XMC7200 Development Environment

Infineon Technologies Japan K.K.

2025.2.19

Infineon Microcontroller Portfolio

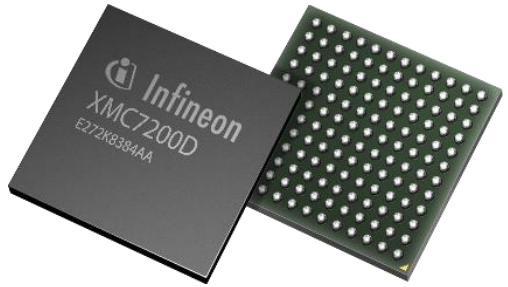
Infineon Microcontroller Portfolio Overview

	32-bit Arm® Cortex® M0/M0+ (32–384KB Flash)	32-bit Arm® Cortex® M4/M0+ (128KB–2MB Flash)	32-bit Arm® Cortex® M33/M55/M7
IoT/Consumer MCUs	PSoC 4000/T, PSoC 4100/S/T, PSoC 4200, PSoC 4700/S **Flexible PSoC™ 4 MCUs** with analog sensor integration, CAPSENSE™ capacitive touch, inductive sensing, wired and wireless connectivity such as USB, CAN, and BLE	PSoC 61, PSoC 62, PSoC 64 **Ultra-low power PSoC™ 6 MCUs** with M4/M0+ dual-core and EPC security, ideal for battery powered applications **Secured PSoC™ 6 MCU** with PSA L2/EPC2 certification	PSOC Edge E84 **Cortex-M55/M33 dual-core DSP+ ML + GPU 6.5 MB SRAM, .5 MB RRAM** PSOC Edge E83 **Cortex-M55/M33 dual-core, DSP+ ML 5.5 MB SRAM, .5 MB RRAM** PSOC Edge E81 **Cortex-M55/M33 dual-core, DSP+ Peripherals 5.5 MB SRAM, .5 MB RRAM**
Industrial MCUs	XMC 1100, XMC 1200, XMC 1300, XMC 1400 **XMC™ 1000 entry-level MCUs** for industrial applications like power tools, LED lightning, eBike and fan motor control	XMC 4100/4200, XMC 4300/4400, XMC 4500, XMC 4700/4800 **XMC™ 4000 MCUs** with built-in DSP instruction set, designed particularly for digital power conversion, motor control, sense & control, and IO applications **XMC™ 4300 and 4800** with integrated EtherCAT®	XMC 7100, XMC 7200 **XMC™ 7000 low-power MCUs** with single- or dual-core M7 are built on 40-nm process technology addressing high-end industrial applications

XMC7000 at a glance

Product features

- Single/ Dual Arm Cortex®-M7 CPU (up to 350-MHz) for primary processing
- Arm Cortex®-M0+ (100-MHz) for peripheral & security processing
- Up to 15x 16-bit & 16x 32-bit timer/counter pulse-width modulator blocks
- Up to 11x reconfigurable Serial Communication Blocks
- Up to 220 Programmable I/Os
- 3x SAR ADC (up to 1Msps) with up to 57 external channels
- Up to 10x CAN FD
- Crypto Engine support
- 5 different low power modes
- Extended voltage operating range: 2.7 to 5.5V
- Extended temperature range: -40 to 125°C



Value proposition

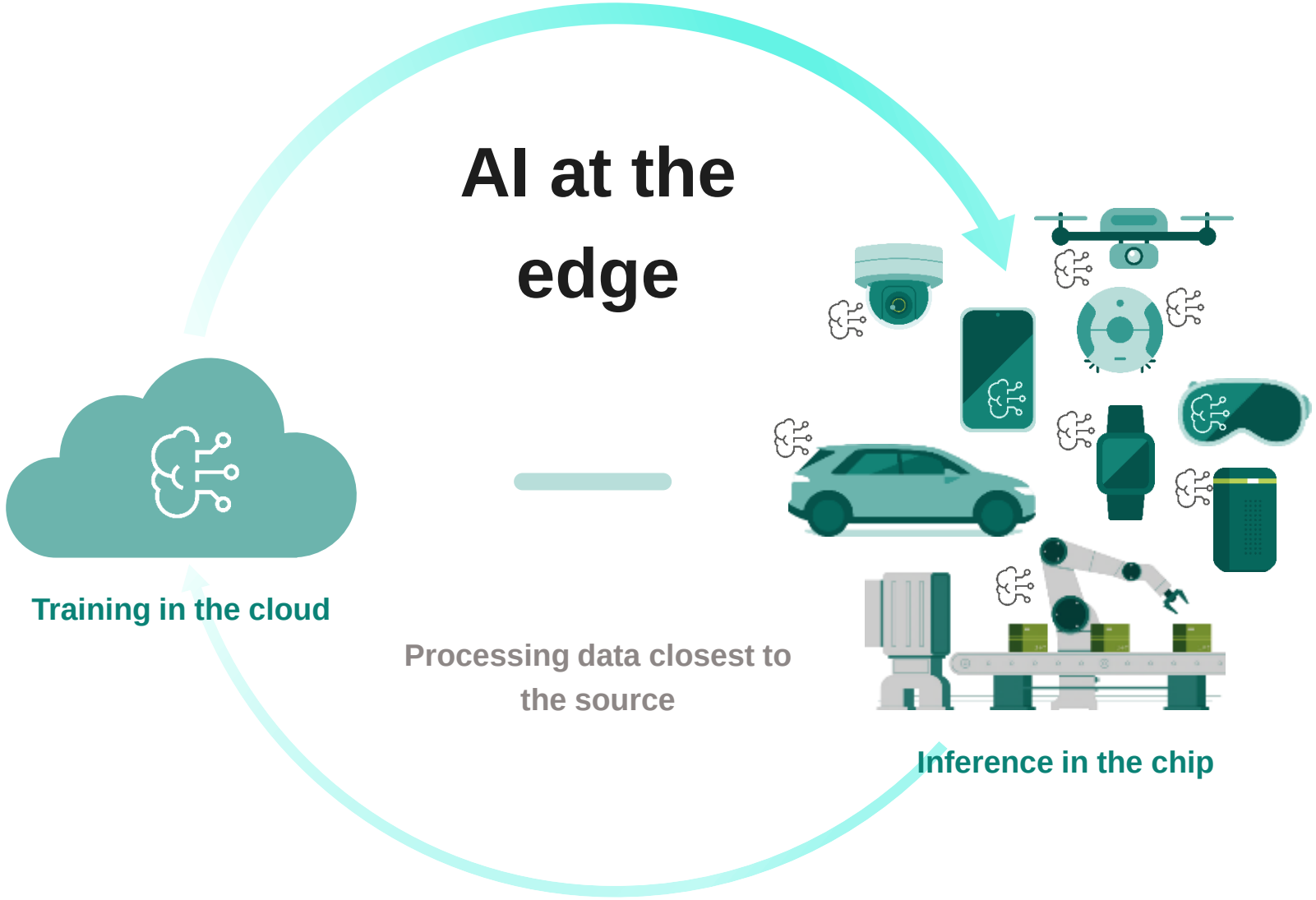
- Optimal solution for motor control
- Cost-optimization & robustness: uses an available 40nm platform
- Scalable solution: 2 series, 17 different package-memory combinations
- ModusToolbox™ as software development platform
- Advanced security options
- Power saving for energy-critical applications

Availability & material

- ✓ Samples already available
- ✓ Evaluation board already available
- ✓ Marketing material & Datasheet: *infineon.com/XMC7000*

–We enable and provide AI

リアルタイムの要件と、電力効率、セキュリティ、プライバシー保護の必要性が、エッジでのAI処理を促進



エッジAIの主な利点

低遅延とリアルタイム応答

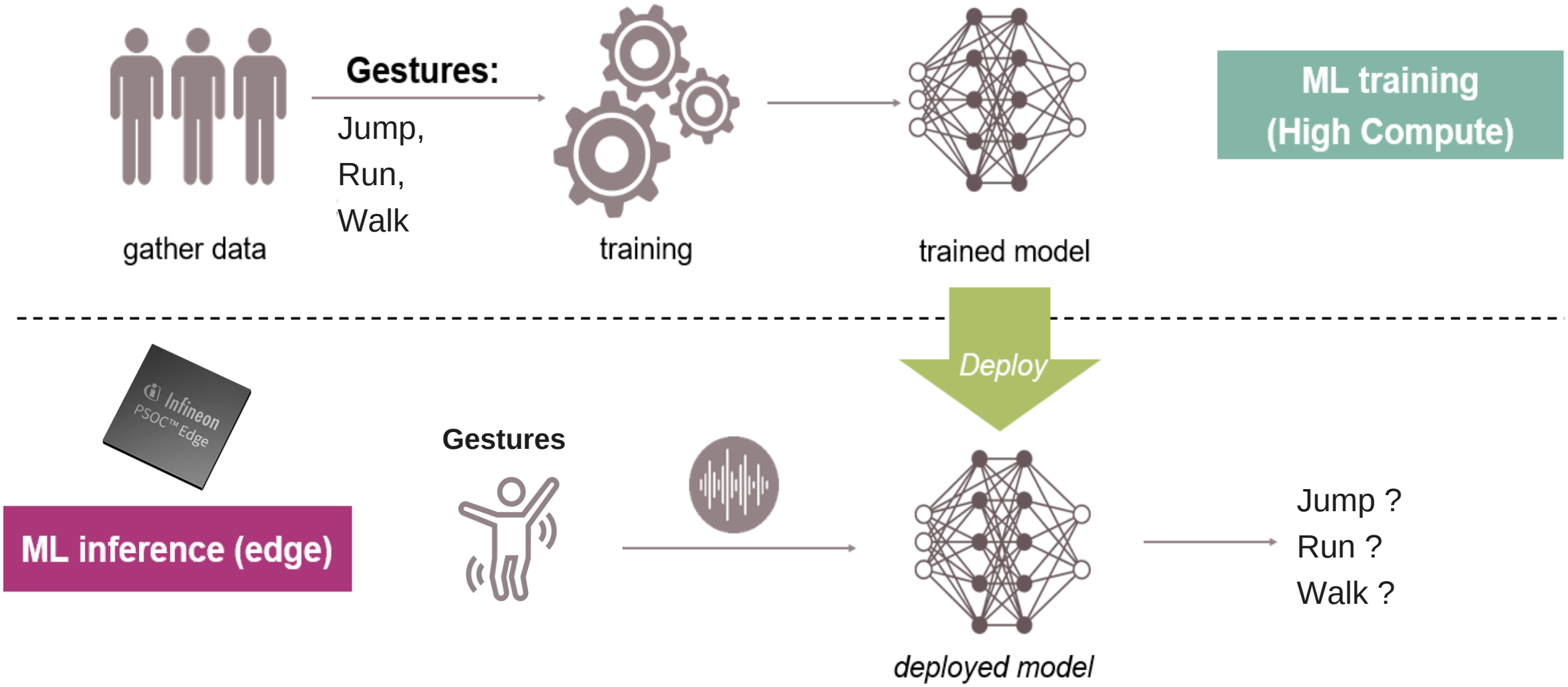
電力効率の向上

セキュリティとデータ プライバシーの改善

コスト削減

Infineon MCU AI開発環境

ジェスチャー検出モデルのための標準的な組み込みMLフロー



インフィニオンのML製品ポートフォリオと開発フロー

<AI-MLシステム機能ブロック図>

Development Environment

- DEEPCRAFT™ Studio
- Development & AI Ecosystem ModusToolbox™

+

MCU Devices

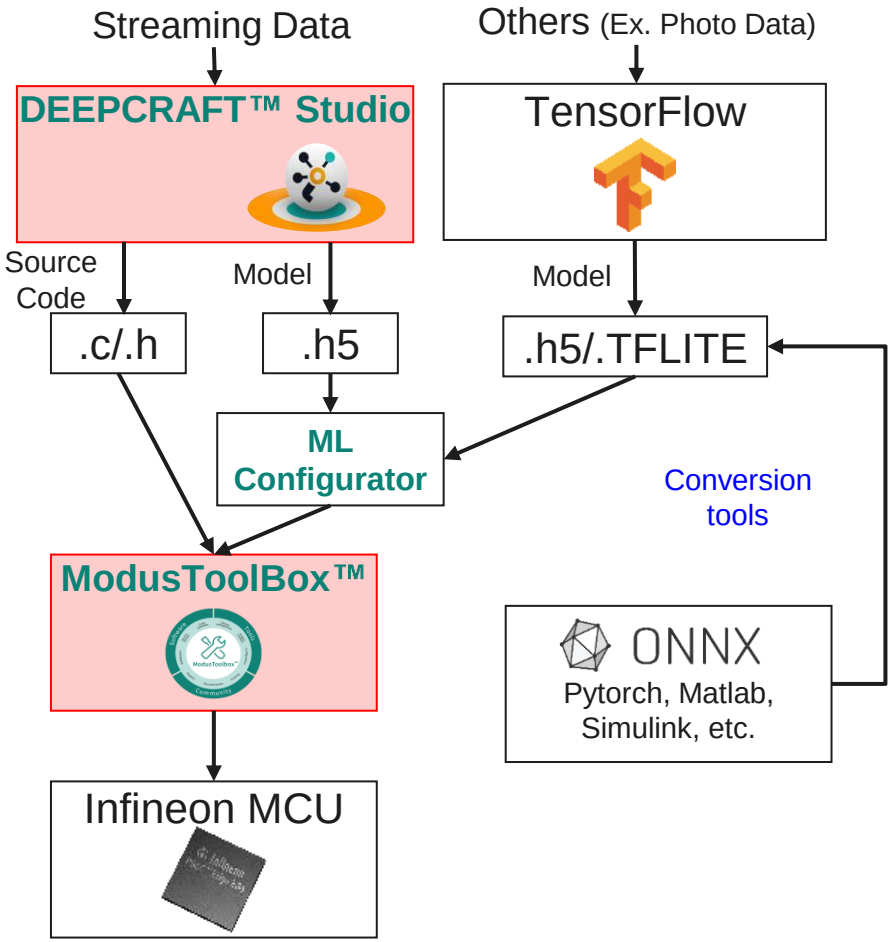
- Infineon Microcontrollers

+

Peripheral Devices

- Infineon Sensors
- Connectivity & Security Solutions

<開発フロー>

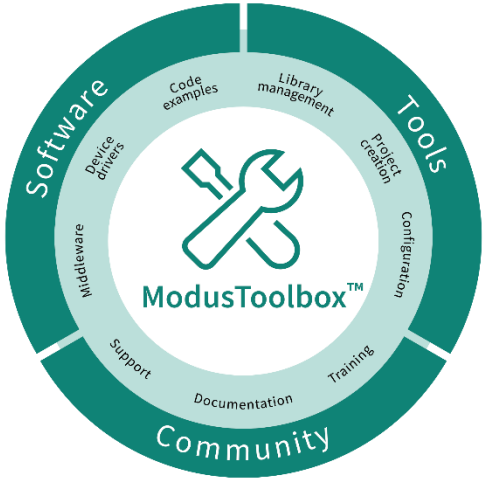


ModusToolbox™

ModusToolbox™とは？

- 特徴
  - Eclipseをベースに作成されたInfineonの統合開発環境(IDE)
  - XMCをはじめPSoC™, AIROC™等のInfineon製デバイスをサポート
  - コードサイズや機能等の制限無く無償で利用可能
  - ツールチェーンによる**ML Configurator**, Connectivity, セキュリティサポート
  - GitHubによるサンプルコード, ミドルウェア, デバイスドライバーの提供
  - カスタムBSP(ボードサポートパッケージ)作成のためのBSP Assistant

ModusToolbox
https://www.infineon.com/cms/jp/design-support/tools/sdk/modustoolbox-software/



DEEPCRAFT™ Studio

DEEPCRAFT™ Studio with ModusToolbox™

Build a model

Bring your own model (ex. TensorFlow) OR

Buy a Ready Model (no optimization needed)

Optimize & validate your model

Develop your embedded product with Infineon MCUs

DEEPCRAFT™ Studio

imagimob

Data Acquisition → Preprocessing → Model Training

- Data Import
- Data Capture
- Data Generation
- Data Augmentation
- Data Labeling
- Preprocessor / Feature extractor selection
- Model Selection
- Model Training
- Model Validation

DEEPCRAFT™ Studio + ModusToolbox™

Optimization

- Hardware Optimization

ModusToolbox™

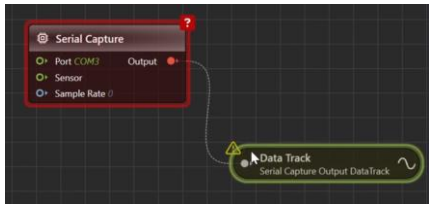
.c .a

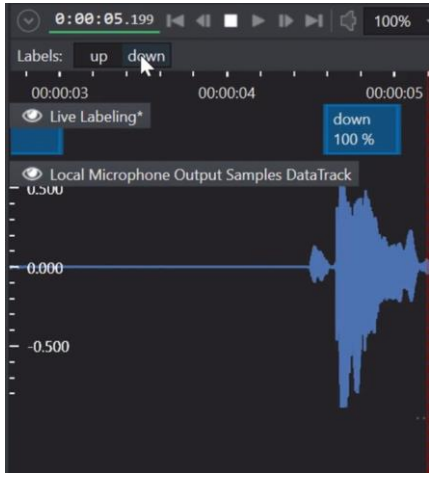
Deployment

- Code Generation
- Target Device Test and Validation
- Field Deployment

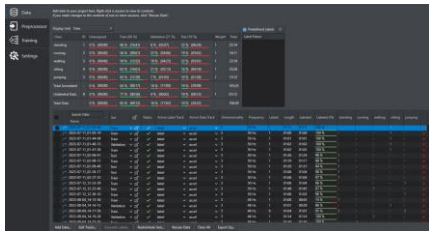
DEEPCRAFT™ StudioによりMLモデルを簡単に作成し実行可能

デバイスからコンピュータへのライブデータ収集と自動ラベリング

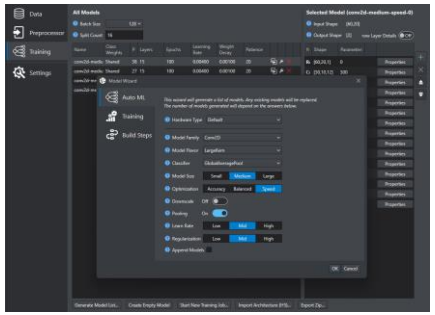


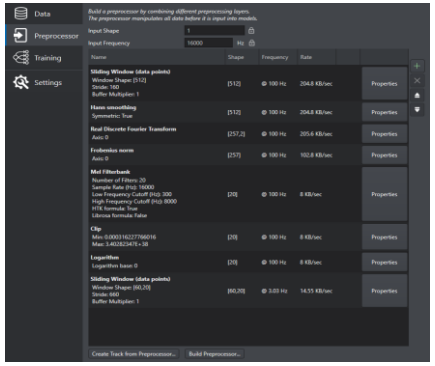


注釈、計量、ラベル付け、配布... プロジェクト内のすべてのデータを簡単に管理

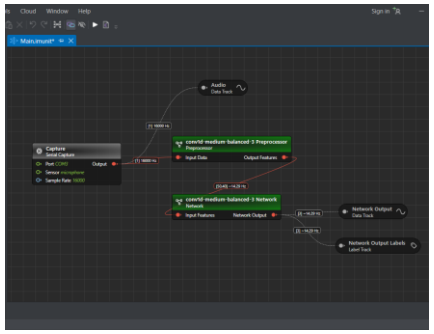


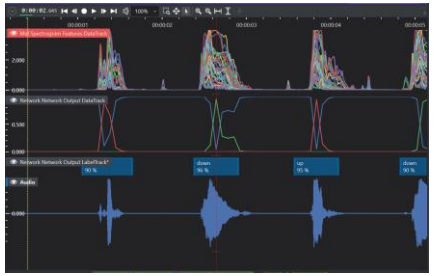
Model Wizardを使用し、高品質のモデルを生成し、トレーニング；



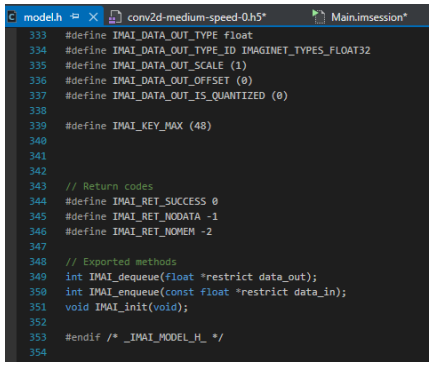


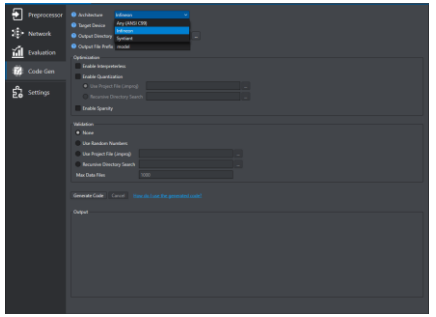
グラフUXを使用してモデルを可視化





インフィニオン・ハードウェアに対し最適化





Collect & annotate high quality data → Manage data into different datasets → Build & train great models → Evaluate and find the best model → Optimize and package application → Deployment and Maintenance

Imagimob レディモデル

For more information, please visit here.

Baby cry

The Baby Cry model is created to be used in smart home or lifestyle products that want to alert adults to the sound of baby or toddler crying in another room.
- Captures at least 93% of cries
- Robust against the most common background sounds, particularly indoor
- Suitable for babies and children up to three years old

Snoring

This model is ideal for companies with healthcare products that want to identify snoring. This is an important feature as snoring can sometimes indicate serious health conditions, in children as well as adults.
- Captures more than 90% of snores
- Robust against the most common background sounds, particularly indoor
- Flexibly designed to be used in wearables or in devices that are placed near the bed

Coughing

The Coughing model is designed for use in healthcare products such as wearables or smartphone apps. It enables the identification of coughing, which can indicate illness or other respiratory conditions, and can even be used to identify 'sick' versus 'healthy' users based on how often coughing occurs.
- Captures over 85% of coughs
- Robust against the most common background sounds, indoor and outdoor
- Measures the number of coughs per hour to determine 'sick' versus 'healthy' user

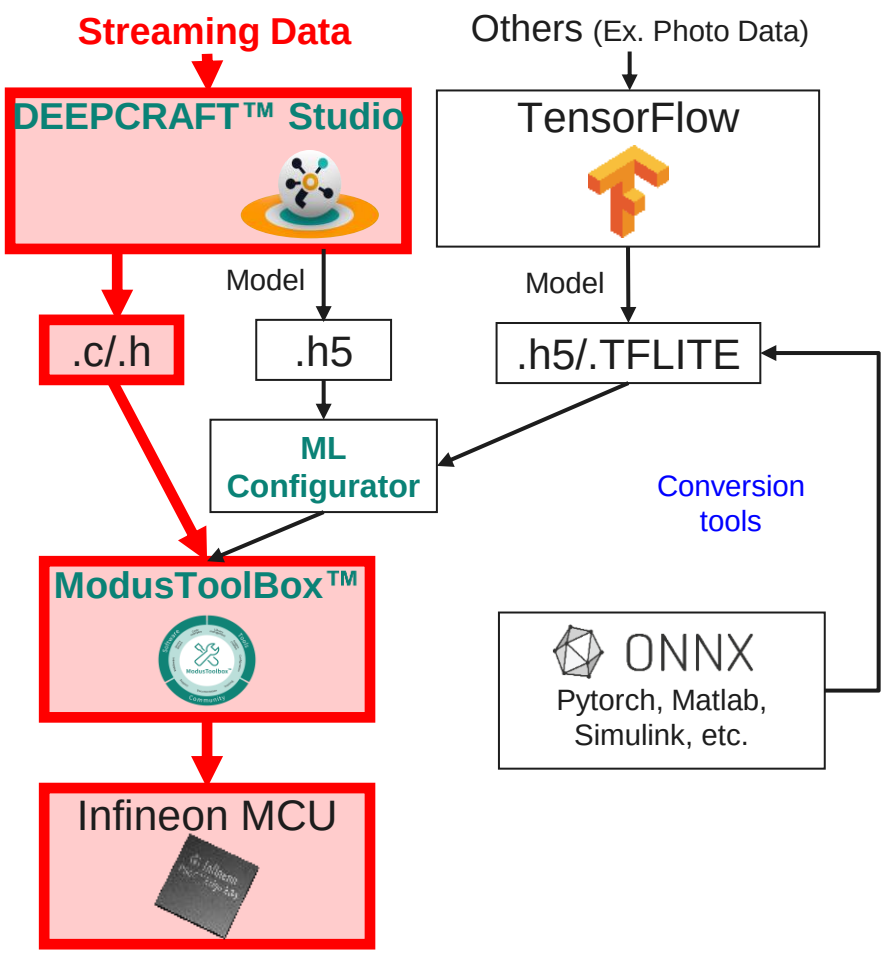
Sirens

This model uses audio event detection to identify emergency vehicle sirens. This can keep pedestrians aware on nearing emergency vehicles in their vicinity.
- Captures over 95% of siren sounds
- Robust against common traffic background sounds in different environments
- Able to detect siren sounds from all directions

DEEPCRAFT™ StudioによるModel生成

機械学習モデルをDEEPCRAFT Studioで生成する方法について

– 「Sirens」の機械学習モデルはC言語のソースファイルとしてCode Exampleに組み込まれています



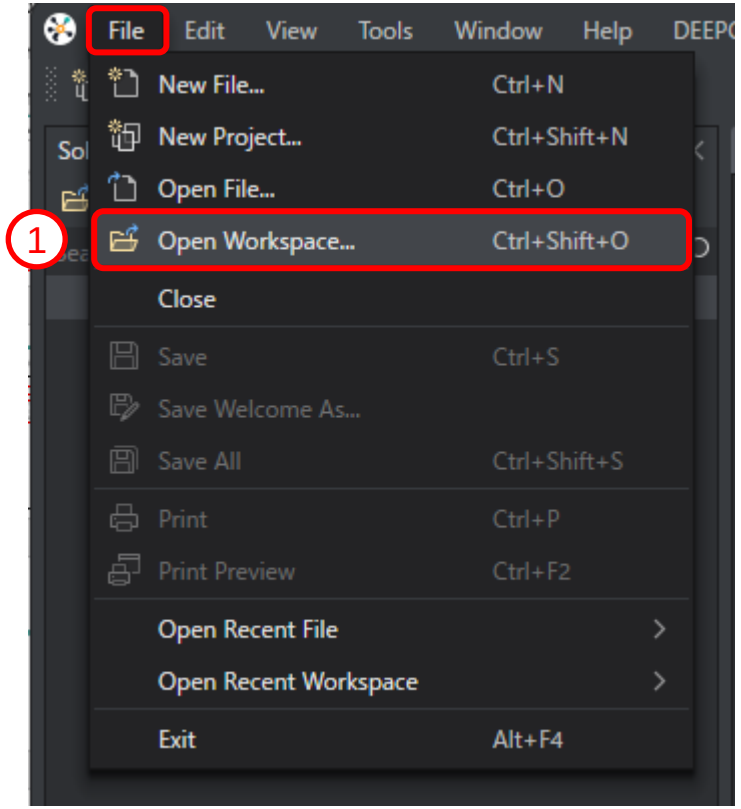
モデルの選択やトレーニングなど、機械学習モデルの設計についての詳細はアプリケーションノート**AN238663** を参照してください。

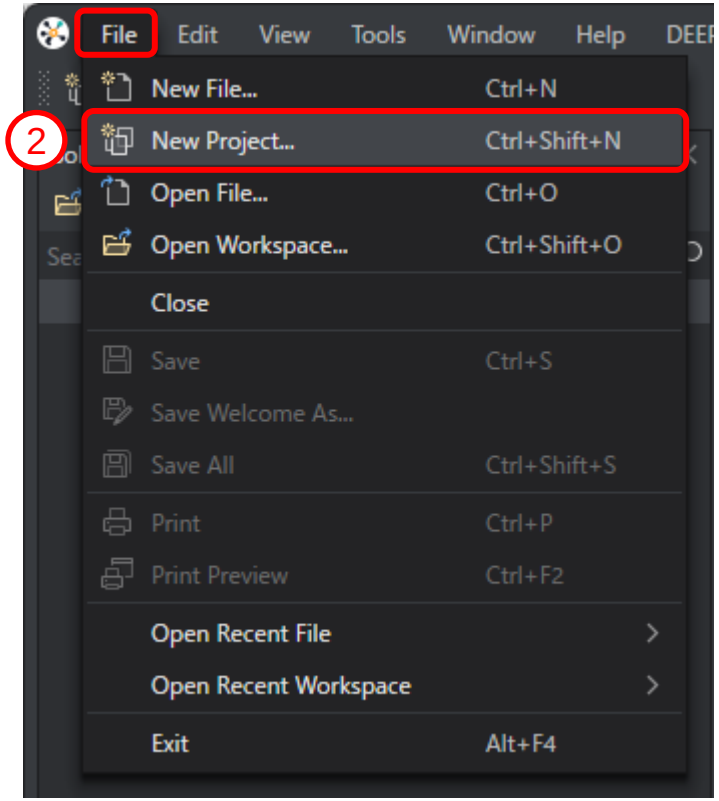
AN238663

Getting started with machine learning using ModusToolbox™ and Imagimob Studio
https://www.infineon.com/dgdl/Infineon-Machine_learning_using_ModusToolbox_Imagimob_Studio-ApplicationNotes-v01_00-EN.pdf?fileId=8ac78c8c8a8d344a018aa850bb2d21b5

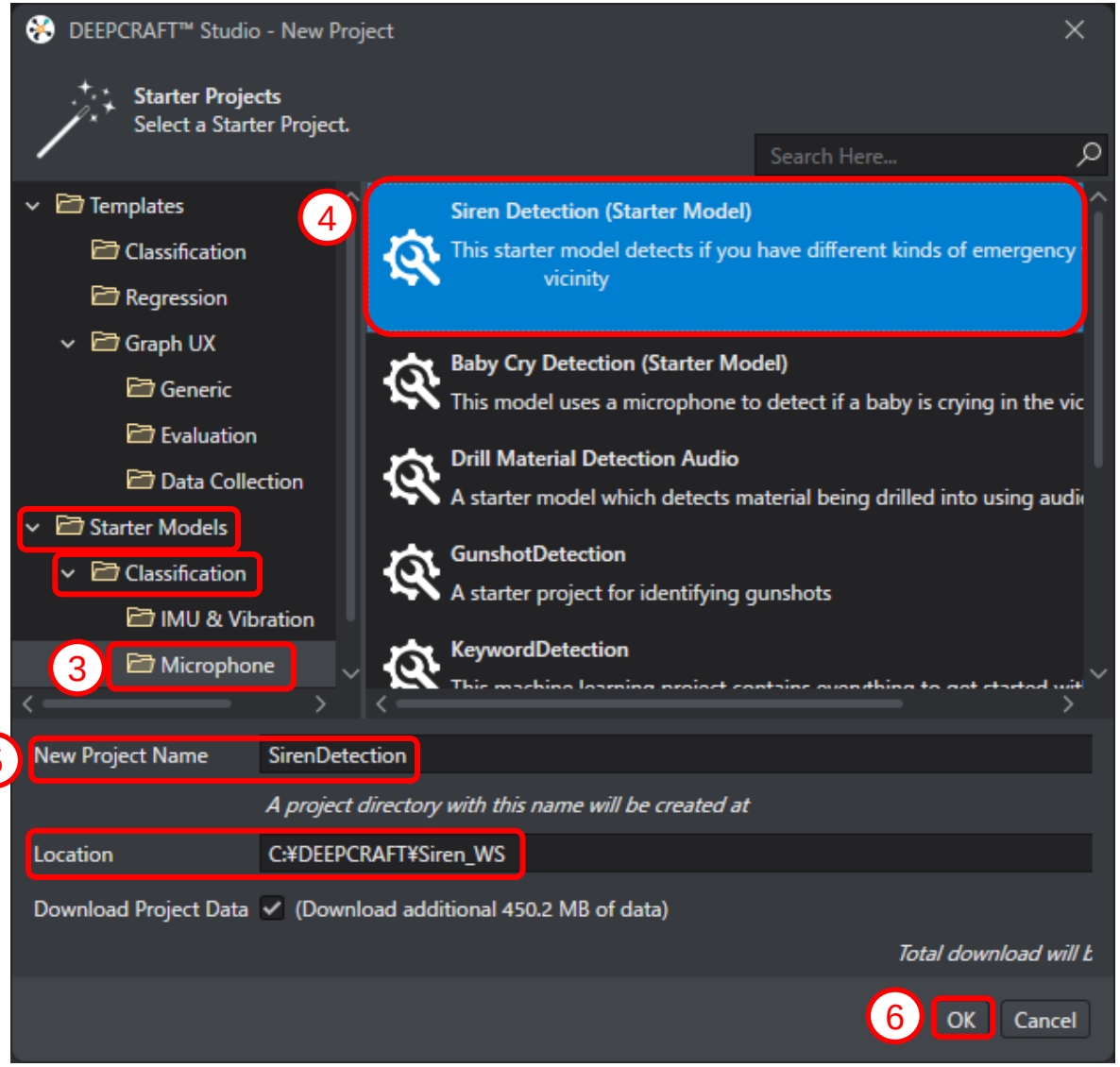
DEEPCRAFT™ Studioによる機械学習モデルの生成(1/)

1. DEEPCRAFT™ Studioを起動して[File]→[Open Workspace]でWorkspaceフォルダを選択
   – 例：C:¥DEEPCRAFT¥Siren_WS
2. [File]→[New Project]を選択

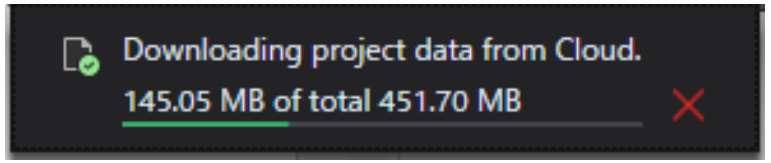




DEEPCRAFT™ Studioによる機械学習モデルの生成(2/)

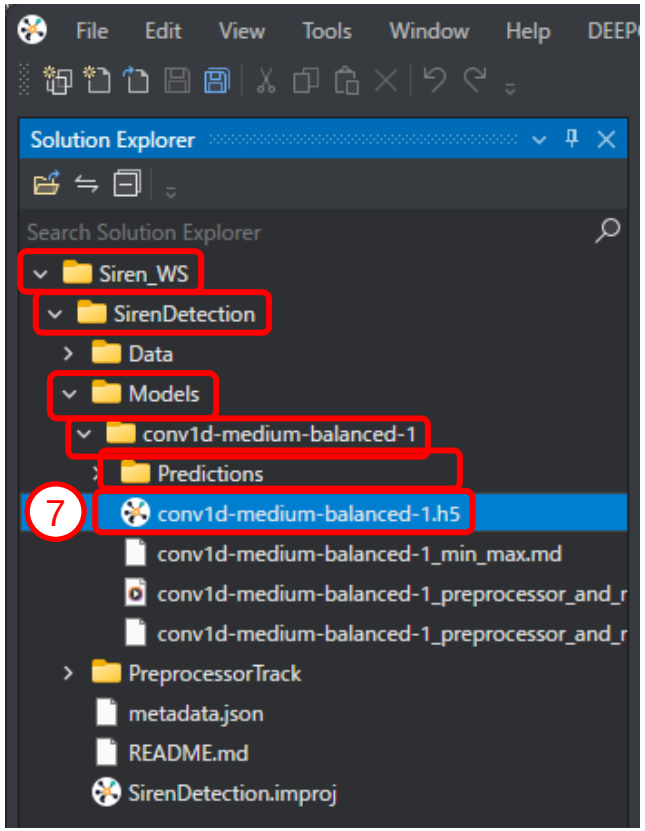


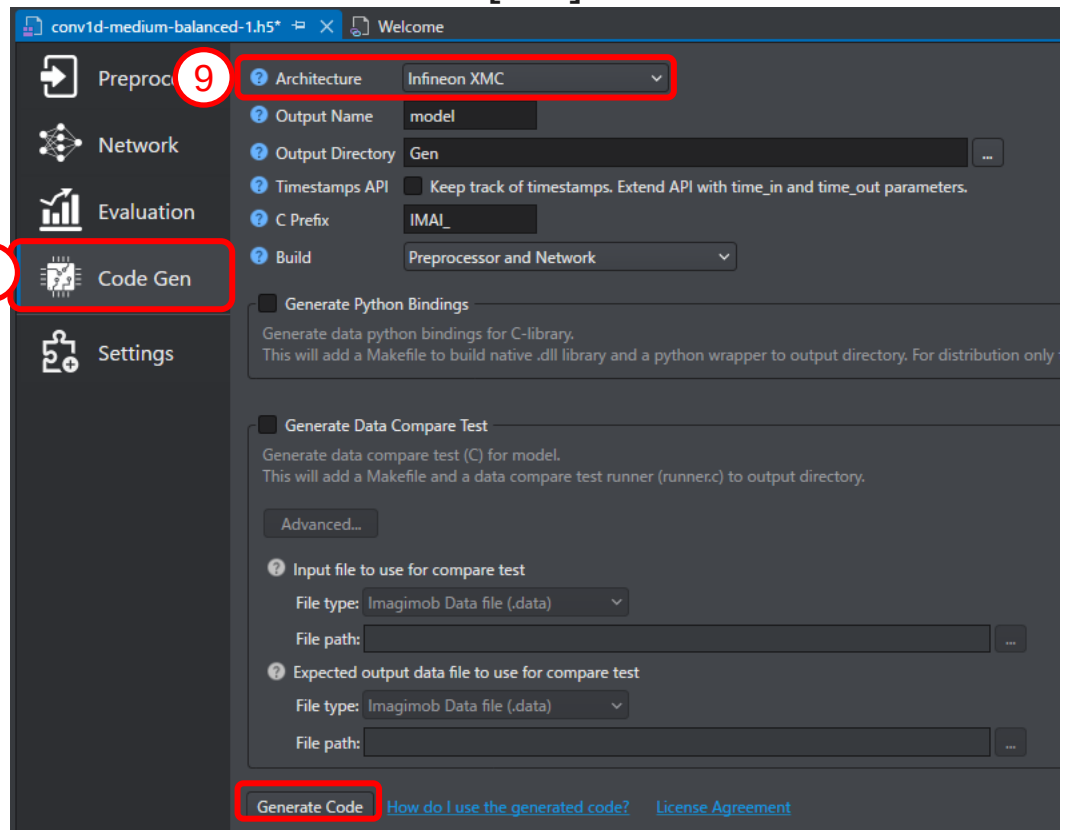
3. New Projectダイアログで[Starter Project] →[Classification] →[Microphone]を選択
4. [Siren Detection]を選択
5. [New Project Name]と[Location]を確認
   - 例： New Project Name： SirenDetection
   - Location ：C:¥DEEPCRAFT¥Siren_WS¥SirenDetection
6. [OK]をクリックしてBackgroundで実行されるダウンロード完了を待つ

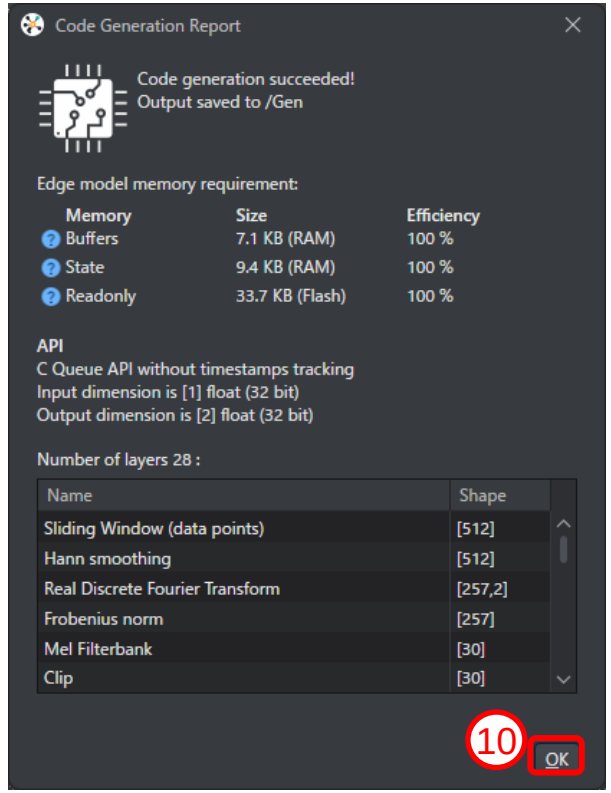


DEEPCRAFT™ Studioによる機械学習モデルの生成(3/)

7. 左側のSolution Explorerで[Siren_WS] → [SirenDetection] →[Models] →[conv1d-medium-balanced-1] →[conv1d-medium-balanced-1.h5]をダブルクリック
8. 右側にconv1d-medium-balanced-1.h5 が表示されるので[Code Gen]をクリック
9. [Architecture] を“Infineon XMC”に設定し、画面下の[Generate Code]をクリック
10. Code generation Reportダイアログが表示されるので[OK]をクリック

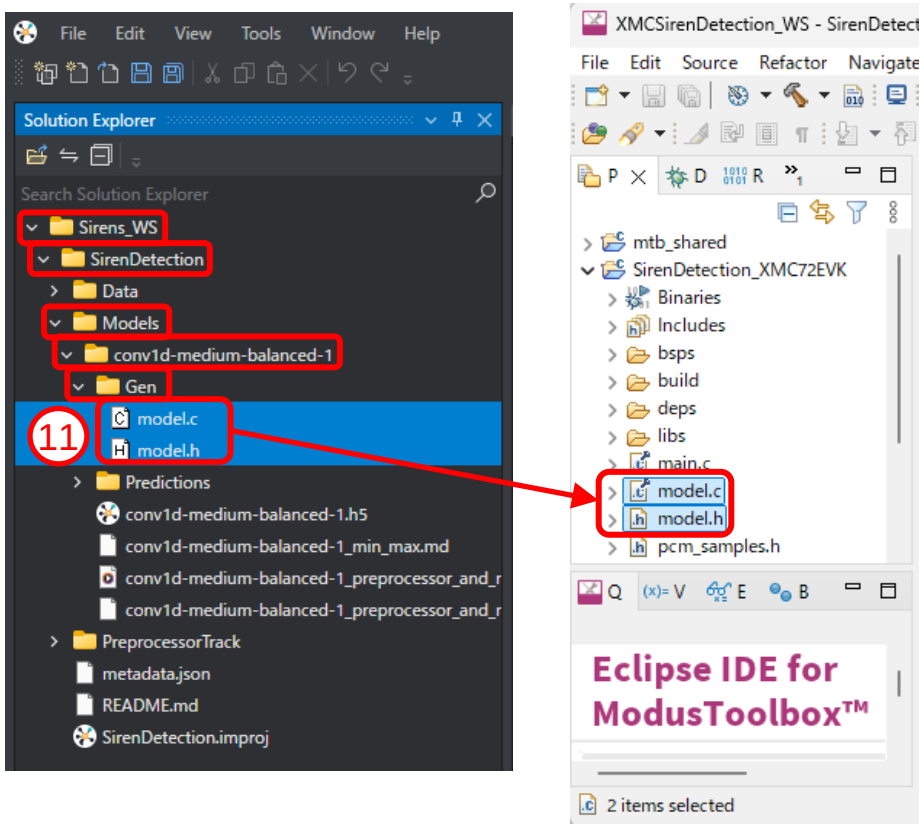






DEEPCRAFT™ Studioによる機械学習モデルの生成(4/)

11. Solution Explorerで[Siren_WS] → [SirenDetection] →[Models] →[conv1d-medium-balanced-1] →[Gen]以下にmodel.c/hが生成された事を確認



model.c/hに生成される関数

- 機械学習モデルの初期化

```
void IMAI_init(void);
```

- 機械学習モデルにデータを入力

```
int IMAI_enqueue(const float *restrict data_in);
```

- 機械学習モデルから検出結果を取得

```
int IMAI_dequeue(float *restrict data_out);
```

Summary

Summary

- XMC7000の AI開発環境
- Code Example：Deploy siren detection model
- DEEPCRAFT™ StudioによるModel生成
- Technical Support：Infineon Developer Community
  https://community.infineon.com/?category.id=jp


Infineon