NanoEdgeAIStudio

Data brief

Automated Machine Learning (ML) tool for STM32 microcontrollers

Features

- Desktop tool for design and generation of STM32-optimized libraries: anomaly and outlier detection, feature classification, and extrapolation of temporal and multivariable signals
  - Anomaly detection libraries are designed using very small datasets: learn normality directly on the STM32 microcontroller and detect defects in real time
  - One-class classification libraries for outlier detection, designed with a very small dataset: acquisition during normal equipment operation and detection of any abnormal pattern deviation
  - N-class classification libraries designed with very small, labeled dataset: classify signals in real time
  - Extrapolation with small, fragmented dataset by means of regression libraries: prediction of future values based on data patterns never seen before
- Supports any type of sensor: vibration, magnetometer, current, voltage, multi-axis accelerometer, temperature, acoustic and more
- Explore millions of possible algorithms to find the optimal library in terms of accuracy, confidence, inference time, and memory footprint
- Generate very small footprint libraries running down to the smallest Arm® Cortex®-M0 microcontrollers
- Embedded emulator to test library performance live with an attached STM32 board or from test data files
- Native support for STM32 development boards, no configuration required
- Easy portability across the various STM32 microcontroller series

Product status link
NanoEdgeAIStudio

NANOEDGE AI STUDIO

1 Description

NanoEdge™ AI Studio (NanoEdgeAIStudio) is a new Machine Learning (ML) technology to bring true innovation easily to the end-users. In just a few steps, developers can create an optimal ML library for their project, based on a minimal amount of data.

A demonstration version is available for three months for free experiments. A professional version provides the yearly Solo or Team licenses for embedded developers.

To help users to bootstrap their projects, STMicroelectronics proposes the Edge AI Sprint Package to limit risks and investments while increasing the chances of success. This is a bundle that includes training sessions, a NanoEdge™ AI Studio license, and technical support.

Check the ordering information section from the data brief for more details and contact STMicroelectronics sales office or authorized business partners to proceed with an order.

NanoEdge™ AI Studio, also called the Studio, is a PC-based push-button development studio for developers, which runs on Windows® or Linux® Ubuntu®.

One of its big advantages is that NanoEdge™ AI Studio requires no specific data science skills. Any software developer using the Studio can create optimal ML libraries from its user-friendly environment with absolutely no Artificial Intelligence (AI) skills.

The Studio can generate four types of libraries: anomaly detection, outlier detection, classification, and regression libraries.

An anomaly detection library is generated from a minimal amount of data examples showing normal and abnormal behaviors. Once created, load the library into the microcontroller to train and infer directly on the device. The library learns the equipment behavior from data acquired locally and adapts to each equipment behavior. Once trained, the library inference compares data coming from equipment over time against the locally created models to identify and report anomalies.

Outlier detection can be used to detect any abnormality with the one-class classification method. No example of abnormal behavior is needed. Import normal signals into the Studio and easily create an optimized outlier detection ML library.

A classification library can be used to classify a collection of data, representing different types of equipment defects (such as bearing problems, cavitation problems or others) or different types of events in equipment environment. Import the signals into the Studio and, in just a few steps, create a classification ML library that gathers all this knowledge into a single library. When running on the microcontroller, the classifier analyzes the live data and indicates the percentage of similarity against this static knowledge.

A regression algorithm can be used to extrapolate data and predict future data patterns. Import signals and targeted values in the desktop tool and generate in a few steps a smart library to, for example, improve energy management or forecast the remaining lifetime of an equipment.

These libraries can be combined and chained: anomaly or outlier detection to detect a problem on the equipment, classification to identify the source of the problem, and regression to extrapolate information and provide real insight to the maintenance team.

The input signals can range from vibration to pressure, sound, magnetic, time of flight just to name a few, or even a combination of several signals. Multiple sensors can be combined, either in a single library, or using multiple libraries concurrently.

Both learning and inference are done directly inside the microcontroller by means of the NanoEdge™ AI self-learning library, which streamlines the AI process and significantly reduces development effort, cost and therefore time to market.

2 General information

NanoEdge™ AI Studio (NanoEdgeAIStudio) provides libraries for STM32 microcontrollers based on the Arm® Cortex®-M processor.

Note: Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

2.1 Ordering information

NanoEdge™ AI Studio (NanoEdgeAIStudio) is available to download from the cartesiam.ai website as described in Table 1. It is available with a 3-month evaluation license for free experiments on supported STMicroelectronics Nucleo boards and Discovery kits.

Table 1. NanoEdgeAIStudio free evaluation license

License	Detailed information	Technical support	Target STM32 MCU
STNEAIEVALLIC	Free experiment for 3 months	None	On supported STM32 Nucleo boards and Discovery kits

For commercial development, contact STMicroelectronics sales office or distributors to purchase a yearly Solo development license or Team development license. The libraries generated with NanoEdge™ AI Studio production licenses can run on any STM32 microcontrollers during development and are subject to licensed conditions for production.

Table 2. NanoEdgeAIStudio commercial offers

Order code	Detailed information	Technical support	Target STM32 MCU
STNEAISOLOLIC	1-year license for one user	None	Any
STNEAITEAMLIC	1-year license for a team	None	Any

To help users to build their prototypes or proofs of concept faster, with limited risk and investment and maximum chance of success, the Edge AI Sprint Packages are also available with a license bundled with different number of days of education and technical support.

Table 3. Edge AI Sprint commercial offers

Order code	Detailed information	Technical support	Target STM32 MCU
STNEAISPR1	3-month license	4 days	Any
STNEAISPR2	3-month license	8 days	Any
STNEAISPR3	6-month license	8 days	Any
STNEAISPR4	6-month license	16 days	Any

For more details and pricing information, contact the local STMicroelectronics sales office or distributors.

2.2 System requirements

- Personal computer
- Multi-OS support: Windows® or Linux® Ubuntu®

Note: *Linux® is a registered trademark of Linus Torvalds.*
Ubuntu® is a registered trademark of Canonical Ltd.
All other trademarks are the property of their respective owners.

3 License

Refer to the cartesiam.ai website for NanoEdge™ AI Studio (NanoEdgeAIStudio) license information.

Revision history

Table 4. **Document revision history**

Date	Revision	Changes
15-Sep-2021	1	Initial release.
5-Nov-2021	2	Updated product ordering and associated license descriptions in *Description* and *Ordering information*.
8-Dec-2021	3	Added library descriptions in Features and Description: • One-class classification libraries (outlier detection) • Regression libraries (extrapolation) Free evaluation license extended from two weeks to three months in Ordering information.