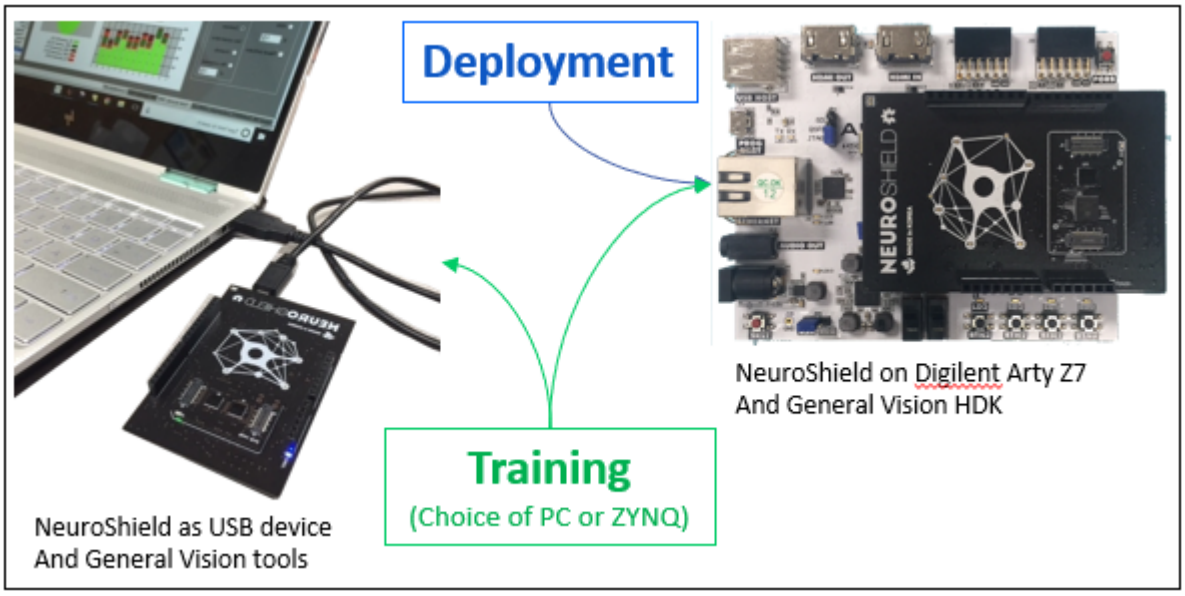
Getting Started with NeuroShield

NeuroShield is a shield board featuring the NM500 neuromorphic chip with 576 neurons ready to learn and recognize stimuli extracted from any type of sensors including IMU, audio, environmental sensors, bio-signal, video and more.

- SPI interface:
  - For use as a shield with Arduino, Raspberry PI, and other microcontrollers to empower embedded systems with access to a NeuroMem network.
- USB Serial interface
  - For use as a simple USB dongle to empower PC-based applications with access to a NeuroMem network.



> NeuroShield and NeuroBrick are products from nepes.
> The NeuroMem® NM500 is a chip manufactured by nepes under license from General Vision Inc.
> General Vision Inc. is the inventor and owner of the NeuroMem® technology.

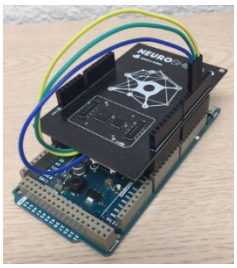
Download the Board Support package at https://github.com/general-vision/neuroshield

Contents

NeuroShield as a shield with SPI interface

NeuroShield for Arduino

Connectivity



Please note that the NeuroShield does not have a 6-pin ICSP connector and can only receive the SPI signals on its digital Arduino connectors.

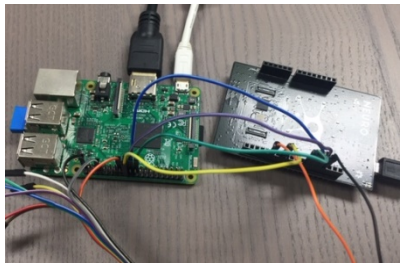
Refer to the latest table at https://www.arduino.cc/en/reference/SPI for the SPI pinout per model of Arduino board.

Examples

- NeuroMem library establishes communication to the NeuroShield through SPI and gives access to the neurons of the NM500 chip.
- Academic Scripts illustrating how to teach the neurons and query them for simple recognition status, or a best match, or a detailed classification of the K nearest neurons.
- Motion recognition examples using the on-board IMU from Invensense (MPU6050) and the IMU from the Arduino101.
- Video recognition examples using an ArduCAM shield

NeuroShield for Raspberry PI

Connectivity



Raspberry Pi	Signal	NeuroShield
GPIO 39	GND	D14
Pin 25 / GPIO	SPI_EN	D5
Pin 23 / GPIO 11	SPI_CLK	D13
Pin 21 / GPIO 9	SPI_MISO	D12
Pin 19 / GPIO 10	SPI_MOSI	D11
Pin 24 / GPIO 8	SPI_NM_CS	D7

Do not forget to enable the SPI interface, under Interfacing options (run sudo raspi-config).

Examples

- NeuroMem library establishes communication to the NeuroShield through SPI and gives access to the neurons of the NM500 chip.
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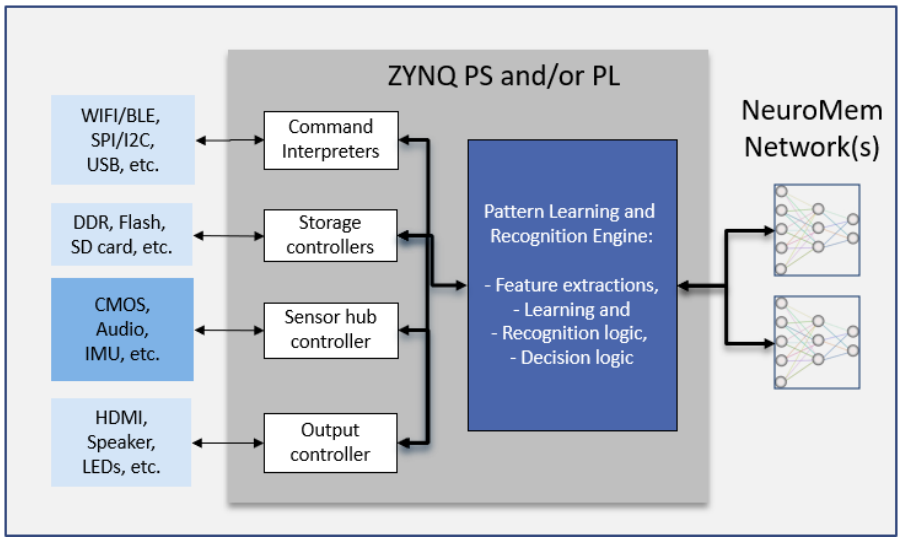
- Video recognition examples using the RaspiCam

NeuroShield for ZYNQ development boards

A new NeuroShield HDK for ZYNQ7000 development boards allows interfacing to the NeuroMem neurons from the Zynq Processor Subsystem (PS) and/or the Programmable Logic (PL) fabric.



Package Content:

- NeuroShield embedded system file for Digilent Arty Z7 and Avnet MiniZed (*.hd file)
- Xilinx SDK standalone project including the NeuroMem API in C/C++ and Academic Script illustrating how to teach the neurons and query them for simple recognition status, or a best match, or a detailed classification of the K nearest neurons.
- Complete Vivado project (** optional use to adapt to your own ZYNQ platform; version 2018.3)

Other SPI interfaces

NeuroShield can be interfaced to any device supporting an SPI interface. Access to the neurons is made through a simple 10-bytes protocol described in https://www.general-vision.com/documentation/TM_NeuroMem_Smart_protocol.pdf.

Example Source code of the primitive SPI_Connect, SPI_Read and SPI_Write can be found in the Board Support Package:

- Arduino\Libraries\Src\NeuroMemSPI.cpp
- Python\GVcommSPI.py
- USB\NeuroMemAPI\lib

NeuroShield as a USB device

Windows

NeuroShield can be connected to a PC through USB so you can access the neurons from our Knowledge Builder software or develop your own applications using our standard API or SDKs.

- NeuroShield Console Manual (PDF) and video tutorial
- NeuroMem API

Linux

The NeuroMem API features C/C++ source code which can be adapted for Linux. Please refer to the Cypress documentation to replace the use of their driver Windows cyusbserial.dll with a native serial API for Linux. http://www.cypress.com/documentation/software-and-drivers/usb-serial-software-development-kit

Supplements for Windows OS

Additional generic tools:

- NeuroMem Knowledge Builder
- CogniPat SDK C++/C#/Python
- CogniPat SDK MatLab
- CogniPat SDK LabVIEW

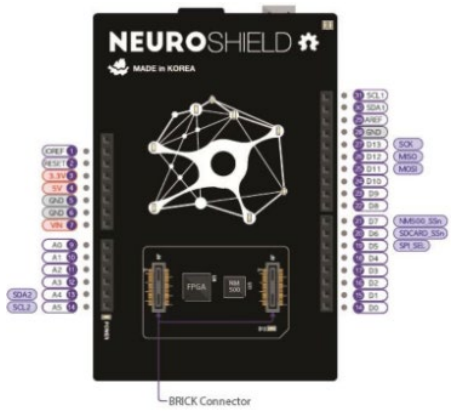
Additional imaging tools:

- Image Knowledge Builder
- CogniSight SDK C++/C#
- CogniSight SDK MatLab
- CogniSight SDK LabVIEW

Hardware Specifications

For more details regarding the hardware, refer to the nepes NeuroShield Hardware Manual

Pinout and Power Supply



pin	Description
D13	SCK
D12	MISO
D11	MOSI
D7	SPI_CS_NMn, SPI select to access the neurons
D6	SPI_CS_SDn, SPI select to access SD card
D5	SPI_SELn, Enable access to the neurons via SPI. If not set the low, the interface is USB.

If using the USB port for power supply, do not forget to connect a GND pin of the NeuroShield to a GND pin of the host.

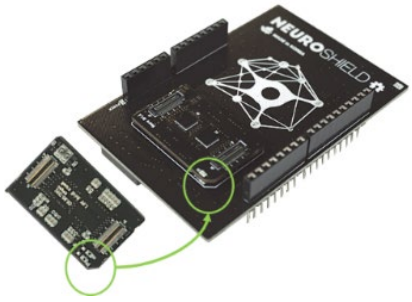
The NeuroShield requires 5V power supply which can be delivered through the USB connector or through the Arduino J1 connector.

NeuroShield V0.3: Compatible with base platforms supporting both 5V and 3.3V IO voltage
(J1, pin 7, IOREF is not connected)

NeuroShield V0.1 and V0.2: Compatible with the Arduino UNO and other base platforms supporting 5V IO voltage.
NOT compatible with base platforms supporting 3.3V IO voltage (J1 , pin 7, IOREF is connected to 5V)

Expanding the network

NeuroShield 576 neurons
+ 1st NeuroBrick 1728 neurons
+ 2nd NeuroBrick 2880 neurons
+ 3rd NeuroBrick 4032 neurons



- Disconnect the NeuroShield from its power supply before plugging a NeuroBrick module
- Align the cut corner of the NeuroBrick with the same marking on the NeuroShield
- The Connect function of the API automatically detects the size of the NeuroMem network and returns its value through the GetNetworkInfo function