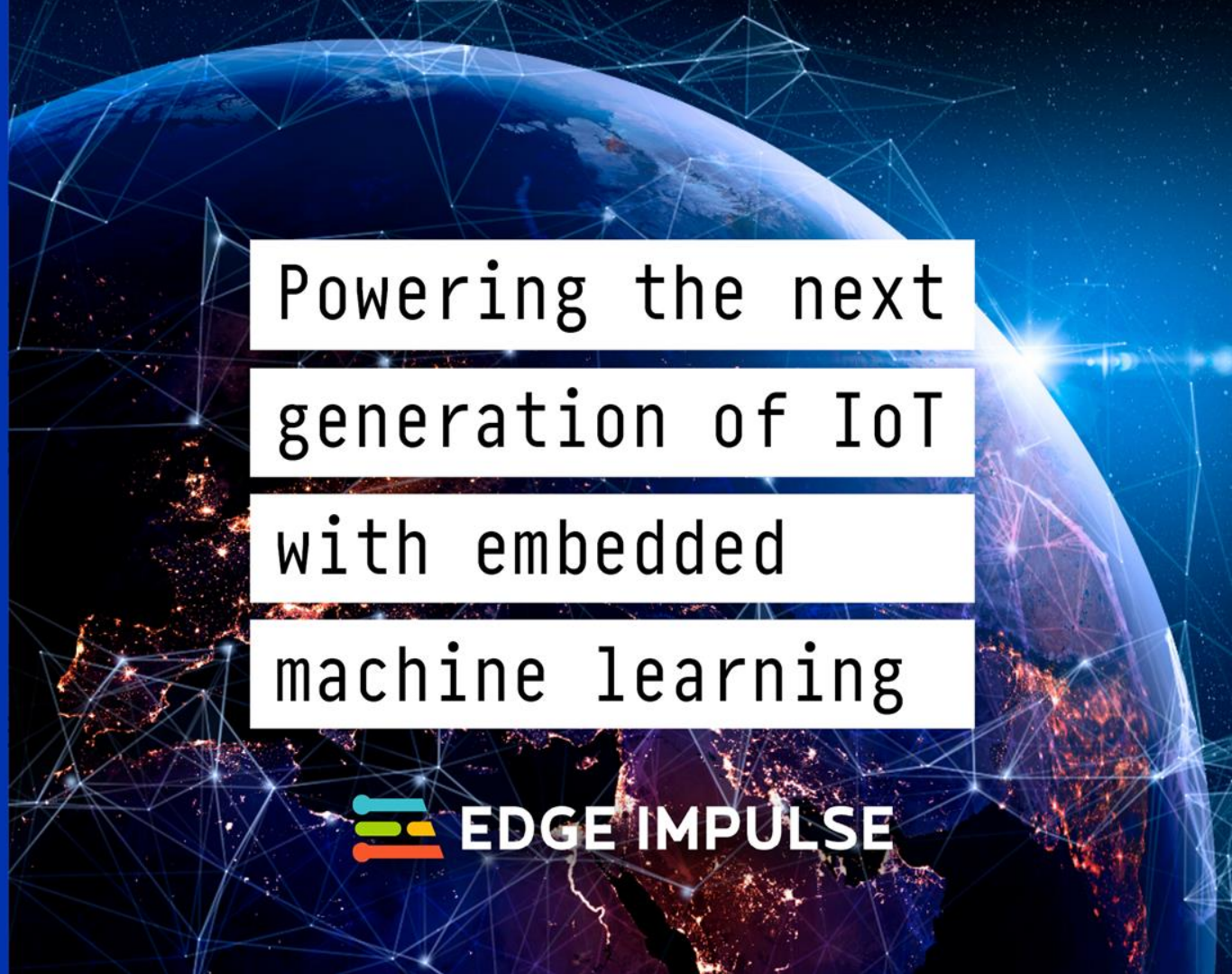
PARTNER
WEBINAR

NORDICTECH
WEBINARS



Today's hosts

Petter Myhre

Head of Product Marketing

NORDIC SEMICONDUCTOR

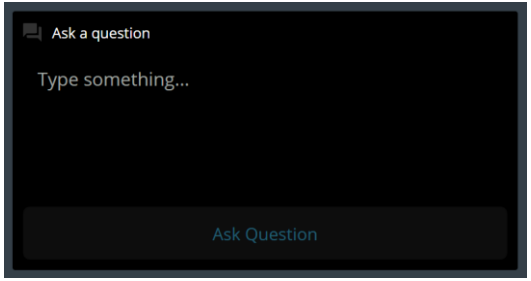
Zin Kyaw

Senior User Success Engineer

EDGE IMPULSE

Practicalities

- Duration: 60 mins
- Questions are encouraged!
- Please type questions in the top of the right sidebar
  - All questions are anonymous
  - Try to keep them relevant to the topic
- We will answer questions towards the end
- The chat is not anonymous, and should **not** be used for questions
- If you have more questions:
  - Go to DevZone for Nordic related questions
  - hello@edgeimpulse.com for questions to Edge Impulse
- A recording of the webinar will be available together with the presentation at webinars.nordicsemi.com



{ DevZone

Agenda

- Background on the “State of the IoT” and Embedded Machine Learning
- Introduction to Edge Impulse
- Edge Impulse Collaboration with Nordic
- Demo
- Q&A

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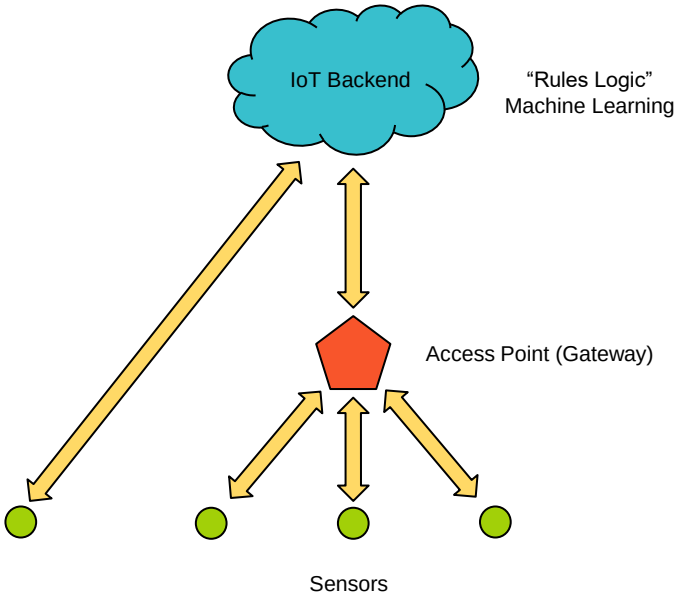
“State of the IoT”

- Measurement samples are typically continuously sent to the cloud or gateway where:
  - Analysis is performed to gain insights (rules logic)
- This traditional technique runs into challenges when:
  - System’s cloud connection is bandwidth constrained
  - Sensors are power consumption constrained
  - System latency is introduced due to compute constraints



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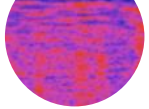
Embedded Machine Learning Makes Devices and Systems Smarter

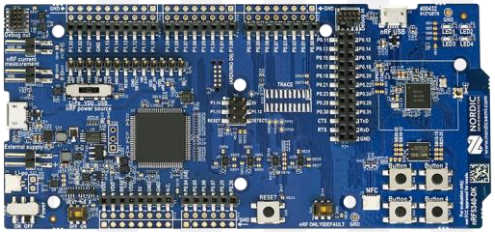
Sensor

Audio



Vision

nRF52840 DK / nRF5340 DK



STATUS
Event Detected 85%

- ✔ From Cortex-M0+ to CPUs
- ✔ Starting at < 10 kB of Flash/RAM
- ✔ Real-time, low-power inference

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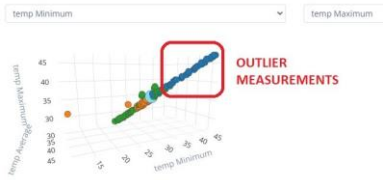
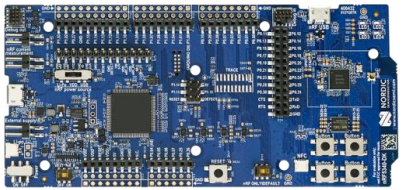
Harness On-device Intelligence to Detect Anomalies

Temperature varies in a way that I've never seen before

Vibration pattern heard that will lead to fault state in a week





Machine oscillates differently than all other machines in the factory

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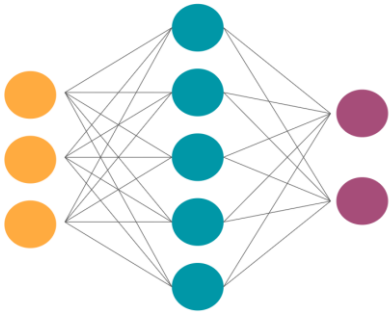
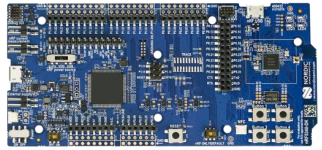
From Model to Device to Cloud



Raw data
Extract meaningful features
Signal processing
Train model



Sample sensor data
Signal processing
Run inference
Arrive at conclusion

Conclusions sent to cloud
Save Energy
Save Bandwidth
Save Costs

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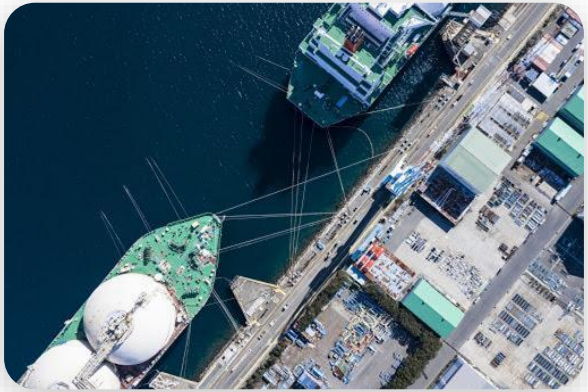
Predictive Maintenance

Motion, current, audio and camera

- ➔ Industrial
- ➔ White Goods
- ➔ Smart City
- ➔ Automotive

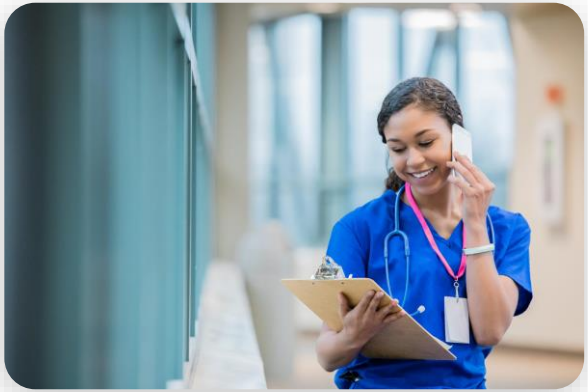
Asset Tracking & Monitoring



Motion, temp/humidity, position, audio and camera

- ➔ Logistics
- ➔ Smart City
- ➔ Smart Spaces
- ➔ Cold Chain

Human & Animal Sensing



Motion, radar, audio, PPG, ECG

- ➔ Health
- ➔ Consumer
- ➔ Industrial
- ➔ Wildlife Conservation

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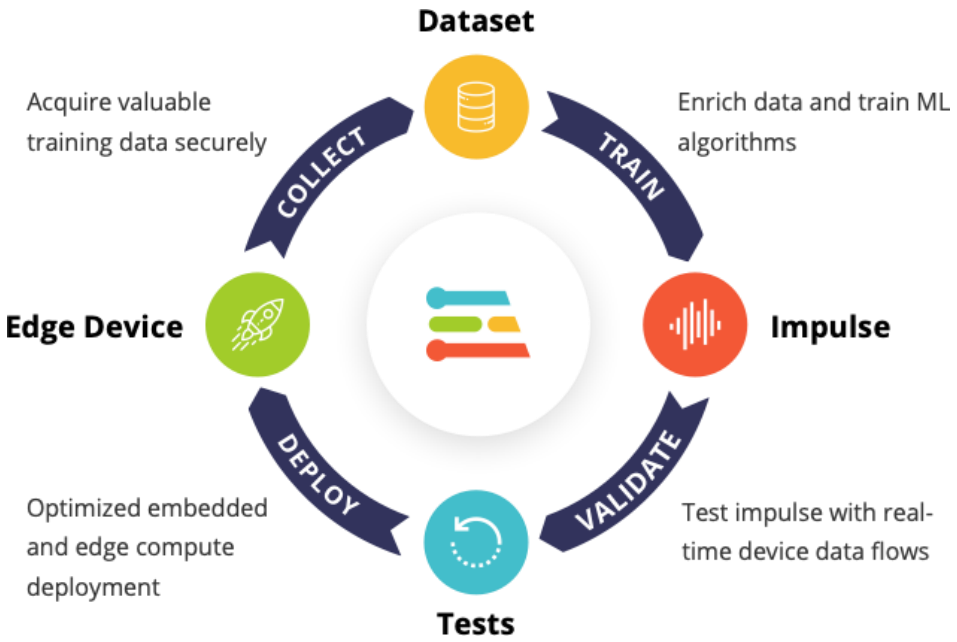
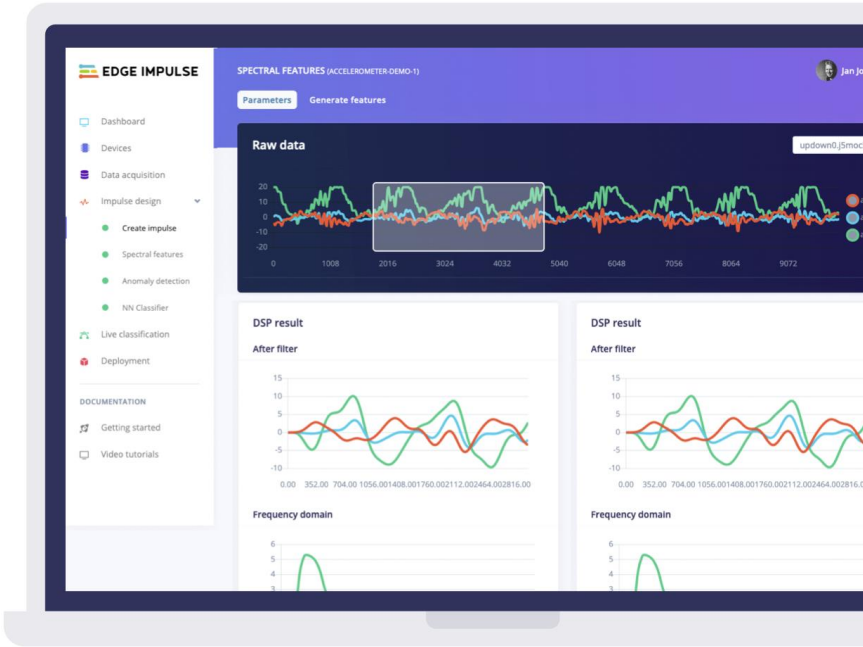
Edge Impulse

The Embedded ML Development Platform





Learn more at http://edgeimpulse.com

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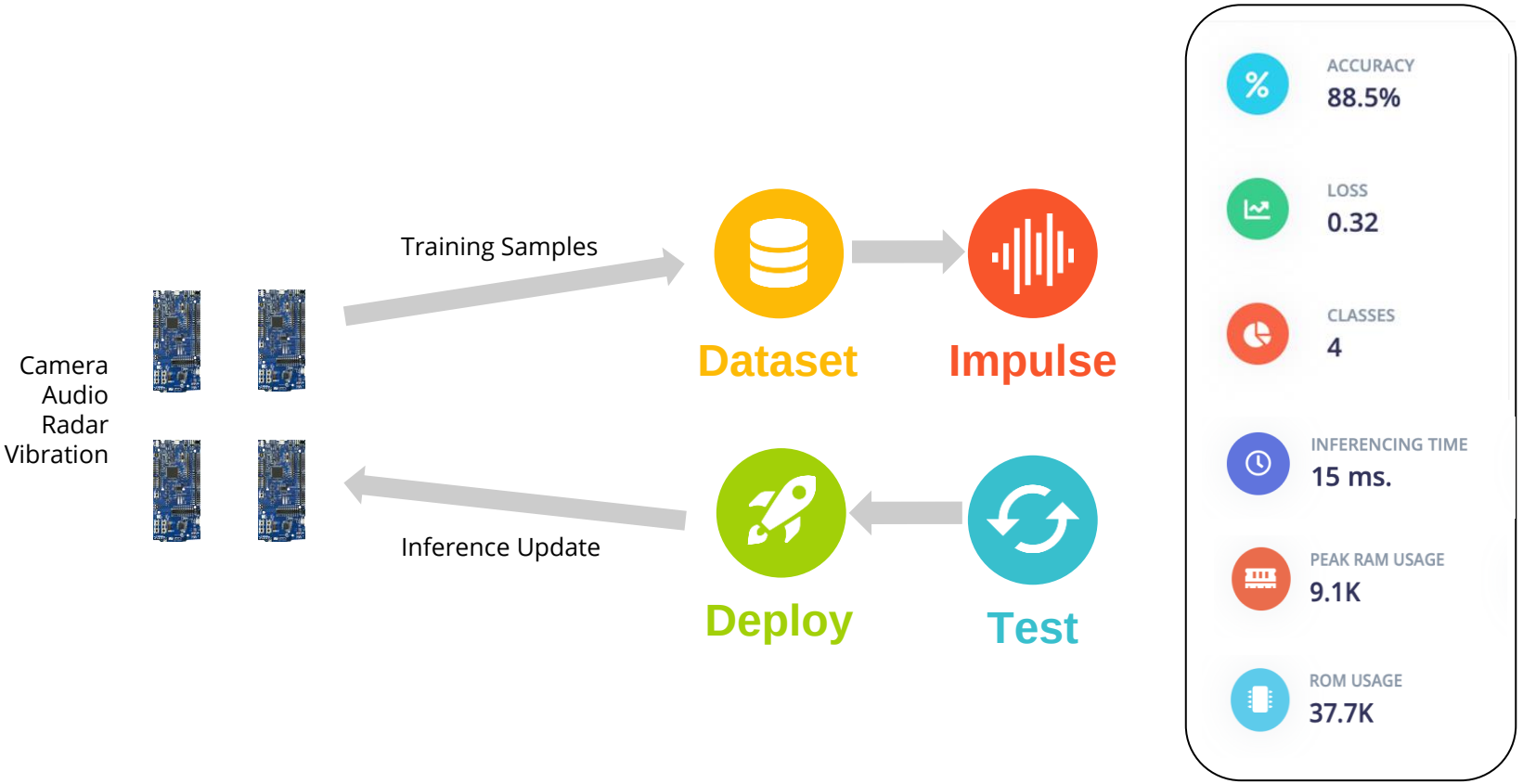
Manage your Entire Embedded ML Pipeline with Edge Impulse



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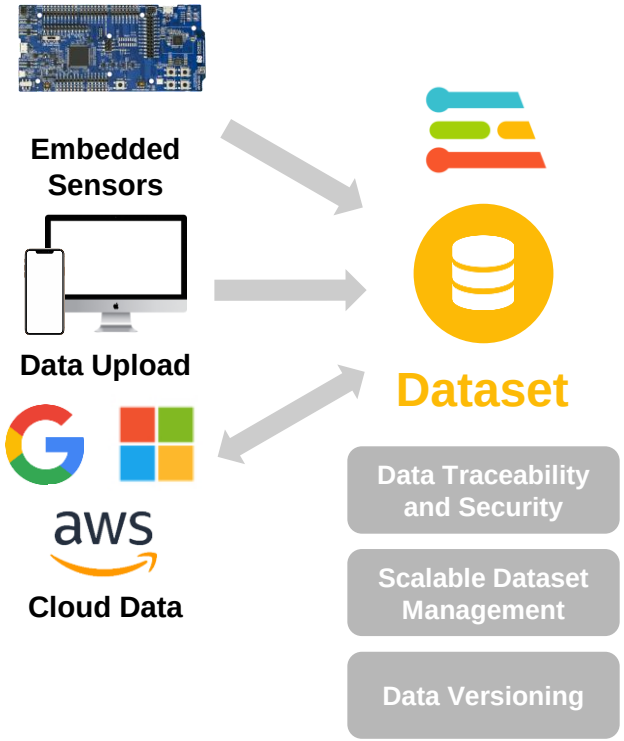
Many Ways to Ingest Data Sets Securely into Edge Impulse



- Most sensor data is discarded today or not compatible with ML use
- Collecting datasets early, often and with ML and security in mind to unlock value from ML
- Edge Impulse saves time and engineering resources by enabling easy, efficient and secure data collection from any source

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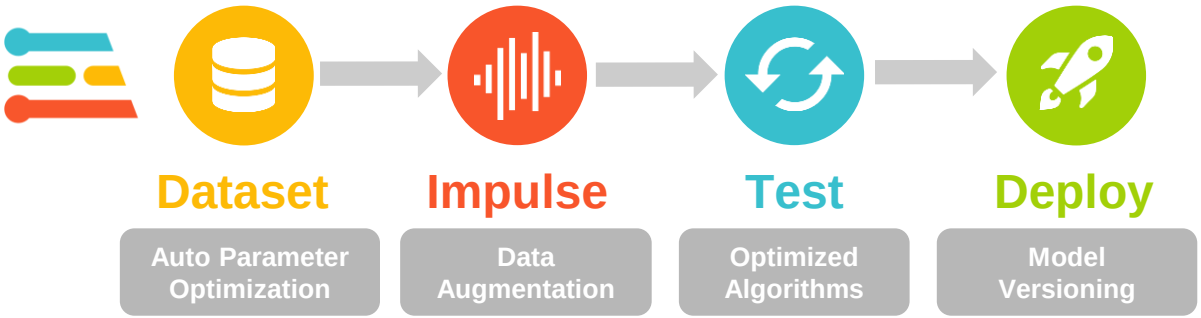
Enable Enterprise Collaboration with Embedded MLOps



25-55% Smaller

The Edge Impulse Edge Optimized Neural (EON)™ Compiler technology reduces the size of ML output by 25-55% compared to TensorFlow Lite Micro.

- Enable your team to innovate with ML, gaining a competitive advantage with advanced tools and algorithms optimized specifically for embedded devices
- Get to market on time, saving man-years of platform development and enabling continuous management and updates with Edge Impulse end-to-end MLOps

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Case Studies

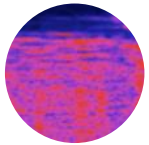
EDGE IMPULSE

Making Health Smarter with ML

Leading wearable health device maker goes big on innovation with Edge Impulse

Heart

Motion



Temp

STATUS
Healthy, Sleep Score
91%

OUTCOMES

- Enabled leading new sleep and flu detection algorithms
- Saved man-years in time and improved team collaboration
- Accelerated algorithm development from years to months

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Making the Grid Smarter with ML

Electric grid solution to enable fault detection in real time with Edge Impulse

Current

Motion

STATUS

Power line fire detected!

OUTCOMES

- Enable automated monitoring of poles and lines
- NB-IoT with 10 year battery life made possible by ML
- Avoid disastrous wildfires and reduce maintenance costs

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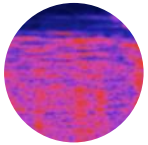
Making Conservation Smarter with ML

ElephantEdge initiative enables advanced wildlife monitoring with Edge Impulse

Motion

Audio



Vision

DETECTED

Elephant Herd Migration

OUTCOMES

- Monitor and reduce poaching and human conflict risk
- Better understand elephant and herd behaviour
- Monitor the activities of elephants to better protect them

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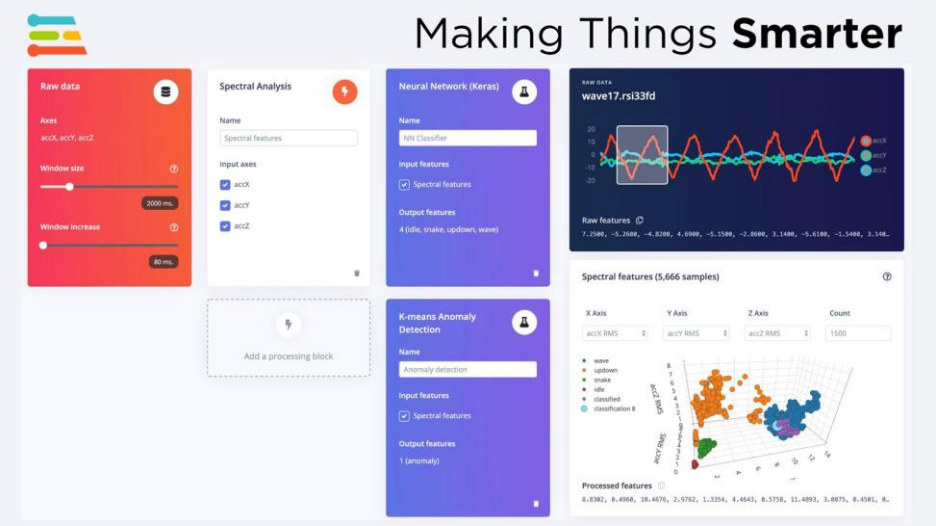
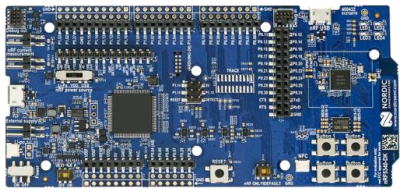
Edge Impulse Collaboration with Nordic

EDGE IMPULSE

Edge Impulse Collaboration with Nordic





- Fully supported standalone inferencing example projects that run on **nRF52840 DK** and **nRF5340 DK** and are based on the **nRF Connect SDK (Zephyr-based)**
    - Use these with the Edge Impulse Data Forwarder tool (https://docs.edgeimpulse.com/docs/cli-data-forwarder) to acquire datasets, train and deploy models
- Train your models in the Edge Impulse studio, then build downloadable binary images that uses the MEMs microphone and MEMs accelerometer on the X-NUCLEO-IKS02A1 Shield

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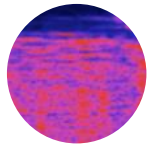
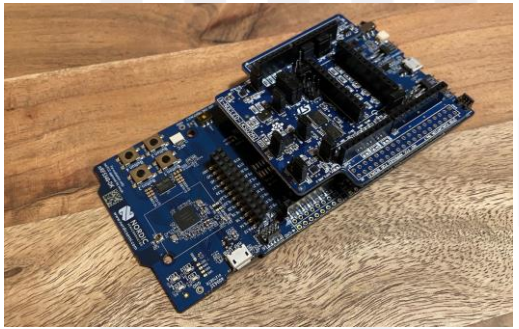
Demo: nRF52840 DK/nRF5340 DK + X-NUCLEO-IKS02A1 Shield

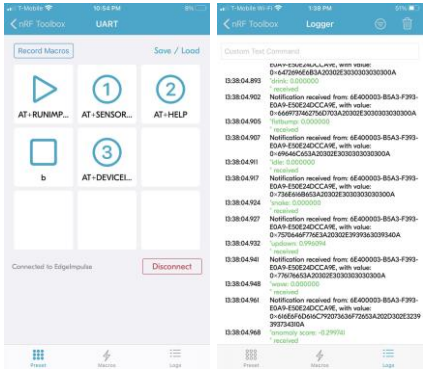
Sensor

Audio





Actuate and Stream classification results over Nordic UART Service (NUS)



- ✔ MEMs Accelerometer
- ✔ MEMs Microphone
- ✔ Real-time, low-power inference

● STATUS
Event Detected 85%

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How to Get Started

- Sign-up for free at https://edgeimpulse.com
- Getting Started Tutorials, Example Projects:
  - https://docs.edgeimpulse.com/docs/nordic-semi-nrf52840-dk
  - https://docs.edgeimpulse.com/docs/nordic-semi-nrf5340-dk
  - https://developer.nordicsemi.com/nRF_Connect_SDK/doc/latest/nrf/ug_edge_impulse.html#
  - https://developer.nordicsemi.com/nRF_Connect_SDK/doc/latest/nrf/samples/ei_data_forwarder/README.html

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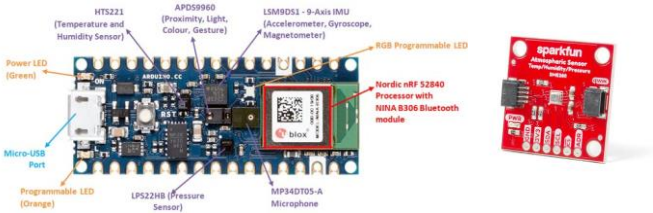
Additional Resources

- Introduction to Embedded Machine Learning Coursera class: https://www.coursera.org/learn/introduction-to-embedded-machine-learning
- Many other sensors you can try on Arduino Nano 33 BLE Sense (and external sensors like BME280 - temp/pressure/humidity)
- Using the data forwarder you can acquire data via UART on any Nordic-based device
- micro:bit v2 (nRF52833): https://www.edgeimpulse.com/blog/voice-activated-microbit
- Edge Impulse + Nordic BLE NUS Example: https://github.com/IRNAS/firmware-nordic-nrf52840dk-ble-nus



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EDGE IMPULSE

A world-class team of industry leaders and embedded experts, **delivering the ultimate developer experience for embedded machine learning solutions, at scale.**

8,000 +
Developers

World's largest Embedded Machine Learning Community 136 countries!

13,000 +
Projects

Using Edge Impulse Studio across more than **1,000 Enterprises**

> 9.5 Million
Dataset samples

Labeled real-world data samples across more than 9K connected devices

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