

FUTURE ELECTRONICS SYSTEM DESIGN CENTER

SENSIML - GESTURE RECOGNITION ML/AI



JANUARY 13, 2022 Revision 1.2

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Overview

In this tutorial, we are going to use the SensiML Analytics Toolkit to build a hand gesture application that will run on the STM STWIN and Future Electronics Compagno board using the Panasonic GridEYE Sensor.

Objective

- Demonstrate how to collect and annotate a high-quality dataset of hand gestures using the Panasonic GridEYE 8x8 thermal array sensor on the Future Compagno board using the SensiML Data Capture Lab
- Build a data pipeline to extract features in real-time on your target device
- Train a Classification model using SensiML AutoML
- Convert the model into a Knowledge Pack
- Perform live validation of the Knowledge Pack running in the SensiML Open Gateway with live data streaming from the boards
- Compile the SensiML knowledge pack library into the firmware and test the classifier on-device using the OpenGateway Interface

Prerequisites

- The Hardware
 - STM STWIN board (<u>STEVAL-STWINKT1B</u>)
 - Future Electronics <u>Compagno board</u>
- The Software
 - ST Micro Integrated Development Environment for STM32: <u>STM32CubeIDE</u>
 - Future Electronics <u>DC Engine</u>

Documents > Future Created Material - Sync to Laptop > Tool Kit > Future Created Demo Kits > Compagno-SensiML

- Future Electronics data collection/recognition firmware: Future-SensiML_xx.zip
 - Future Electronics data collection project file: Future-SensiML_DataCollection.xx.bin
- Future Electronics Compagno_GridEYE20Hz.ssf configuration file for live data streaming over SimpleStreaming InferFace
- Future Electronics Data Capture Lab project file:
 - FutureCompagnoGridEYE_xx.zip
 - Future Electronics Recognition project file: Future-SensiML_Reconition.xx.bin
- o SensiML Analytics Toolkits
 - SensiML Data Capture Lab: <u>Download</u>, <u>Documentation</u>
 - SensiML Open Gateway: <u>Download</u>, <u>Documentation</u>
 - Create SensiML Community Edition account
 - <u>https://sensiml.com/plans/community-edition/</u>
- Python <u>3.7 or 3.8</u>





Capturing Sensor Data

For every machine learning project, the quality of the final product depends on the quality of your curated data set. Time series sensor data, unlike image and audio voice wake-word detection, are often unique to the application as the combination of sensor placement, sensor type, and event type greatly affects the type of data created. Because of this, you will be unlikely to have a relevant dataset already available, meaning you will need to collect and annotate your own dataset.

To help you to build a dataset for your application we have created the <u>SensiML Data Capture Lab</u>, which we are going to use for collecting and annotating data for different hand gestures.

Data Collection Firmware

In order to collect sensor data, you will need to flash the STWIN board with data collection firmware. For this tutorial, we have already built the data collection firmware which you can flash to the device using the <u>STM32CubeProgrammer</u> software. The device will reboot and load the new firmware.

Detailed instructions for building and flashing the firmware is available from <u>Future Electronics Compagno</u> <u>User Guide on DC Engine</u>.

Connecting to the Firmware

To begin data collection, we will use the SensiML Data Capture Lab. Log in to the SensiML Community Edition account you created. We have created an initial project for you to get started quickly. First:

- 1. Download this project and unzip it
- 2. Open the Data Capture Lab and select Upload Project

	Recent Projects	
New project		
New project		
Open project		
Upload project		
Opioad project		
Download project		

Figure 1. SensiML Data Capture Lab



- 3. Select browse and find the FutureCompagnoGridEYE.dclproj file inside of the FutureCompagnoGridEYE_xx.zip folder
- 4. Click the **Upload** button to upload the project to your account. You are now ready to start collecting your own Sensor Data

Community Edition	Capture Lab robert.dawson@sensiml.com Logout
	Recent Projects
Jpload project to t	he cloud
Select the local project to upload:	E:\Future\Sandbox\FutureCompagnoGridEYE\FutureCompagnoGridEYE.dc Browse
Name:	FutureCompagnoGridEYE1
	Upload Cancel

Figure 2. Upload Project

- 5. The Data Capture Lab opens to the Label Explore Screen, switch to the Capture Mode Screen by clicking the **Switch Mode** button and selecting **Capture** mode
- 6. If the Sensor Configuration is not available select EDIT->IMPORT DEVICE PLUG_IN, browse to the location of the Compagno_GridEYE20Hz.ssf
- 7. Select Sensor Configuration

Sensor C	onfigurati	on				
elect a sensor co Profile Name	nfiguration profile to	o use during data colle Sample Rate	ection. This will be saved Manufacturer	as metadata to each file. Device	Plugin Developer	Capture Protocol
GridEYE	GE	20	Future Electronics	Compagno Grid Eye	Future System Design Center	Simple Streaming
		Add new config	uration Cancel	Select		
					Label Dow	nUp 🔹

Figure 3. Sensor Configuration

- 8. Now that you are in Capture mode, we can connect to the sensor to record data.
- 9. First, switch the connection method to Serial Port



- 10. Next, click the Find Devices button and then the Scan button. After it scans it will display a list of devices. Select the one corresponding to your board and click the Connect button
- 11. Now you are ready to begin recording sensor data

പ്	Robert_PoC_Campagno_v2.dclproj	_ a ×
File Edit Help		Hardware Setup
Project Explorer	Mode: Capture Switch modes	Sensor Configuration
30000	Compagno Grid Eye - COM8	Profile Name: Cirdilya Device: Companyo Grid Bye Sample Rate: 20 Sensora: GE
		Capture Method: Live Stream Capture -
		Connection Method: Serial Port *
20000		Connected Connected Forget
10000		
		₽ Find Devices
•		Capture Properties
		Select a label for the event you will be recording Add Labels
-10000		Label -
		Select metadata for the current recording Add Metadata
-20000		Device Compagno Grid Eye *
		Direction *
		Duration -
-30000		
GE00 GE01	GE02 GE03 GE04 GE05 GE06 GE10 GE11 GE12 GE13 GE14 GE15 GE16 GE17 ·	
at Sensor Select 00:00:00:00	(B) Degen Recording 😃 🕂 Add Segment Start Session (M) Detection_Test 🔹	[]
	Figure 4. Capture Sensor Data	

See tutorial video 1 below for details:

	Recent Projects	
New project		
Open project		
Upload project		
Download project		

Video 1. LiveStreamingGridEyeDataToSensiMLDCL.mp4



Capturing Environmental Context

The data capture lab uses Labels to identify regions of sensor data as belonging to a specific class. For example, we would put a label around the region of sensor data that corresponds to the gesture of moving the handle over the GridEYE sensor arriving from the bottom and departing from the top and the opposite arriving from the top and departing from the bottom.

- 1. Identify which type of data you are going to collect
- 2. Select the option from the Label in the dropdown menu

Note: If you are going to be recording multiple types of events, I typically use the label **Unknown**. The file that is recorded will start with the name of the **Label** that you select. In addition to labels, it is also important to capture information about the environment. Capturing this contextual information enables you to build highly tailored models. Additionally, it makes it possible to diagnose why a model might be failing for subsets of your data. For example, in this gesture dataset, we captured the contextual properties **data collector** and **speed of movement**. This metadata can be useful in building models for subtypes of data as well as debugging problems with model accuracy.

You can capture the contextual information in the Data Capture Lab using the metadata properties. Metadata is applied to the entire captured file, so when you are creating your data collection strategy think carefully about what information you may need. Metadata can be created as a selectable dropdown or text field.



See tutorial video 2 below for details:

Video 2. SetupProject.mp4

Recording data

The data collection firmware streams GridEYE sample data at a sample rate of 20Hz using a simple streaming interface over UART. The captured data will be saved locally to your computer as well as be synced up to the SensiML Cloud. This allows other members of your team who have permission to see and label your new captured file. Alternatively, if you already have a data collection method for your device, the Data Capture Lab can import CSV and WAV files directly.





See tutorial video 3 below for details:



Video 3. DataCollection.mp4

Labelling Sensor Data

Now that we have collected example sensor data, it is time to annotate the dataset by applying labels.

See tutorial video 4 below for details:

ed -	Falane, Good VE, CockT diskong	
An la la ha	Mode: Lidel Captorer and the	
	New Labeling Session Hadra sub any many many many many many many many	

Video 4. LabelDataAutoSegment.mp4





Building a Model

The SensiML Analytic Studio is where you can create a query to pull data into your model, build models using AutoML, validate model accuracy against held out test data and finally download your model as firmware code for the target device. For the next part of the tutorial, you will need to log into Analytic Studio (https://app.sensiml.cloud).



After logging in, open the FutureCompagnoGridEYE Project we created in the Data Capture Lab by clicking the open icon. This will set the FutureCompagnoGridEYE as the active project in the Analytics Studio.

ń	Home	PROJECT DESCRIPTION	CAPTURES	QUERIES F	PIPELINES KNOWLEI	DGE PACKS				c			
	Summary												
≡	Prepare Data				Captures	Queries	A Pipelines	* Models	Segments	Size(MB)			
٩	Build Model				11	1	1	5	143	1.82			
0	Explore Model				Created Date	м		CONTRACTION OF CONTRACT OF CONTRACT.	-b28a-fb258f09468a				
≡,∕	Test Model				Sensors								
۵	Download Model				GE00, GE01, GE02, GE GE25, GE26, GE27, GE GE52, GE53, GE54, GE	03, GE04, GE05, GE06, G 30, GE31, GE32, GE33, G 55, GE56, GE57, GE60, G	3E07, GE10, GE11, GE1 3E34, GE35, GE36, GE3 3E61, GE62, GE63, GE6	2, GE13, GE14, GE15, GE 7, GE40, GE41, GE42, GE 4, GE65, GE66, GE67, GE	16, GE17, GE20, GE21, G 43, GE44, GE45, GE46, G 70, GE71, GE72, GE73, G	E22, GE23, GE24, E47, GE50, GE51, E74, GE75, GE76,			
\$	Get Started				GE77								
	Demos				Labels								
0	Documentation				Label : Test_Data_3TE	1_3BT_2TB_2BT, ArriveTi	opDepartBottom, Arriv	BottomDepartTop					
					Metadata AmbientTemperature,	User, Device							
		Project Descript	ion: Future_GridE	YE_Oct21						1			

Figure 6. Analytic Studio Active Project

Prepare Data

Next, we can create a query that will generate the input data for our modelling. Click on the **Prepare Data** tab on the left and fill in the fields as shown in the image below.





	Hama		
п	Pione	Cuery Future_GridEye1	- Label
	Summary	Future_GridEye1 00	
_		Session	
	Prepare Data	AutoGestureDetect *	
٩	Build Model	Label	
_		Label	
0	Explore Model	Metsásta 40	
E,	Test Model	segment_uuid, capture_uuid	
		Source 30	
۵	Download Model	GE00, GE01, GE02, GE03, GE04, GE05, GE06, GE07, GE10, GE11, GE12, GE13, GE14, GE15, GE16, GE17, GE20, GE21, GE22, G 👻	
-	Get Started	29	
		Query Filter 😴	
	Demos	Pist	
0	Documentation	Segment +	
			ArriveBottomDepartTop AniveTopDepartBottom

Figure 7. Preparing Data

Once you have filled in the fields, click save which will create the query that can then be used to build a model. You will select his query on the next screen. After you save the query, you will also see a graph that contains statistics about the size of the dataset that is going to be used.

See tutorial video 5 below for details:

Name Import Statuth Propertification Control Control <th>SensiML</th> <th>SensiM</th> <th>L^{**} Analytics Studio</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>😌 dawa</th> <th>ngak</th> <th>****</th>	SensiML	SensiM	L ^{**} Analytics Studio								😌 dawa	ngak	****
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Test Mold Demonstration Demonstration	Explore Model									= + 10/26/2021			
Demissi Monti Demissi Demos	Test Model		Future_GridEvE_Oct21	11	1	1.82	1	1	143	10/26/2021			
On Rome Pensa Pe	Download Model									Rows per page: 10 + 1	1.01 10		
Demos Constructurios	Get Started												
Documentation	Demos						5						
	Documentation												

Video 5. AnalyticStudioPrepareData.mp4

Setting up a pipeline

Now that we have created a query, we can go to the build model screen. Click on the **Build Model** tab in the navbar on the left side. This will bring you to the model building screen. At this point, you have not yet created a pipeline. Click on the **+ Add New Pipeline** button and enter the name of your pipeline.

SensiML	Project : Thunderboard Sense 2 - Condition Monitoring	
 Home Summary 	Pipeline	+ ADD NEW PIPELINE
Prepare Data	AUTONE PIPELINE	RESULT
Explore Model	Advanced Pipeline Settings	AutoML Results
Test Model Download Model		
🕏 Get Started	\downarrow	
Demos Documentation		
	+	
	\downarrow	
	Ļ	
	Figure 8. Adding Pipeline	





Ensure that the Advanced Pipeline Settings slider is enabled.



Figure 9. Advanced Pipeline Settings





Validation Settings

Enter your search term	< Project : Future	e_Grid	IEYE_Oct21				
A Home			Name: Isolation Forest Filtering Type: Outlier Filter	i 🖉 🗊	RESULT		Validation
Summary					AutoMI Results		Validation Method
Prepare Data			\downarrow		Autome Results	_	Validation Method
🔦 Build Model		Ð	Name: Min Max Scale	1	MODEL NAME	ACCURACY	Stratified Metadata k-fold 🔹 🕄
Ø Explore Model			rype. reature quantization				Number Of Folds 3
≡, Test Model			¢		Future_GridEye3_rank_0	95	1 5
Download Model			Type: Feature Selector	ē / i	Future_GridEye3_rank_1	95	Metadata Name
I Get Started					Future_GridEye3_rank_2	94	capture_uuid *
📾 Demos							
O Deserved at lar			· · · · ·	10	Future_GridEye3_rank_3	94	
Documentation		ø	Name: Stratified Metadata k-fold Type: Validation	<i>v</i> U	Future_GridEye3_rank_4	93	
			Type: AutoML Parameters	/ (i)			
		E					
		-	Classifier SRAM 32000 f1-score 100				
			⊳ OPTIMIZE				⊗ CANCEL SAVE

Figure 10. Validation Settings

At the moment we need to select Advanced Pipeline Settings, the plan is to add a Future GridEYE pipeline drop-down option, if this is not available follow the following steps to manually set up the pipeline.

SensiML	Project : Future_	BridEY	E_0ct21								e de	manpeak	dogis co
n Hone	Future_GridEye1				•	+ ADD 7	IEW PIPELINE						
E Prepare Data			AUTOM, PIPELINE				REBULT				2011		
Capitore Model			Advanced Pipeline Settings			Aut	oML Result:						
Downlast Model			ame Future,GridEye1 spec Input Query	New Pip	er'		-						
Det Startet	-		0	Please ar		pipeline.	Gentlyet, was, a	.85	1995	(16))	- 95	(95)	0
Derrice	Demos	II			JuniEye Lower, 1	84			- 94	.84	0		
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			9			- Falue	Condependences	(02).	ж.	×	94	-307	0
		N T	ame Sing ype: Segment Transform	8/0		Falary	Uniderstank.4	92	2468	×	92	11	0
			©_		-								
		. 1)	rpe Feature Generator	10									

See tutorial video 6 below for details:

Video 6. BuildModel.mp4

Training the model with AutoML

AutoML is used to create a set of models within the desired statistical (accuracy, f1-score, sensitivity, etc.) and classifier size. As the algorithm iterates each optimization step, it narrows down the searching space to find a desired number of models. The optimization terminates when the desired model is found, or the number of iterations reaches the max number of iterations.





We take advantage of dynamic programming and optimizations for training algorithms to speed up the computation. This makes it possible to search for large parameter spaces quickly and efficiently. The results are ranked by the fitness score which considers the model's statistical and hardware parameters.

RESULT		ITERATIO	INS	с	ONSOLE 🛷	
AutoML Results						
MODEL NAME	ACCURACY	CLASSIFER SIZE(B)	NUM. FEATURES	SENSITIVITY	F1-SCORE	
Future_GridEye3_rank_0	95	8	2	95	95	0
Future_GridEye3_rank_1	95	10	3	95	95	0
Future_GridEye3_rank_2	94	730	3	94	94	0
Future_GridEye3_rank_3	94	829	4	94	94	0
Future_GridEye3_rank_4	93	2315	5	93	93	Ø

Figure 11. AutoML

Once the models have been generated, you can explore the details of the top five candidate models in the explore models tab. In this tab, there are visualizations and information about the models including, features, confusion matrix, model hyperparameters, and the Knowledge Pack training and inference pipeline.



Figure 12. AutoML models

Validating the model against the Test Set

Before you flash the model to the device, you can test the model using the Test Modell tab. You can test against any of the captured data files. To do this:

- 1. Go to the Explore Model tab of the Analytic Studio
- 2. Select the pipeline you built the model with
- 3. Select the model you want to test
- 4. Add a filter to the Set column to only include Test data





- 5. Click on the three dots menu and the top left->Select All
- 6. Click the Compute Accuracy button to classify the selected capture files

The model will be compiled in the SensiML Cloud and the output of the model will be returned.



See tutorial video 7 below for details:

Video 7. FirstTestOfModel.mp4

The Figure 13 shows the segment start and segment classified for all the detected events. You can click on the Results button in the table to see more detailed information for how each of the captures were classified by the selected model.



Figure 13. Validating the Model



Deploying Knowledge Pack Firmware in Open Gateway

Open Gateway

The Open Gateway implements the Simple Streaming Service protocol to enable forwarding data to the SensiML Data Capture Lab for recording and annotation. The Gateway supports connecting to sensor sources over a Serial, BLE, and TCP/IP connections. It also supports recording video and sensor data locally to the gateway.

Clone the github from https://github.com/sensiml/open-gateway

In the directory for the open-gateway open a command box

- a. pip install -r requireds.txt
- b. pip install appdirs

Note: On windows use python 3.7 or 3.8. You can install python from Microsoft Store for Windows 10

Data Collection Mode

1. Open a command window in the open-gateway-main directory, at the prompt type:

>python app.py

C:\Windows\System32\cmd.exe - python app.py		×
Microsoft Windows [Version 10.0.19043.1237]		^
(c) Microsoft Corporation. All Fights reserved.		-
E:\Future\open-gateway-main>python app.py		
captured data stored in C:\Users\dawso\AppData\Local\SensiML\Open Gateway		
* Serving Flask app open_galeway.app (lazy loading)		
WARNING This is a development server. Do not use it in a production deployment		
Use a production WSGI server instead.		
* Debug mode: off		
* Running on http://localhost:5555/ (Press CTRL+C to quit)		
127.0.0.1 [27/Sep/2021 16:52:42] "GET / HTTP/1.1" 304 -		
127.0.0.1 [27/Sep/2021 16:52:42] "GET /static/css/main.8c8b27c+.chunk.css HTTP/1.1" 304 -		
127.0.0.1 - [27/Sep/2021 10:52:42] GET /static/js/2.00d2de22.cnunk.js HTTP/1.1 304 -		
127.0.0.1 - [27/Sap/2021 10.52.42] GET /Statt()s/main/s/dot.chuik.js/http/1.1 504 -		
127.0.0.1 - [27/Sep/201110:52:43] "GFT /manifest.ison HTTP/1.1" 304 -		
127.0.0.1 [27/Sep/2021 16:52:43] "GET /config HTTP/1.1" 200 -		
127.0.0.1 [27/Sep/2021 16:52:47] "GET /scan-video HTTP/1.1" 200 -		

Figure 14. Commend Mode

This will open a browser





KersiML Gateway Configuration × ← → C ② localhost5555 Apps	+ negator Fix. D Lat WE & Tename. III QF, SERI User Ma. III QF SERI Databerr & Module 1 involute.	🖢 New Salts Academy 📓 Physical Design Gul. 📓 QuistLagie PKU+T	
Home Test Mode	Device Source	Video Source	
Not Connected Video Status Not Connected	Device Mode:	Video Source is not connected	
		Villes Bases Camera 0 CONNECT TO CAMERA 0	

Figure 15. Open a Browser

2. Ensure that you have the following settings

Device Mode -> Select Data Capture

Connection Type -> Serial

- 3. Make sure that the STWIN and Compagno board is powered with the data collection binary
- 4. Scan for Serial Devices, select the USB Serial Device for the STWIN board, COM8 in example above then press SELECT in the bottom right-hand corner
- 5. Press CONNECT TO DEVICE
- 6. TEST MODE
- 7. To start streaming data select VIEW



Figure 16. Test Mode



Running the New Knowledge Pack in the Gateway using Data Collection Firmware

The Open Gateway implements the Simple Streaming Service protocol to enable forwarding data to the SensiML Data Capture Lab for recording and annotation. The Gateway supports connecting to sensor sources over a Serial, BLE, and TCP/IP connections. It also supports recording video and sensor data locally to the gateway.

1. In the Analytic Studio -> Download Model, select HW Platform -> Windows x86_64

SensiML (Project : Robert_PoC_Campagno_v2	🖯 dawson@quict
 Home Summary Prepare Data 	Ppetre Test080321	ModelName → Test080321,rank_0
 Build Model Explore Model Test Model Download Model Get Started 	Download Knowledge Pack Target Device Options: Windows x86_64 Processer x86_64 Constitute	
Demos Documentation	mingu-64.9.3 Format Library Data Source GridiEye	Sources: Name: Crid Eye Sample Rate: 20 Sensors: GE Application Name: SensiML Al Model Runner
	Agriciation General Al Model Runner Output Sertal Advanced Settings	Description: Provides example code to feed sensor data into a SensiML Knowledge Pack model *
	Figure 17. D	ownload Model

2. Then DOWNLOAD, browse to the download directory you will find a zip file similar to:

kp_e4e28e94-c7ba-4346-97c8-aec5a8ede494_Windows-x86_64_lib_9.3_p.zip

(red text will be unique)

 Unzip the knowledge pack referred to in step 2 and browse to the knowledgepack\libsensiml directory, copy the libsensiml.dll file into the \open-gateway-main\knowledgepack\libsensiml directory

🛛 📮 💌 E:\Future\open-gateway-main\knowledgepack\libsensiml							
File Home Share View							
- \rightarrow \checkmark \uparrow I w Future \rightarrow open-gateway-main \rightarrow knowledgepack \rightarrow libsensiml	~	Ü		Ø Search libsensiml			
✓ ▲ open-gateway-main			^	Name	Date modified	Туре	Size
📕 img				libsensiml.dll	27/09/2021 12:49	Application extens	615 KB
✓ ↓ knowledgepack				W README.md	27/09/2021 12:42	MD File	1 KB
📜 libsensiml							
> 📜 open_gateway							
> 📕 webui							



4. In the Windows Explorer browse to the open-gateway-main directory type cmd in the address window, which will open a command box in the open-gateway-main directory



🕑 📜 ∓ E:\Fu	iture\open-gateway-main		
File Home	Share View		
	cmd	~	\rightarrow
] open-gate	Search for "cmd"		
📕 img			

Figure 19. Open a Command Box



Figure 20. Command Box

5. At the prompt >python app.py -s knowledgepack/libsensiml

E.Vieture Augum gataway anticografion ago, go a konsindigenski/Ellowsikal danbrod data strengt in Clumerkanok/Mathatalakas/Mathatalakas/Mathatalakas/ under anosh at heredorlegenski/Kaharnikal "- Service Tarka way 'core, gataway ogo' (Lary Ganding)	🖭 Apps 🧧 SS - Dukatopic 🏢 🖽 SensiML Gateway	🔄 Area 📕 SI - Guadage 📳 Ell Integration Re. 😆 Lat 1616 & Internet. 📳 Gui/S493 Care Ma. 📰 Gui/S493 Detailord SensiML Gateway					
Transmission (Section 1997) (Section	Kone Test Mode Test Mode Not Connected Video Status * Not Connected Video Status * Not Connected	Device Source Prive Mark					

Figure 21. Running Knowledge Pack

6. SCAN FOR SERIAL DEVICES, find the Serial COM port of the STWIN board, In the example above it is COM8





- 7. CONNECT TO DEVICE
- 8. Select TEST MODE
- 9. Select VIEW, the command window will show the Classification detected, and the Web Page will show the data, if you see unexpected results you can record the data to debug

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Figure 22. Test Mode Result

See tutorial video 8 below for details:



Video 8. testing_Knowledge_pack_in_gateway.mp4





Deploying Knowledge Pack Firmware in Compagno Board

Downloading the Knowledge Pack

Now that we have validated our model it is time for a live test. To build the firmware for the STWIN Compagno board go to the Download Model tab of the Analytic Studio.

If you are using the community edition of SensiML you can download the firmware library for ARM GCC. For the full source code, see <u>SensiML Plans</u>.

- 1. Go to the Download Model tab of the Analytic Studio
- 2. Select the pipeline and model you want to download
- 3. Select the HW platform ARM GCC Generic
- 4. Click Download and the model will be compiled and downloaded to your computer
- 5. Unzip the downloaded file and copy the library folder into the Future Electronics firmware folder Core/Src/SensiML/knowledgepack/lib



6. You need to make sure the define SENSIML_RECOGNITION is one in the file Core/Src/SensiML/sensiml.h





us_STWINCustomV04_GridEye - Future-SensiML/Core/Src/SensiML/sen Eile Edit Source Refactor <u>N</u> avigate Se <u>a</u> rch Project <u>Run Wi</u> ni	simi.h - STM32CubelDE dow Help
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> @ system.c > @ system_stm32l4xx.c > @ Startup	2 #else 26 #else 26 #define MOTION_CAPTURE_RATE 20 27 #endif 28
Figu	re 24. Firmware Folder

7. Reflash and running the new model firmware

See tutorial video 9 below for details:

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	Project : Future_GridEYE_OCt21	🖨 dawson@quicklogic.c
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Video 9. DownloadKnowledgePack.mp4

Running Knowledge Pack (Classifier) on Target GridEYE

1. Integrate the knowledge pack library into your firmware and flash the binary to the STWIN





2. Open a command window in the open-gateway-main directory, at the prompt type:

>python app.py

SensiML Gateway		
A Home		
Test Mode	Device Source	
Not Connected Video Status Not Connected	Device Mode: Data Capture Recognition Connection Type Serial D BLE O TCP/IP O Test SCAN FOR SERIAL DEVICES	
	Device ID: COM8	
	CONNECT TO DEVICE	

Figure 25. Open Gateway

- 3. SCAN FOR SERIAL DEVICES, find the Serial COM port of the STWIN board, In the example above it is COM8
- 4. CONNECT TO DEVICE (If the board doesn't connect, close down the browser and cmd windows, power cycle the target and then reconnect)
- 5. Select TEST MODE
- 6. START STREAM



Figure 26. Running Knowledge Pack on Target GridEYE





See tutorial video 10 below for details:



Video 10. Recognition_in_gateway.mp4

Summary

We hope you enjoyed this tutorial using the SensiML Analytics Toolkit. In this tutorial we have covered how to:

- 1. Collect and annotate a high-quality data set using the STWIN and Future Compagno Board
- 2. Build a query as input to your model
- 3. Use SensiML AutoML to search for an edge-optimized model
- 4. Use the SensiML Analytic Studio to test the model offline

For more information about SensiML, STM and the Compagno board contact our local Future Electronics Sales Office.



