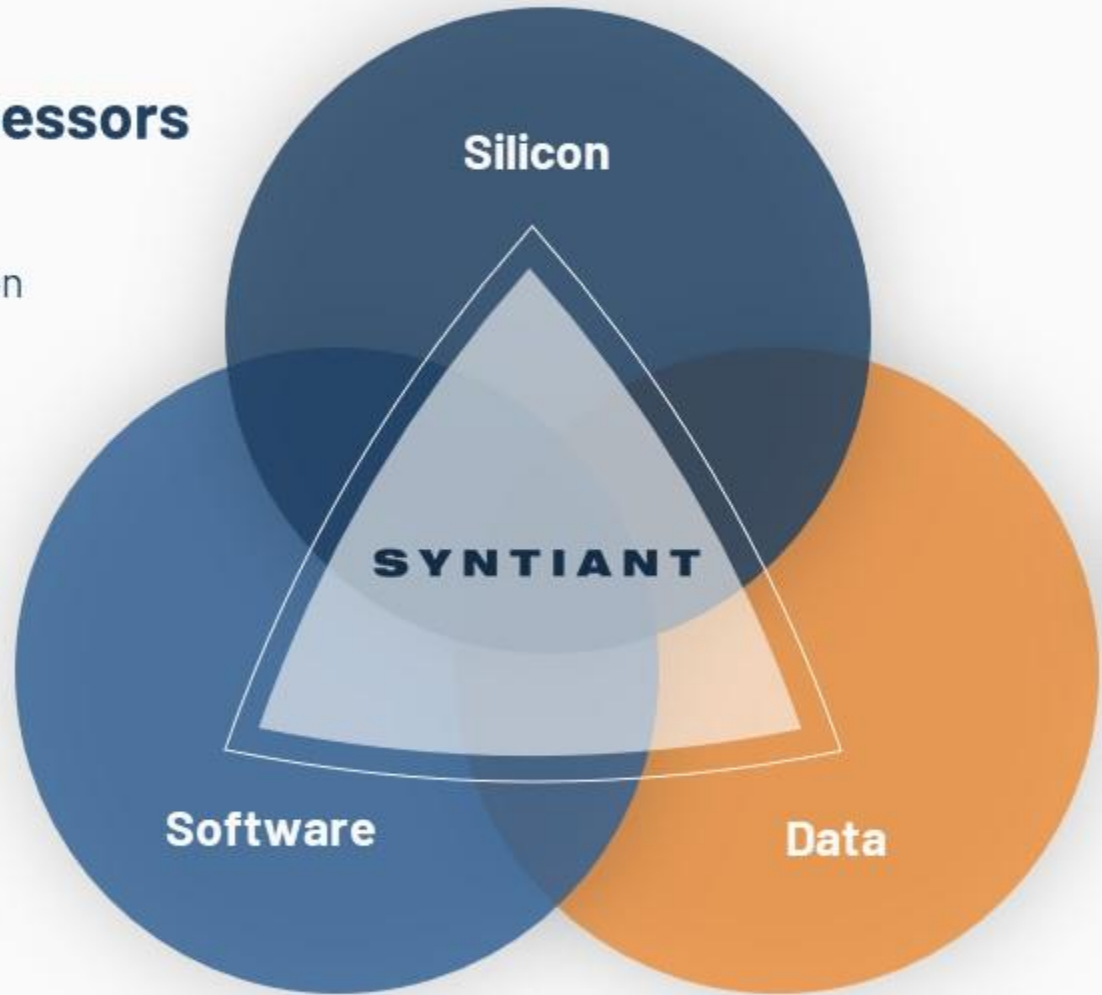
Neural Decision Processors

- At-Memory Compute
- Sustained High MAC Utilization
- Native Neural Network Processing



ML Training Pipeline

- Enables Production Quality Deep Learning Deployments



Data Platform

- Reduces Data Collection Time and Cost
- Increases Model Performance



Platinum Strategic Partners



WE USE AI TO MAKE OTHER AI FASTER, SMALLER AND MORE POWER EFFICIENT



Automatically compress SOTA models like MobileNet to <200KB with **little to no drop in accuracy** for inference on resource-limited MCUs



Reduce model optimization trial & error from weeks to days using Deeplite's **design space exploration**



Deploy more models to your device without sacrificing performance or battery life with our **easy-to-use software**

BECOME BETA USER bit.ly/testdeeplite

mobilityXlab

arm





KLIKA · TECH

GLOBAL IOT SOLUTIONS



Reality AI[®]

Add Advanced Sensing to your Product with Edge AI / TinyML

<https://reality.ai>



info@reality.ai



[@SensorAI](https://twitter.com/SensorAI)



[Reality AI](https://www.linkedin.com/company/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

BROAD AND SCALABLE EDGE COMPUTING PORTFOLIO

Microcontrollers & Microprocessors

Arm® Core



Arm® Cortex®-M 32-bit MCUs
Arm ecosystem, Advanced security, Intelligent IoT



Arm®-based High-end 32 & 64-bit MPUs
High-resolution HMI, Industrial network & real-time control



Arm® Cortex®-M0+ Ultra-low Power 32-bit MCUs
Innovative process tech (SOTB), Energy harvesting

Renesas Synergy™ Arm®-based 32-bit MCUs for Qualified Platform
Qualified software and tools

Renesas Core



Ultra-low Energy 8 & 16-bit MCUs
Bluetooth® Low Energy, SubGHz, LoRa®-based Solutions



High Power Efficiently 32-bit MCUs
Motor control, Capacitive touch, Functional safety, GUI



40nm/28nm process Automotive 32-bit MCUs
Rich functional safety and embedded security features

Core technologies

AI

A broad set of high-power and energy-efficient embedded processors

Security & Safety

Comprehensive technology and support that meet the industry's stringent standards



Digital & Analog & Power Solution

Winning Combinations that combine our complementary product portfolios

Cloud Native

Cross-platforms working with partners in different verticals and organizations

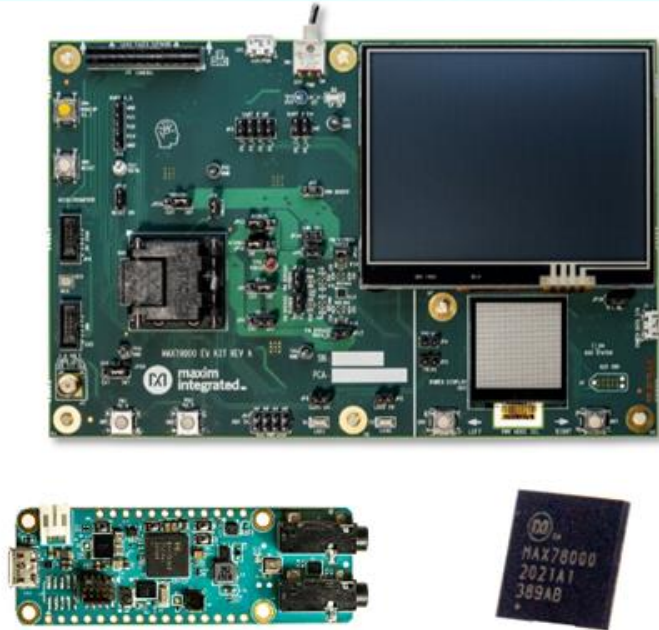


Gold Strategic Partners



Maxim Integrated: Enabling Edge Intelligence

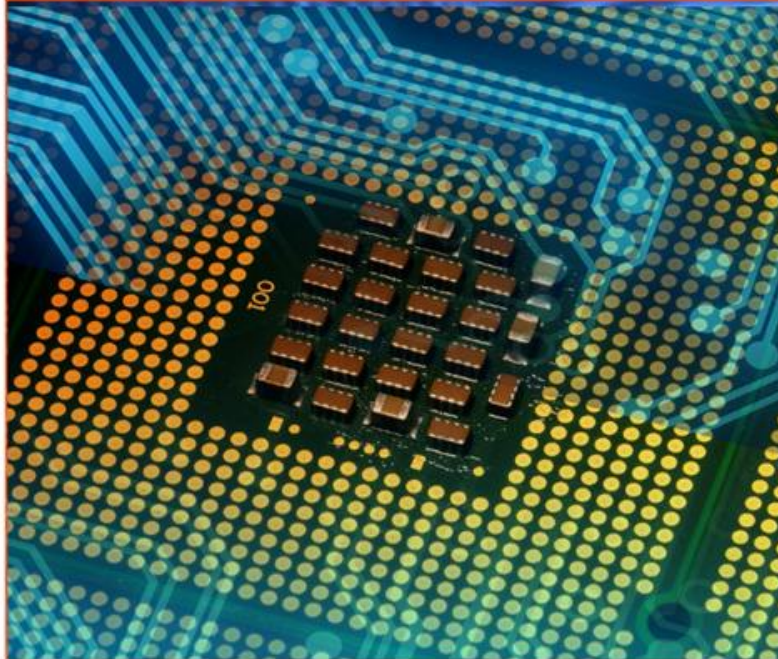
Advanced AI Acceleration IC



The new MAX78000 implements AI inferences at low energy levels, enabling complex audio and video inferencing to run on small batteries. Now the edge can see and hear like never before.

www.maximintegrated.com/MAX78000

Low Power Cortex M4 Micros



Large (3MB flash + 1MB SRAM) and small (256KB flash + 96KB SRAM, 1.6mm x 1.6mm) Cortex M4 microcontrollers enable algorithms and neural networks to run at wearable power levels.

www.maximintegrated.com/microcontrollers

Sensors and Signal Conditioning



Health sensors measure PPG and ECG signals critical to understanding vital signs. Signal chain products enable measuring even the most sensitive signals.

www.maximintegrated.com/sensors



Latent AI

Adaptive AI for the Intelligent Edge

[Latentai.com](https://latent.ai)



NXP

Deploy TinyML into the Real World - Plug and Play ML



Sensors:

- modulated and ready-to-use sensors to simplify the setup process
- support 500+ grove modules



Wio Terminal:

- completed AI platform --- integrated with a 2.4" LCD Screen, onboard IMU (LIS3DHTR), microphone, buzzer, microSD card slot, light sensor, infrared emitter(IR 940nm)

Sense



Codecraft:

- no code Programming platform to Get Started With TinML
- supports Arduino, Python, C or JavaScript etc.



Edge Impulse:

- to optimize data utilization and enable deploy a machine learning model faster than ever



TensorFlow Lite:

- to easily train low memory usage machine learning models

Train



Motion /Gesture/Speech /Smell/ Sports
Barcode/Face/Image

Inference



Artificial Nose



AI Thermal Camera for Safe Camping



Azure IoT Squirrel Feeder

Applications



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



life.augmented



SynSense

SynSense builds **sensing and inference** hardware for **ultra-low-power** (sub-mW) **embedded, mobile and edge** devices. We design systems for **real-time always-on smart sensing**, for audio, vision, IMUs, bio-signals and more.

<https://SynSense.ai>





Silver Strategic Partners

AONdevices



Grovety Inc.

HOTC





tinyML EMEA Innovation Forum 2022

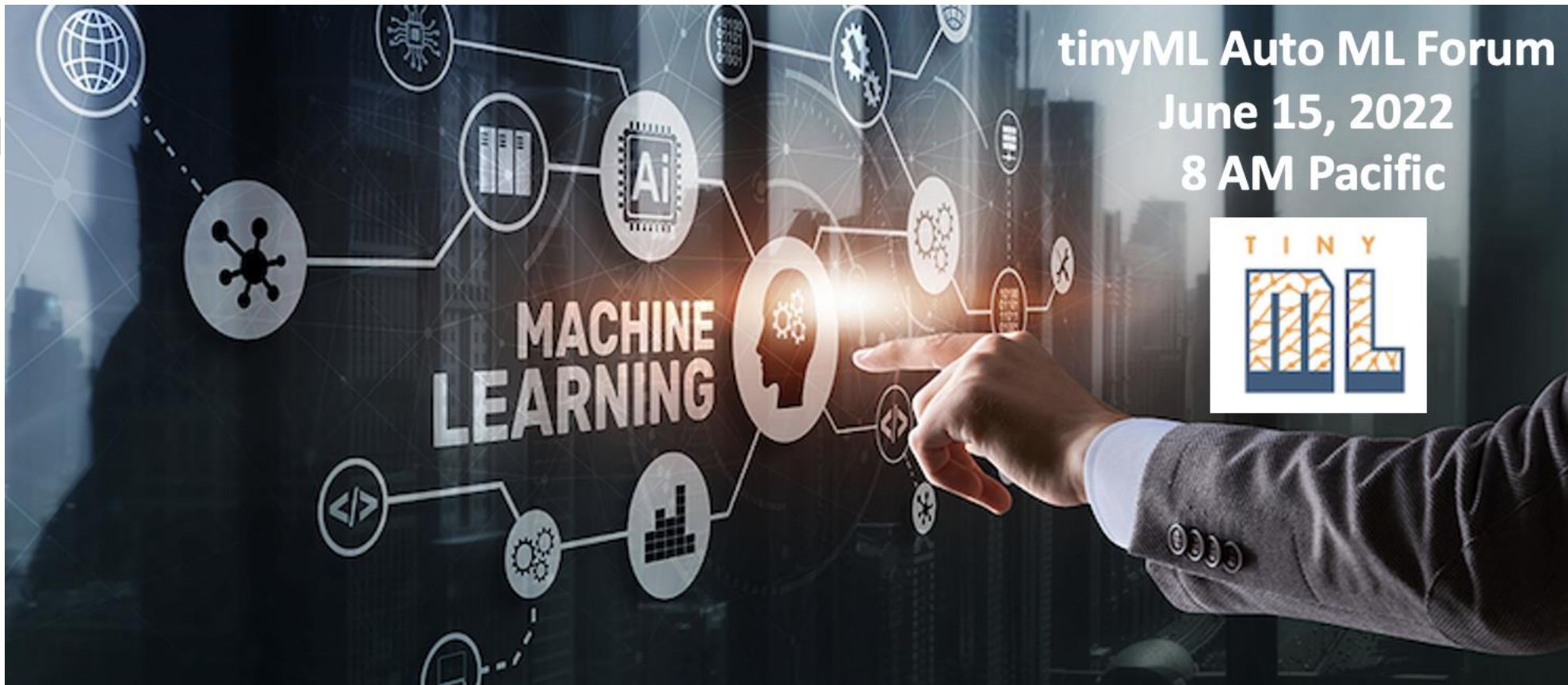
Connect, Unify, and Grow the tinyML EMEA Community
October 10-12, 2022

<https://www.tinyml.org/event/emea-2022>

Event will be held in person in Cyprus.

EMEA 2022 Call for Presentations is open till August 1st, 2022.

More sponsorships are available: sponsorships@tinyML.org



Register now!





Our next tinyML Trailblazers Series

Success Stories with Yoram Zylberberg
(CEO, Emza Visual Sense)

LIVE ONLINE July 6th, 2022 at 8 am PDT



Register now!





Join Growing tinyML Communities:



9.8k members in
45 Groups in 36 Countries

tinyML - Enabling ultra-low Power ML at the Edge

<https://www.meetup.com/tinyML-Enabling-ultra-low-Power-ML-at-the-Edge/>



2.8k members
&
7.3k followers

The tinyML Community

<https://www.linkedin.com/groups/13694488/>





Subscribe to
tinyML YouTube Channel
for updates and notifications
(including this video)
www.youtube.com/tinyML



tinyML
4.33K subscribers

6.9k subscribers, 363 videos with 219k views

HOME VIDEOS PLAYLISTS COMMUNITY CHANNELS ABOUT

tinyML Summit 2021 Partner Session: Productio... 146 views • 1 month ago

tinyML Summit 2021 Partner Session: System... 131 views • 1 month ago

tinyML Talks Massimo Banzi: tiny machine learnin... 1.4K views • 1 month ago

tinyML Summit 2021 Partner Session: It's an SN... 420 views • 1 month ago

tinyML Summit 2021 Partner Session: The... 104 views • 1 month ago

tinyML Summit 2021 Partner Session: Innovativ... 110 views • 1 month ago

Deploying AI to Embedded Systems 1:00:55

tinyML Talks: Deploying AI to Embedded Systems 430 views • 1 month ago

tinyML Summit 2021 Breaking News on... 472 views • 1 month ago

tinyML Summit 2021 Partner Session: TinyML... 160 views • 1 month ago

tinyML Summit 2021 Breaking News on... 257 views • 1 month ago

tinyML Summit 2021 Breaking News on... 299 views • 1 month ago

tinyML Summit 2021 Breaking News on... 173 views • 1 month ago

tinyML Summit 2021 Partner Session: Machine... 14:50

tinyML Summit 2021 Partner Session: Tiny and... 18:00

tinyML Summit 2021 tiny Talks: Real-World... 16:21

tinyML Summit 2021 tiny Talks: Environmental Nois... 14:49

tinyML Summit 2021 tiny Talks: Breaking News on... 15:26

tinyML Summit 2021 tiny Talks: Insights from a Mult... 19:18

tinyML Summit 2021 tiny Talks: TinyML Software... 24:18

tinyML Summit 2021 Keynote: Data-Free Model... 47:01

tinyML Summit Partner Session: Pushing the AI... 34:12

tinyML Summit 2021 Partner Session: Low pow... 18:27

tinyML Summit 2021 Partner Session: How... 21:48

tinyML Summit 2021 Partner Session: Low-pow... 17:42

tinyML Summit 2021 Partner Session: TinyML is... 13:09

tinyML Summit 2021 Keynote: Efficient Audio... 42:31

tinyML Summit 2021 tiny Talks: An Introduction to a... 19:23

tinyML Summit 2021 tiny Talks: Low-precision... 16:20

tinyML Summit 2021 tiny Talks: Hardware Aware... 16:18

tinyML Summit 2021 tiny Talks: Neutrino: A BlackBo... 14:27

tinyML Summit 2021 Panel Discussion: tinyML... 1:01:15

tinyML Summit 2021 tiny Talks: Person Detection... 18:26

tinyML Summit 2021 tiny Talks: Using Neural... 19:03

tinyML Summit 2021 Keynote: Adaptive Neural... 55:15

tinyML Summit 2021 Keynote: milliJoules for... 99:43

tinyML Summit 2021 Market Opportunities for Edge AI 51:28



Reminders

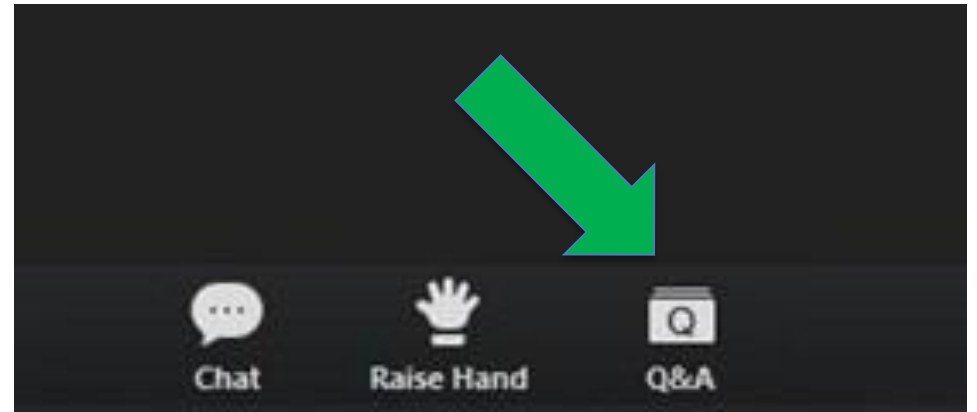
Slides & Videos will be posted tomorrow

Please use the Q&A window for your questions



tinyml.org/forums

youtube.com/tinyml





Host of the Trailblazers Series

Chris Rowen



Chris is a Silicon Valley entrepreneur and technologist, now VP of AI Engineering and Product for Webex Collaboration in Cisco. Most recently he was co-founder and CEO of BabbleLabs, a speech ML company, acquired by Cisco in 2020. Prior to Babblelabs, Chris served as CTO for Cadence's IP Group, which he joined after Cadence's acquisition of Tensilica, the company he founded in 1997 to develop extensible processors. He led Tensilica as CEO and later, CTO, to develop one of the most prolific embedded processor architectures, especially for compute-intensive embedded processing. Chris was a pioneer in developing RISC architecture and helped found MIPS Computer Systems in 1984. He has an MS and PhD in EE from Stanford and a BA in physics from Harvard. He was named an IEEE Fellow in 2015 for his work in development of microprocessor technology.



Today's Guest

Mouna Elkhatib



Mouna Elkhatib, CEO, CTO, and Co-Founder of AONDevices, Inc, a leader in edge AI for speech, sound, and sensor fusion. Mouna managed the formation of AONDevices, growing the team locally and internationally. An industry expert in voice and audio processing, she architected and led the development of the AONDevices product line and won multiple agreements with tier 1 semiconductor companies. Prior to AONDevices, Mouna architected and led the development of industry leading voice and audio semiconductor solutions for smartphones, PCs, smart speakers, and Internet of Things (IoT) at Qualcomm and Conexant. Mouna is an active member of a number of industry organization, serves on the Global Semiconductor Alliance Women's Leadership Council, runs the WLI Entrepreneurial Committee, and contributes to the advancement of Edge AI. She holds an engineering degree from Ecole Nationale Supérieure d'Electricité et de Mécanique (ENSEM), eleven US patents and eleven pending patents.



Thank you, **tinyML Strategic Partners***,
for committing to take tinyML to the next Level, together



* as of March 28, 2022; several more under final reviews



Copyright Notice

This multimedia file is copyright © 2022 by tinyML Foundation. All rights reserved. It may not be duplicated or distributed in any form without prior written approval.

tinyML[®] is a registered trademark of the tinyML Foundation.

www.tinyml.org



Copyright Notice

This presentation in this publication was presented as a tinyML® Talks webcast. The content reflects the opinion of the author(s) and their respective companies. The inclusion of presentations in this publication does not constitute an endorsement by tinyML Foundation or the sponsors.

There is no copyright protection claimed by this publication. However, each presentation is the work of the authors and their respective companies and may contain copyrighted material. As such, it is strongly encouraged that any use reflect proper acknowledgement to the appropriate source. Any questions regarding the use of any materials presented should be directed to the author(s) or their companies.

tinyML is a registered trademark of the tinyML Foundation.

www.tinyML.org