

OBJECT LEARNING AND MONITORING In live video

Powered by ArduCam and a NeuroMem network

Applications

- Inspect a part passing on a conveyor
- Detect if someone is coming towards a door
- Ring alarm if a raccoon comes through the cat door
- Etc.

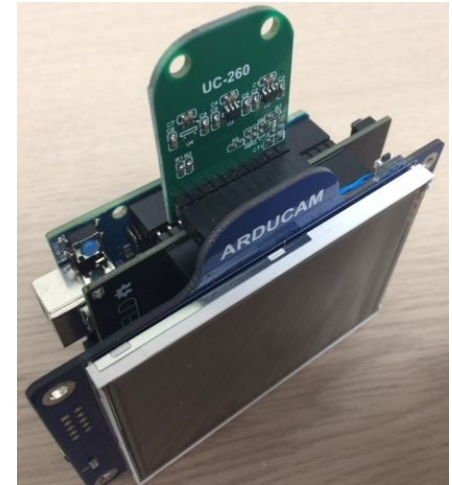
Learning and Monitoring of a fixed region

Including the detection of novelties



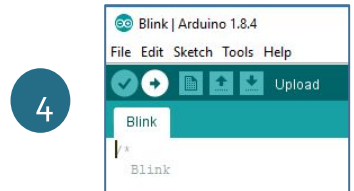
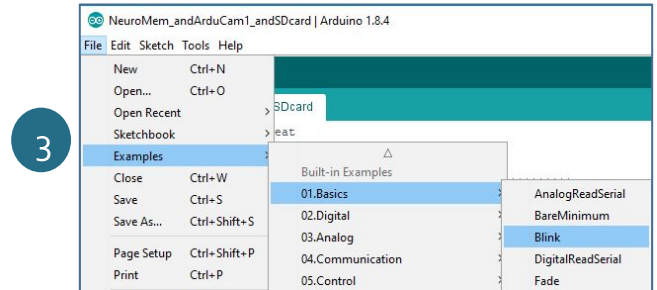
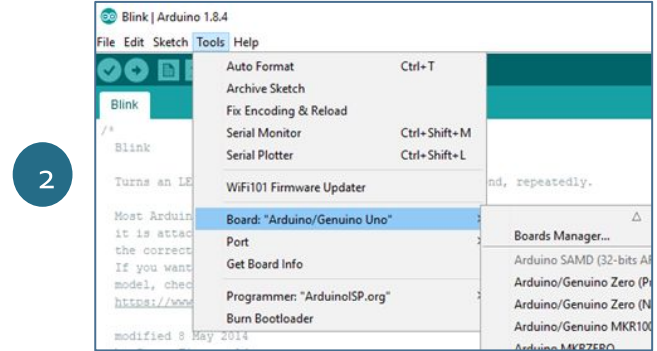
Hardware Setup

- Two options:
 - 1) Arduino/Genuino 101 featuring 128 neurons in the Curie module
 - 2) Arduino board with at least 5 KB memory combined with the NeuroShield board featuring 576 neurons (**see last page for wiring instructions)
- ArduCam Shield V2 featuring
 - Color low-res CMOS sensor
 - LCD display
 - SD card



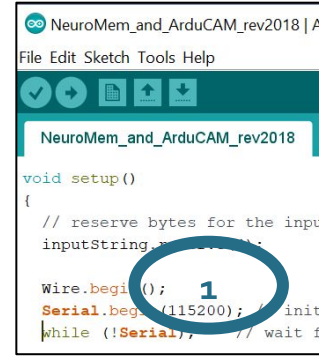
Arduino IDE Installation

1. Download the latest Arduino IDE (<https://www.arduino.cc/en/Main/Software>)
2. Under the Tools\Board menu, select your board model.
 - If not in the list, select Board Manager and install its driver
3. Load the File\Examples\Basic\Blink script
4. Upload the script to your board
5. Verify that the LED is blinking

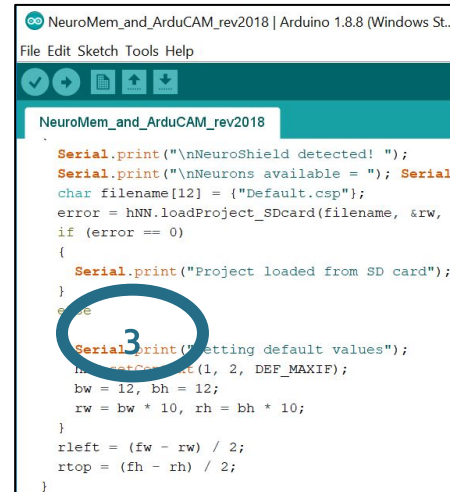


Configure the script

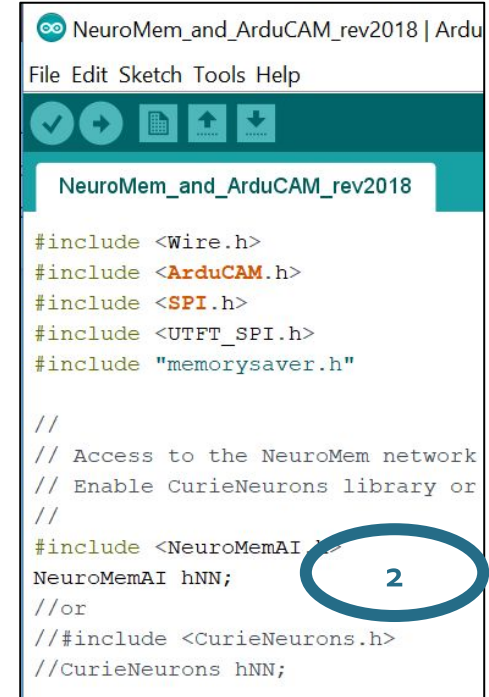
1. Adjust the baud rate of the serial monitor
2. Select the NeuroMem platform by commenting out its library
3. Set your preferred settings if no project file is found on the SD card



```
NeuroMem_and_ArduCAM_rev2018 | Ar
File Edit Sketch Tools Help
NeuroMem_and_ArduCAM_rev2018
void setup()
{
  // reserve bytes for the input
  inputString.reserve(100);
  Wire.begin();
  Serial.begin(115200); // wait f
  while (!Serial); // wait f
```



```
NeuroMem_and_ArduCAM_rev2018 | Arduino 1.8.8 (Windows St...
File Edit Sketch Tools Help
NeuroMem_and_ArduCAM_rev2018
Serial.print("\nNeuroShield detected! ");
Serial.print("\nNeurons available = "); Serial.
char filename[12] = {"Default.csp"};
error = hNN.loadProject_SDcard(filename, &rw, &
if (error == 0)
{
  Serial.print("Project loaded from SD card");
}
else
{
  Serial.print("Setting default values");
  hNN.setConfig(1, 2, DEF_MAXIF);
  bw = 12, bh = 12;
  rw = bw * 10, rh = bh * 10;
}
rleft = (fw - rw) / 2;
rtop = (fh - rh) / 2;
}
```



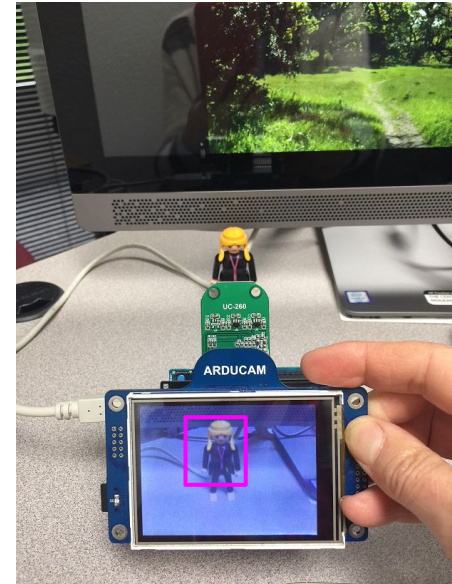
```
NeuroMem_and_ArduCAM_rev2018 | Ardu
File Edit Sketch Tools Help
NeuroMem_and_ArduCAM_rev2018
#include <Wire.h>
#include <ArduCAM.h>
#include <SPI.h>
#include <UTFT_SPI.h>
#include "memorysaver.h"

//
// Access to the NeuroMem network
// Enable CurieNeurons library or
//
#include <NeuroMemAI.h>
NeuroMemAI hNN;
//or
//#include <CurieNeurons.h>
//CurieNeurons hNN;
```



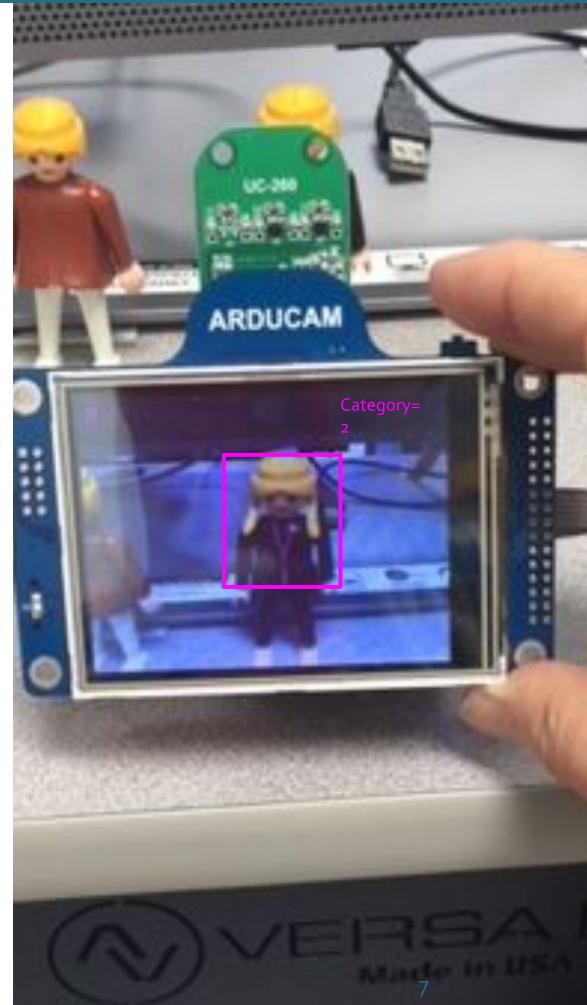
Launch the script

- Open the serial monitor
- Live video appears at the end of the setup
- The blinking rectangle at the center of the screen is the region to learn or monitor
- The result of the recognition is displayed in upper left corner
- Type "h" to view the HELP menu



Learn a 1st object

- Type the category to learn and Enter
- Move camera so the object appears within the rectangle
- Press the shutter button until blink stops
- Bottom line reports the number of committed neurons
- Upper line displays the recognized category



More training

Learn a 2nd object

- Type a new category number and Enter
- Move camera so the object appears within the rectangle
- Press the shutter button until blink stops

Correct false positive

- Type “o” and Enter
- Move camera where an incorrect category is report
- Press the shutter button until blink stops



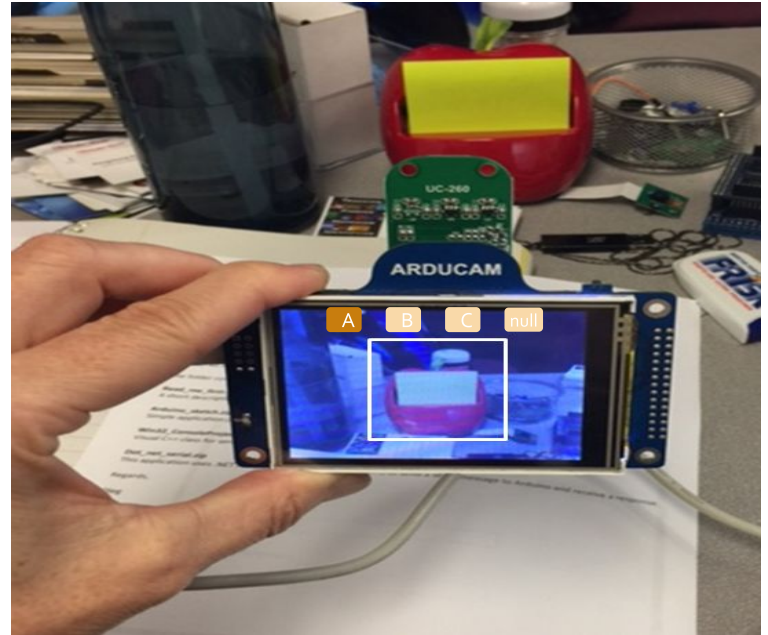
Option to build a knowledge of novelties

- Enable the learning of novelties by typing “rn”
- The neurons start learning novel patterns under context #2.
- Save the knowledge by typing “skn”
- Review the knowledge at later time with Image Knowledge builder or applications developed with the CogniSight SDK
- Decide if the models saved under context #2 should be learned or discarded



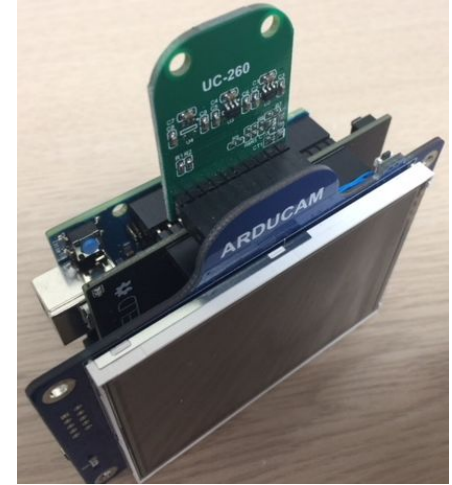
What is next?

- Design UI allowing category selection on the touch screen
- Improve UI to better synchronize the teaching instruction to the real-time image acquisition
- And more....

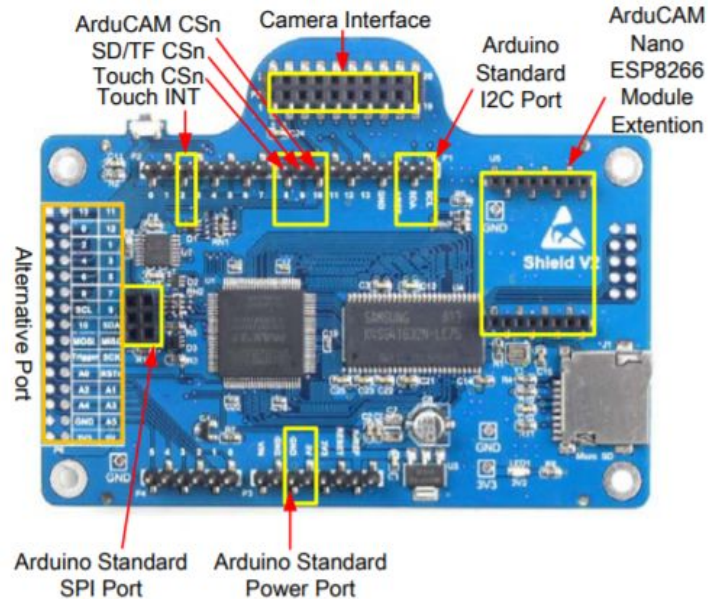


Optional SD card usage

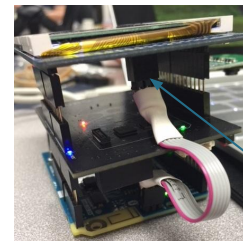
- Load an initial knowledge at startup
- Save the knowledge after teaching new examples
- Export this knowledge for use with the General Vision Image Knowledge Builder and SDKs



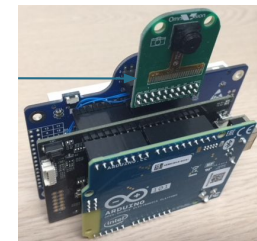
Connecting ArduCAM SPI to NeuroShield



- The NeuroShield does not pass-thru the lines of the ICSP 6-pin connector
- You need to bring the lines SPI_CLK, MISO, MOSI, from the ICSP of the Arduino board to the ICSP connector of the shield or to the lines 11, 12 and 13 to the J2 or Alternative port of the shield



J2



ICSP

