MOTION LEARNING AND MONITORING

Powered by a NeuroMem network

On Arduino platform

General Vision Technical Brief

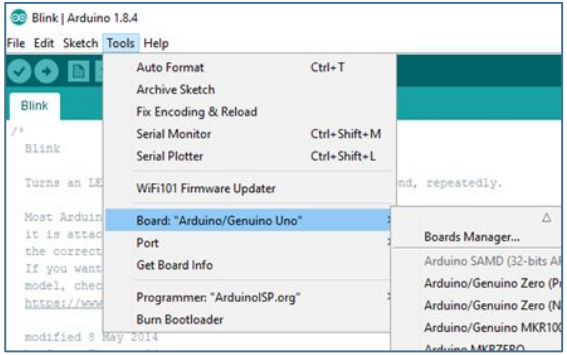
Assembly

- Arduino microcontroller board with at least 3 KB of dynamic memory
- NeuroShield featuring
  - InvenSense Accel/Gyro
  - 576 NeuroMem neurons
- Optional set of spacers

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

2



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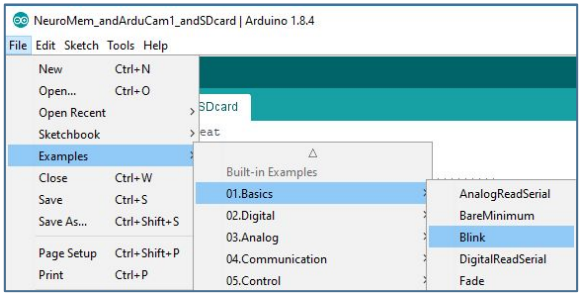

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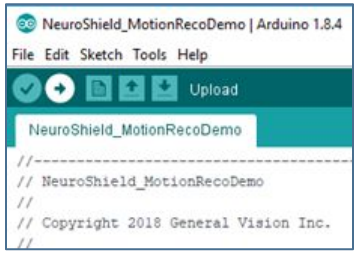
Running the demo

1. Load the NeuroShield_MotionRecoDemo
2. Upload the script to the Arduino
3. Verify that the upload is successful.
   - If not, go to troubleshooting slide
4. Open the serial Monitor
5. Follow the instructions on the screen.
   - If the window is blank and frozen, go to the Troubleshooting slide

2



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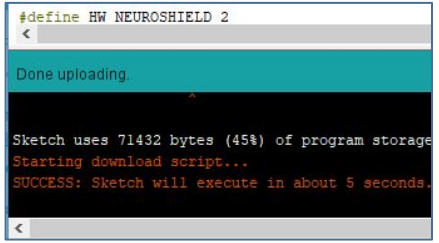

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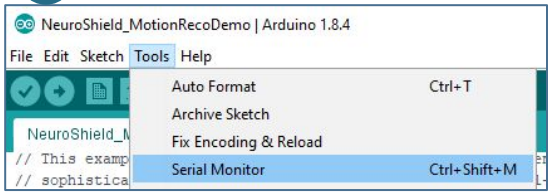
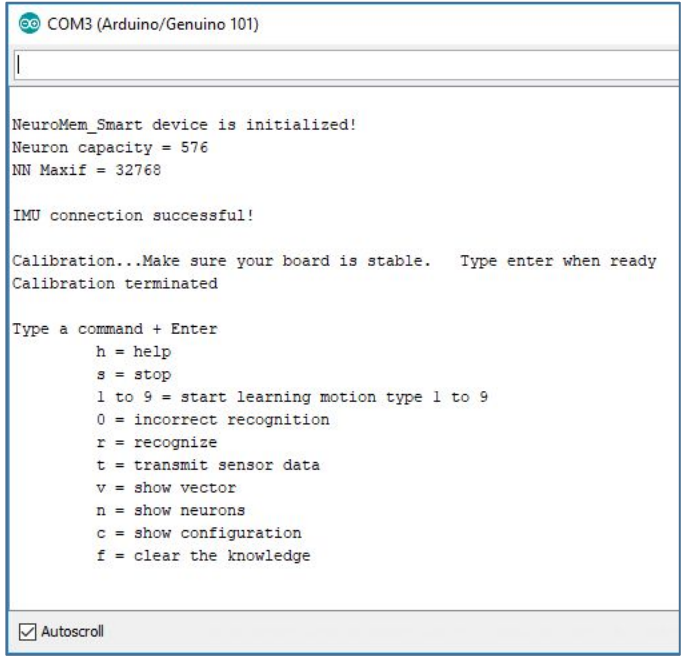


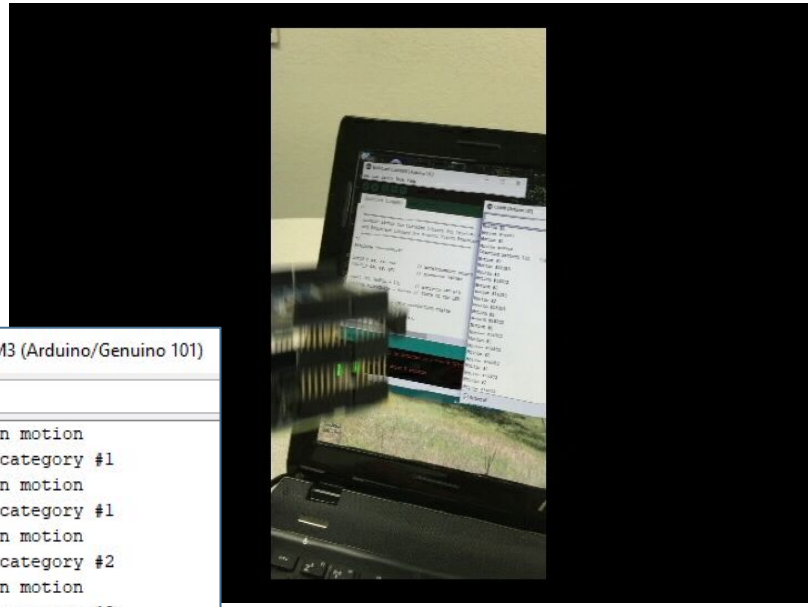
Academic training case

- Move the board up and down
- Type 1+Enter to teach vertical motion
- Move the board left and right
- Type 2+Enter to teach horizontal motion
- Stop moving
- Type 0 + Enter to teach “No motion”



Continuous recognition

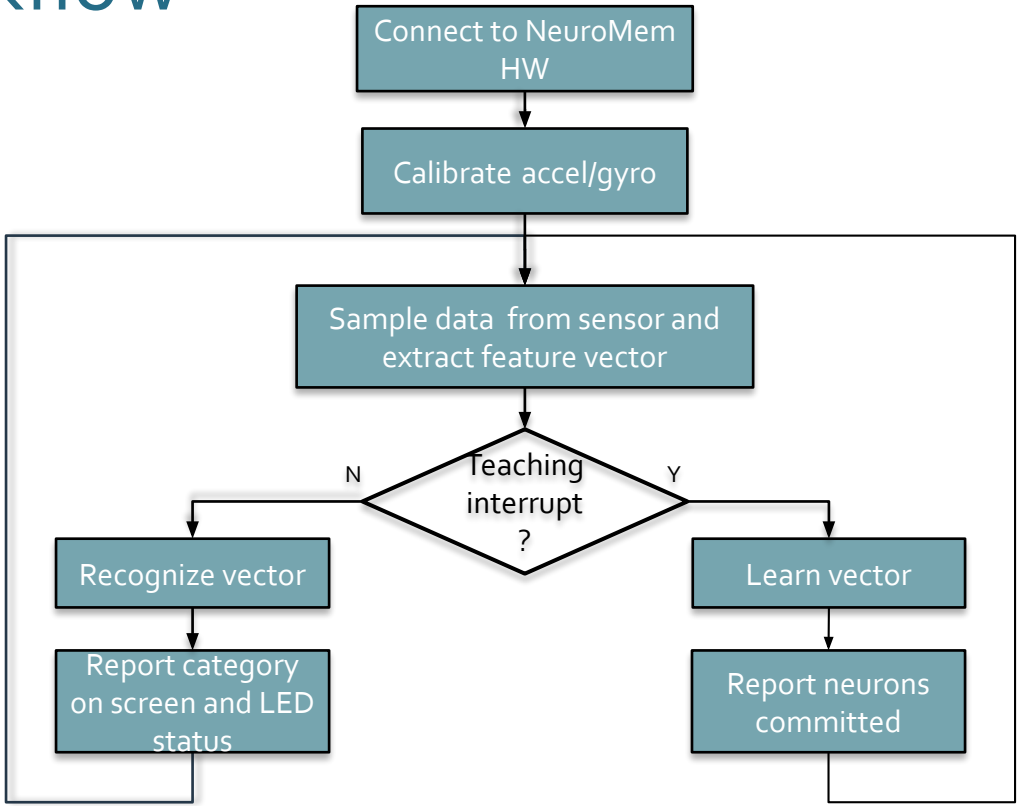
- Report 1 for up-down motion
- Report 2 for left-right motion
- Report Unknown for anything else



COM3 (Arduino/Genuino 101)

```
No known motion
Motion category #1
No known motion
Motion category #1
No known motion
Motion category #2
No known motion
Motion category #2
No known motion
Motion category #2
```

Script workflow



About the feature extraction

// This example is very academic and assemble a simple sequence pattern which should be more
// sophisticated to address a real-life problem such as real-time sampling rate and calibration
// adequate for the type of motion being studied.
// More advanced feature extractions can include waveform profiles, distribution of peaks and zero crossing, etc.

NeuroShield_MotionRecoDemo

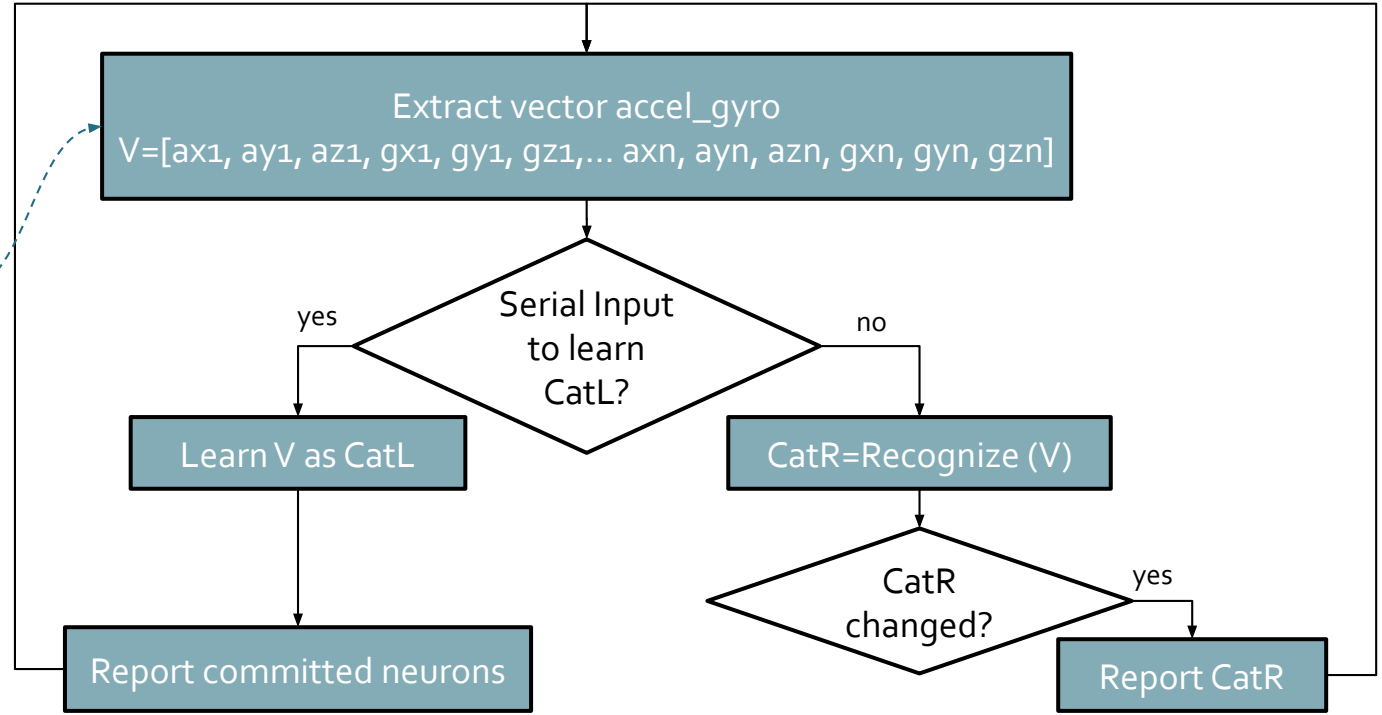
```
for (int j=0; j<sampleNbr; j++)
{
  getSensorData();
  vector[(j*channelNbr)]= (int)(ax);
  vector[(j*channelNbr)+1]= (int)(ay);
  vector[(j*channelNbr)+2]= (int)(az);
  vector[(j*channelNbr)+3]= (int)(gx);
  vector[(j*channelNbr)+4]= (int)(gy);
  vector[(j*channelNbr)+5]= (int)(gz);
```

Collect N consecutive measurements of ax, ay, az, gx, gy, gz and append to a feature vector

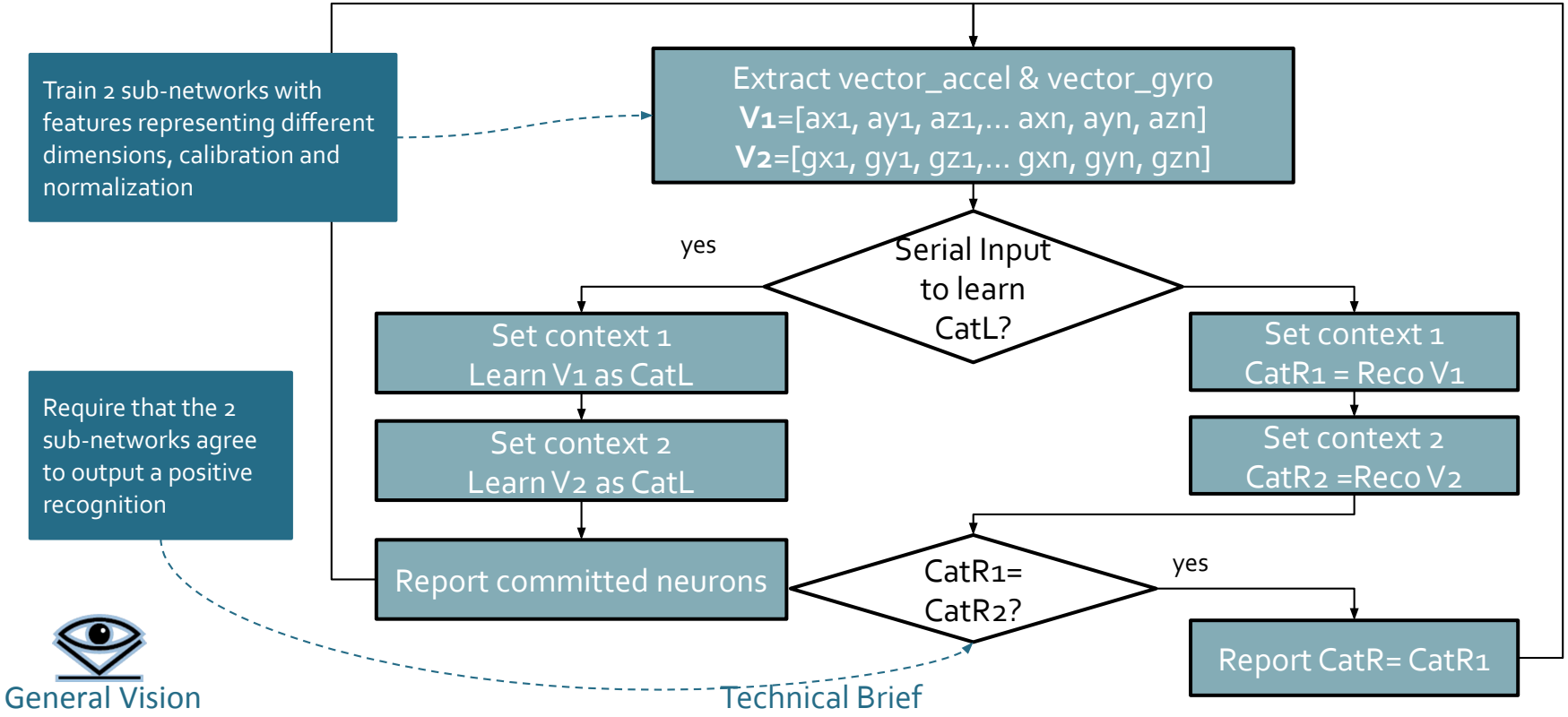
Example using 1 feature

Quick & simple sampling

WARNING:
combines data with different dimensions, different calibration and normalization



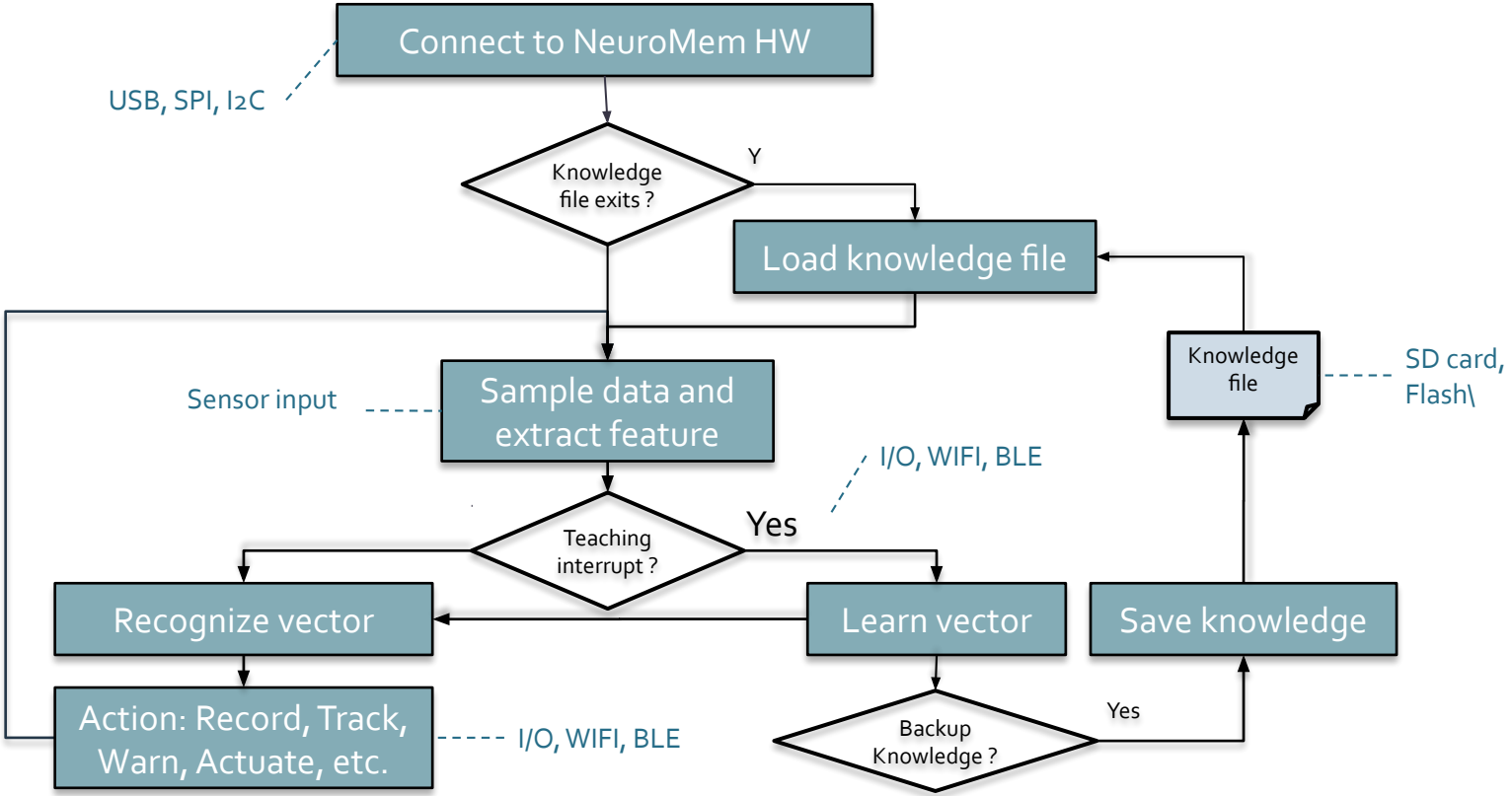
Examples using 2 features



What is next?

- Improve the calibration routine
- Extract more advanced feature(s) depending on the application
- Improve UI to better synchronize the teaching instruction to the real-time motion
- And more….

Typical signal monitoring workflow



Troubleshooting

- Script does not load properly
  - Verify the selected platform and COM port under Tools menu
  - Use the board's external power supply instead of the USB power
  - Unplug all shields for the duration of the upload
- Serial monitor is blank and frozen
  - Verify the selected baud rate
  - Close the window
  - Unplug / Replug the Arduino board
  - Wait a few seconds and re-open the serial monitor