Accelerated development and deployment workflows for AI automotive applications

eIQ™ Auto Deep Learning Toolkit

NXP'S SOLUTION FOR AUTOMOTIVE AI APPLICATIONS

- NXP eIQ Auto toolkit for deep learning software development and deployment

NXP'S SUPPORTING TECHNOLOGY

- NXP S32V2 automotive processing platform for multi-camera vision processing

KEY AUTOMOTIVE APPLICATIONS:

- Driver monitoring systems (DMS) and occupant monitoring systems
- LiDAR segmentation
- Object detection, classification and tracking
- Surround view
- Front view
- Advanced park assist

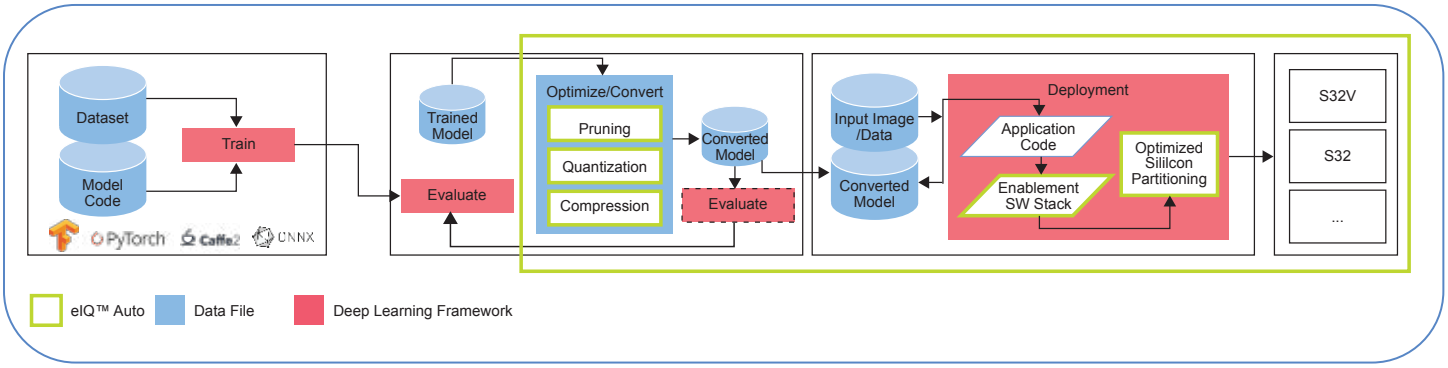
In the evolution toward fully autonomous L5 vehicles, artificial intelligence (AI) will play an increasingly crucial role across an ever-widening range of automated driving applications. These applications span from object classification and path planning to driver/occupant monitoring, powertrain optimization and far beyond. This AI enablement–made possible in part by advanced deep learning capabilities for vision, LiDAR and RADAR technologies–heralds a sea of change for automotive safety, intelligence, and eco-friendliness.

To date, deep learning algorithms and neural network frameworks targeting AI applications have been cultivated in datacenter-class compute environments leveraging power-hungry, general-purpose processor cores. But the attendant complexity, cost, power budget and development workflows are not readily transferable to embedded automotive applications. A new approach is required—one that leverages automotive-optimized development toolkits, inference engines and embedded processing platforms that maximize processing agility and performance for real-time AI automation while satisfying stringent automotive quality and reliability standards.

NXP BENEFITS

Development and Deployment Agility

With NXP's eIQ Auto toolkit, users can seamlessly transition from development environment to full implementation, converting and fine-tuning their AI models while leveraging familiar platforms and libraries such as TensorFlow, Caffe and/or PyTorch to port their deep learning training frameworks to a high-performance, automotive-grade NXP processing platform. Neural networks can be optimized for maximum efficiency utilizing pruning and compression techniques.

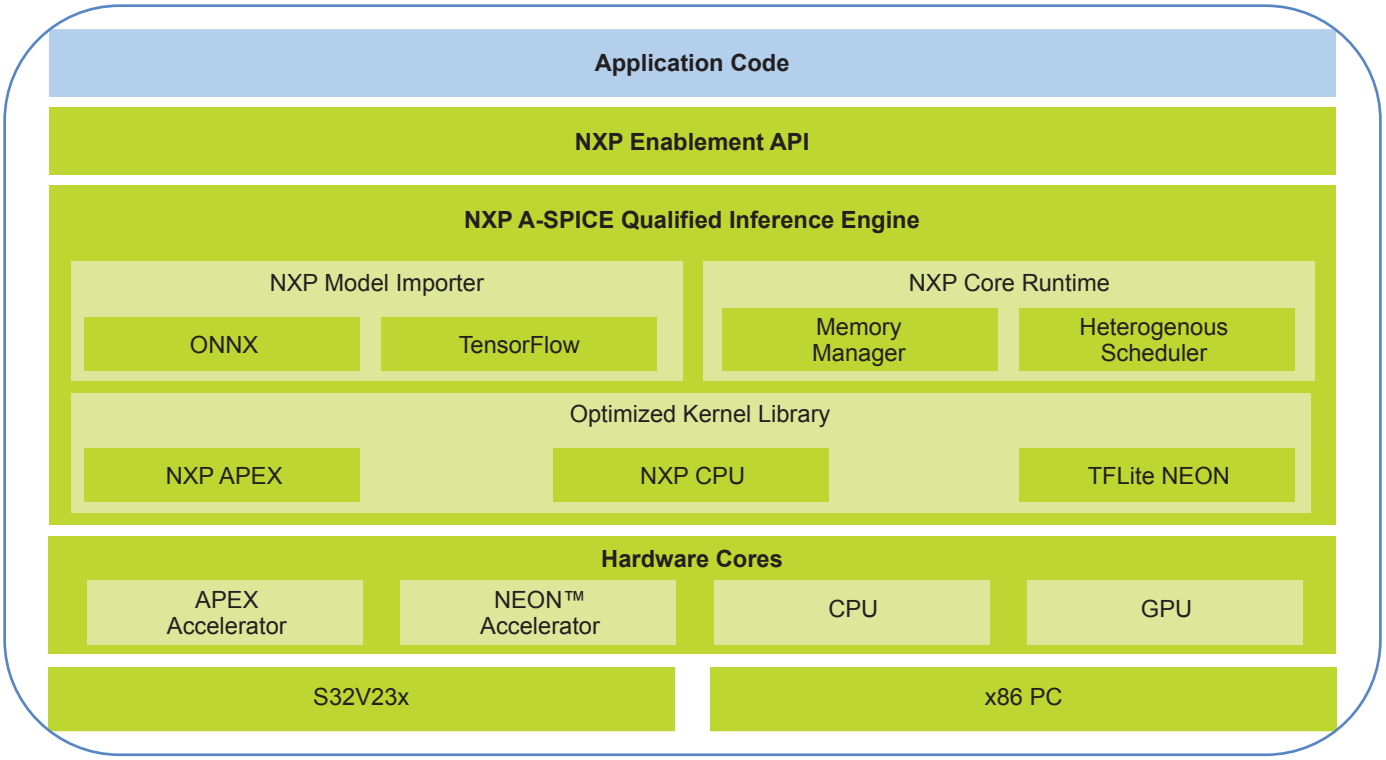


API Advantages

NXP provides a unified API that enables the same application code and neural network models to be utilized across multiple development stages. Once the model has been quantized, it can be run on the device target or on the bit-exact simulator, greatly accelerating development processes.

Automotive-Grade Quality and Reliability

NXP's achievement of Automotive SPICE compliance ensures that the eIQ Auto toolkit meets the stringent, international automotive development standards established by leading vehicle manufacturers. In contrast with competing inference engines developed with open-source tools, NXP's eIQ Auto toolkit helps enable seamless standards conformance for safety-critical automotive applications.



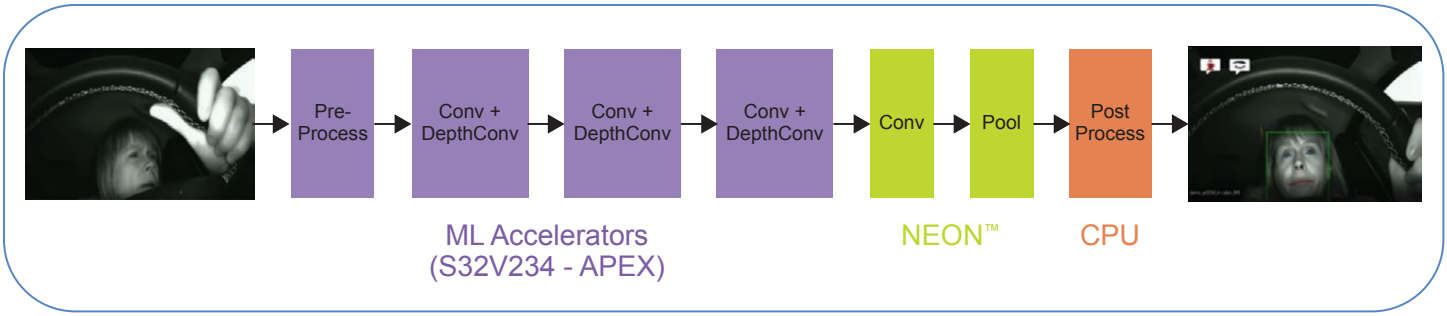
PROCESSING EFFICIENCY

NXP eIQ Auto toolkit users can provision task scheduling to the best-suited onboard compute engines, leveraging all available CPU/GPU cores and accelerators with maximum efficiency. This helps ensure that every layer of a deep learning algorithm is serviced by the most appropriate embedded compute resources, thereby optimizing performance-per-watt and thermal management agility while shortening design and development cycles.

Network	eIQ™ Auto Speed-Up vs. TF-Lite on S32V234[1]	
	TF-Lite Float	TF-Lite int8
MobileNetv1	34 x faster	18 x faster
MobileNetv1	14 x faster	9 x faster
SqueezeNet1.1	26 x faster	15 x faster
SSDMobileNet	33 x faster	12 x faster
ResNet-50	36 x faster	22 x faster

AUTOMATED NETWORK DEPLOYMENT

Driver monitoring application optimized and deployed on S32V234



eIQ AUTO, VISION AND LiDAR APPLICATION NETWORK MAP FOR S32V234

Function	Supported Neural Network
Vision Semantic Segmentation	DeepLab V3
2D/3D Object Detection	SSD-MobileNet
Classification	MobileNet ResNet-50
LiDAR Semantic Segmentation	SqueezeSeg

Application	Applicable Functions	
Front vision	Vision semantic segmentation	2D/3D object detection
APA	Vision semantic segmentation	2D/3D object detection
Blind spot	2D/3D object detection	Classification
Rear vision	2D/3D object detection	
DMS	Classification	
Highway pilot	Lidar semantic segmentation	
Traffic jam chauffeur	Lidar semantic segmentation	

Features	
Training Frameworks	Interface to standard frameworks such as TensorFlow, Pytorch, Caffe, and ONNX
Optimization	Prunes, quantizes, and compresses the neural network
Embedded Deployment	Automated neural net layer deployment to the optimum available compute resource
Auto Quality Inference Engine	A-SPICE qualified inference engine
Supported Networks	Different types of networks are supported including detection, classification and segmentation. Includes optimized support for the following networks: MobileNetV1, MobileNetV2, SqueezeNet1.1, SSDMobileNet, ResNet-50, DeepLab v3 and SqueezeSeg

REQUIREMENTS

- Ubuntu® LTS 16.04 64-bit
- SBC-S32V234 development board
- Vision SDK software for S32V234

eIQ AUTO TOOLKIT SOFTWARE LICENSES

Part Number	Type	License Term	Technical Support	Runtime Limitations
SW32V23-AIR01E	Evaluation	3 months	Community	30 mins
SW32V23-AIR01S	Development	1 year	Direct 40hrs	3 hours

Access to the evaluation version of the eIQ Auto Toolkit is available via the eIQ Auto Community (apply for access on nxp.com).

Development and production licenses available via a quotation. Contact your NXP representative for more information.

LEGACY OF LEADERSHIP

The eIQ Auto toolkit is a specialty component of NXP's eIQ ("edge intelligence") machine learning software development environment. Widely deployed today across a broad range of advanced AI development applications, NXP's eIQ software leverages inference engines, neural network compliers and optimized libraries for holistic system-level application development and machine learning algorithm enablement on NXP processors.

[1] Based on Internal NXP benchmarks. Comparisons using single thread Tensor Flow TF Lite quantized model running on the Arm Cortex-A53 at 1 GHz versus eIQ Auto version of the model, running on dual APEX2 on S32V234.

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