# eIQ MACHINE LEARNING SOFTWARE DEVELOPMENT ENVIRONMENT

eIQ Machine Learning (ML) software development environment leverages inference engines, neural network compilers, optimized libraries, deep learning toolkits and open-source technologies for easier, more secure system-level application development and ML algorithm enablement, as well as auto-quality ML enablement.

## OVERVIEW

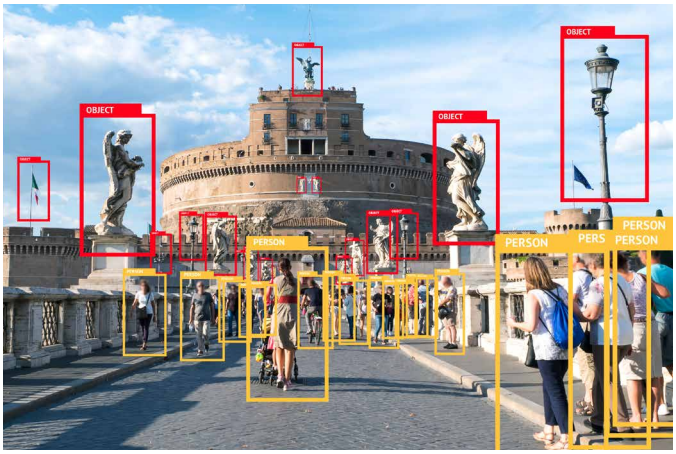
The NXP® eIQ ("edge intelligence") ML software environment provides the key ingredients to do inference with neural network (NN) models on embedded systems and deploy ML algorithms on NXP microprocessors and microcontrollers for edge nodes. It includes inference engines, NN compilers, libraries and hardware abstraction layers that support TensorFlow Lite, Glow, Arm® NN and Arm CMSIS-NN.

With NXP's i.MX applications processors and i.MX RT crossover MCUs based on Arm Cortex®-A and M cores, respectively, embedded designs can now support deep learning applications that require high-performance data analytics and fast inferencing.

eIQ machine learning software includes a variety of application examples that demonstrate how to integrate neural networks into voice, vision and sensor applications. The developer can choose whether to deploy their ML applications on Arm Cortex A, Cortex M and GPUs, or for high-end acceleration on the neural processing unit of the i.MX 8M Plus.

## APPLICATIONS

eIQ ML software helps enable a variety of vision and sensor applications working in conjunction with a collection of device drivers and functions for cameras, microphones and a wide range of environmental sensor types.




- Object detection and recognition
- Voice command and keyword recognition
- Anomaly detection
- Image and video processing
- Other AI and ML application domains include:
  - Smart wearables
  - Intelligent factories and smart buildings
  - Healthcare and diagnostics
  - Augmented reality
  - Logistics
  - Public safety

## FEATURES

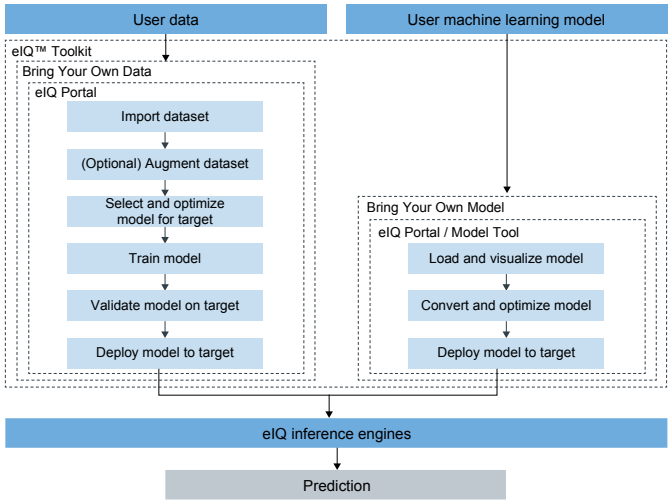
- Machine learning workflow tool
- Open-source and proprietary inference engines
- Neural network compilers
- Model validation and profiling tools
- Optimized libraries
- Application samples
- Runtime components included in NXP's Yocto Linux® BSP and MCUXpresso SDK software releases

## eIQ TOOLKIT

The eIQ machine learning software development environment includes the eIQ Toolkit, an easy-to-use ML workflow tool designed to ease ML development. The eIQ Toolkit enables graph-level profiling capabilities with runtime insights to optimize neural network architectures for execution on EdgeVerse™ processors.

The eIQ Toolkit output seamlessly feeds into DeepViewRT™, TensorFlow™ Lite, TensorFlow Lite Micro, Glow and Arm NN inference engines.

### eIQ TOOLKIT WORKFLOW



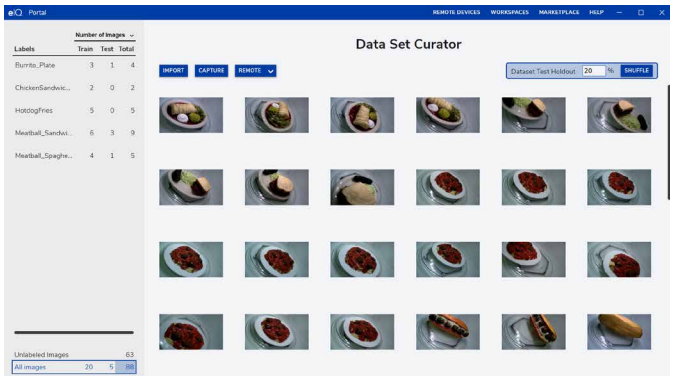

## eIQ PORTAL

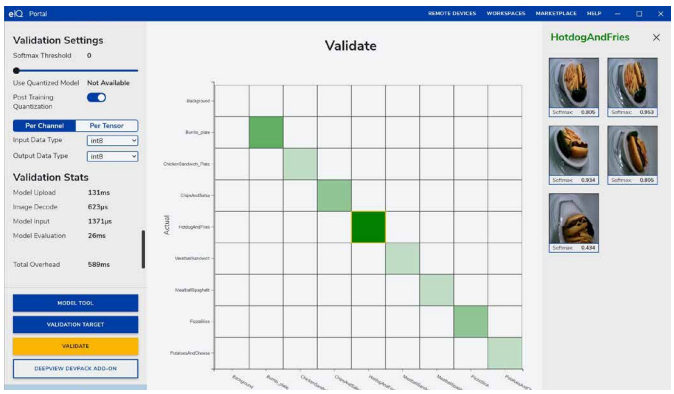
The eIQ Portal is an intuitive graphical user interface (GUI) within the eIQ Toolkit that simplifies ML development. It allows users to create, optimize, debug, convert and export ML models. In addition, embedded developers can import datasets and models from TensorFlow and ONNX formats, and then rapidly train and deploy neural network models and ML workloads.

## eIQ TOOLKIT — COMMAND LINE HOST TOOL SUPPORT

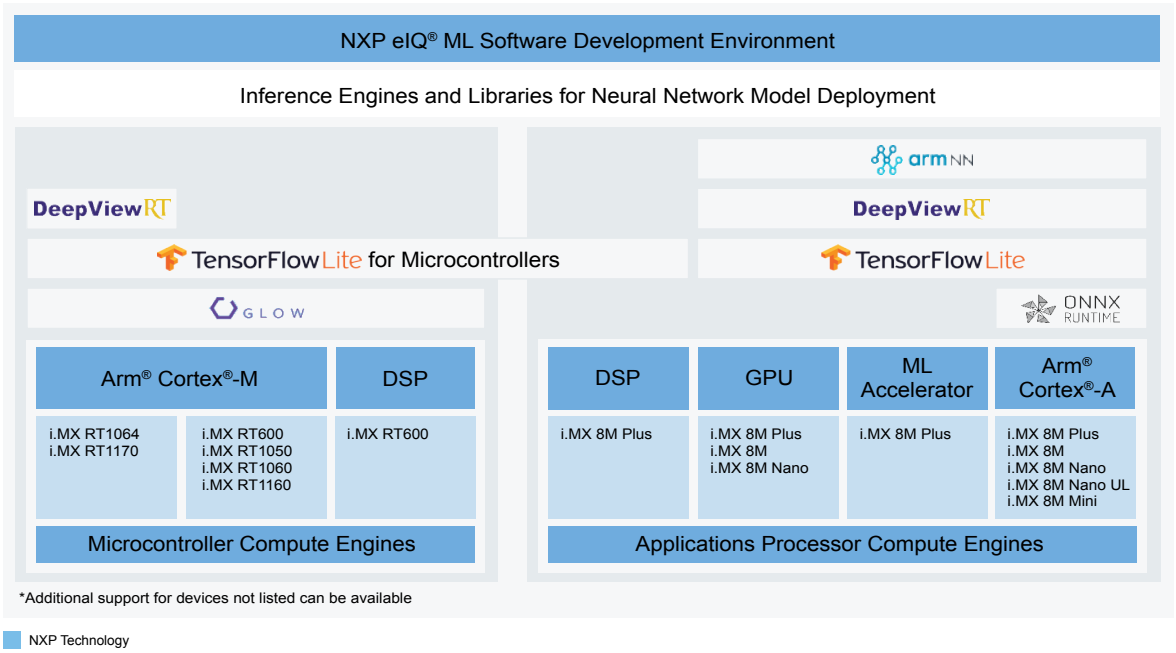
The eIQ Toolkit and the eIQ Portal are provided with examples demonstrating use cases and guidelines for the different process flow options such as importing pretrained models based on popular frameworks, creating, importing and augmenting datasets to develop models.

The eIQ Toolkit, including eIQ Portal, is delivered with a single click at www.nxp.com/eIQ.



NXP eIQ MACHINE LEARNING SOFTWARE — INFERENCE ENGINES BY CORE




## eIQ INFERENCE ENGINES

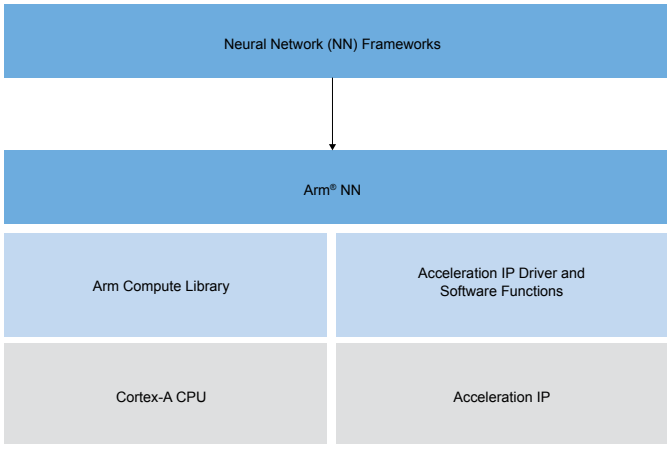
The following inference engines are included as part of the eIQ ML software development kit and serve as options for deploying trained NN models.

### Arm NN INFERENCE ENGINE

eIQ ML software supports Arm NN SDK on the i.MX 8 series applications processor family and is available through the NXP Yocto Linux-based releases.

Arm NN SDK is open-source, inference engine software that allows embedded processors to run trained deep learning models. This tool utilizes the Arm Compute Library to optimize neural network operations running on Cortex-A cores (using Neon acceleration). NXP has also integrated Arm NN with proprietary drivers to support the i.MX GPUs and i.MX 8M Plus NPU.

### eIQ INFERENCE WITH Arm NN

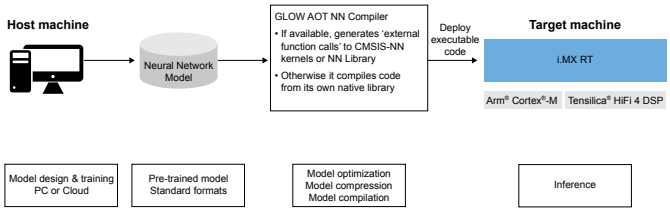



### GLOW

eIQ ML software supports Glow neural network compiler on the i.MX RT crossover MCU family and is available in the MCUXpresso SDK.

Glow is a machine learning compiler that enables ahead-of-time compilation for increased performance and smaller memory footprint as compared to a traditional runtime inference engine. NXP offers optimizations for its i.MX RT crossover MCUs based on Cortex-M cores and Cadence® Tensilica® HiFi 4 DSP.

### eIQ INFERENCE WITH GLOW

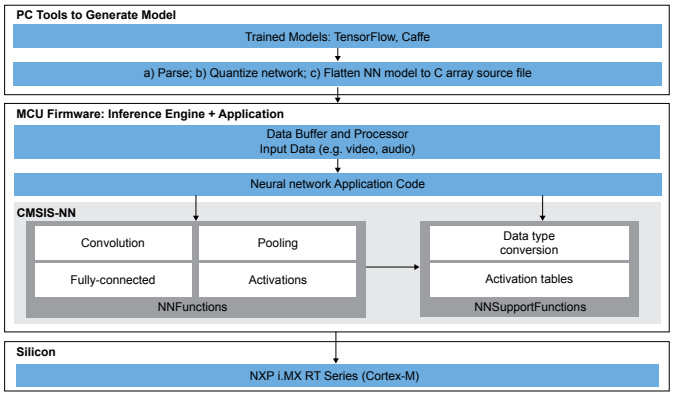


## Arm CMSIS-NN

eIQ ML software supports Arm CMSIS-NN on the i.MX RT crossover processor family and is fully integrated and available in the MCUXpresso SDK.

Arm CMSIS-NN is a collection of efficient neural network kernels used to maximize the performance and minimize the memory footprint of neural networks on Arm Cortex-M processor cores.

### eIQ INFERENCE WITH Arm CMSIS-NN

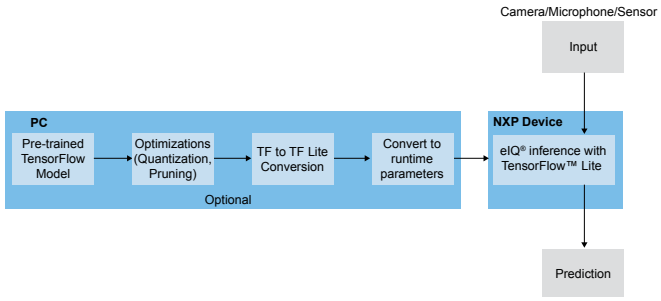



## TENSORFLOW LITE

eIQ ML software supports TensorFlow Lite on the i.MX 8 applications processor and i.MX RT crossover processor families, and is available through Yocto and MCUXpresso environments, respectively.

TensorFlow Lite is a set of tools that allows users to convert and deploy TensorFlow models to perform faster inferences. It requires less memory than TensorFlow, making it a good match for resource-constrained, low-power devices.

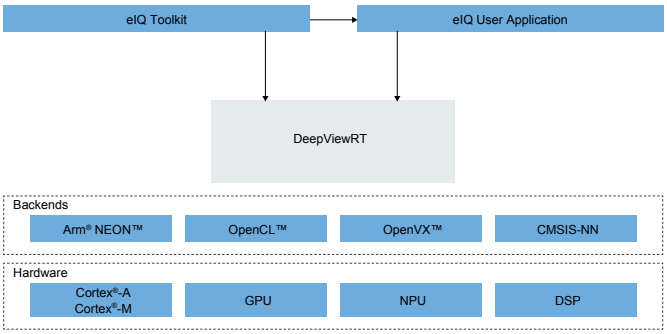
### eIQ SOFTWARE FOR TENSORFLOW LITE




## DeepViewRT™ RUNTIME

eIQ ML software supports the platform-optimized, proprietary DeepViewRT runtime inference engine for EdgeVerse processors, including the i.MX RT crossover MCUs and i.MX applications processors. This inference engine enables compact code size for resource-constrained devices and is available through the NXP Yocto Linux OS-based software and MCUXpresso SDK.

### eIQ INFERENCE WITH DeepViewRT




## SOFTWARE AVAILABILITY

eIQ ML software currently supports NXP i.MX and i.MX RT processors, with additional MCU/MPU support planned in the future.

- eIQ ML software for i.MX applications processors is supported on the current Yocto Linux release
- eIQ ML software for i.MX RT crossover processors is fully integrated into the MCUXpresso SDK release
- eIQ Toolkit is available for download at www.nxp.com/eiq/toolkit

## GET STARTED:

Learn more: www.nxp.com/ai and www.nxp.com/eiq

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