

Neural Networks on the STM32 with STM32Cube.AI



The Key Steps Behind Neural Networks



Capture data



1

2



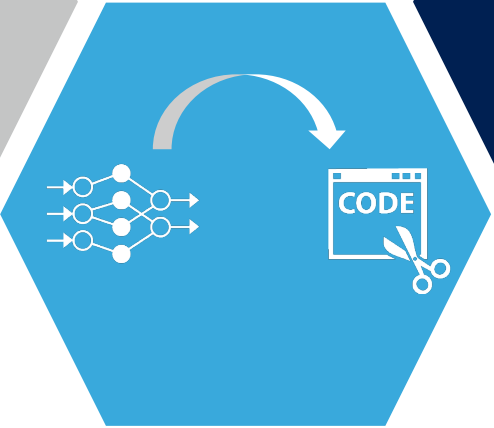
Clean, label Data
Build NN topology

Train NN Model



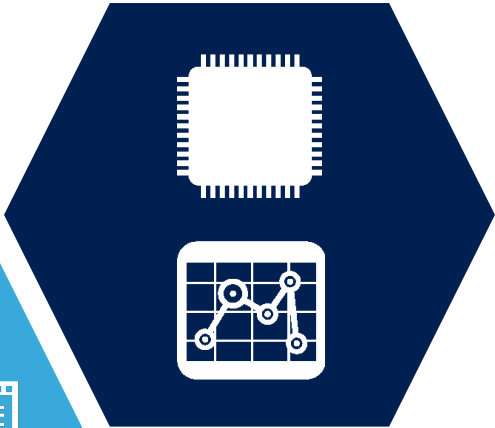
3

4

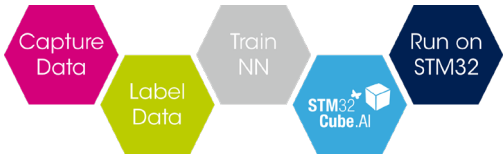


Convert NN into
optimized code for MCU

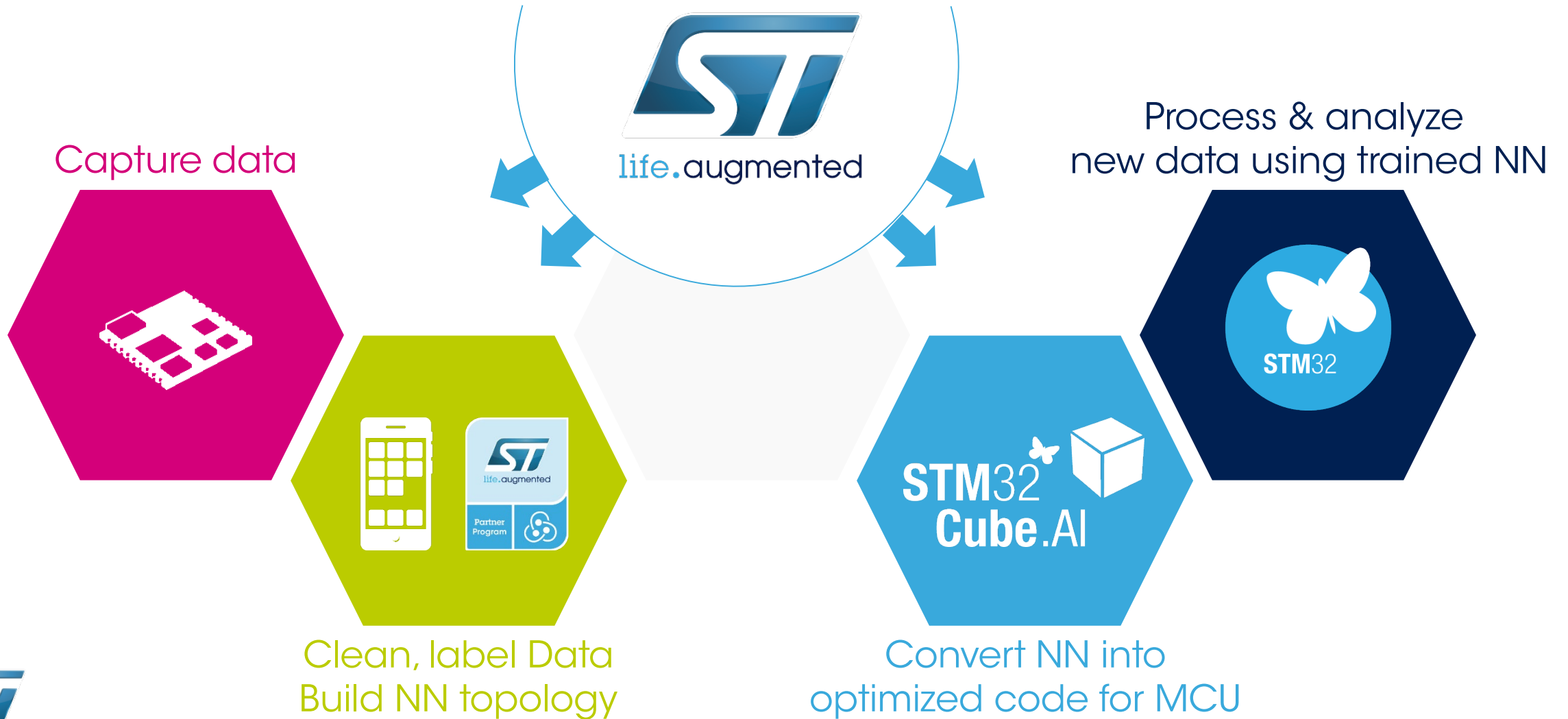
Process & analyze
new data using trained NN

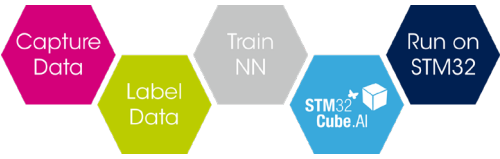


5



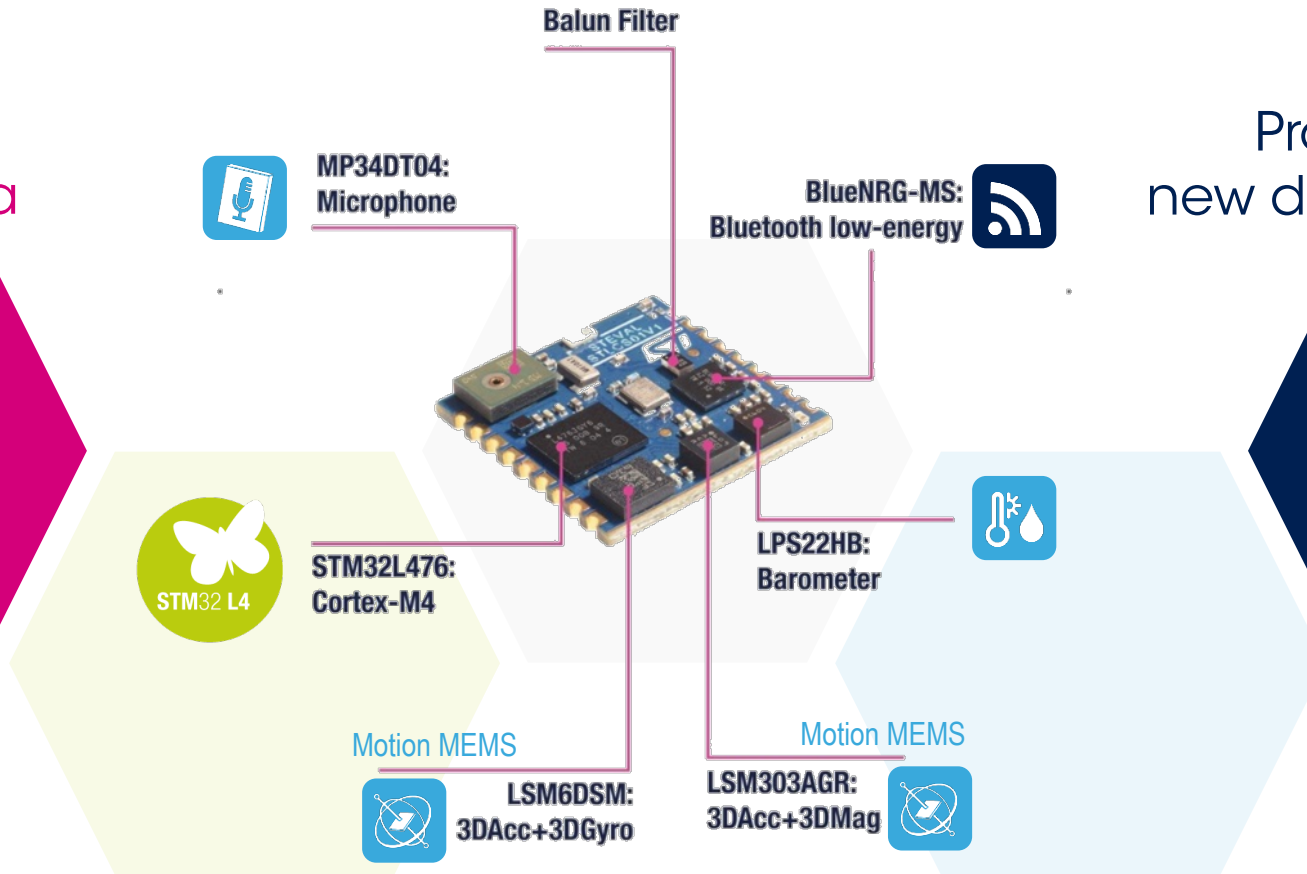
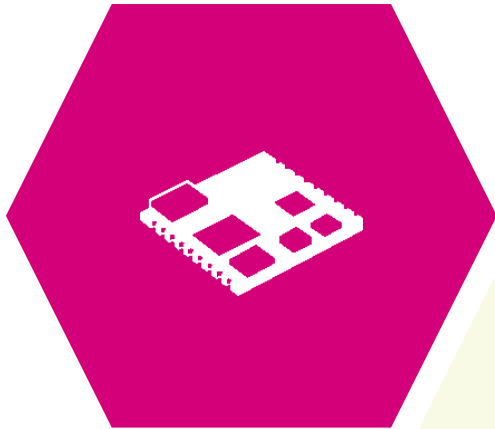
ST Toolbox for Neural Networks



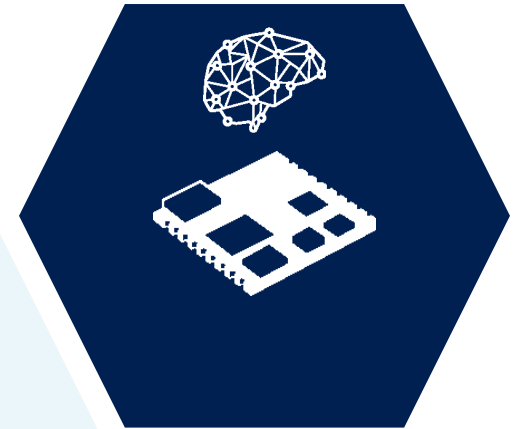


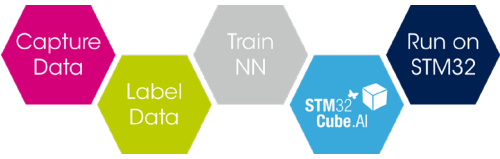
Form Factor Hardware to Capture and Process Data

Capture data



Process & analyze new data using trained NN

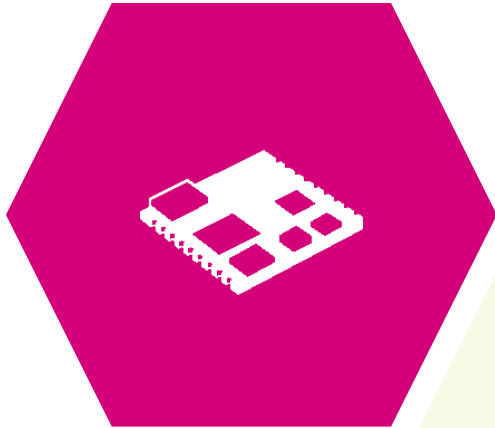




Form Factor Hardware

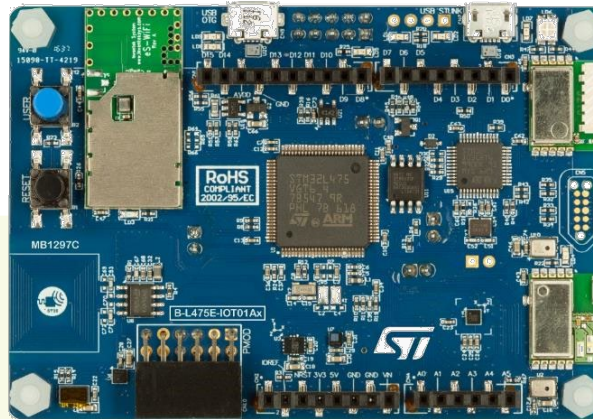
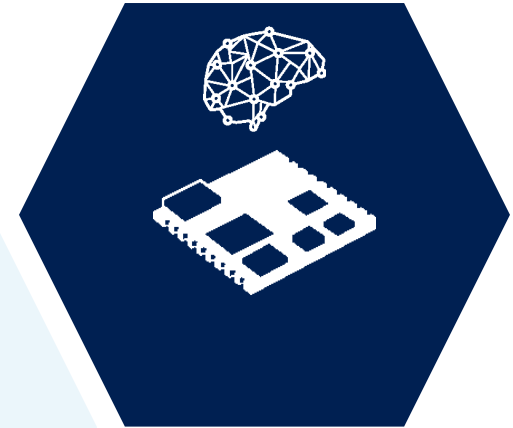
AI IoT Node for More Connectivity (Q1 2019)

Capture data



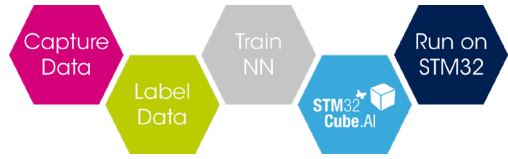
- +
-  Sub-1GHz
 -  Dynamic NFC Tag
 -  Wi-Fi

Process & analyze new data using trained NN



More debug capabilities

- Integrated ST-Link/V2.1
- PMOD extension connector
- Arduino Uno extension connectors



Collecting Data & Architecting a NN Topology

Services provided by Partners

ST tools to support

Capture data



Clean, label Data
Build NN topology



ST BLE Sensor mobile phone application
Collect and label data from the SensorTile.

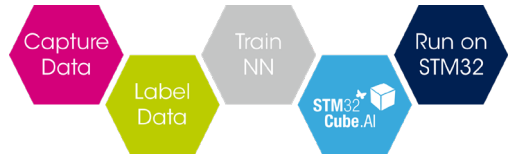


ST BLE
Sensor



Selected partners

Neural Networks engineering services support.
Data scientists and Neural network architects.



STM32CubeMX Extension

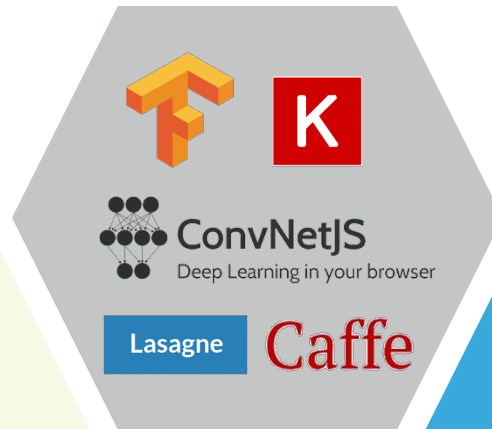
AI Conversion Tool

Input your framework-dependent, pre-trained Neural Network into the **STM32Cube.AI** conversion tool

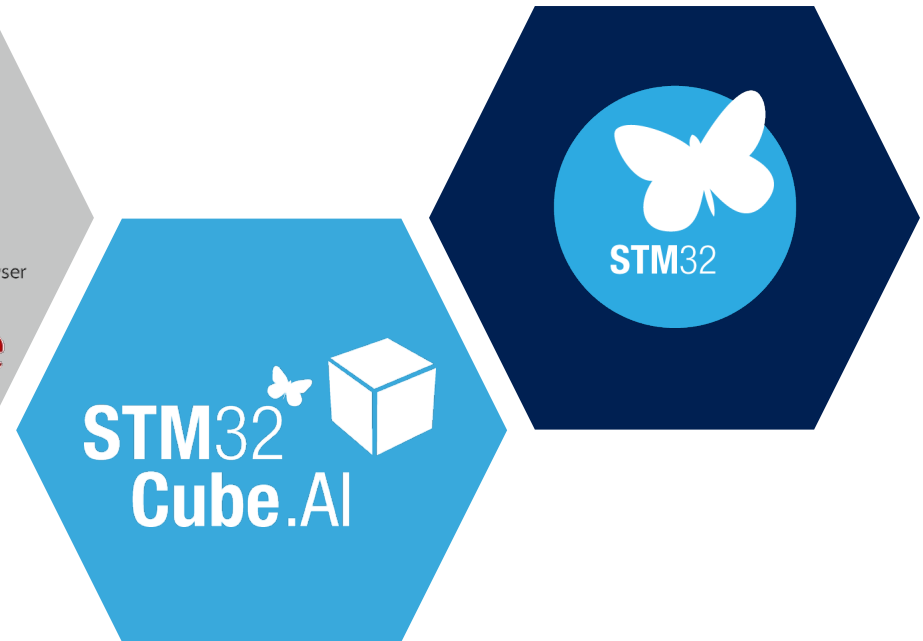
Automatic and fast generation of an STM32-optimized library

STM32Cube.AI offers interoperability with state-of-the-art Deep Learning design frameworks

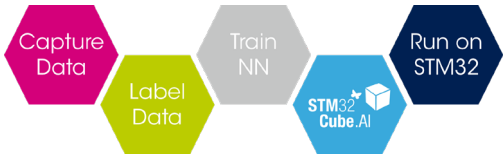
Train NN Model



Process & analyze new data using trained NN

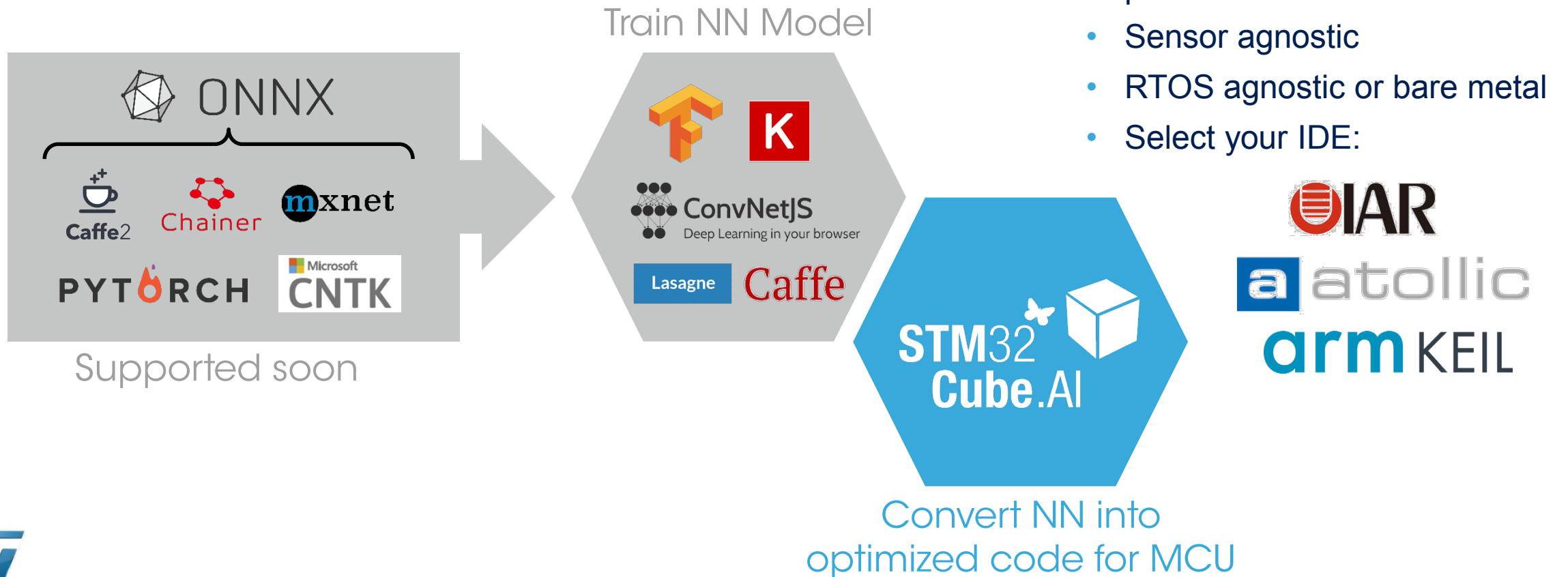


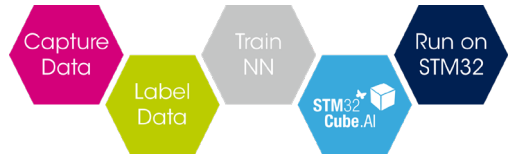
Convert NN into optimized code for MCU



STM32CubeMX Extension

STM32Cube.AI Interoperability





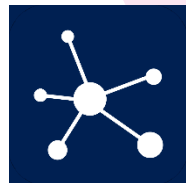
ST Toolbox for Neural Networks

More Than Just a Conversion Tool



Resources

- Function packs for **quick prototyping**
- **Audio** and **motion** examples

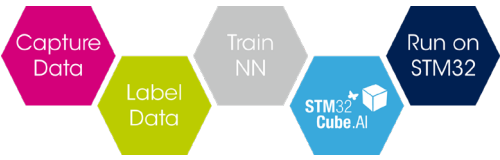


- **STM32 Community** for **support** and **idea** exchange
- **Dedicated** topic for Neural Networks

Process & analyze new data using trained NN

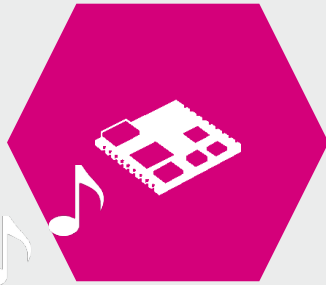
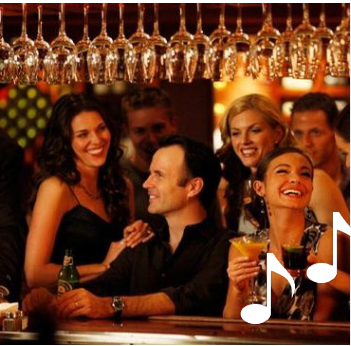


Convert NN into optimized code for MCU

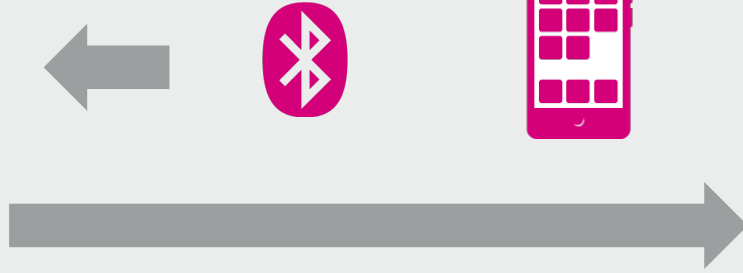


Audio Scene Classification (ASC)

Audio Example in FP-AI-SENSING1 Package



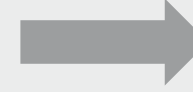
Embedded audio



Labelling controlled by smartphone application

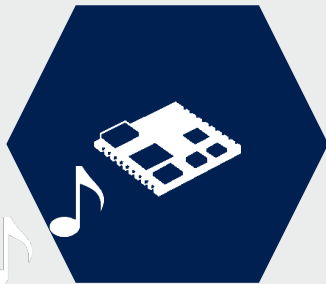
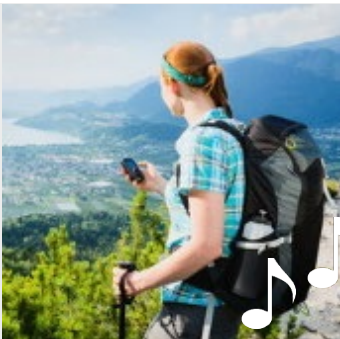


Data stored on the device SD card for future learning



3 classes

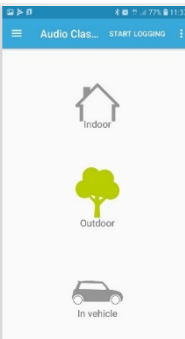
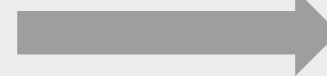
Indoor, Outdoor, In vehicle



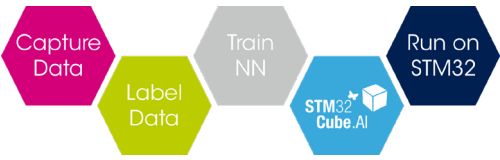
Embedded audio pre-processing



NN & example dataset provided

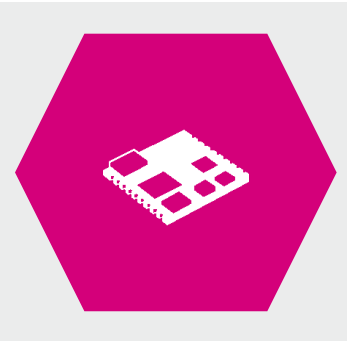


Inference result displayed on mobile app

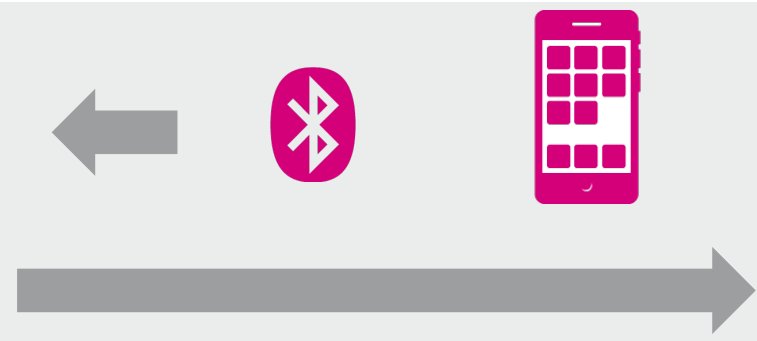


Human Activity Recognition (HAR)

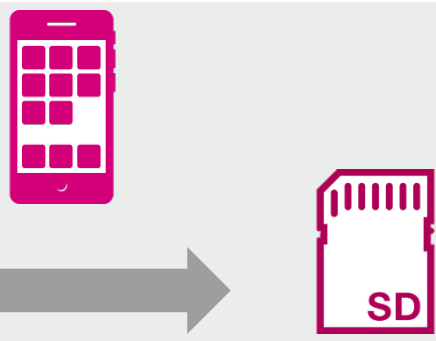
Motion Example in FP-AI-SENSING1 Package



Embedded motion



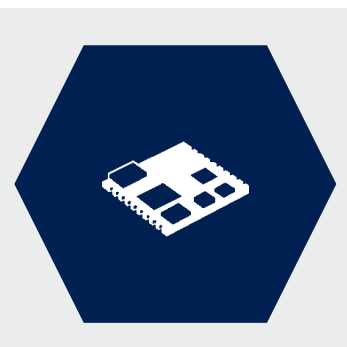
Labelling controlled by smartphone application



Data stored on the device SD card for future learning



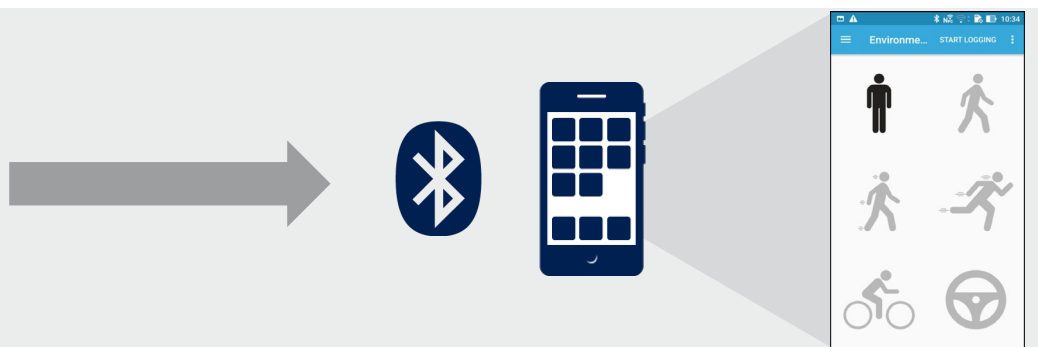
Stationary, walking, running, biking, driving
5 classes



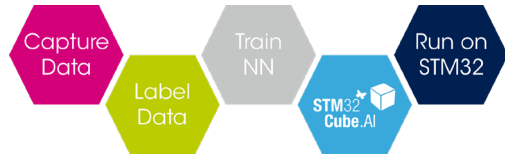
Embedded motion pre-processing



Inferences running on the microcontroller



Inference result displayed on mobile app



STM32 Solutions for AI

More Than Just the STM32Cube.AI

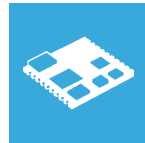
An extensive toolbox to support easy creation of your AI application

AI extension for STM32CubeMX
To map pre-trained Neural Networks onto the STM32



Function packs for Quick prototyping
Audio and motion examples

SensorTile reference hardware
To run inferences or data collection

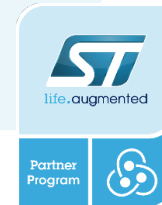


... And more coming!



STM32 Community with dedicated Neural Networks topic

Mobile phone application
To collect and label data
To display the result of inference processing on the STM32



ST Partner Program with a dedicated group of Partners providing Neural Networks engineering services
Data scientists and Neural network architects



For more Information

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www.st.com/STM32CubeAI

