Demystify artificial intelligence on Arm MCUs

Cartesiam

Joël Rubino (CEO) & Francois de Rochebouët (CTO)

July 2020
CARTESIAM
WE HELP EMBEDDED DEVELOPERS
MAKE OBJECTS SELF-AWARE
AGENDA

Joël Rubino (CEO)
• Who we are / The problem we solve

François de Rochebouet (CTO)
• Live creation of a « smart sensor »

Q & A
Software company founded in 2016
Focus on Machine Learning at the Edge

#MISSION
To help developers to easily and quickly create smart objects without AI skills

#INNOVATION
Training and inference exactly where data turn into a signal

#TEAM
Strong scientific and business background, PHDs in advanced mathematics, machine learning, signal processing
« Edge AI » is a catch-all word.
Training and Inference are different

Cloud
Train the model on GPU/CPU
Training

Device
Apply the model « at the Edge »
Inference

https://discord.gg/rcTyQrY
« Edge AI » is a catch-all word. CURRENT AI APPROACH IS **IRRELEVANT** FOR OBJECTS

![Diagram showing cloud with text: Train the model on GPU/CPU]

### Top 3 challenges to AI/ML adoption
Sum of 1 to 3 rank

<table>
<thead>
<tr>
<th>Enterprise maturity</th>
<th>Skills of staff</th>
<th>Data scope or quality</th>
<th>Governance issues or concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>56%</td>
<td>34%</td>
<td>13%</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Fear of unknown</th>
<th>Understanding AI benefits and use</th>
<th>Security or privacy concerns</th>
<th>Measuring the value</th>
<th>Risk or liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>42%</td>
<td>20%</td>
<td>17%</td>
<td>6%</td>
</tr>
</tbody>
</table>

EXPENSIVE, YEARS–LONG and COMPLEX
Projects NEVER GO FURTHER THAN A POC

https://www.gartner.com/smarterwithgartner/3-barriers-to-ai-adoption/

https://discord.gg/rcTyQrY
"Edge AI" is a catch-all word. Training and Inference are different.

OPTION 1

Make this easier, simpler, faster for embedded dev / data-scientists.

Cloud
- Train the model on GPU/CPU
- Training

Device
- Apply the model « at the Edge »
- Inference
« Edge AI » is a catch-all word.
A data scientist in an MCU

OPTION 2

IDE for **embedded dev** to create the **best ML library** for each project

Train the model « at the Edge »
- Dynamic learning “on device”
- Any embedded developer
- Any arm Cortex M0 – M7

**Training + Inference at the Edge**
HOW?

NanoEdge™ AI Studio: REAL EDGE MACHINE LEARNING

We re-wrote (starting from the algebra) every single ML and signal processing algorithms so they can run inside a microcontroller (learning and inference).

- Ultra optimized / customized for optimal performance
- What is not used is not loaded
- Ultra memory efficient
- Super specialized models
- Learning and analysis inside the microcontroller

We created NANOEDGE AI studio, a software for embedded developers, running autonomously on a PC, and capable of simply generating the right learning machine library for your project from among 500 million possibilities.

https://discord.gg/rcTyQrY
Expand ML usage below and beyond the obvious sweet spot

Relative control code performance

Cortex-M Today
- Cortex-M7
- Cortex-M35P
- Cortex-M33
- Cortex-M3

New Cortex-M (enabled by Helium)
- Cortex-M55

Cortex-M Today
- Cortex-M7
- Cortex-M35P
- Cortex-M33
- Cortex-M3

Cortex-M4
- Cortex-M23
- Cortex-M0+
- Cortex-M0
- Cortex-M1

Well suited for ML and DSP application
Expand ML usage below and beyond the obvious sweet spot

Cortex-M Today
- Cortex-M7
- Cortex-M35P
- Cortex-M33
- Cortex-M3

Cortex-M Today
- Cortex-M23
- Cortex-M0+
- Cortex-M0
- Cortex-M1

New Cortex-M (enabled by Helium)
- Cortex-M55

Well suited for ML technology from Cartesiam
WE ARE THE AI POSTER CHILD FOR THE MICROCONTROLLER LEADERS.... AND IT GOT NOTICED!

PARTNERSHIP

AI Partner

ANALYSTS

Gartner

2019 “Hype Cycle for Semiconductors and Electronics Technologies TOP 3 EDGE AI VENDORS “

2020 “Cartesiam named “Cool Vendor 2020 IOT”

2019 “Enterprise of the year” Category ‘AI at the Edge’

TESTIMONIAL

the life augmented blog

NanoEdge AI: Their First Machine Learning Application on the STM32G4 Series Blew Our Minds

INDUSTRY

2019 WINNER

Category ‘Technology Showcase of the year’

2019 WINNER

Category ‘Most Innovative Technology’

CUSTOMERS

LIFE is ON Schneider Electric NAVAL GROUP VDSYS Vape Rail VR Actility WITTI Technologies Electronics LACROIX

https://discord.gg/rcTyQrY
INDUSTRY AND USE-CASE AGNOSTIC
THREE CLIENT EXAMPLES OUT OF ENDLESS POSSIBILITIES

Predictive maintenance
Industry
Bob Assistant™ learns the patterns of any engine and sends alerts if anomalies occur. Thousands Units sold across Europe.

Home appliance upgrade
Mass market
In Japan, a home appliance leader upgraded its offerings to provide filter clogging detection on air conditioning systems using current monitoring. Software update on existing hardware. Time to market massively reduced. Works with all compatible filters.

Confidential
Defense
French Navy is currently using our solution. We have no clue about the use case as all happens on the PC with no data sent to Cartesiam/cloud.

Endless use cases
Any Industry
CURRENTLY AVAILABLE SIGNALS

We can handle:
- Vibrations
- Pressure
- (VOC) Volatile organic compound
- Current
- Magnetic
- Temperature
- Ultrasound
- Multi signal sensor

We currently do not handle:
- Video
- Voice
ONE SOFTWARE TO DELIVER
500 MILLION
MACHINE LEARNING LIBRARIES

DEMO
Thank You
Danke
Merci
谢谢
ありがとう
Gracias
Kiitos
감사합니다
धन्यवाद
شكرًا
شكرا
توفد