

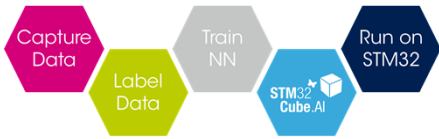
AI on STM32 Hands-on seminar

Gesture recognition

Matteo Maravita



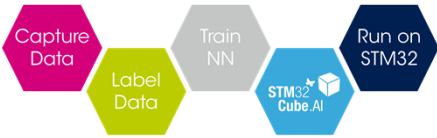
Updated: 09/09/19



- Session 1: HW and PC SW setup
- Session 2: Dataset preprocessing and NN training
 - Data collection on Sensortile board
 - Data formatting for NN input (Python script)
 - NN training (Keras model)
- NN model porting and integration in STM32 FW project
 - STM32Cube.AI: NN model porting
 - STM32Cube.IDE: integration in the FW project
 - Details of FW project relative to NN inference
- Demo verification



Session 1: HW and PC SW setup



HW and SW setup checklist

HW

SensorTile kit

Nucleo-64 board (any PN ok)

Micro SD card (few KB needed)

Wrist Strap band

Mini USB cable

Micro USB cable

SW

STM32CubeIDE 1.0.1 or later

(STM32CubeMX 5.0.1 or later included in STM32CubeIDE installation)

X-CUBE-AI 4.0.0 or later

STM32CubeL4 (STM32L4 latest libraries)

Python 3.6 and specific libraries (including Tensorflow 1.5 and Keras 2.2.2)

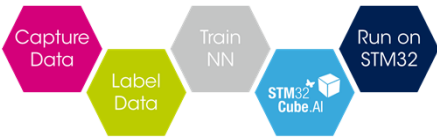
Github Demo project (Python + STM32 FW)

ST BLE Sensor app on mobiphone/tablet

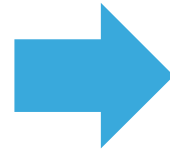


Gesture recognition project available at Github repository:

https://github.com/teomaras76/AI_on_STM32_Gesture_recognition

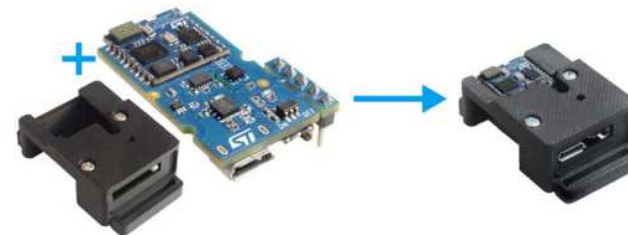
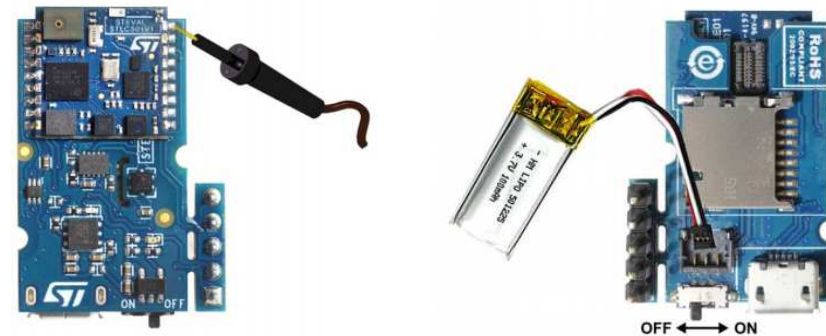


HW setup (1/3)



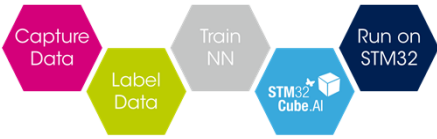
Sensortile board must be soldered on the cradle board, connected to the battery and inserted in the plastic case (for details please refer to UM2101

https://www.st.com/content/ccc/resource/technical/document/user_manual/group0/bc/b1/ad/c8/36/de/40/92/DM00320099/files/DM00320099.pdf/jcr:content/translations/en.DM00320099.pdf)



SensorTile kit:

https://www.st.com/content/st_com/en/products/evaluation-tools/solution-evaluation-tools/sensor-solution-eval-boards/steval-stlkt01v1.html



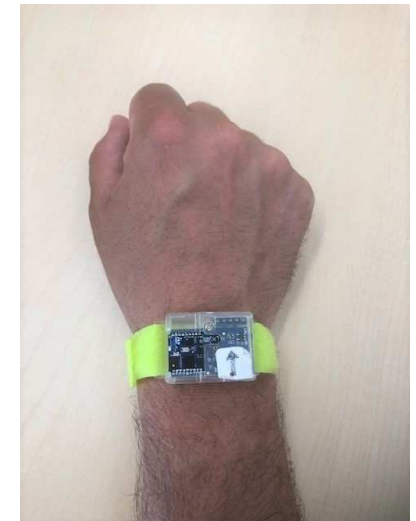
HW setup (2/3)

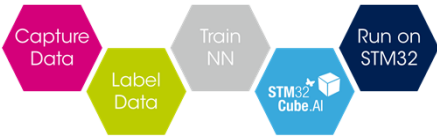
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A micro-SD card (only few KB will be used for the demo) must be inserted in the Sensortile. It will be used to log the RAW data of the sensors used as input of the NN. You will need also a micro-SD card reader adapter for your PC.



A strap band will be used to fix the sensortile to the wrist for demo purpose.
It will be useful to use also a sticker to mark the direction of the Sensortile.



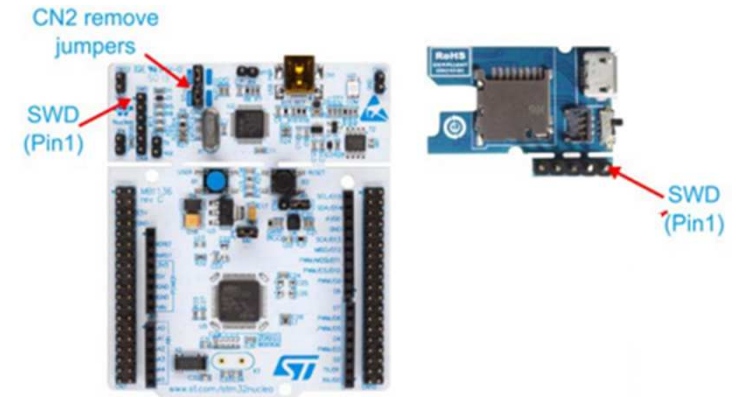


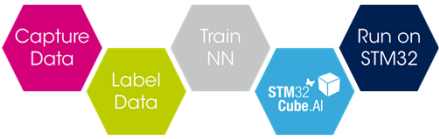
HW setup (3/3)

In order to program the SensorTile we will need later to connect it to the SWD connector of an STLink . For this purpose we can use the STLink present in a Nucleo board and follow the instructions in the UM2101.

The cable to connect the SensorTile to the X-Nucleo board is already present in the SensorTile kit.

A mini-USB cable would be needed to connect the Nucleo board to the PC, and a micro-USB cable to connect the SensorTile (to charge the battery).



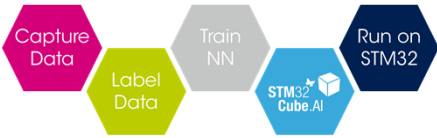


STM32CubeIDE download

- Download the latest version of STM32CubeIDEのv1.x.x from below URL:
 - https://www.st.com/content/st_com/en/products/development-tools/software-development-tools/stm32-software-development-tools/stm32-ides/stm32cubeide.html

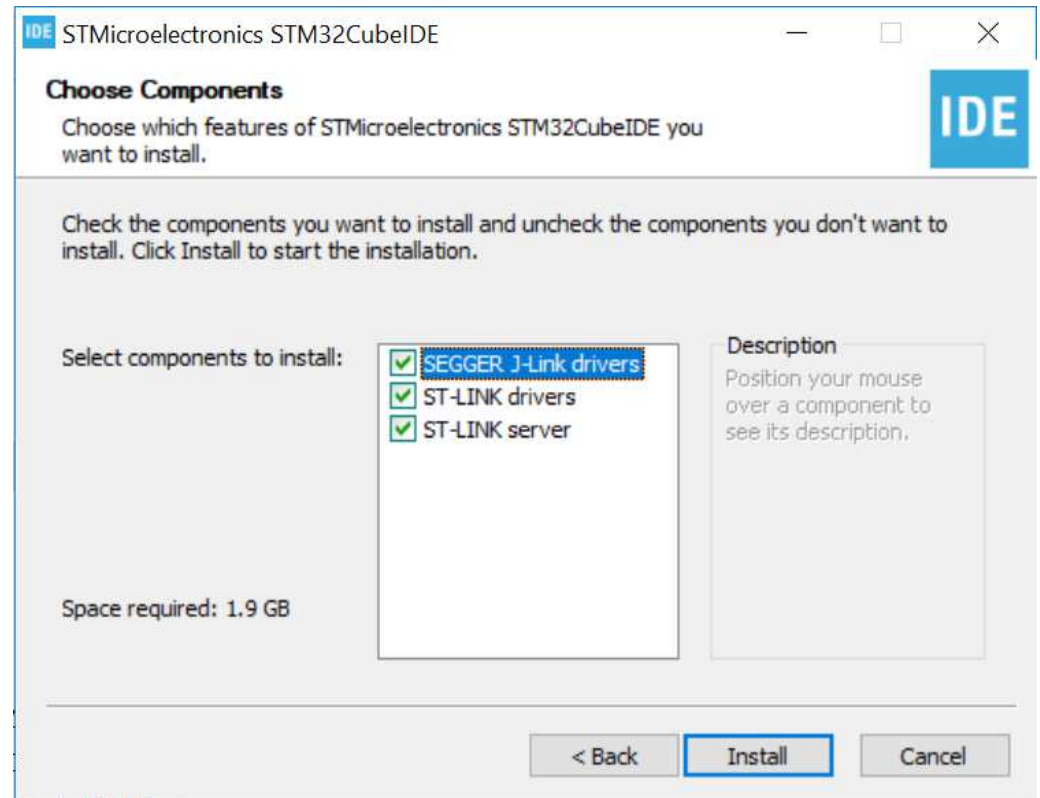
Get Software

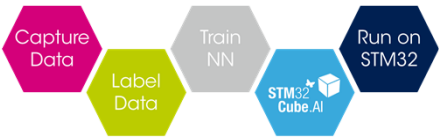
Part Number	General Description	Software Version	Download	Previous versions
+ STM32CubeIDE-DEB	STM32CubeIDE Debian Linux Installer	1.0.2	Get Software	Select version ▼
+ STM32CubeIDE-Lnx	STM32CubeIDE Generic Linux Installer	1.0.2	Get Software	Select version ▼
+ STM32CubeIDE-Mac	STM32CubeIDE macOS Installer	1.0.2	Get Software	Select version ▼
+ STM32CubeIDE-RPM	STM32CubeIDE RPM Linux Installer	1.0.2	Get Software	Select version ▼
+ STM32CubeIDE-Win	STM32CubeIDE Windows Installer	1.0.2	Get Software	Select version ▼



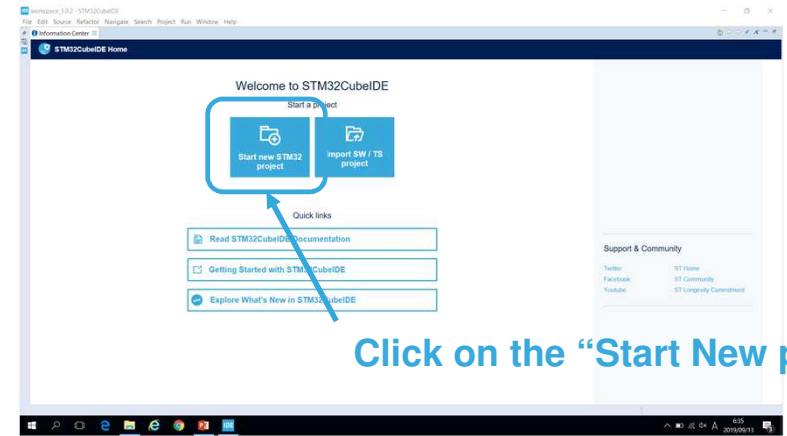
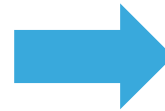
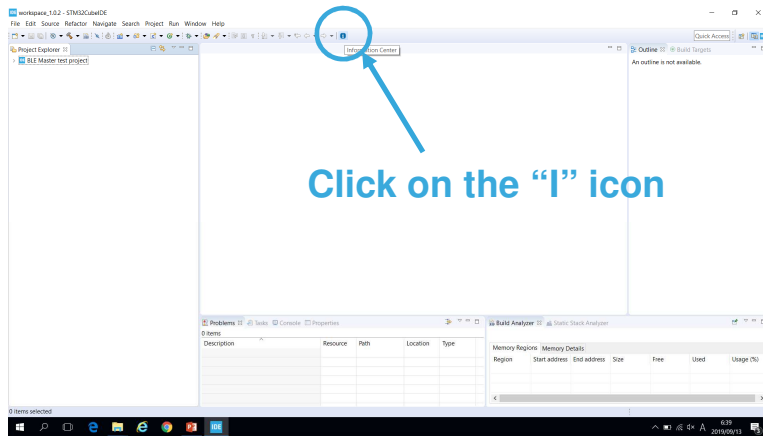
STM32CubeIDE installation

- Uncompress the .zip file downloaded and launch the installation .exe file
- During the installation process take care of installing also the debugger driver

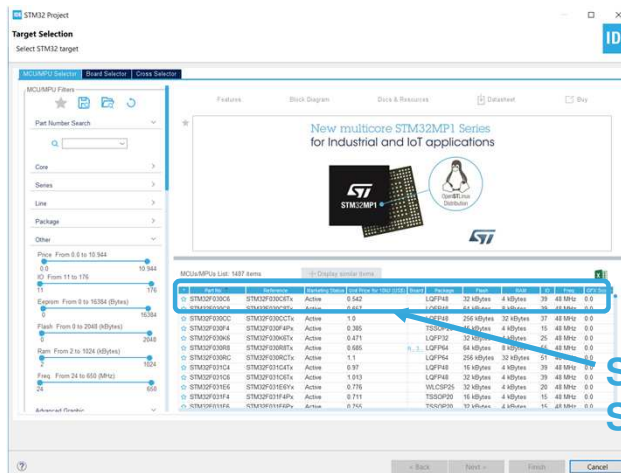




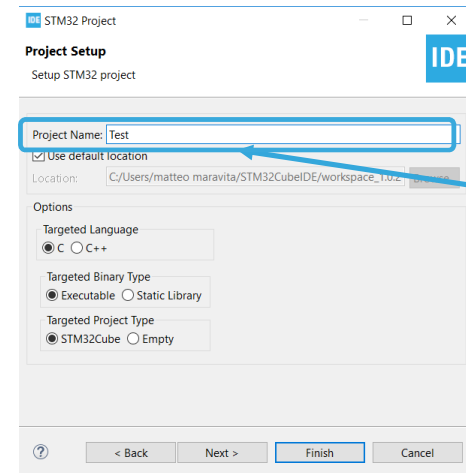
STM32CubeL4 and X-CUBE-AI installation from STM32CubeIDE



Click on the "Start New project"

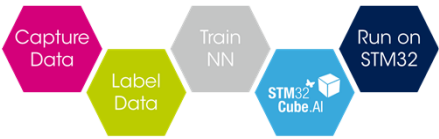


Select one STM32L4 P/N



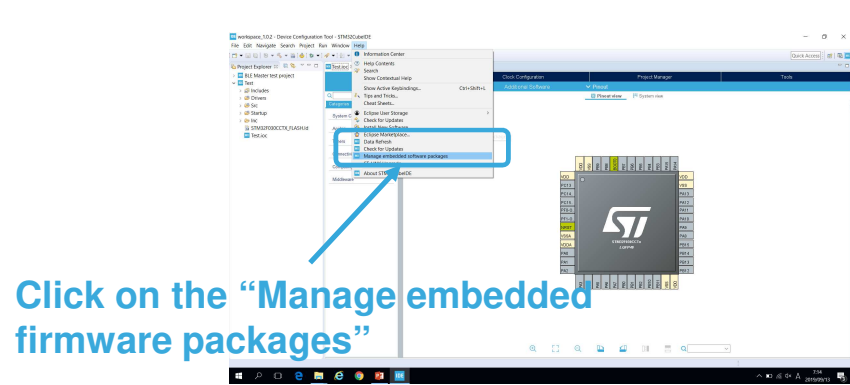
Insert a project name



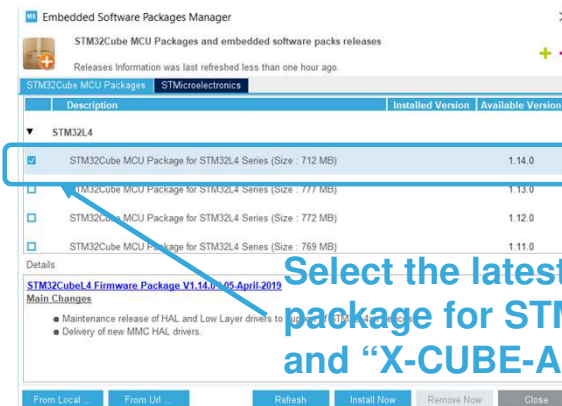


STM32CubeL4 and X-CUBE-AI installation from STM32CubeIDE

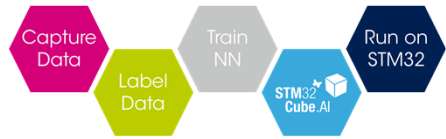
With the previous steps we opened STM32 CubeMX tools inside STM32CubeIDE. Now we can download and update the needed libraries from STM32CubeMX.



Click on the “Manage embedded firmware packages”



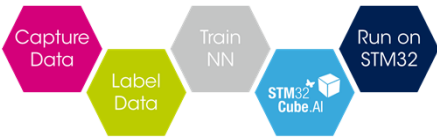
Select the latest “STM32Cube package for STM32L4 Series” and “X-CUBE-AI”



STM32CubeL4 and X-CUBE-AI installation from packages

- Download STM32CubeL4 library package from:
 - https://www.stmcu.jp/design/sw_dev/firmware/52726/
- Download X-CUBE-AI library package from:
 - https://www.stmcu.jp/design/sw_dev/firmware/64058/

To add instruction how to install the downloaded package



SW setup – Python 3.6.x

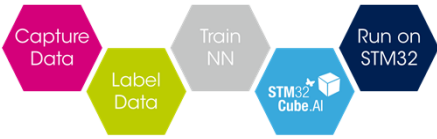
At first Python must be installed on the PC (<https://www.python.org/downloads/>), Python 3.6.x is recommended.

Tensorflow and Keras are only supported in a x86-64 bit desktops/laptops, so you must choose the python version 64 bit.

Version	Operating System	Description	MD5 Sum	File Size	PGP
Gzipped source tarball	Source release		9a080a86e1a8d85e45eee4b1cd0a18a2	22930752	SIG
XZ compressed source tarball	Source release		c3f30a0aff425dda77d19e02f420d6ba	17156744	SIG
macOS 64-bit/32-bit installer	Mac OS X	for Mac OS X 10.6 and later	c58267cab96f6d291d332a2b163edd33	28060853	SIG
macOS 64-bit installer	Mac OS X	for OS X 10.9 and later	3ad13cc51c488182ed21a50050a38ba7	26954940	SIG
Windows help file	Windows		e01b52e24494611121b4a866932b4123	8139973	SIG
Windows x86-64 embeddable zip file	Windows	for AMD64/EM64T/x64	7148ec14edfd13f42e06a14d617c921	7186734	SIG
Windows x86-64 executable installer	Windows	for AMD64/EM64T/x64	767db14ed07b245e24e10785f9d28e29	31930528	SIG
Windows x86-64 web-based installer	Windows	for AMD64/EM64T/x64	f30be4659721a0ef68e29cae099fed6f	1319992	SIG
Windows x86 embeddable zip file	Windows		b4c424de065bad238c71359f3cd71ef2	6401894	SIG
Windows x86 executable installer	Windows		467161f1e894254096f9a69e2db3302c	30878752	SIG
Windows x86 web-based installer	Windows		a940f770b4bc617ab4a308ff1e27abd6	1293456	SIG

Please make sure to select the option “Add Python 3.X to PATH” before launching the installation.

Once the installation is finished, open a “Command Prompt” and check your installation using the command “*python3 --version*”.



SW setup – Python packages installation

To install a package in python, you must use the “pip” package which is installed by default by python. The “pip” is a tool which manage the packages installations. Most python packages depend on other package and “pip” can manage with these dependencies. It installs automatically all the dependencies required for a package.

(for more details on pip → https://pip.pypa.io/en/stable/reference/pip_install/).

Using pip tool, you must specify and set the proxy connection.

Once the installation is finished, open a “Command Prompt” and check your installation using the command “*pip3 --version*”. After verified it you can now install the needed packages by launching the commands:

- *pip3 install tensorflow>=1.5*
- *pip3 install h5py>=2.7.0*
- *pip3 install Keras>=2.1.6*
- *pip3 install matplotlib>=2.0*
- *pip3 install scikit-learn>=0.17*
- *pip3 install scikit-image>=0.10*