



Knowledge Studio

User Manual V 1.0.4

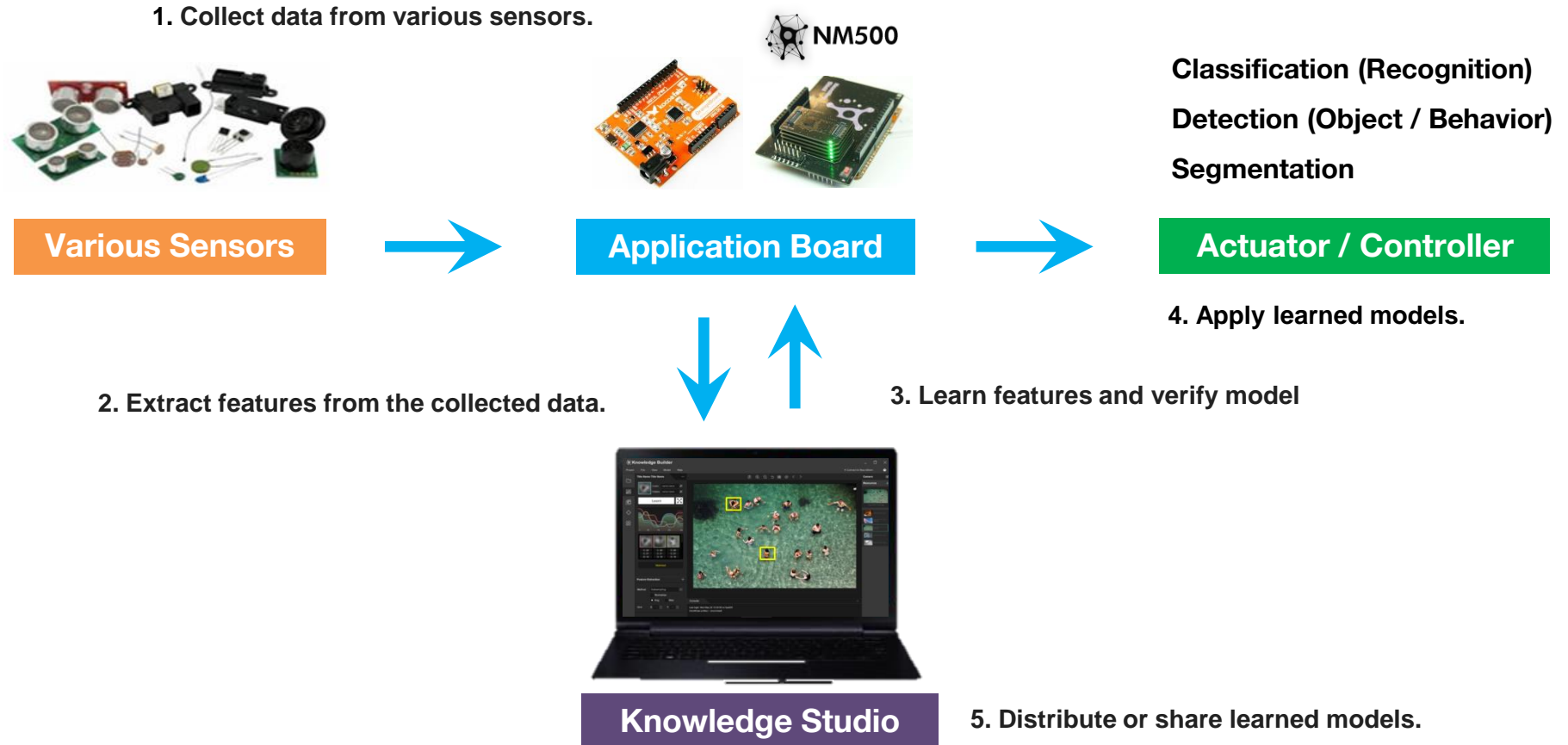
The Knowledge Studio is a development tool that can help you to build your knowledge model quick and easy.

Contents

1. How to build a knowledge model using the Knowledge Studio
2. Application Board Setup
3. Using Knowledge Studio

1. How to build a knowledge model using the Knowledge Studio

*The NeuroShield is an open source hardware compatible shield board.
It can be used by connecting to the Arduino or mbed platform.*



2. Application Board Setup



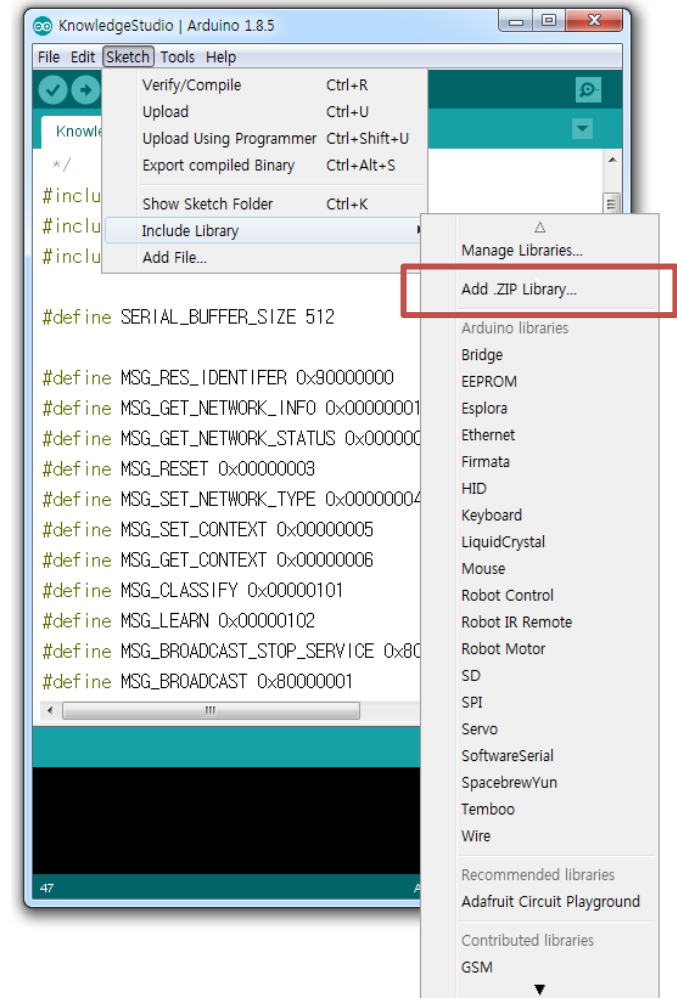
1. Connect NeuroShield to Arduino.



2. Connect the Arduino to your PC using a USB cable.

3. Download NSNeuralNetwork.zip and add it to the Arduino IDE as a library.

<https://github.com/nepes-ai/knowledgestudio>

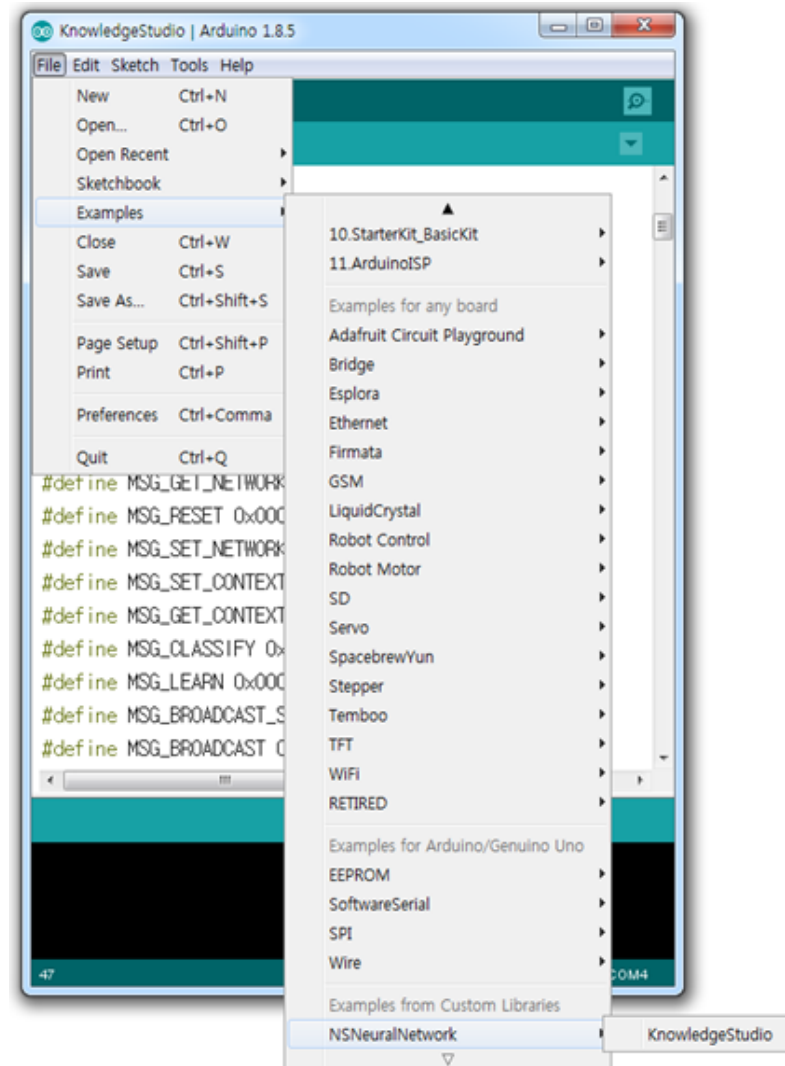


2. Application Board Setup



4. If the library has been successfully added,
move to **File > Examples > NSNeuralNetwork**
and select the **KnowledgeStudio** example.

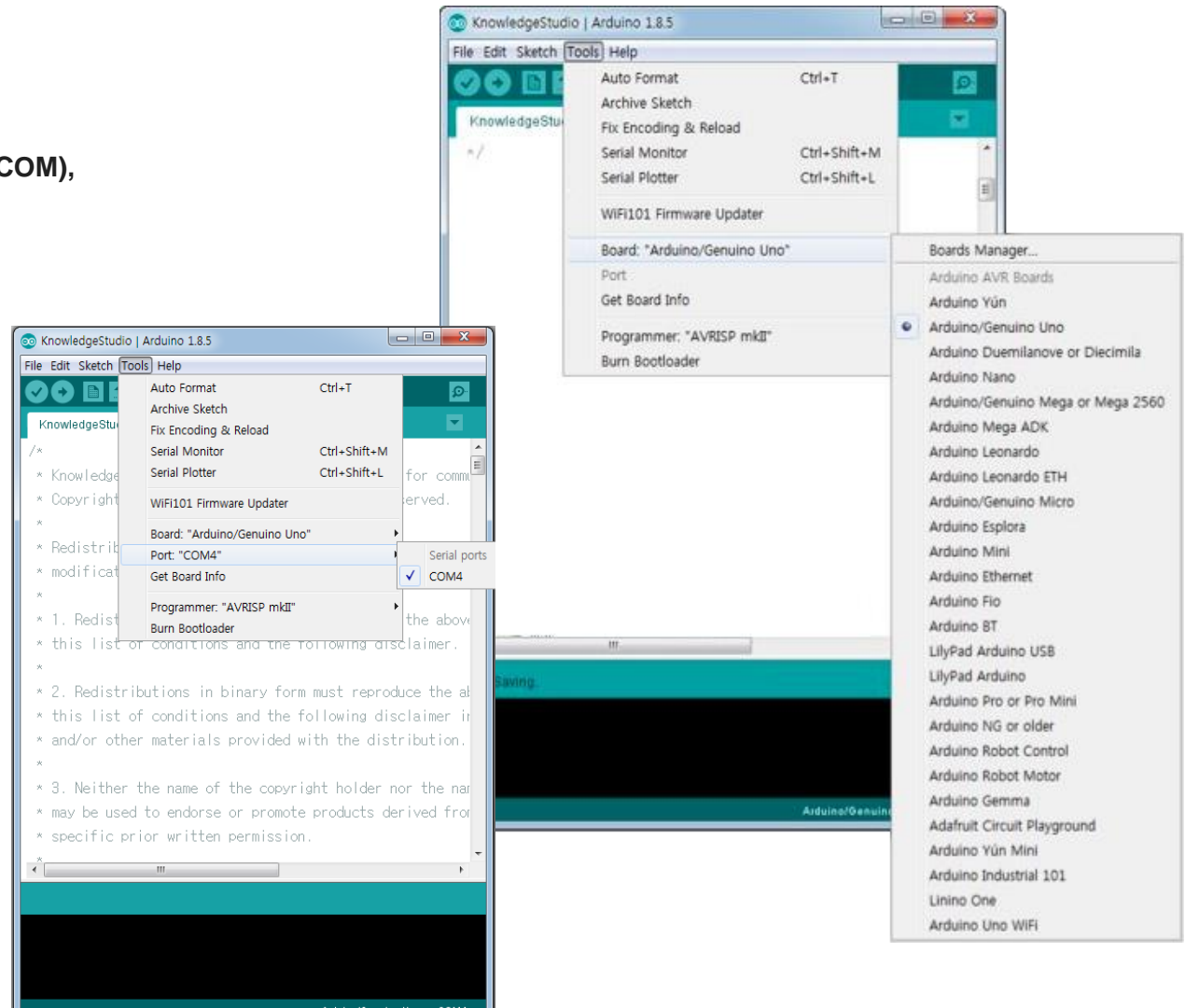
The KnowledgeStudio sketch file is implemented communication protocol between the Knowledge Studio and Arduino through USB Serial.



2. Application Board Setup



5. Select your Arduino board and port(COM),

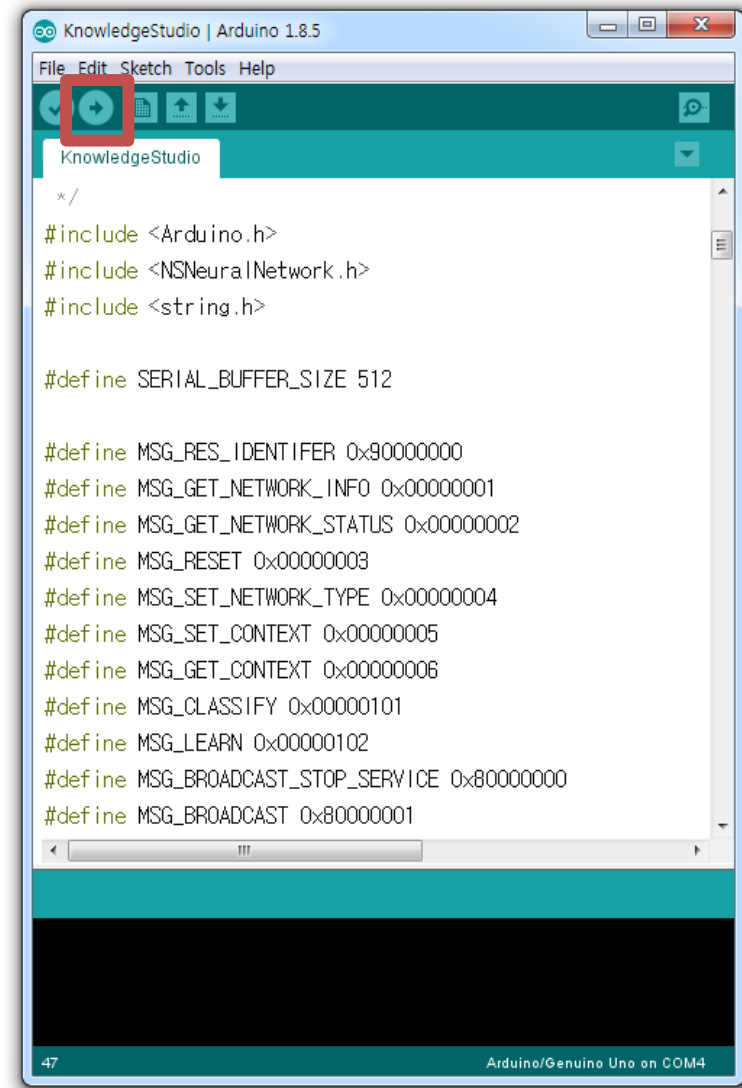


2. Application Board Setup



6. Upload the KnowledgeStudio.ino sketch.

7. If the sketch file has been uploaded successfully,
close the Arduino IDE.



3. Knowledge Studio



Function Navigation

- The icons may be changed depending on data type selected

Device Connection

- It manages to connect to the device like application boards

The screenshot shows the Knowledge Studio application window. The title bar reads 'Knowledge Studio - Image (/Users/bagminson/FACE-001)'. The menu bar includes 'Project', 'File', 'View', 'Model', and 'Help'. On the left, a vertical sidebar contains icons for 'Project Explorer', 'Training Data', 'Image Segmentation', 'Recognition', and 'Detection'. The main workspace displays a 'WELCOME Knowledge Studio' message. Below this is a 'NEW PROJECT' section with eight icons representing different data types: image, video, audio, heart rate, text, brain scan, waveform, and document. To the right of this is a 'Tips & Tutorials' section with a link to 'RBF Demo - It shows you how each neuron works in neural network.' At the bottom left, a 'Recent projects' section shows a project named 'FACE-001' with a small image icon and the date 'Jan - 08 - 2018'. Annotations include: an orange arrow pointing to the sidebar icons; a red arrow pointing to a 'Connect to Device' button in the top right; a green arrow pointing to the 'NEW PROJECT' icons with the text 'Create a new project with data type - Image(video)'; and a blue arrow pointing to the 'Recent projects' section with the text 'Recent Projects - It provides quick access to recently opened project'.

Project Explorer

Training Data

Image Segmentation

Recognition

Detection

Recent Projects

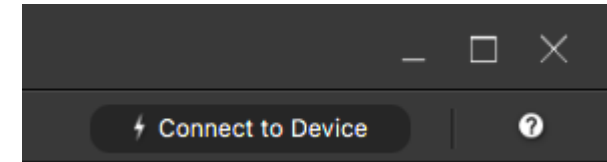
- It provides quick access to recently opened project

Create a new project with data type
- Image(video)

3. Knowledge Studio – Connect to Device



1. Click the “Connect to Device” button in the top right corner.



2. The Device Connection dialog shows list of devices,

3. Select the port to which the application board is connected.

4. Click “Connect” button,

The icon colors on device name represent the status of the connection.



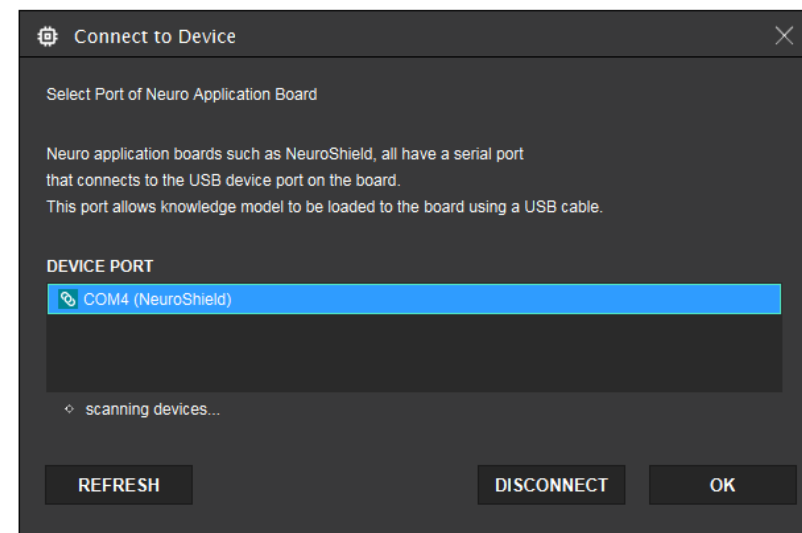
Disconnected



Connected. Not ready for use (identifying)



Ready for use

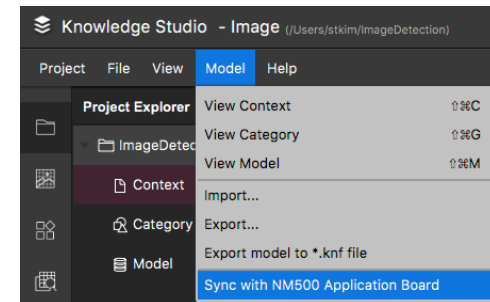
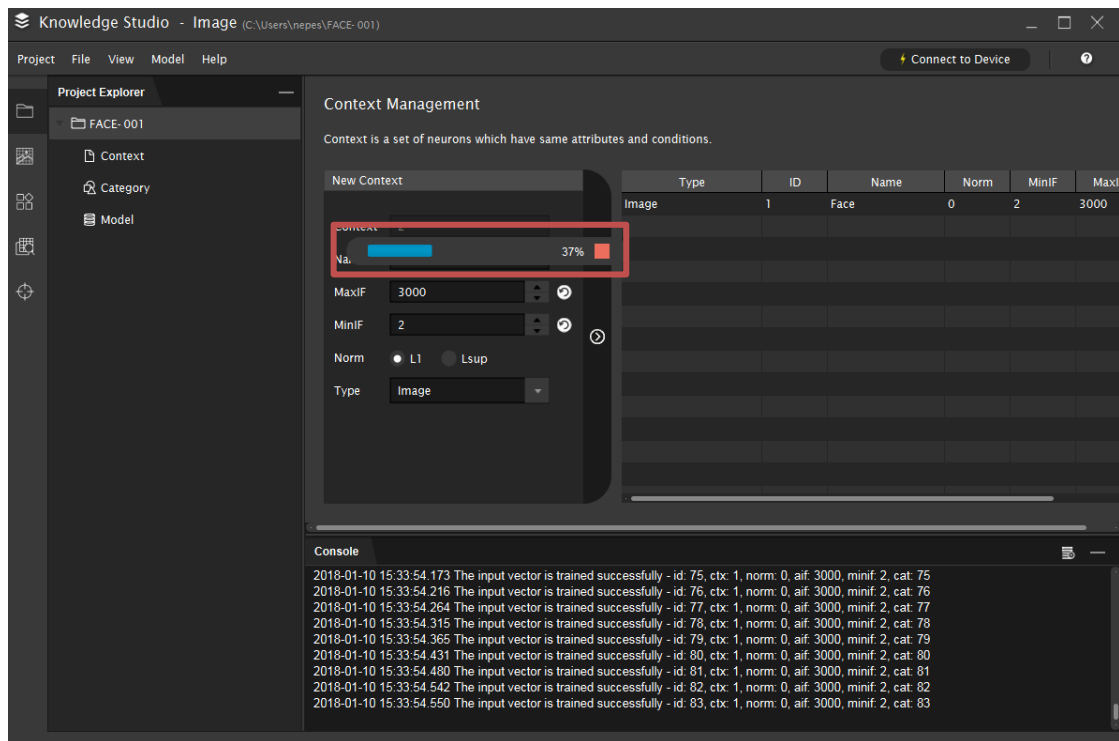


3. Knowledge Studio – Model Synchronization



5. If the project already has a learned model, it will perform the sync automatically.

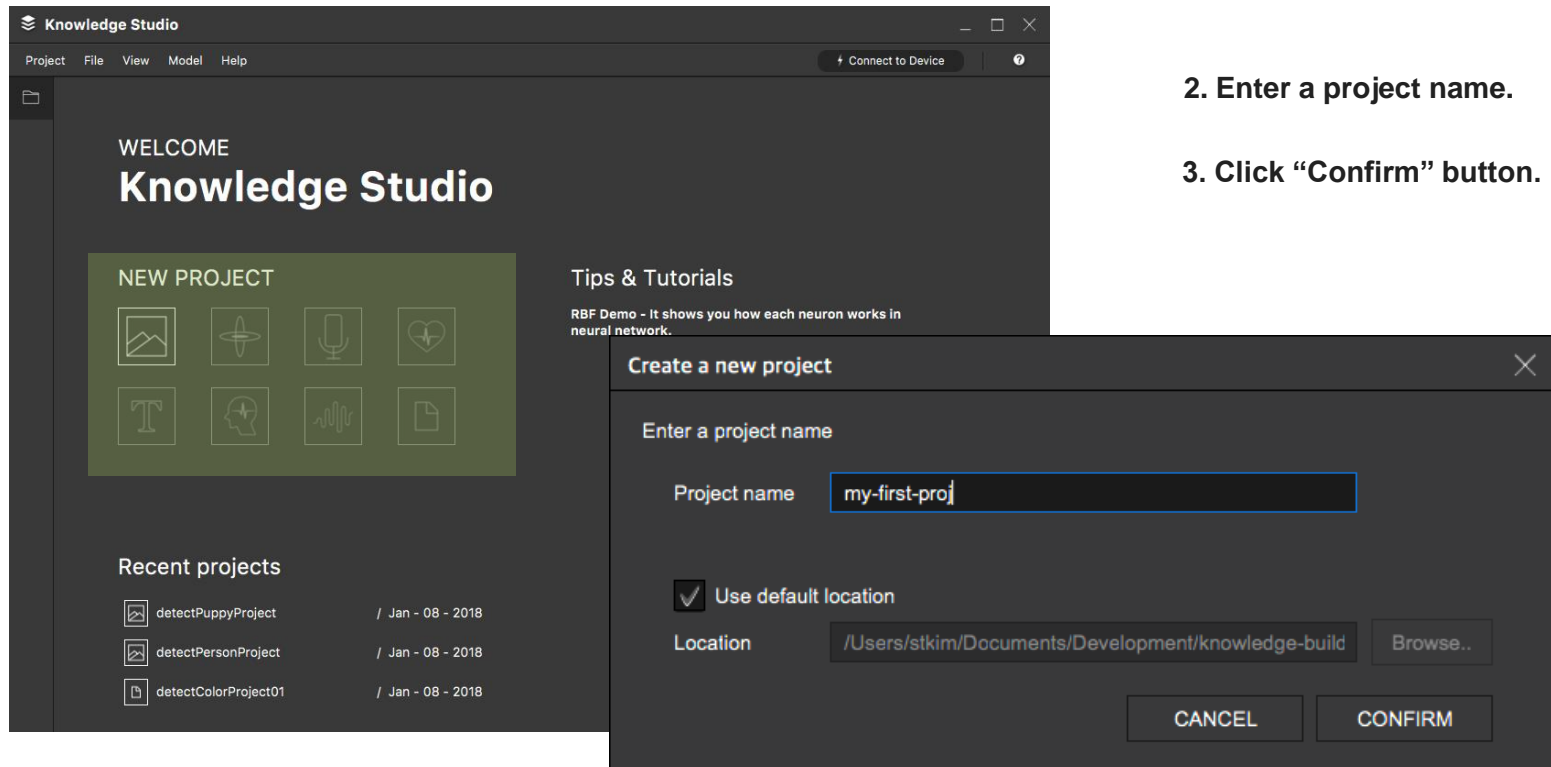
The sync also can be done manually from the Top Menu > Model > “Sync with NM500 Application Board”



3. Knowledge Studio – Create a project

1. Click one of icons. It represents the data type. The current beta version only supports for image data type.

Selecting the data type is just a way for ease of use. There is no limitation even if wrong data type was selected. It can be changed anytime.



The screenshot shows the Knowledge Studio application window. The main interface has a dark theme with a menu bar (Project, File, View, Model, Help) and a toolbar (Connect to Device). The main content area displays a 'WELCOME Knowledge Studio' message, a 'NEW PROJECT' section with eight icons representing different data types (image, audio, video, text, etc.), and a 'Recent projects' list. A 'Tips & Tutorials' section is also visible. Overlaid on the main window is a 'Create a new project' dialog box. The dialog box has a title bar with a close button. It contains a label 'Enter a project name' above a text input field with the value 'my-first-proj'. Below this is a checked checkbox labeled 'Use default location'. Underneath is a 'Location' label followed by a text field containing the path '/Users/stkim/Documents/Development/knowledge-build' and a 'Browse..' button. At the bottom of the dialog are two buttons: 'CANCEL' and 'CONFIRM'.

2. Enter a project name.

3. Click “Confirm” button.

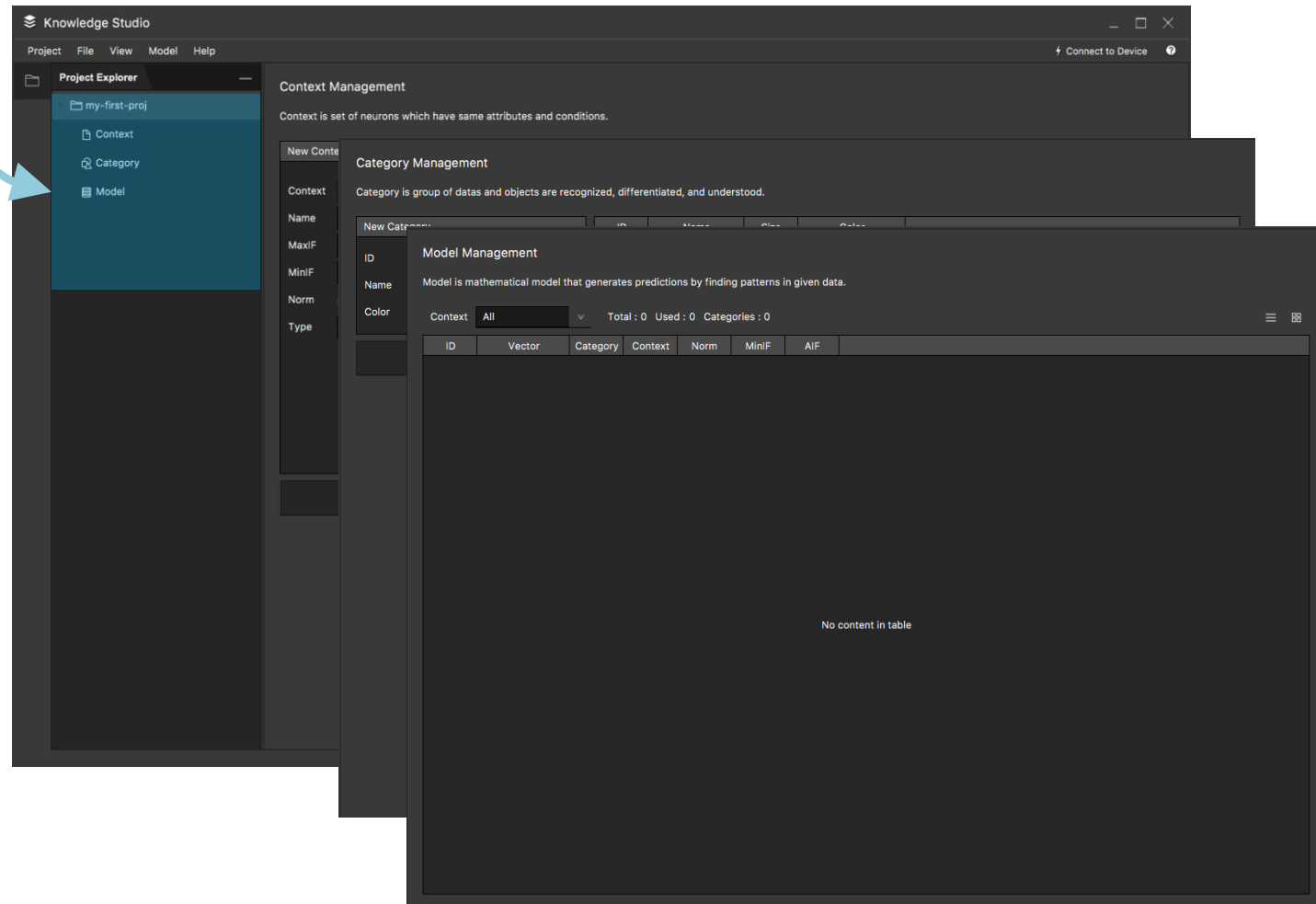
3. Knowledge Studio – Project Explorer



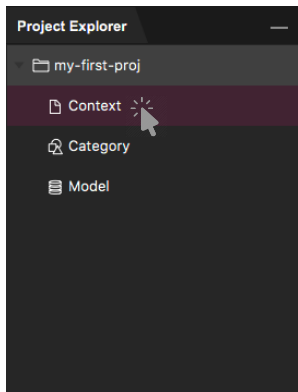
Project Explorer

- It shows basic structure of the project, It consists of context, category and model

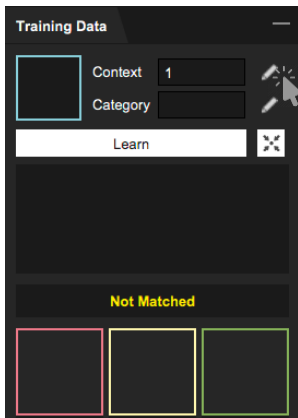
Context
Category
Model



1. Enter the value for each property and click add button.



Project Explorer



Training View

[illegible]

2. Select added context and double click to apply selected context to network.

3. Knowledge Studio – Add a Context



- The neurons can be associated to different contexts and their use can be enabled or disabled by selecting a context value.
- The all of neurons assigned with the same context, will be run with the same condition(properties), such as MinIF, MaxIF, Norm and the method for feature extraction.
- If any of neuron has been learned with certain context id, the Knowledge Studio doesn't allow to change the condition with that context id.

New Context

Context: 2

Name:

MaxIF: 3000

MinIF: 2

Norm: ☒ L1 ☐ Lsup

Type: Image

Property	Desc.
Context ID	The values range from 1 to 127.
MaxIF (Maximum Influence Field)	It represents maximum differences for similarity judgement and it is used to adjust conservatism. The values range from 1 to 65535. The default value is 3000 in Knowledge Studio.
MinIF (Minimum Influence Field)	It represents minimum differences for dissimilarity judgement and it is used to control uncertain domain. The default value is 2.
Norm	It is method to calculate the distance (similarity) between featured input vector and stored weight vector in neuron. The NM500 supports L1 (Manhattan) and Lsup (Supremum) as norm.

3. Knowledge Studio – Understanding How NM500 works



The screenshot shows the Knowledge Studio application interface. The main window has a dark theme with a sidebar on the left containing icons for Project, File, View, Model, and Help. The top menu bar includes Project, File, View, Model, and Help. The Help menu is open, showing options: Welcome, RBF Tutorial (highlighted), Tips, and About Knowledge Studio. The main area displays a 'WELCOME Knowledge Studio' message and a 'NEW PROJECT' section with icons for Image, Audio, Video, and Text. Below this is a 'Recent projects' section listing 'ImageDetection', 'voice002', and 'HelloAI'. On the right, a 'RBF Tutorial' window is open, showing a 'Tutorial Explorer' with settings for Context (tutorial-cxt-L1), MaxiF (200), MiniF (2), Norm (L1), and Vector (52, 213). A 'Category' section shows color swatches for red, yellow, green, blue (selected), violet, and gray. The 'Follow me!' section provides instructions for setting MaxiF, MiniF, and Norm. The background of the RBF Tutorial window shows a complex geometric pattern of overlapping colored shapes.

1. Open tutorial from the top menu > Help > RBF Tutorial
2. Set the values for the network properties like MiniF, MaxiF and Norm
3. Point and click.

3. Knowledge Studio – Learning Workspace



Training Data

- It shows featured vector data and provide functions to learn

Recognition Results

- It shows recognition results from model.

Feature Selection

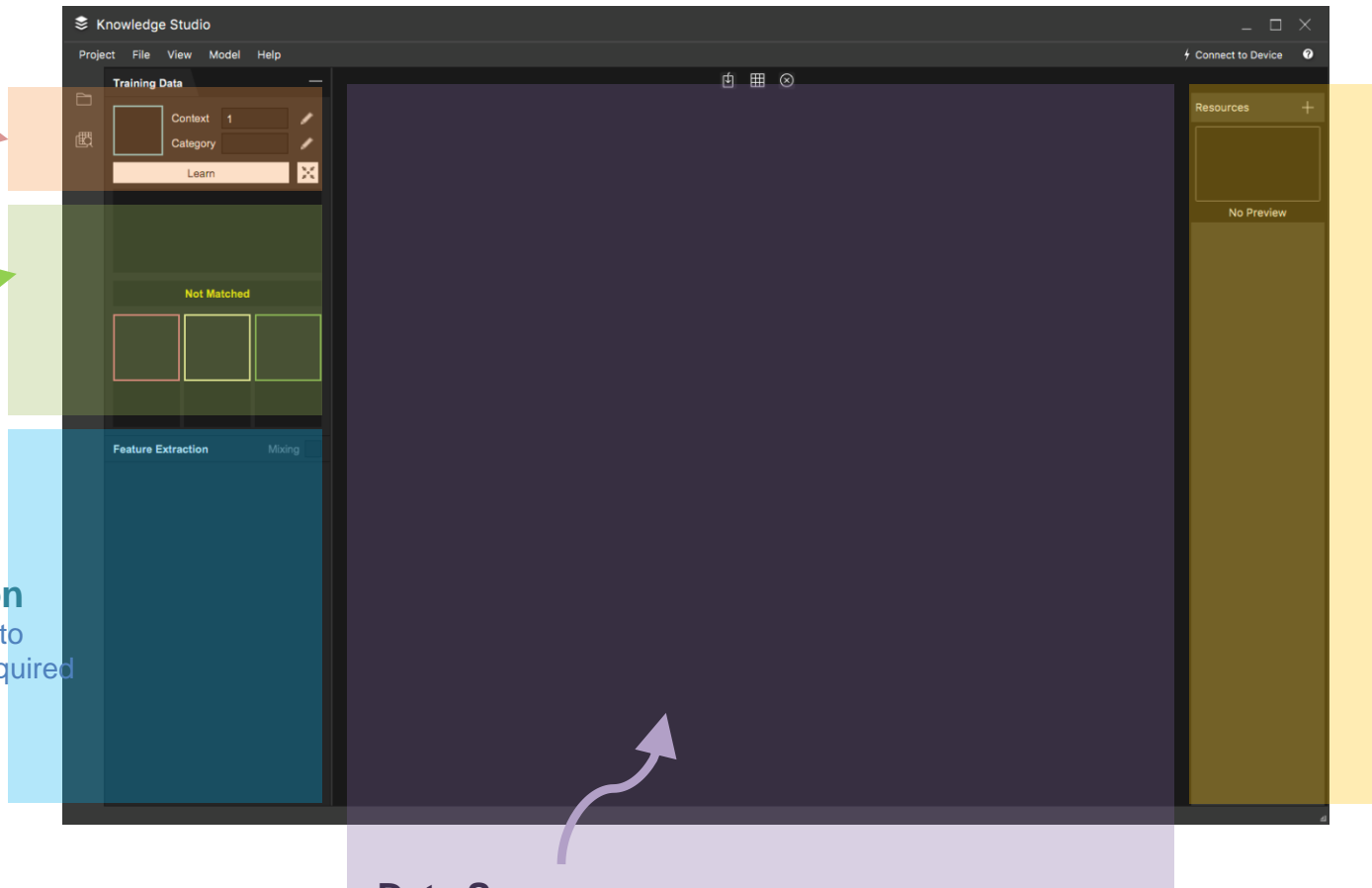
- It provides functions to select an algorithm required for feature extraction..

Resources List

- It shows all list of resources added.

Data Source

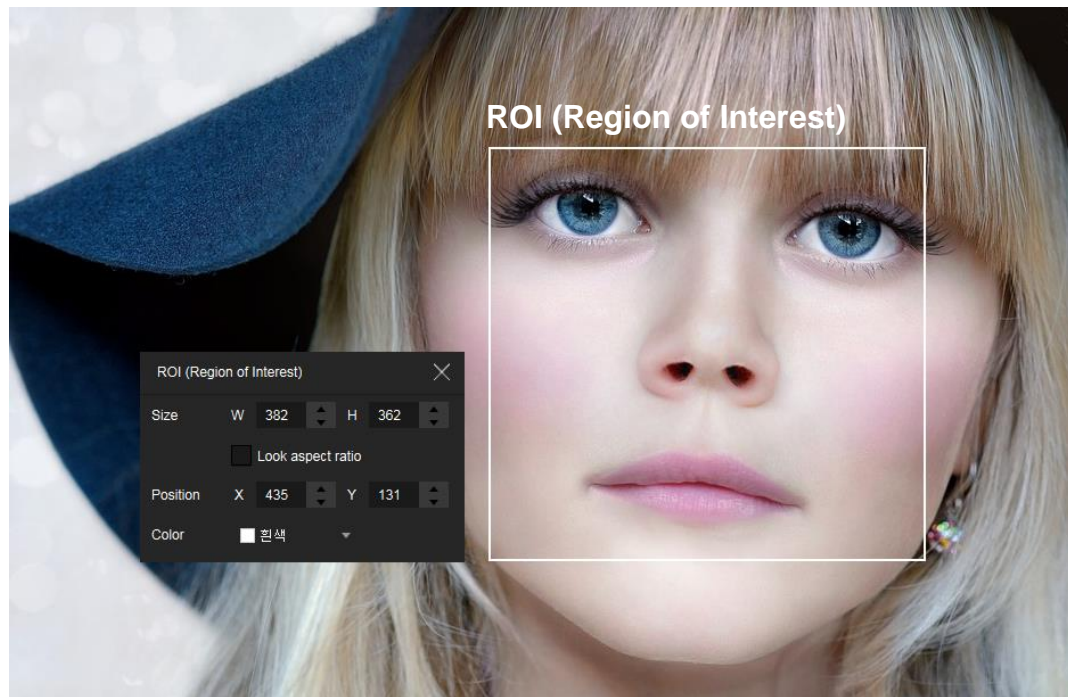
- It shows image that is selected from resources list.
- The ROI/ROS can be set in here.



3. Knowledge Studio – Feature Extraction / Selection



- It reduces the high-dimensional data to 256 dimensional data. (Each neuron of NM500 has 256 bytes weight memory)
- To obtain the expected result, the best-fitting algorithm should be selected for feature extraction.
- Knowledge Studio provides subsampling, histogram, and composition profile as the default features extraction algorithms.



Average Subsampling



Max Subsampling



Nth Entry Subsampling



3. Knowledge Studio – Training Data (Learning)



Knowledge Studio – Image

Project File View Model Help

Connect to Device

Training Data

Context
Category

Learn

Matched

Feature Extraction

Method: Subsampling
Sample: Last
Color: Gray Scale
Grid: X 16 Y 16

ROI (Region of Interest)

Size W 382 H 362
Look aspect ratio
Position X 435 Y 131
Color 흰색

Classify
Properties
Duplicate
Delete

Camera

Resources

person-11856...
person-11...
132.1 kB

1

2

3

4

5

6

3. Knowledge Studio – Training Data (Learning)



- 1) Add image file and double click the file. It will be presented at workspace.
- 2) Click right-button and select “*New ROI*” menu. You can scale the ROI as much as you want.
- 3) Select feature extraction method. (If any of neuron has been learned with certain context id, it cannot be changed)
- 4) Double click on the ROI area or Click right-button within the ROI and select “*Classify*” menu.
- 5) The result of classifying is shown. Assign a category for the result.
- 6) Press the “*Learn*” button.

3. Knowledge Studio – Image Data Format



- **Supported Image data format**

Format	Description
PNG	Portable Network Graphics
GIF	Graphics Interchange Format
BMP	Bitmap image file
JPEG (JPG)	Joint Photographic Experts Group

3. Knowledge Studio – Video Data Format



- Supported Video Formats

Container	Description	Video Encoding	Audio Encoding	MIME Type	File Extension
FXM, FLV	FX Media, Flash Video	VP6	MP3	video/x-javafx, video/x-flv	.fxm, .flv
HLS (*)	MP2T HTTP Live Streaming (audiovisual)	H.264/AVC	AAC	application/vnd.apple.mpegurl, audio/mpegurl	.m3u8
MP4	MPEG-4 Part 14	H.264/AVC	AAC	video/mp4, audio/x-m4a, video/x-m4v	.mp4, .m4a, .m4v

To convert video format supported, refer to the following URL,

http://www.freemake.com/free_video_converter/

3. Knowledge Studio – Video Data Learning workspace



Knowledge Studio - Image (J:/Users/bagminseon/FACE-001)

Project File View Model Help

Connect to Device

Training Data

Context 1

Category

Learn

UNKNOWN

Feature Extraction Multiple

Image Workspace
- Clicking on this area will play/pause it.

2018/03/10 14:43:53

Camera

Resource

video.mp4

video.mp4 42.1 MB

00:00 / 01:59

Console

Video Controller

3. Knowledge Studio – Video Data Learning workspace



- The features available on the media bar are described as follows,



Play video
- When video playback begins, this button is replaced by the pause button.

Stop Video
- The video stops and playback time is initialized.

Playback time
- Indicates the time the video was played.
- Indicates the total playback time for the video.



Time Slider
- You can drag the button to any time point.

3. Knowledge Studio – Segmentation / Clustering



Knowledge Studio - Image

Project File View Model Help

⚡ Connect to Device ⓘ

Segmentation

Context 1 **5**

Start

🔍 Searching

ROS W: 665 H: 476

ROI X: 15 Y: 15

Stride X: 15 Y: 15

⊕ Feature Extraction

Method Subsampling

Sample Average **4**

Color RGB

☐ Normalize

Grid X 16 Y 16

Camera

Resource +

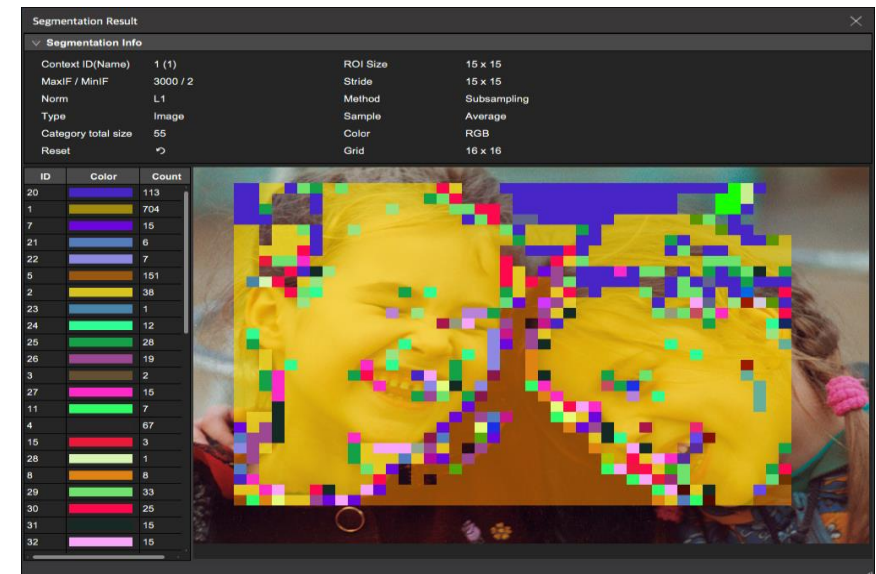
stockvault-am...
5106 KB

stockvault-...
5106 KB

3. Knowledge Studio – Segmentation / Clustering



- 1) Add image file and Double click the file. It will be presented at workspace.
- 2) Click right-button and select “Set ROS” menu. ROS is an area that show a result of segmentation. By dragging or input values on the function view, You can scale the ROS as much as you want.
- 3) Click right-button and select “New ROI “ menu. By dragging or input values on the function view, You can scale the ROS as much as you want.
- 4) Set the subsampling details. Once a segmentation begins with that value in a context, it cannot be changed.
- 5) Select a context and click “Start” button.



3. Knowledge Studio – Segmentation / Clustering



Knowledge Builder

Segmentation Result

Segmentation Info

Context ID(Name)	6 (6)	ROI Size	35 x 27
MaxIF / MinIF	5000 / 2	Stride	15 x 15
Norm	L1	Method	Subsampling
Type	IMAGE_SEGMENTATION	Sample	Average
Category size	8	Color	RGB
Category	<div></div>	Grid	16 x 16

Connect to Device

Resources

ChicagoCAC-...
491.8 kB

children-di...
308.4 kB

children-gr...
137.3 kB

Segmentation Result

Segmentation Info

Context ID(Name)	6 (6)	ROI Size	35 x 27
MaxIF / MinIF	5000 / 2	Stride	15 x 15
Norm	L1	Method	Subsampling
Type	IMAGE_SEGMENTATION	Sample	Average
Category size	8	Color	RGB
Category	1... <div></div>	Grid	16 x 16

3. Knowledge Studio – Recognition



Knowledge Studio - Image

Project File View Model Help

Connect to Device

Recognition

Mode: ☒ RBF ☐ KNN 1

Context: 1

336 (label) IDENTIFIED

Feature Extraction

Method: Subsampling

Sample: Average

Color: RGB

Normalize

Grid: X 16 Y 16

Camera

Resource

wine-label.j...

1

2

3

4

5

3. Knowledge Studio – Recognition



- 1) Add image file and double click the file. It will be presented at workspace.
- 2) Click right-button and select “*New ROI*” menu. You can scale the ROI as much as you want.
- 3) Set the subsampling details. Once a learning begins with that value in a context, it cannot be changed.
- 4) Select a network mode(RBF | KNN) and a context.
- 5) Double click on the ROI area.

3. Knowledge Studio – Detection



Knowledge Studio - Image

Project File View Model Help

Connect to Device

Detection

Network RBF

Context 1

Start

Continuous Mode

Parameter

ROS W: 287 H: 38

ROI X: 161 Y: 144

Stride X: 15 Y: 15

Scale 1

Mode ☒ Object ☐ Novelty

Feature Extraction

Method Subsampling

Sample Average

Color RGB

Normalize

Grid X 16 Y 16

Camera

Resource

wine-label.j...

3. Knowledge Studio – Detection



- 1) Add image file and double click the file. It will be presented at workspace.
- 2) Click right-button and Select “*Set ROS*” menu. The ROS is an area that show a result of segmentation. By dragging or input values on the function view, You can scale the ROS as much as you want.
- 3) Click right-button and select “*New ROI*” menu. By dragging or input values on the function view, You can scale the ROS as much as you want.
- 4) Set the subsampling details. Once a detection begins with that value in a context, it cannot be changed.
- 5) Select a detection mode. (object mode is to show what it is, and novelty mode is to find where is the unknown area.)
- 6) Select a context and click “*Start*” button.



3. Knowledge Studio – Model View



- Using the model view, you can see what conditions the learned neurons are in.

Model

Context: 2

ID	ctx	cat
id : 1	ctx: 2	cat: 4
id : 2	ctx: 2	cat: 1
id : 3	ctx: 2	cat: 2
id : 4	ctx: 2	cat: 5
id : 5	ctx: 2	cat: 6
id : 6	ctx: 2	cat: 7
id : 7	ctx: 2	cat: 8
id : 8	ctx: 2	cat: 9
id : 9	ctx: 2	cat: 10

Total: 9 Used: 9 Categories: 9

Model

Context: 2

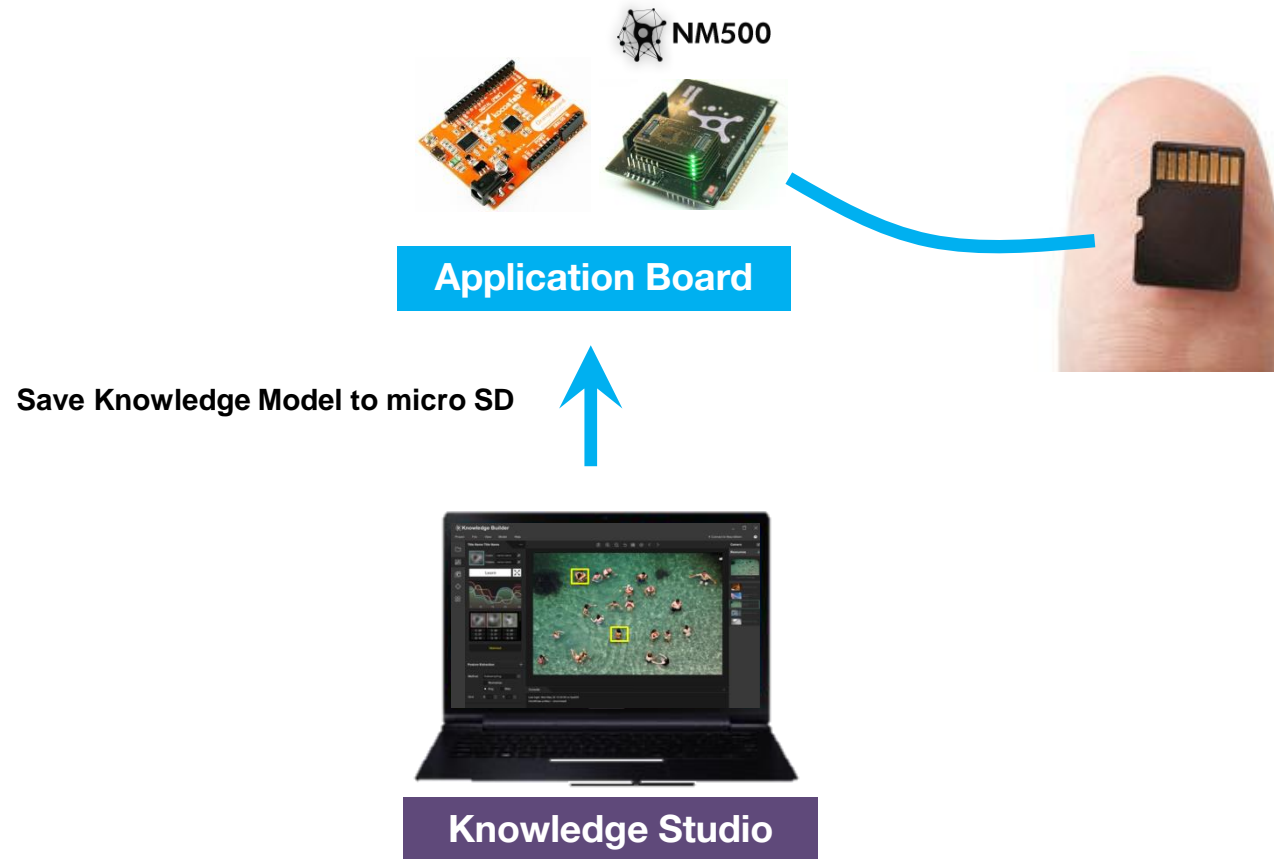
ID	Vector	Context	Category	Norm	MinIF	AIF
1		2 (2)	4 (4)	0 (L1)	2	16384
2		2 (2)	1 (1)	0 (L1)	2	1164
3		2 (2)	2 (2)	0 (L1)	2	2972
4		2 (2)	5 (5)	0 (L1)	2	1947
5		2 (2)	6 (6)	0 (L1)	2	1294

Total: 9 Used: 9 Categories: 9

3. Knowledge Studio – Deployment



- The learned models can be uploaded directly to the device or can be distributed using an SD card.





End of Document