tinyML® Talks

Enabling Ultra-low Power Machine Learning at the Edge

"TinyML SG Meet and Greet"

Vincent Kok - UBTECH Robotics

Soham Chatterjee - Sleek Tech

Archana Vaidheeswaran - DHL Express

March 16, 2022

www.tinyML.org

tinyML Talks Strategic Partners

Additional Sponsorships available – contact Olga@tinyML.org for info

TINY ML TALKS webcast

Executive Strategic Partners

arm AI

Powering tinyML Innovation

Arm AI Virtual Tech Talks

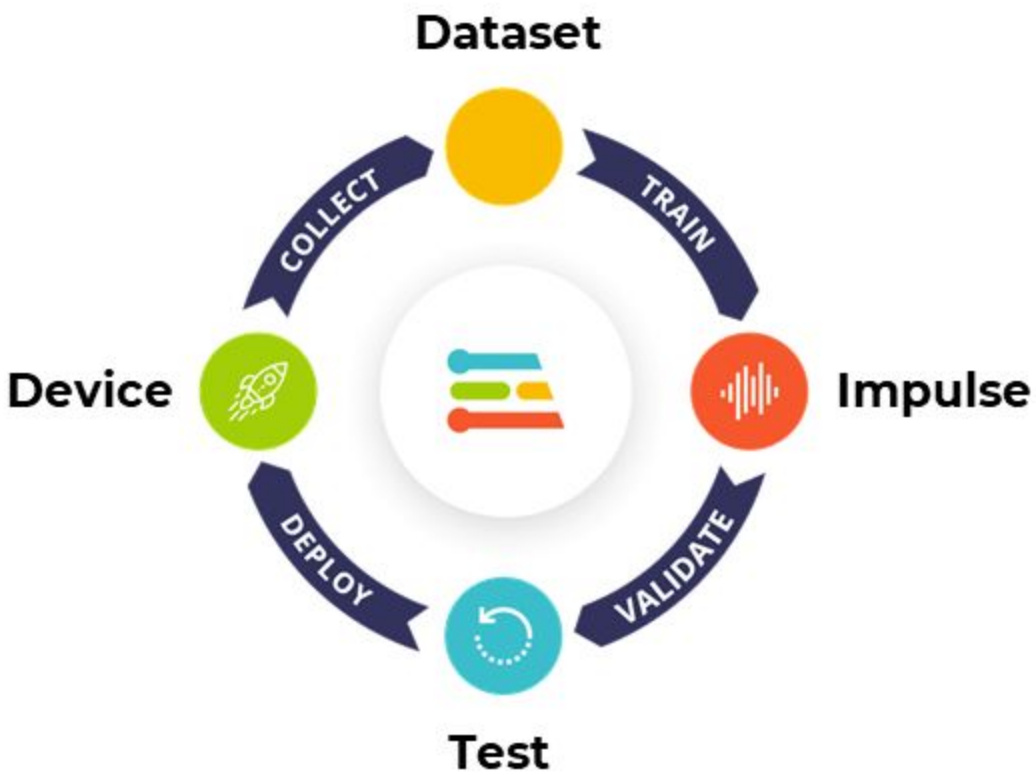
The latest in AI trends, technologies & best practices from Arm and our Ecosystem Partners.

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

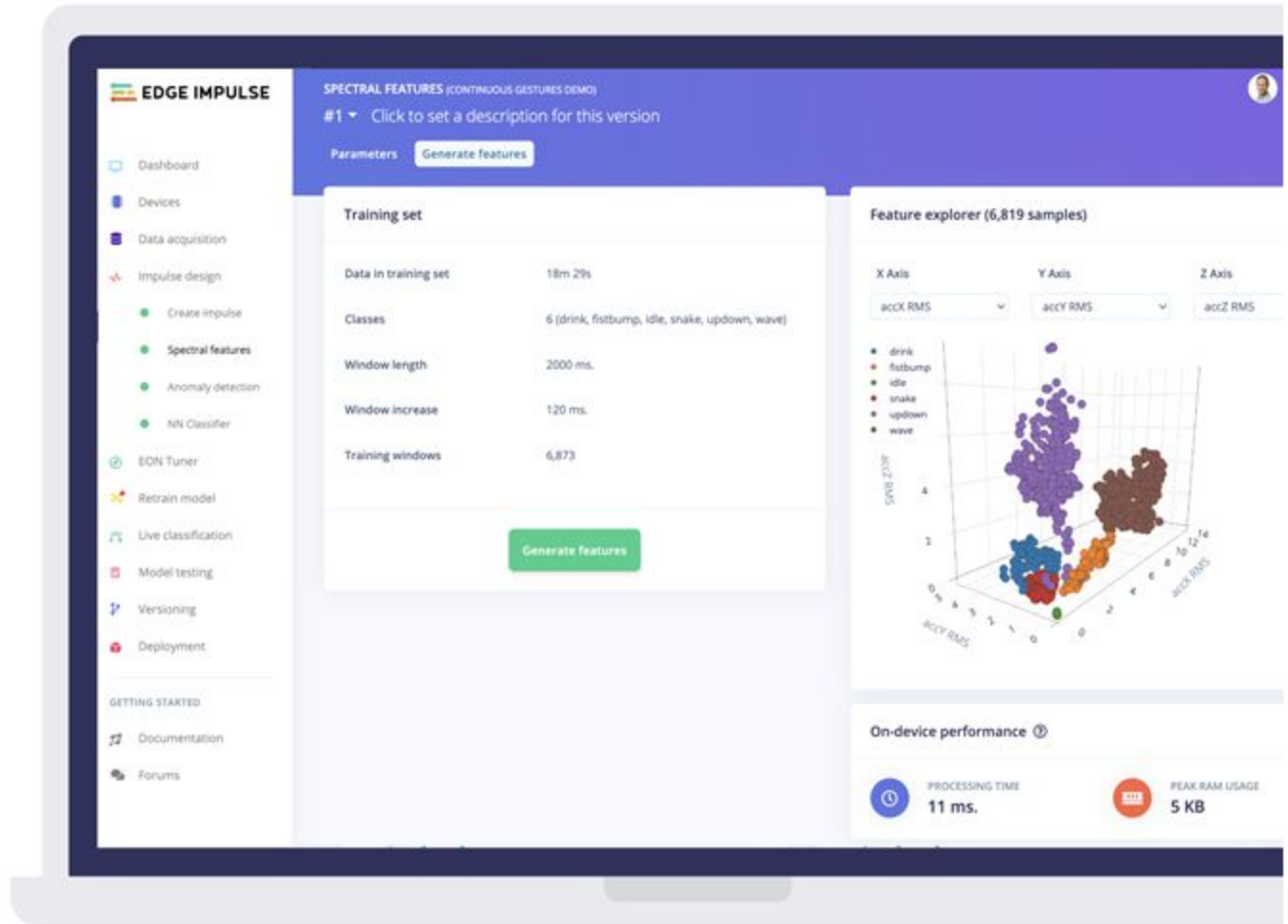
Fortnightly Tuesday @ 4pm GMT/8am PT

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

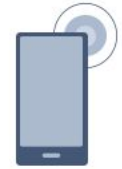
Reinforcement learning for decision making

Edge cloud

Cloud

IoT/IIoT

Automotive



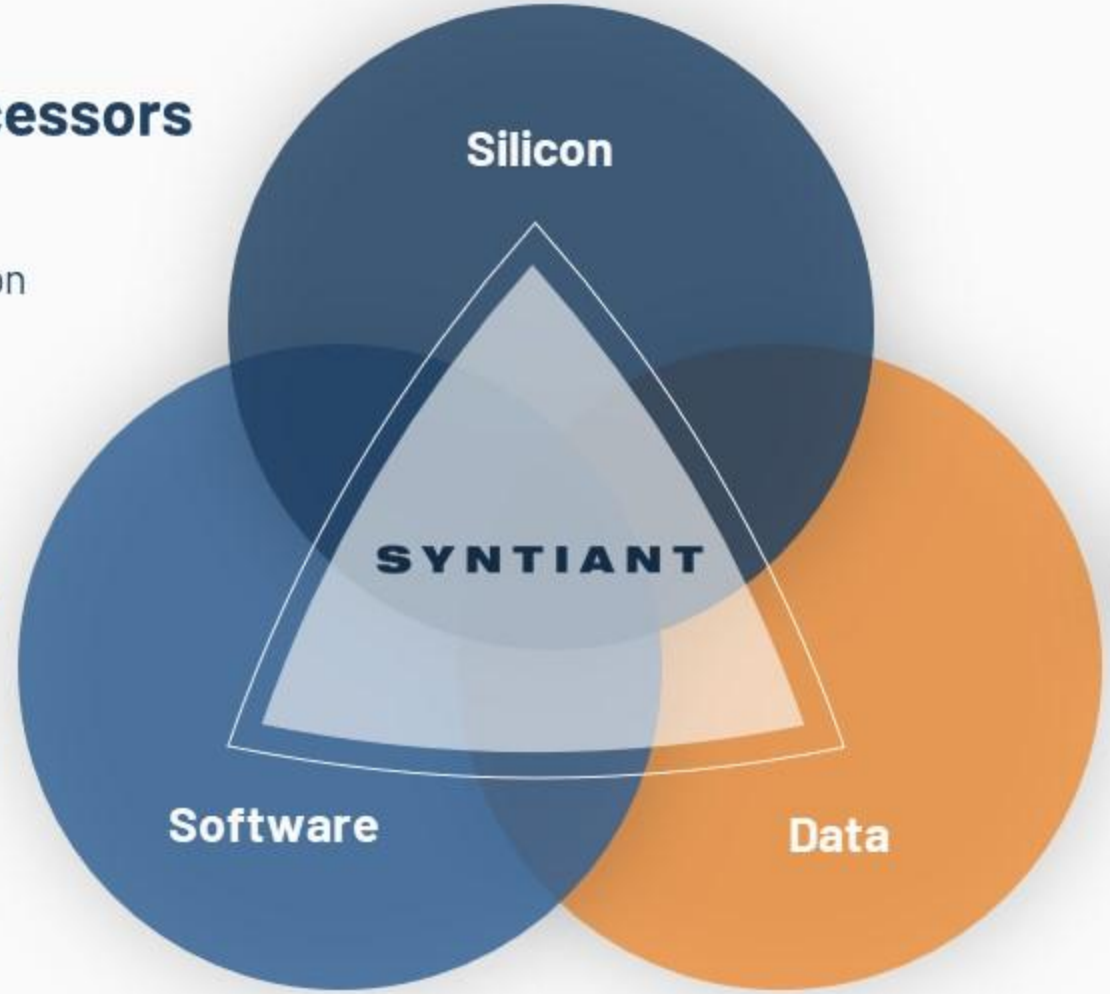
Mobile

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

partners@syntiant.com

www.syntiant.com

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Deeplite

Fastest Video Analytics Solutions on Arm CPUs

AI Trailblazers Award Winner

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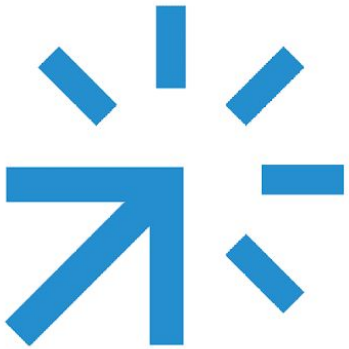

KLIKA·TECH

GLOBAL IOT SOLUTIONS

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

BROAD AND SCALABLE EDGE COMPUTING PORTFOLIO

Microcontrollers & Microprocessors

Arm® Core

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

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

RE — 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

RL78 — Ultra-low Energy 8 & 16-bit MCUs
Bluetooth® Low Energy, SubGHz, LoRa®-based Solutions

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

RH850 — 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

BIG IDEAS FOR EVERY SPACE RENESAS

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Gold Strategic Partners

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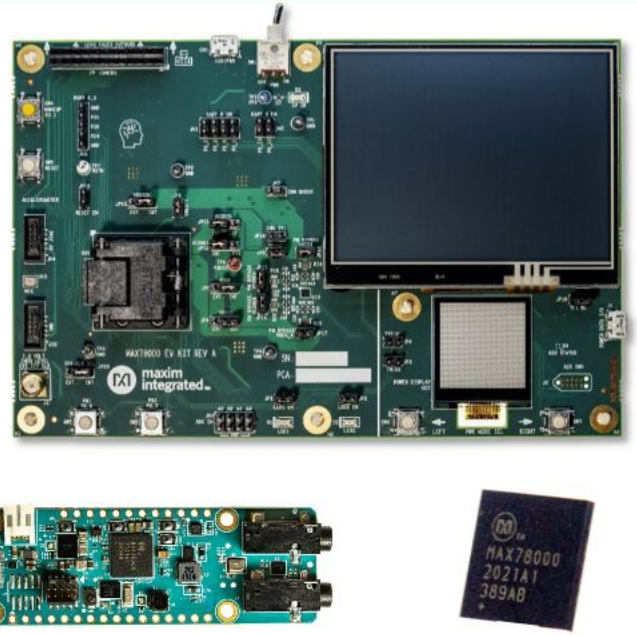
Maxim Integrated: Enabling Edge Intelligence

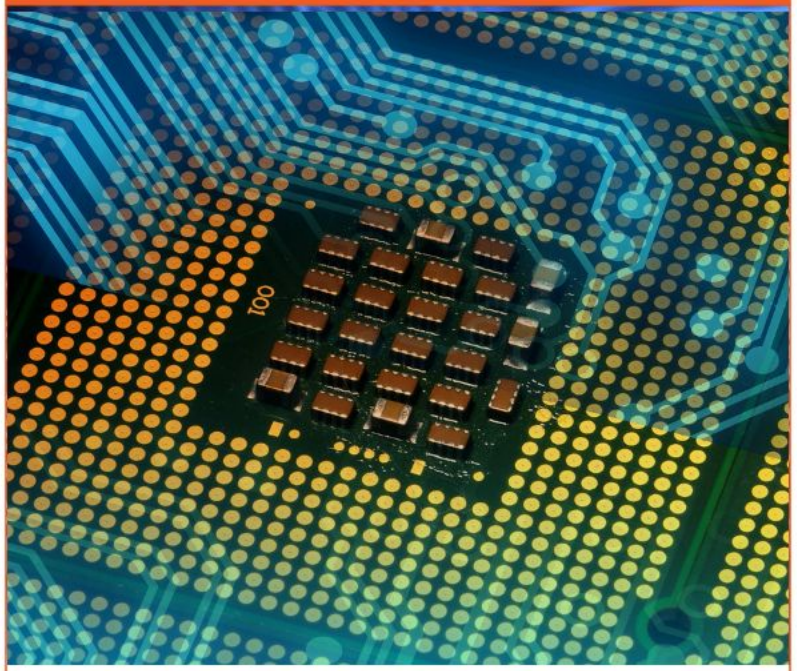
Advanced AI Acceleration IC



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

LatentAI

Adaptive AI for the Intelligent Edge

Latentai.com

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NXP


seeed
studio
The IoT Hardware Enabler

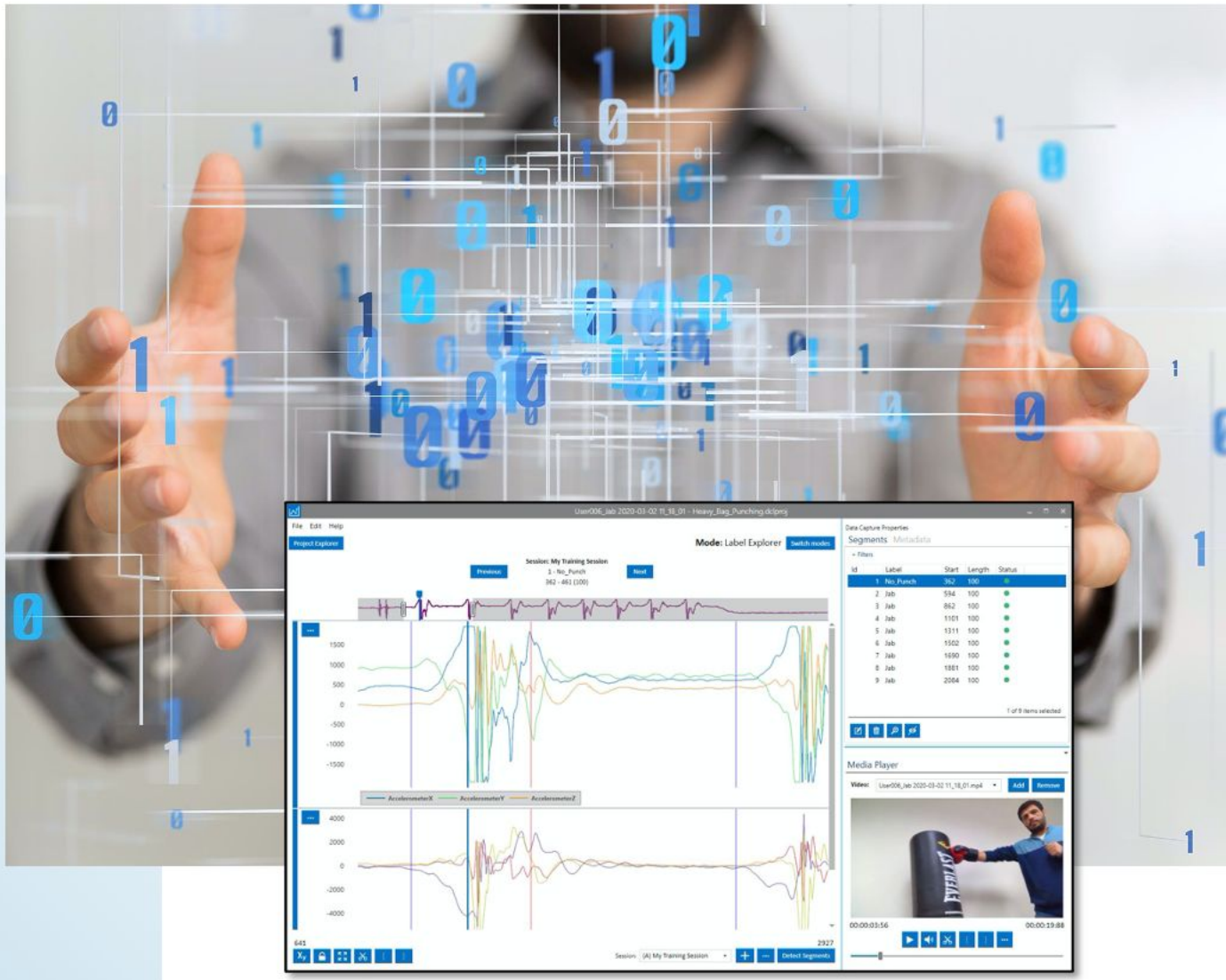
SensiML™

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

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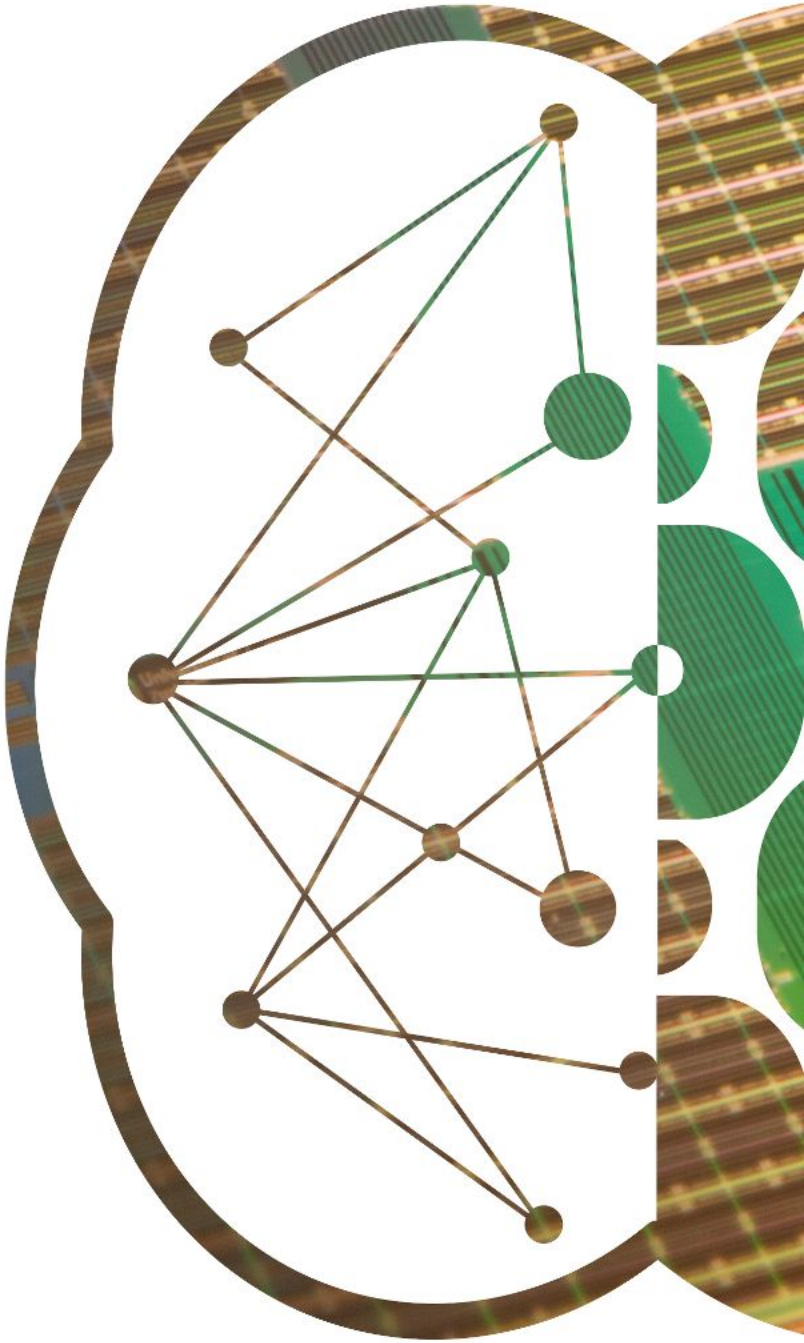
SynSense

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



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AONdevIces

emza visual sense

GREENWAVES TECHNOLOGIES

Groovety Inc.

HOTG

imagimob

itemis

PROPHESEE METAVISION FOR MACHINES

Qeexo

REXEN technology

SAP

SA STREAM ANALYZE

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tinyML Summit 2022

Miniature dreams can come true…

March 28-30, 2022

Hyatt Regency San Francisco Airport

https://www.tinyml.org/event/summit-2022/

*The Best Product of the Year and the Best Innovation of the Year awards are open for nominations between **November 15 and March 14.***

tinyML Research Symposium 2022

March 28, 2022

https://www.tinyml.org/event/research-symposium-2022

More sponsorships are available: sponsorships@tinyML.org

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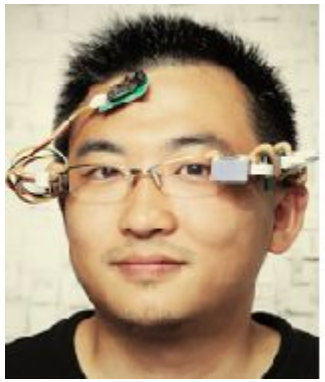
Our next tinyML Trailblazers Series

Success Stories with Eric Pan

(Founder, Seeed Studio and Chaihuo Makerspace)

LIVE ONLINE **April 6th, 2022 at 8 am PST**



TINY ML TRAILBLAZERS

Register now!

Join Growing tinyML Communities:

8.5k members in
43 Groups in 34 Countries

tinyML - Enabling ultra-low Power ML at the Edge

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

2.7k members
&
5.4k followers

The tinyML Community

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

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YouTube

Subscribe to tinyML YouTube Channel for updates and notifications

(including this video)

www.youtube.com/tinyML

Next tinyML Talks

Date	Presenter	Topic / Title
Friday, March 25	Mithun Das and Sashrika Das, Distinguished Software Engineer, Cox Automotive	How A Middle School Girl Solves a Real-Life Challenge Using TinyML: Gas Leak Detection

Webcast start time is 6:00 pm Pacific time

Please contact talks@tinyml.org if you are interested in presenting

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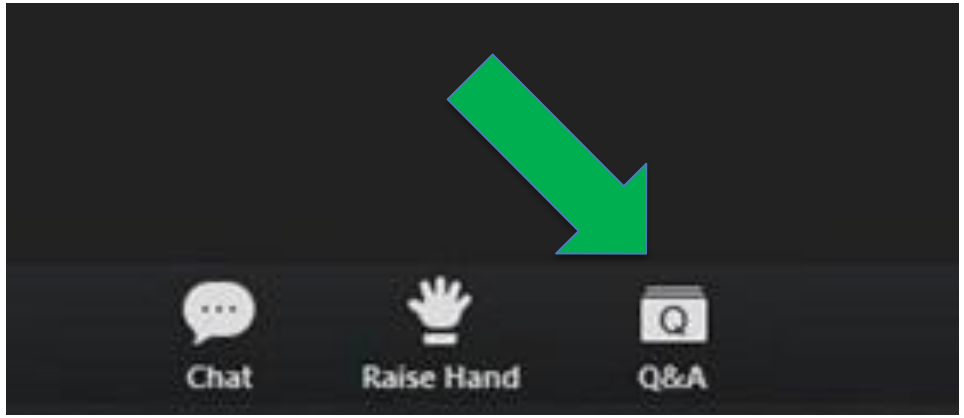
Reminders

Slides & Videos will be posted tomorrow

tinyml.org/forums

youtube.com/tinyml

Please use the Q&A window for your questions



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Vincent Kok

Vincent's areas of focus are AI + Robotics, Internet of Things (IoT), Machine Learning, Cloud & Edge Computing, and Community Building. Currently, he is a Product & Sales Manager working along with an AI unicorn company based in Shenzhen (UBTECH Robotics). Vincent is actively involved with the developer community, loves empowering others to learn and share their work. He enjoys attending Maker Faire events worldwide, to learn about different innovations and network with like-minded people. Act as Community Evangelist for the Embedded Systems Professionals Discord channel, FIRST by Packt: Embedded System Professionals. Vincent has a passion for constant learning and keeping himself current with the latest technology and its applications and the impact it has on the community. His tagline is "GET INSPIRED, MAKE THINGS HAPPEN!"

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Archana Vaidheeswaran

Archana works as a Data Scientist at DHL Express. She loves dabbling in TinyML i.e applying machine learning models to small devices with low power and memory requirements. She is currently running the ScaleDown project. After work, you can usually find Archana at Women Who Code, helping to build analytics dashboards for online events.

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Soham Chatterjee

Soham is a machine learning engineer at Sleek Tech, Singapore. Previously, he was a research master's Student at NTU where he did research on combining edge computing techniques with neuromorphic hardware to build optimized microcontrollers. He is also the instructor for Udacity Nanodegree "Intel Edge AI for IoT Developers", where he taught how to optimize models for edge computing applications. Soham's passion for TinyML and MLOps led him to combine the two to build tools and techniques to efficiently and easily deploy TinyML models including ScaleDown where he is a core developer. Apart from this, Soham is also the instructor for Udacity's "Machine Learning Engineer with Microsoft Azure" Nanodegree and "AWS Machine Learning" Nanodegree.

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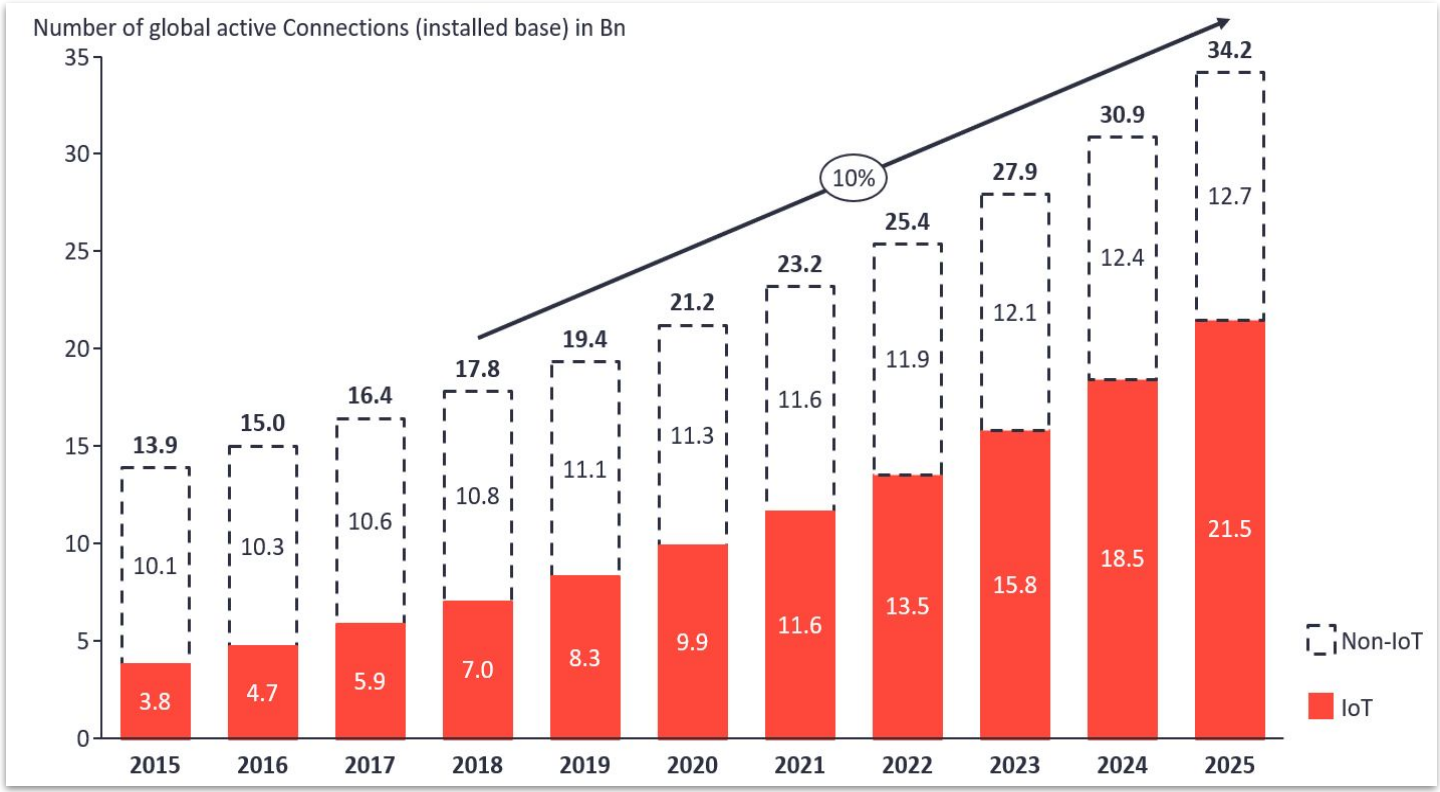
Internet of Things

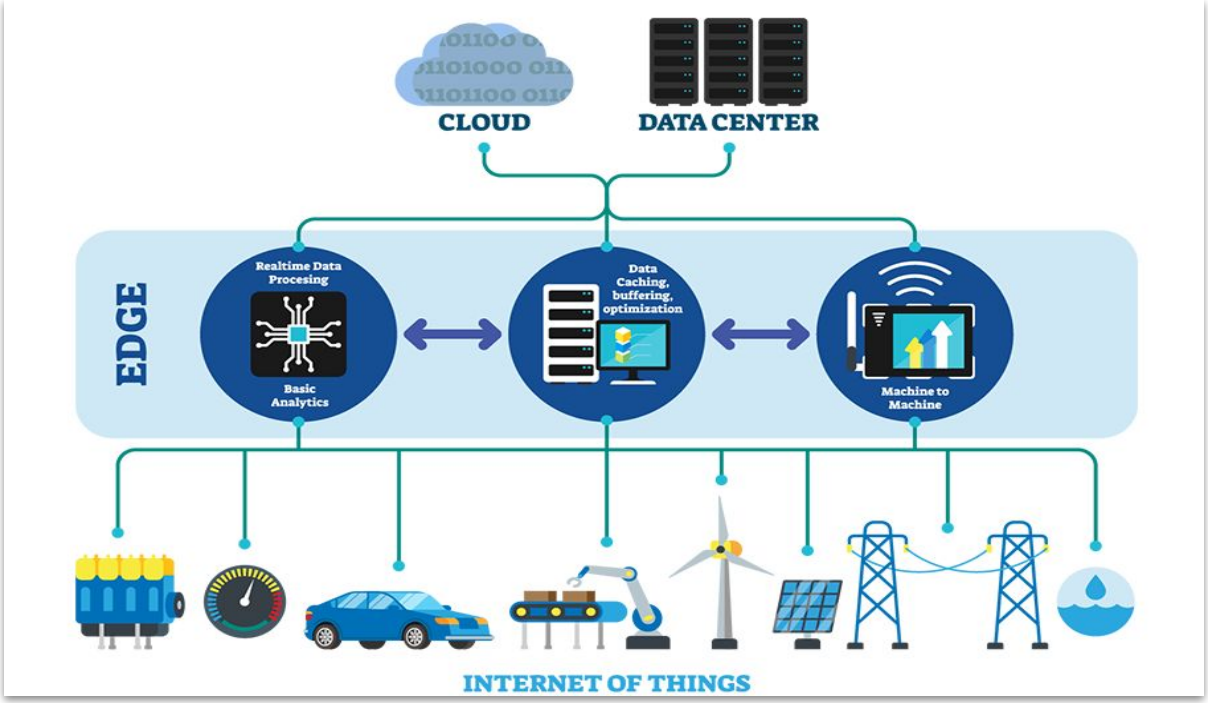
- IoT devices have a microcontroller and sensors
- They can collect and transfer data, as well as perform simple tasks
- IoT devices have become popular over the last few years
- They are used as smart home and fitness devices, but are also being used in industrial settings
- However **99% of IoT sensor data is discarded**



State of IoT; iot-analytics.com

Internet of Things and Edge Computing

- Most DL models are deployed on cloud servers
- Running models closer to where the data is being generated is called edge computing



Edge Computing Use Cases; innovationatwork.ieee.org

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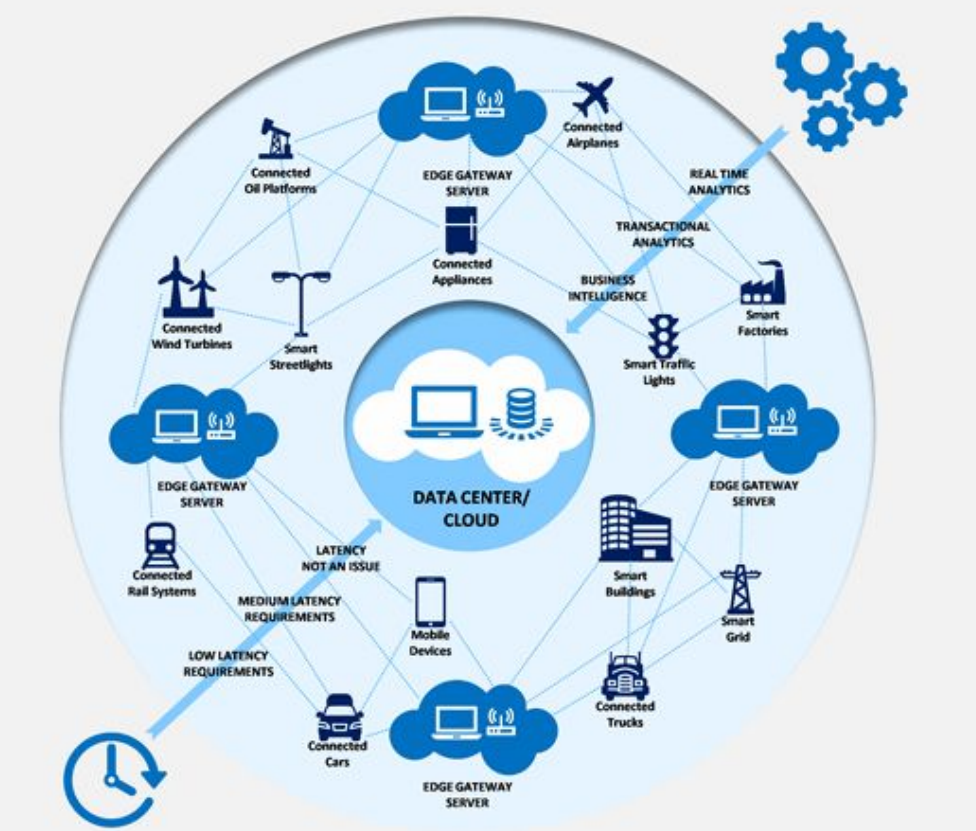
Edge Computing



1- Increase in IoT devices causes an increase in cloud dependency

2-Need edge devices which have their own data centres

3-The computing that is performed in those data centers is Edge computing

4- Application: Security Cameras, Self Driving Cars

Advantages of Edge Computing

- Reduced Latency
- Reduced Internet Bandwidth
- Increased Security
- Reduction in Dependence on Cloud Services

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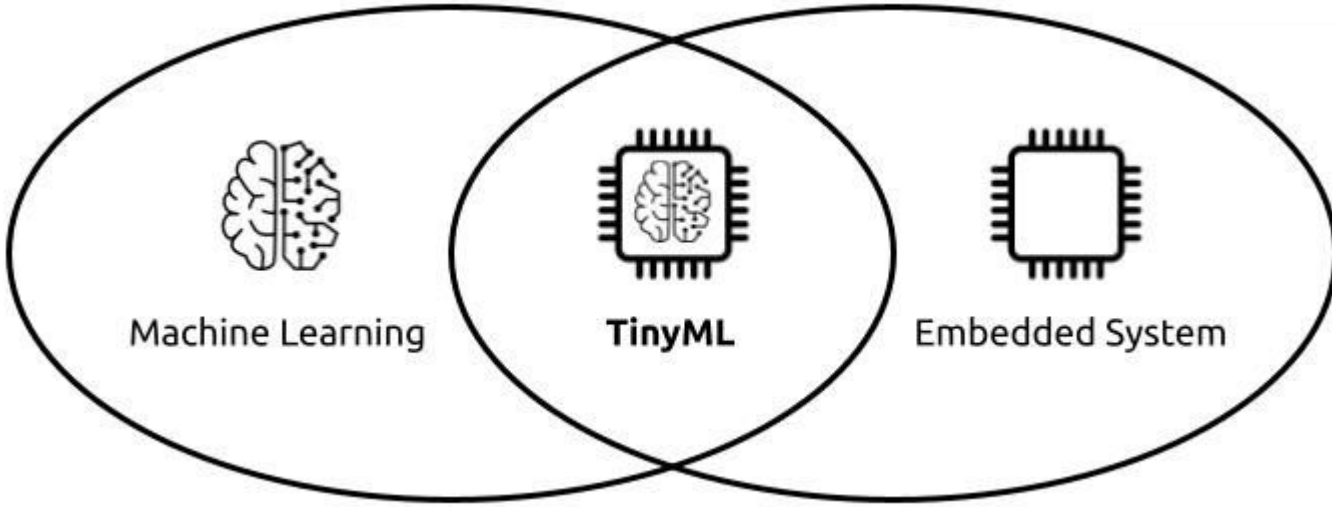
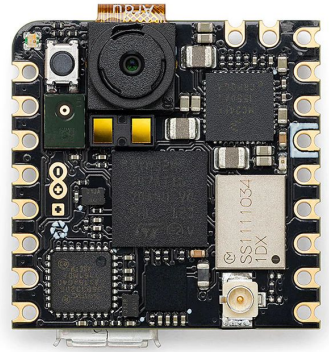
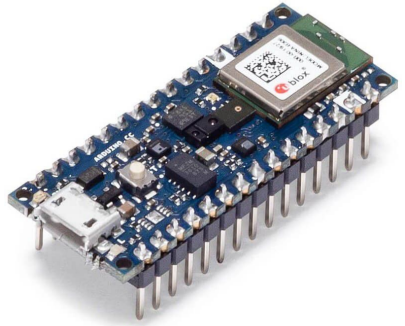
TinyML?

TensorFlow Lite





EDGE IMPULSE



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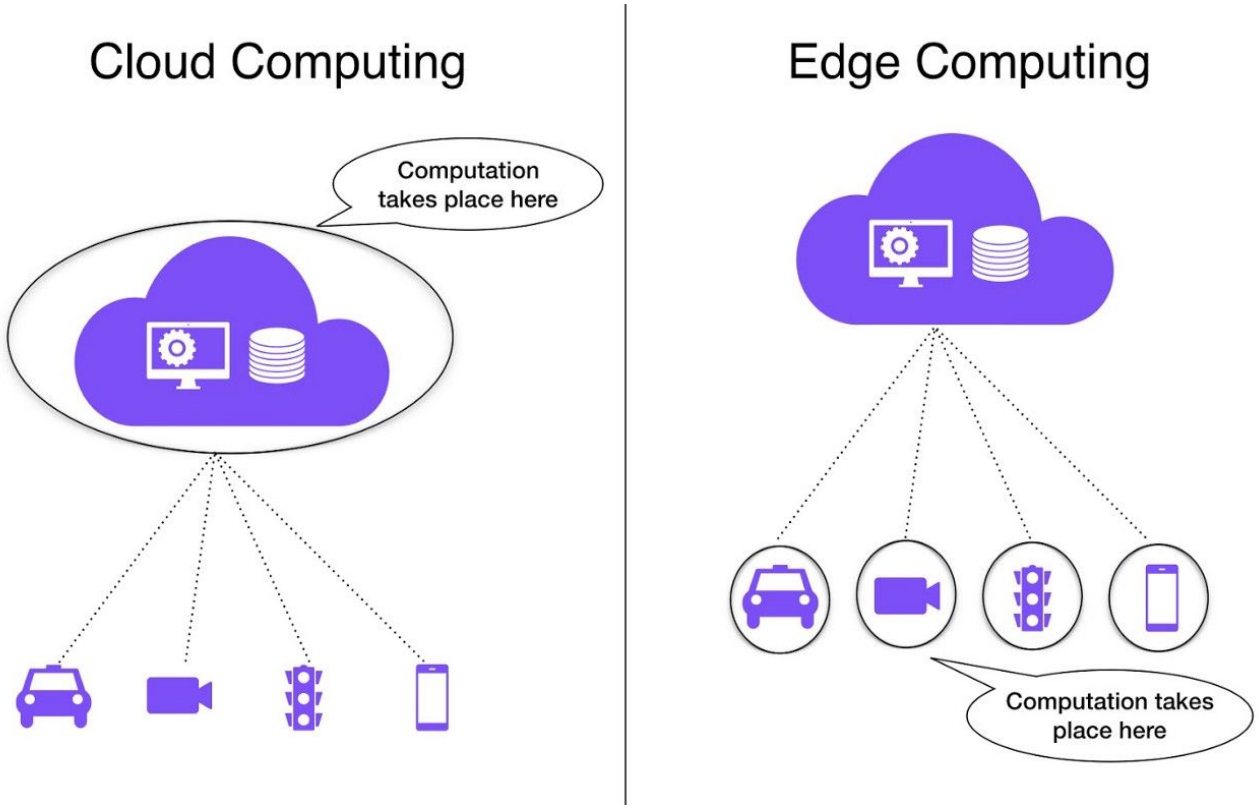
Cloud Computing & Edge Computing

A **hybrid cloud solution** means different things for different organizations. It can mean training in the cloud and deploying at the edge, training in the data center and using cloud management tools at the edge, or training at the edge and using the cloud to centralize models for federated learning. There are limitless opportunities to bring the cloud and edge together.



TinyML In SG

- Communities
  - Embedded System Professionals Discord: https://discord.gg/U9VxMpm7eG
  - TinyML SG Slack: tinyurl.com/tinymlsgslack
- Research
  - NUS
    - Prof Tulika Mitra
    - Prof Ambuj Varshney: Weiser Lab
  - NTU
    - Prof Chang Chip Hong
    - Prof Shivam Bhasin
- Industry
  - Continental Automotive (Lab in NTU)
  - Dyson
  - UBTECH Robotics

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Introducing TinyML SG

- Team:
  - Vincent
  - Archana
  - Soham
- Planned Events
  - Study Group
  - Paper Reading
- Participate
  - Speakers
  - Organisers
  - Projects
  - Other Opportunities

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Codecraft Graphical Programming for TinyML

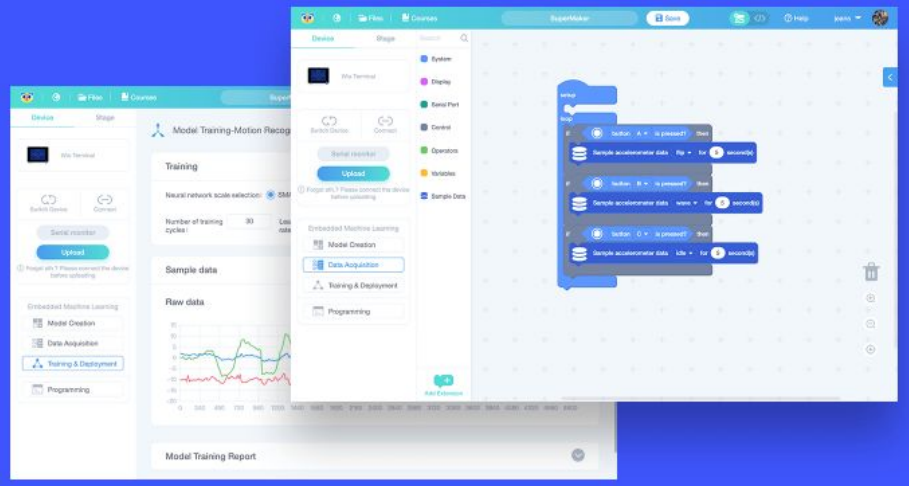
NEW

Codecraft Graphical Programming for TinyML

The Future of Machine Learning is Bright and Tiny.

Codecraft is super friendly to TinyML beginners and even people with no programming background

Powered by Edge Impulse, Tiny Machine Learning is easily accessible by beginners using Codecraft graphical programming. By simple drag-and-drop coding, acquiring data, training, and deploying model is more vivid than ever.



seeed studio
The IoT Hardware Enabler

EDGE IMPULSE

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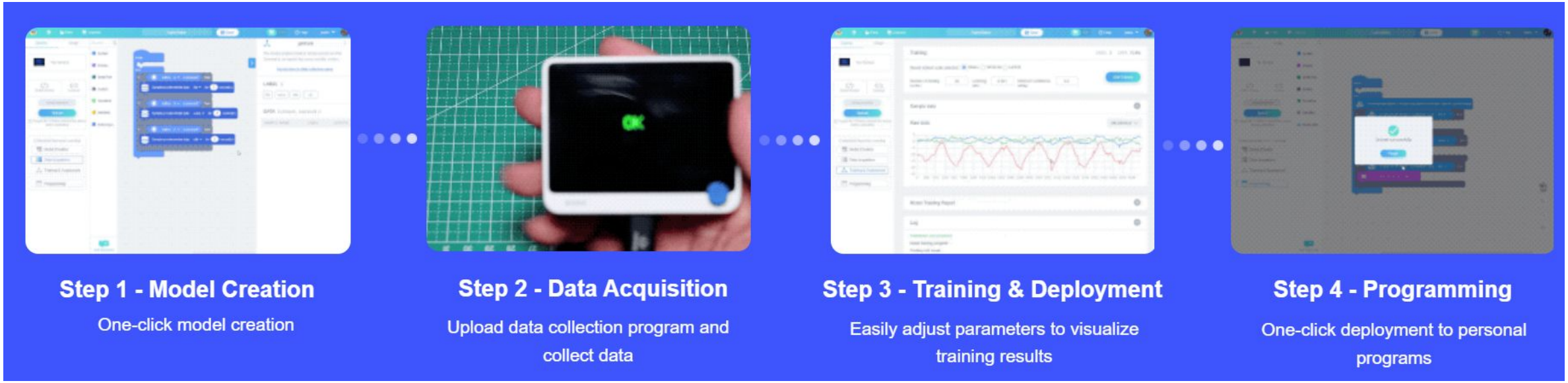
TinyML Deployment Process



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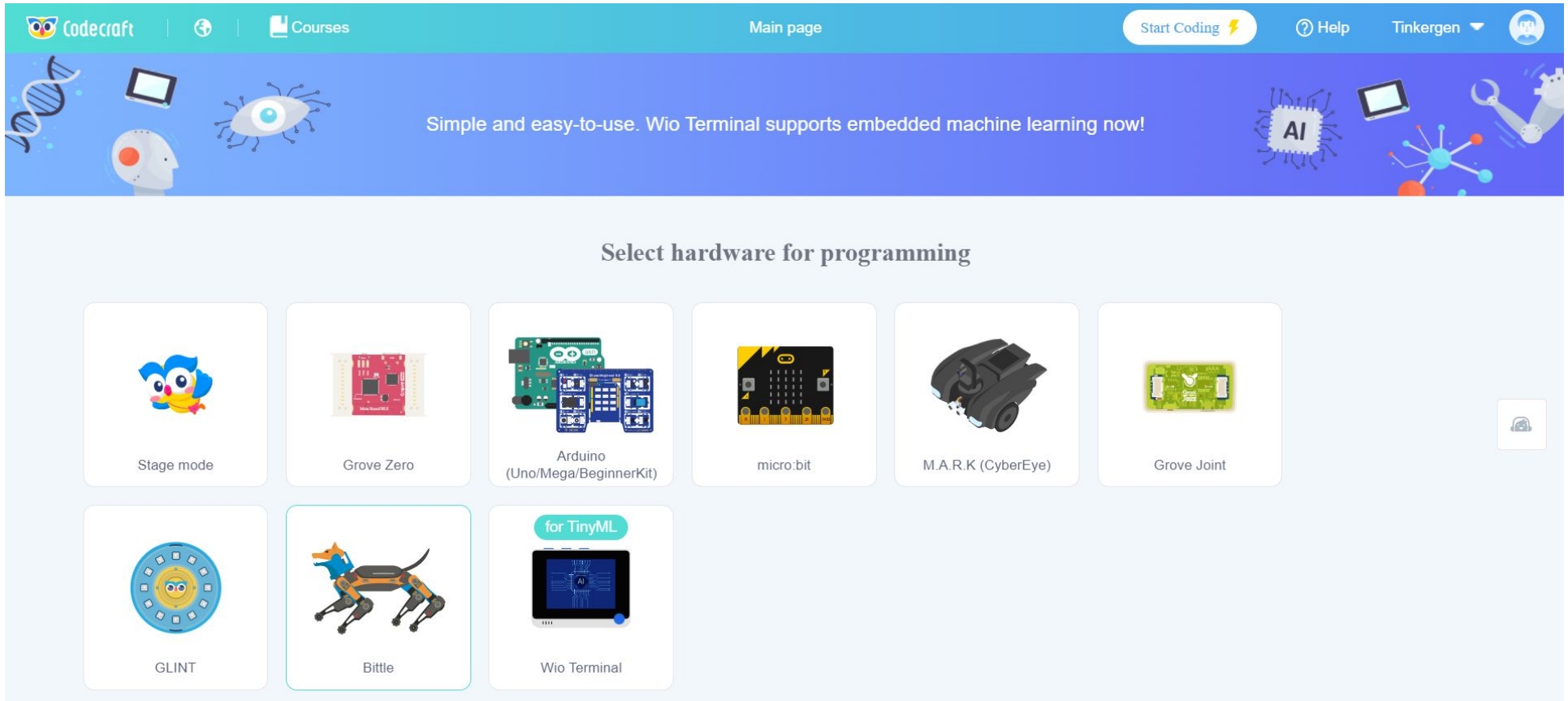
Access to Codecraft

https://ide.tinkergen.com/



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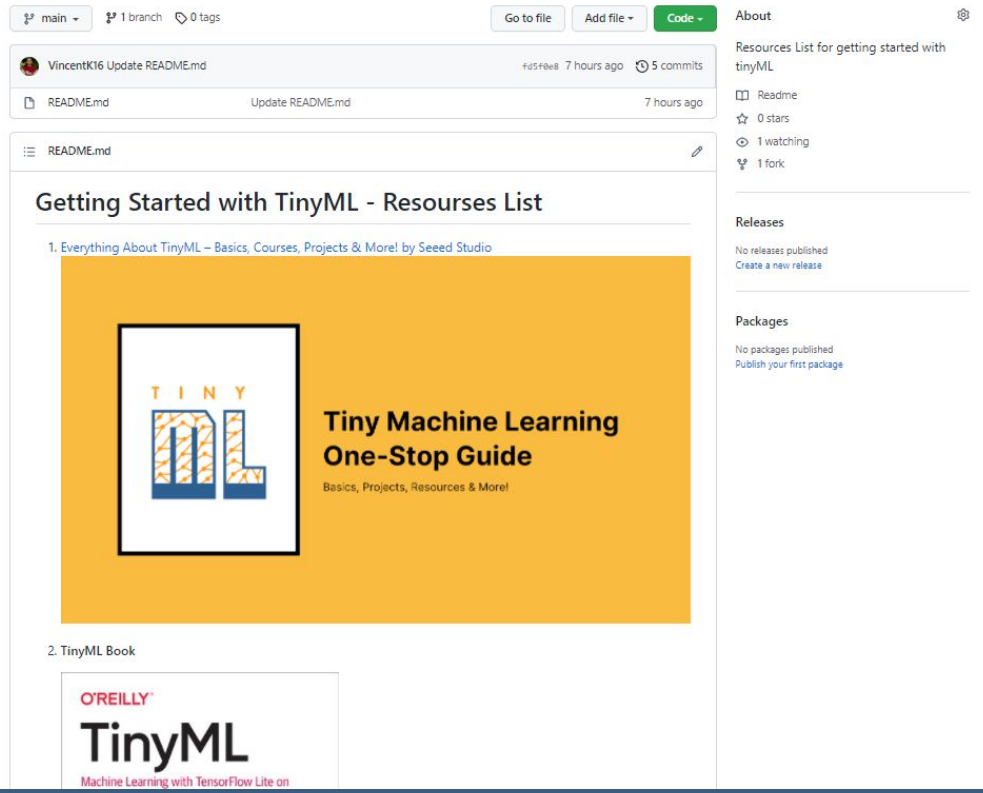
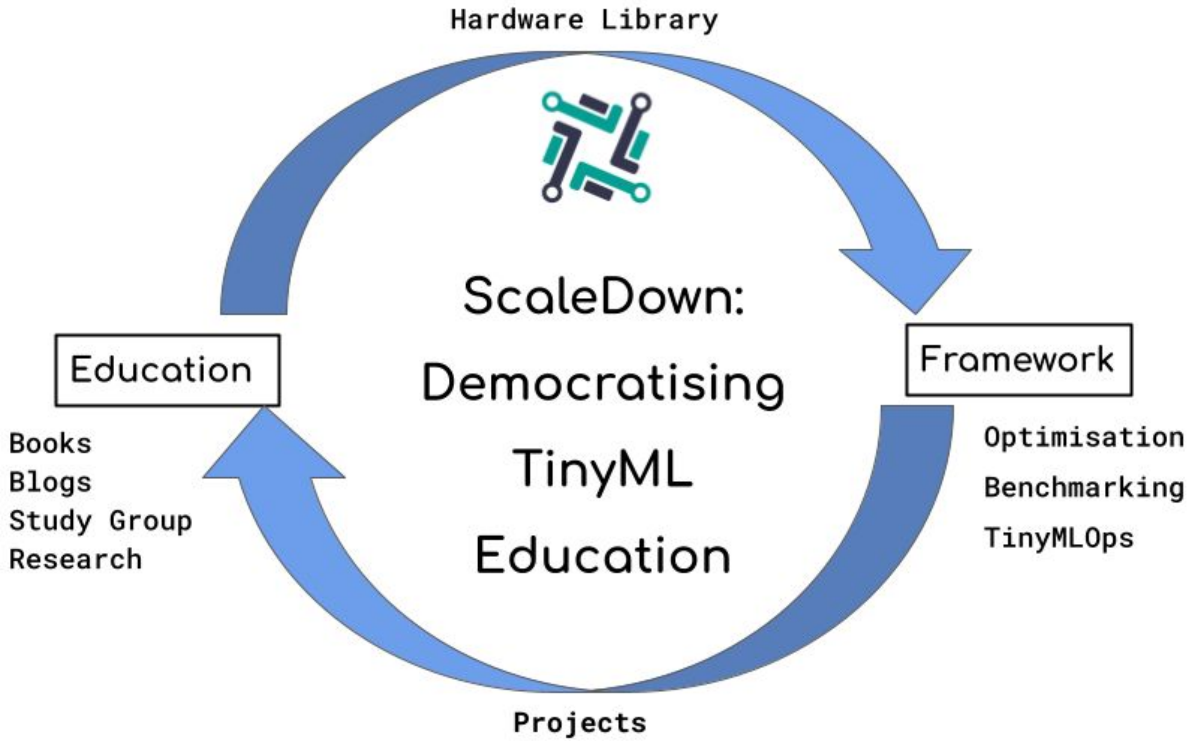
Resources

https://github.com/VincentK16/tinymlresources



ScaleDown

ScaleDown is an Open-Source Neural Network Optimization Framework for TinyML Devices.



Website
scaledown-team.github.io/

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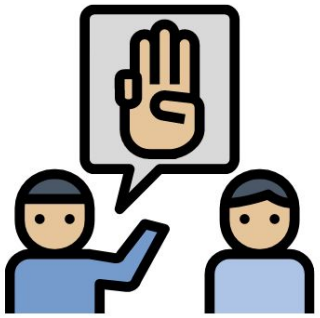
Meet and Greet!

Please do raise up your hands to be unmuted!

TINY ML

TINYML SG
Meet and Greet



1. Tell us your name
2. Where do you work/study?
3. What is the most exciting thing about TinyML for you?
4. One interesting fact about you!

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JamBoard

https://tinyurl.com/tinymlsg

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