

LogicTronix

March 30, 2022

LogicTronix Technologies

FPGA Design and ML Acceleration Company

Email: info@logictronix.com , ip-sales@logictronix.com

LogicTronix - *Introduction, Solutions, IP Cores and Services*

1. Introduction to LogicTronix
2. LogicTronix ANPR and TVAS Solution
3. AI/ML in Cloud
4. LogicTronix IP Cores: Computer Vision, Crypto-Hashing Applications & HFT.
5. LogicTronix- Design Services
6. White-papers & Resources
7. Satisfied Clients: Design Services
8. LogicTronix-Collaborators
9. LogicTronix-Team details: FPGA and ML Acceleration

Introduction to LogicTronix

We are

✓ FPGA Design & Machine Learning Company

Expertise (Design Service) & IP Cores:

- ❖ FPGA based development for Computer Vision, Sensor Fusion, Embedded Solutions, etc.
- ❖ Machine Learning Acceleration with FPGA for Surveillance/Security, Automotive (ADAS), Industrial, Medical & Financial Applications (HFT).
- ❖ Offering IP Cores in Computer Vision, Cryptographic-hashing, HFT and Machine Learning.

Solutions:

- ❖ Smart City and Smart Parking Solutions: TVAS and ANPR
- ❖ High Frequency Trading (HFT) IP Cores-Pipeline

Mission and Vision

❖ Mission:

- Accelerating real world solutions with AI and Machine Learning
- Providing optimized and user-friendly **Edge and Cloud based solutions.**

❖ Vision:

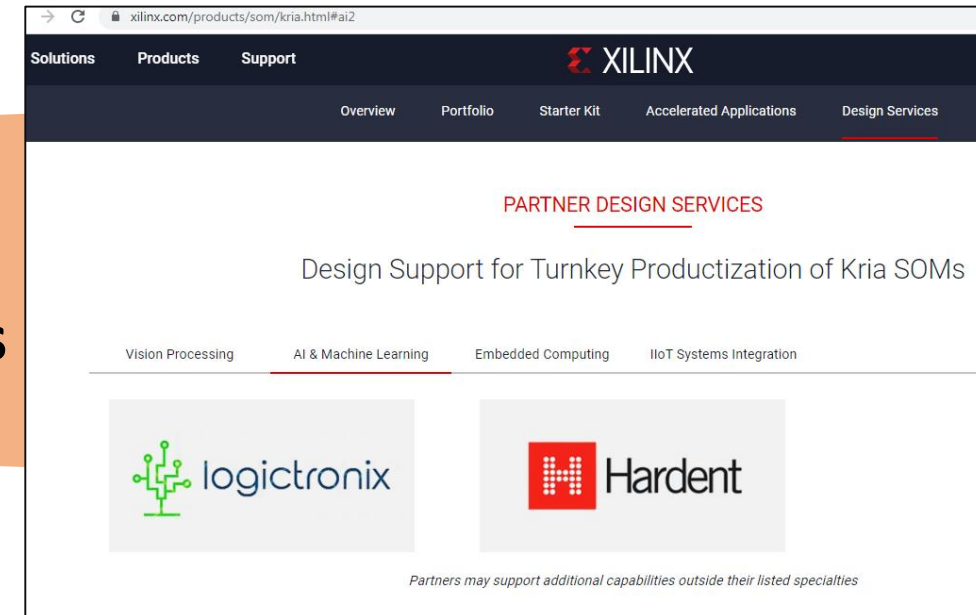
- Being the top-notch “**AI Acceleration Company**”

We are:

❖ Xilinx Certified Partner



❖ Design Service Partner for
Machine Learning for Xilinx Kria SoM FPGAs



Xilinx Partner Profile Link: <https://www.xilinx.com/alliance/memberlocator/1-1dturdk.html>

LogicTronix ANPR Solution : **Features**

- ❖ AI as a Service (AlaaS) Solution.
- ❖ **Plug and Play solution (Embedded Linux based Solution) for Xilinx Kria SoM- KV260 and Xilinx MPSoC based platforms.**
- ❖ Edge based AI-Solution with GUI features.
- ❖ Can process 25+ FPS per stream on single camera and 2 camera streams at 15 FPS. Supports 4 streams on single Kria-KV260.
- ❖ Highly competitive **Cost per Stream (CPS) Solution** with compared to available solutions on market.
- ❖ Works with IP Camera or RTSP streams as well as USB and MIPI streams.
- ❖ **Offering solution for English-Character License Plates as well as Regional languages for Thailand and Japan.**
- ❖ Solution is deploying over Asia Pacific, North America and EU Countries.

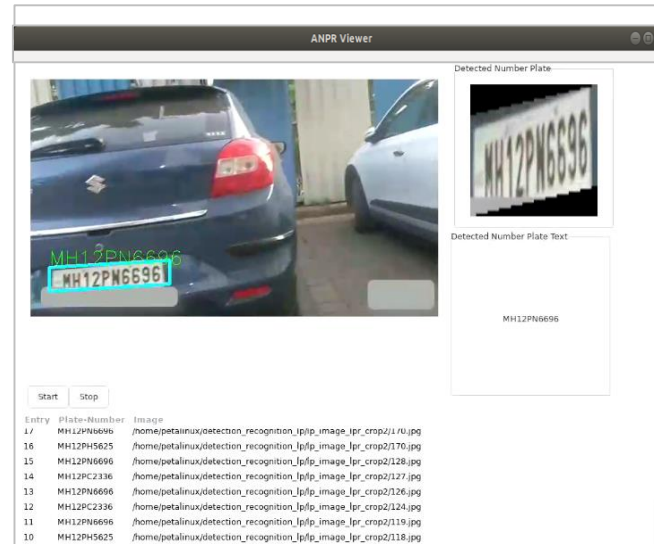


LogicTronix ANPR Solution : Use Cases

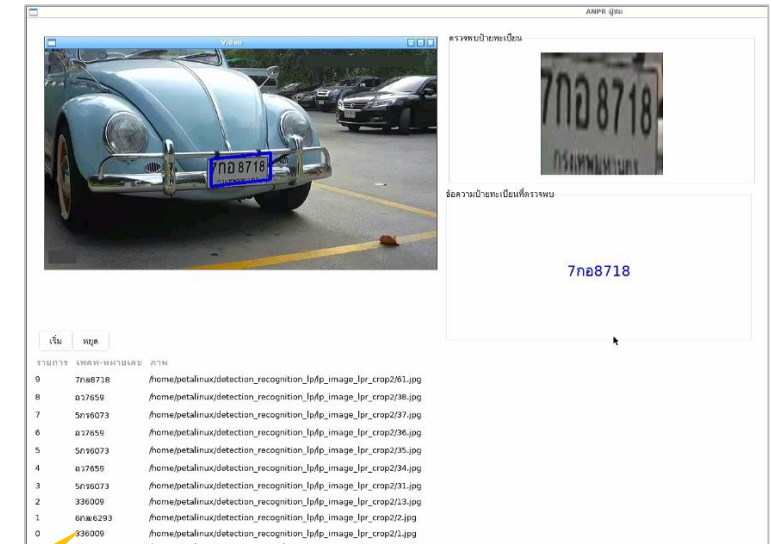
- Private Parking
- Public Parking
- Toll Booth Management

❖ Traffic Video Analytics Solution (TVAS):

- ✓ Larger Solution of ANPR,
- ✓ Vehicle Counting, Vehicle type recognition
- ✓ Traffic rules violation: Speed, lane etc.



ANPR- Parking
Use Case-India



ANPR- Parking
Field Test-Thailand



ANPR- Toll Booth
Use Case- India



LogicTronix ANPR Solution : License Plates



Non Embossed
License Plates



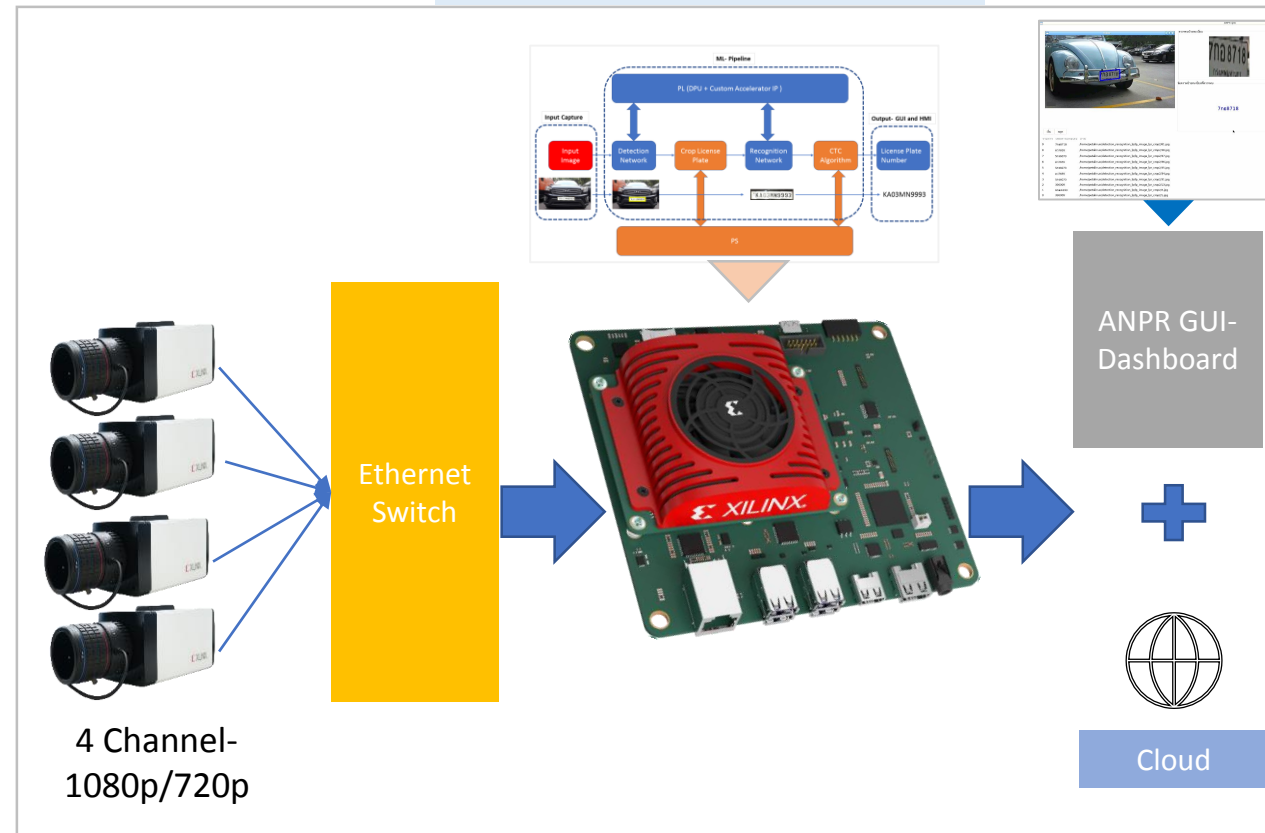
Yellow color License
Plates – Public Vehicles

Embossed
License Plates



Multichannel ANPR

Multi-channel ANPR



ANPR Solution: Supported Devices

- ❖ Input capture device can be of MIPI, USB3, GigE etc.
- ❖ Current Kria apps supports(USB webcams, Onboard OnSemi MIPI camera, video file).

ANPR Solution- Supports



**AR0144 | AR1335
Camera**



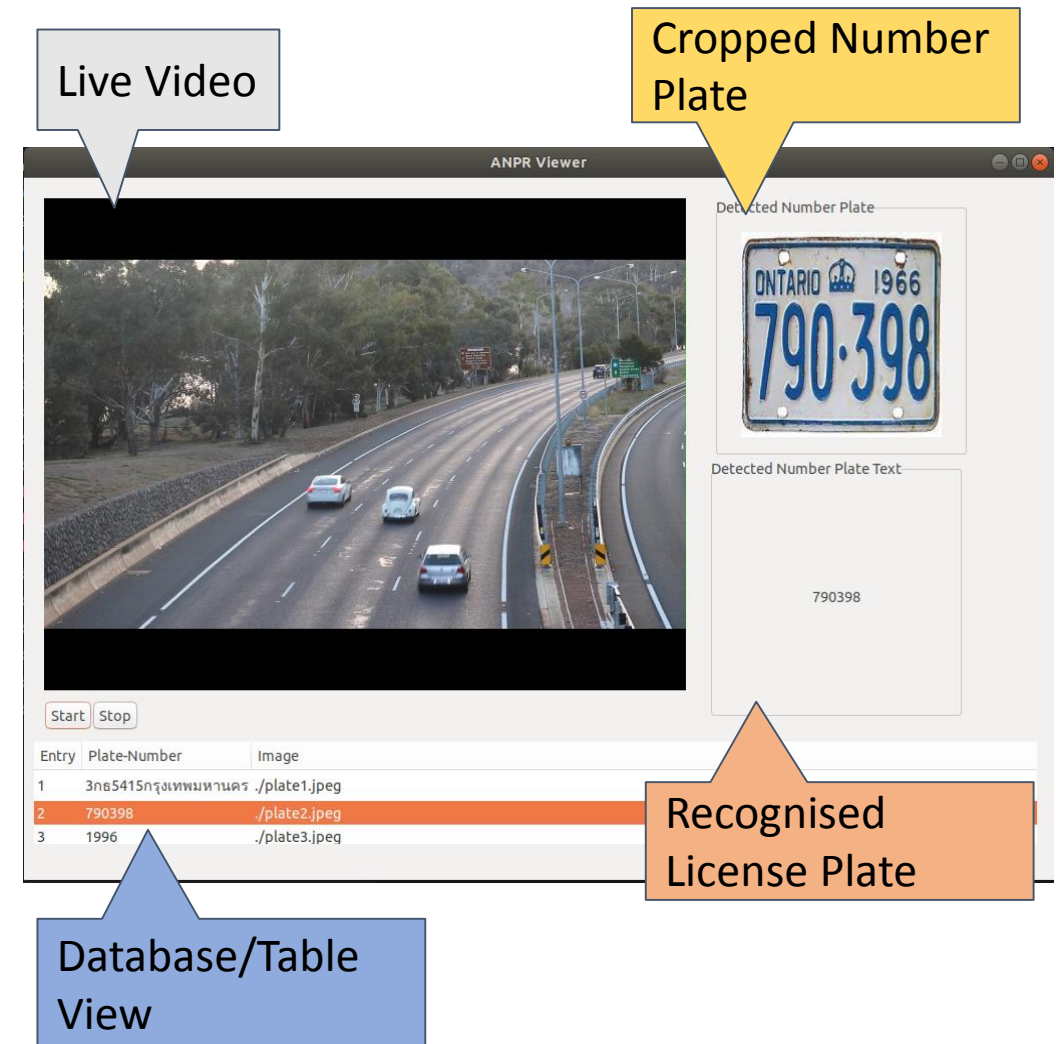
USB Camera



RTSP Camera

ANPR Viewer- GUI features

- ❖ Lightweight Edge based GUI
- ❖ Standalone application developed with GTK+.
- ❖ Live Feed to camera with detected bounding box.
- ❖ Parse the MQTT payload.
- ❖ Show detected number plate image and string.
- ❖ Updates the dashboard table to view the list of detected Plate Number and image.

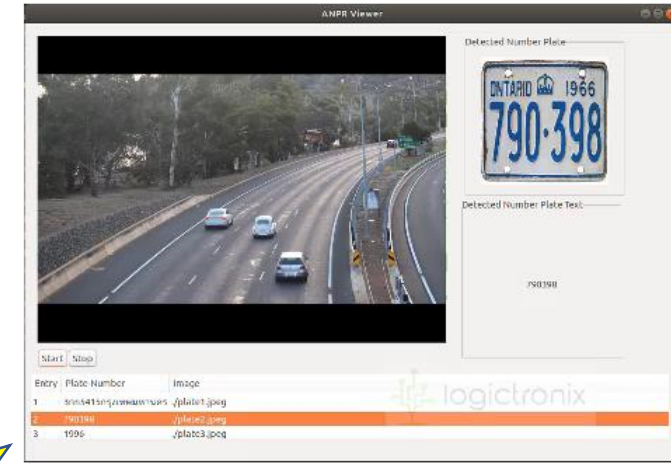


ANPR

Solution-Demo on


Xilinx Kria-KV260 / MPSoC FPGA

Solution by
LogicTronix




Video Demo of ANPR Solution:
[\[Link\]](#)

LogicTronix-Xilinx Webinar on Kria-AI/ML

The AMD Xilinx logo, with "AMD" in a bold sans-serif font and "XILINX" in a smaller, all-caps sans-serif font below it.

Kria SOM - KV260 Development and Machine Learning Acceleration Webinar

A photograph of a white car on a road, with a license plate "12C D78G" highlighted by a blue and yellow rectangular box. The text "LICENSE PLATE" is visible above the plate number.

Summary

Presented in collaboration with [Xilinx Kria SOM partner LogicTronix](#), this webinar will focus on the methodologies about Machine Learning Acceleration, developing ML based solution on Xilinx Kria KV260 Vision AI Starter Kit, creating custom Accelerated Applications for Kria SOMs. During the webinar, we will also discuss how to use Petalinux or Yocto layers for creating customization on real world solutions and creating Vitis Video Analytics SDK based pipelines for ML inference.

WATCH ON-DEMAND

bit.ly/KriaSoM_Webinar

LogicTronix ML Solution (TVAS/ANPR) on Cloud

❖ We are planning to host our “Edge-Kria based TVAS and ANPR” to cloud based platform

- Few Customer from North America (NA) and Asia Pacific are lined, who are having large parking spaces to manage.
- Our Cloud based ML solution, TVAS is part of “Smart City” solution.
- Cloud based solution will use number of camera input to Alveo (U30/U50) card server rack (RU) and do the video processing and ML inferencing workloads.

LogicTronix's Machine Vision solution with Xilinx FPGAs

❖ Machine Vision with High Speed Camera and Machine Learning

- Targeted to industrial customers
- For LVDS Stream Processing with FPGA is prototyped with Xilinx 7 Series FPGA then we will migrate it into Kria SoM.



Processing High-Speed Camera Stream in FPGA [LVDS into FPGA]



LogicTronix
FPGA Design and ML Acceleration Company
Email: info@logictronix.com



Our Reference Design on LVDS-FPGA Processing

- FPGA SoM Based LVDS-FPGA Processing Design
- Features of our design
 - 4K@60 FPS processing capabilities,
 - Vivado 2018.1 and above,
 - References design only consumes 30% of chip area of Kintex-7,
 - Enough spaces left for extra high-speed processing with Vivado HLS and R
 - AI inferencing capabilities,
 - Can produce preferable output stream (HDMI, DP, MIPI, 10G Ethernet)
 - Design and Technical Support.



High Speed Camera-FPGA: Applications

The FPGA processing of high-speed camera has wide application in several fields.

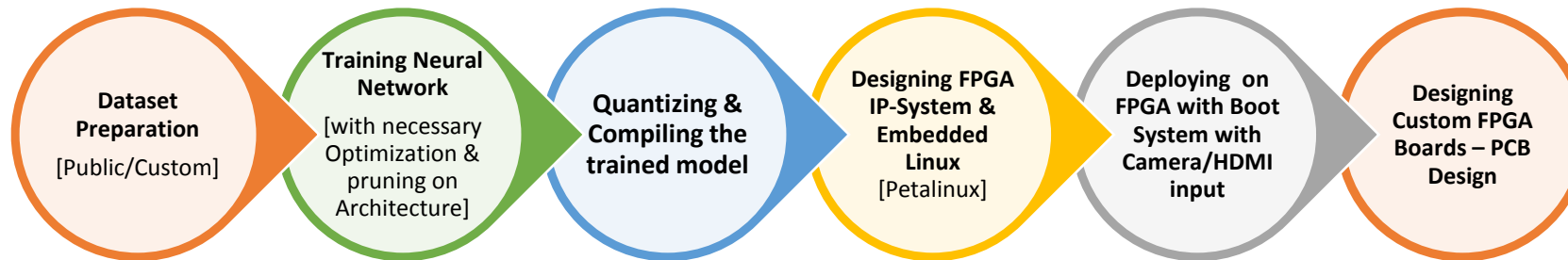
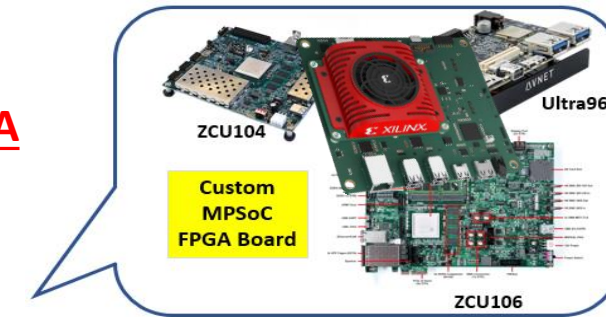
- ❖ Industrial Inspection
- ❖ Machine Vision
- ❖ Bio-Medical Imaging
- ❖ Defense and Aerospace
- ❖ Surveillance
- ❖ Automotive Driving
- ❖ Video Conferencing
- ❖ Commercial film production
- ❖ Television and Studio Production



ML Acceleration Flow: top-level Recipe of our Solutions



Machine Learning Acceleration flow on FPGA



Accelerating Yolo V2 for Object detection on Image on VCU1252



Multi-Stream + Multi-Model based ML Inferencing

-Running Multiple Neural Network model on multiple streams of video on single device-Xilinx Kria KV260



Kria-NLP SmartVision Demo

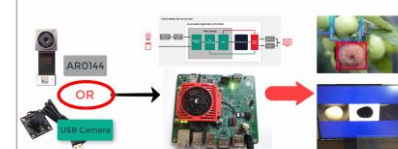
Keyword based ML Model Switching on Xilinx Kria SoM-KV260 Board

30 FPS



Kria KV260- Defect Detection Demo

Running Defect-Detect application with AR0144-Sensor/USB-Camera-Stream



Yolo-V3-Tiny for Object Detection with DPU-DNNDK 3.0 [AI SDK]
-Demo with Ultra96 FPGA

For any queries: info@logictronix.com

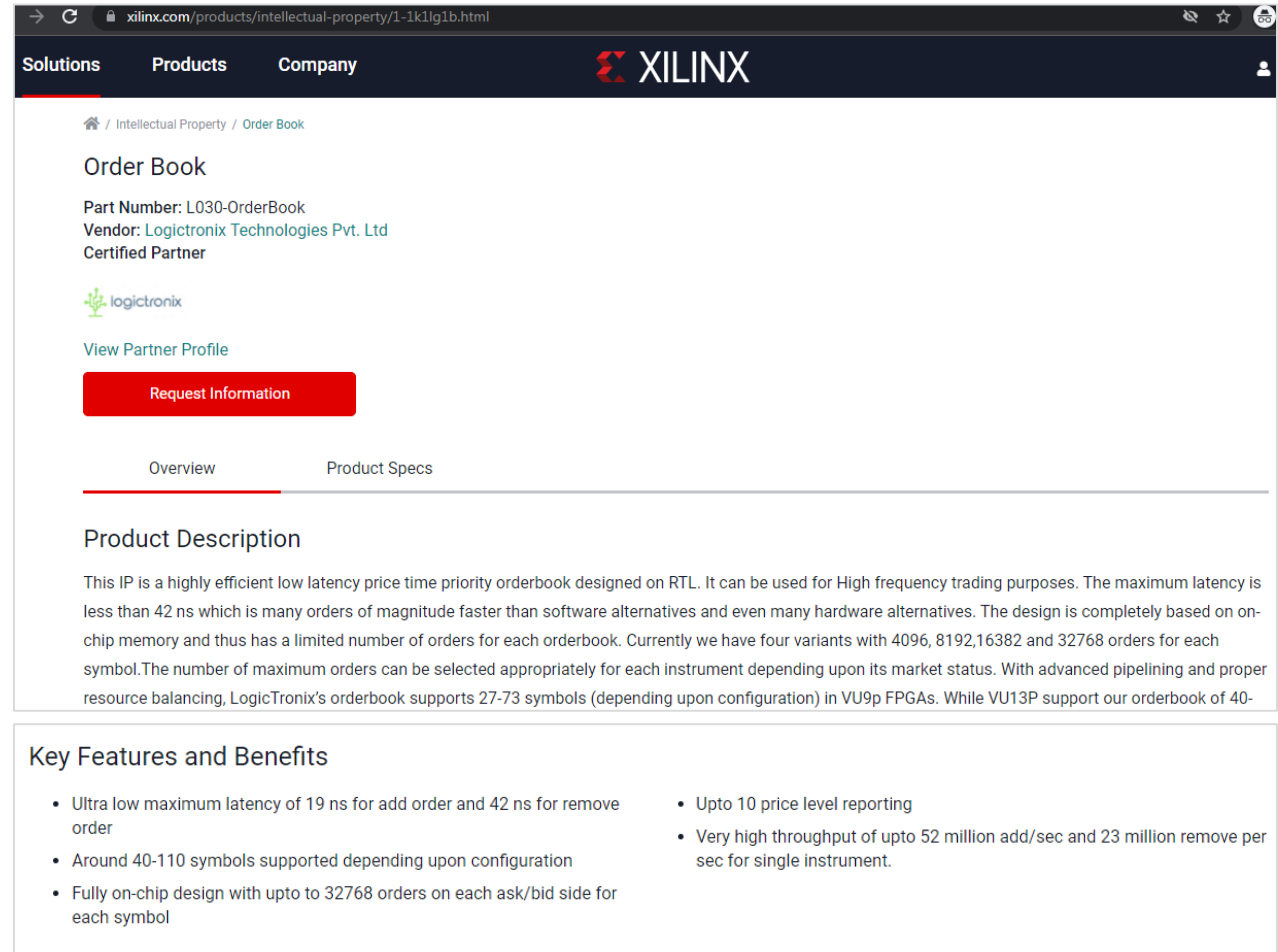


LogicTronix IP Portfolio on

1. HFT
2. Crypto Hashing
3. Machine Learning
4. Computer Vision

Our IP Portfolio: Categories

❖ HFT: Order Book IP Core

A screenshot of the Xilinx website showing the product page for the "Order Book" IP core. The page has a dark blue header with "Solutions", "Products", and "Company" links, and the Xilinx logo. Below the header, the breadcrumb "Intellectual Property / Order Book" is shown. The main content area includes the title "Order Book", the part number "L030-OrderBook", the vendor "LogicTronix Technologies Pvt. Ltd", and a "Certified Partner" badge. There is a "View Partner Profile" link and a red "Request Information" button. Below this is a tabbed interface with "Overview" and "Product Specs" tabs. The "Overview" tab is active, showing a "Product Description" and a "Key Features and Benefits" section with two columns of bullet points.

Order Book

Part Number: L030-OrderBook
Vendor: LogicTronix Technologies Pvt. Ltd
Certified Partner

logictronix

[View Partner Profile](#)

[Request Information](#)

Overview Product Specs

Product Description

This IP is a highly efficient low latency price time priority orderbook designed on RTL. It can be used for High frequency trading purposes. The maximum latency is less than 42 ns which is many orders of magnitude faster than software alternatives and even many hardware alternatives. The design is completely based on on-chip memory and thus has a limited number of orders for each orderbook. Currently we have four variants with 4096, 8192, 16382 and 32768 orders for each symbol. The number of maximum orders can be selected appropriately for each instrument depending upon its market status. With advanced pipelining and proper resource balancing, LogicTronix's orderbook supports 27-73 symbols (depending upon configuration) in VU9p FPGAs. While VU13P support our orderbook of 40-

Key Features and Benefits

- Ultra low maximum latency of 19 ns for add order and 42 ns for remove order
- Around 40-110 symbols supported depending upon configuration
- Fully on-chip design with upto to 32768 orders on each ask/bid side for each symbol
- Upto 10 price level reporting
- Very high throughput of upto 52 million add/sec and 23 million remove per sec for single instrument.

LogicTronix Order Book at Xilinx IP Page: www.xilinx.com/products/intellectual-property/1-1k1lg1b.html

Our IP Portfolio: **IP Cores with Categories**

❖ Computer/Machine Vision , Machine Learning and AI Inferencing

- i. **Non-Uniform Correction (NUC)-IP Core** for Machine Vision Application and Thermal Imaging Applications
- ii. **Thermal Color Profile (ThCP) IP core** is applied for Machine Vision, Thermal Imaging , Industrial and Biomedical Applications
- iii. **Auto Contrast Enhancement (ACE) IP Core** for Thermal Imaging Applications.
- iv. **Bayer2RGB IP** core for low FPGA resource based Camera Image processor
- v. **GammaCorrection, SharpEnhancement, EdgeEnhancement and AlphaBlending .**

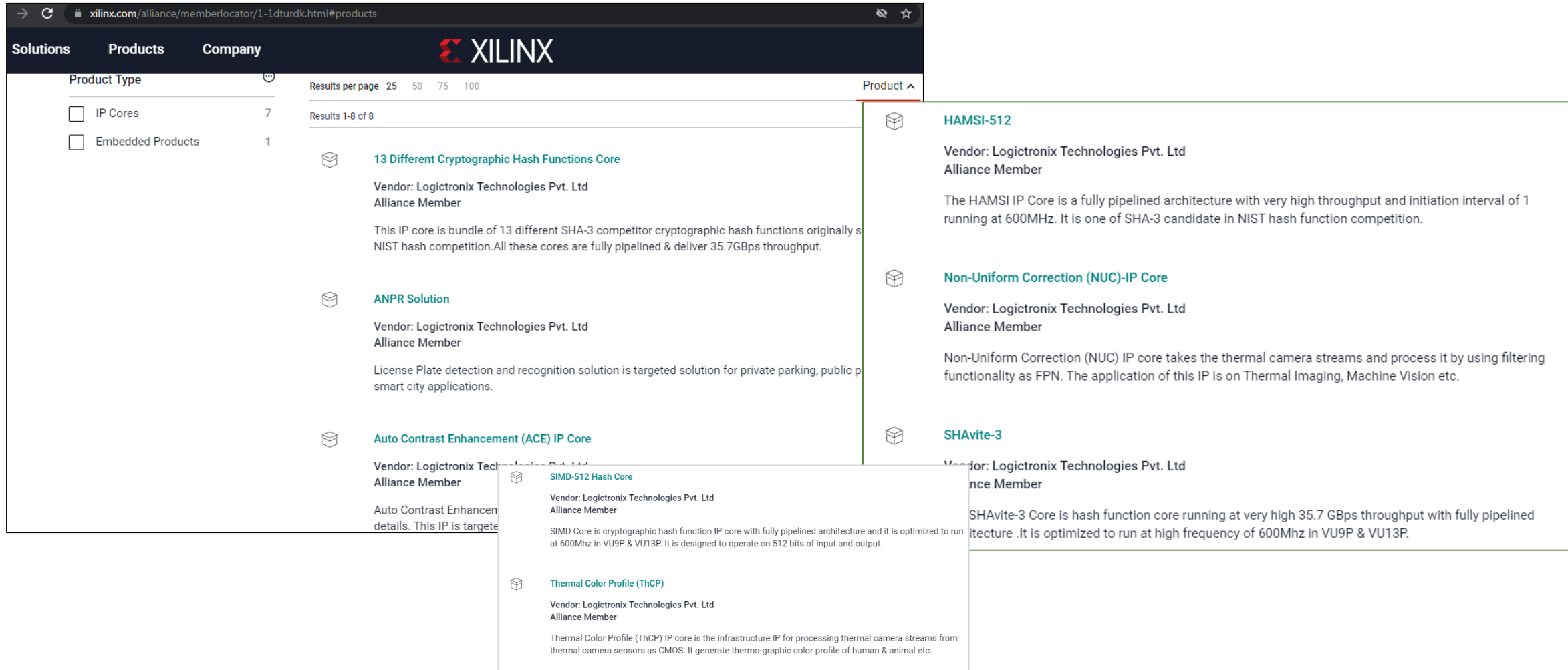
❖ Cryptographic Hash Function IP cores

- i. HAMSI-512
- ii. SHAvite
- iii. SIMD
- iv. 13 different cryptographic hash function IP Cores- bundle [SHA-3, Keccak, Blake, Grostl, JH, Skein, BMW, Echo, Shabal, Cubehash, Fugue, Luffa, Whirlpool]

@ 600 Mil hash/Sec

For IP Cores, Sales and Support, contact: ip-sales@logictronix.com

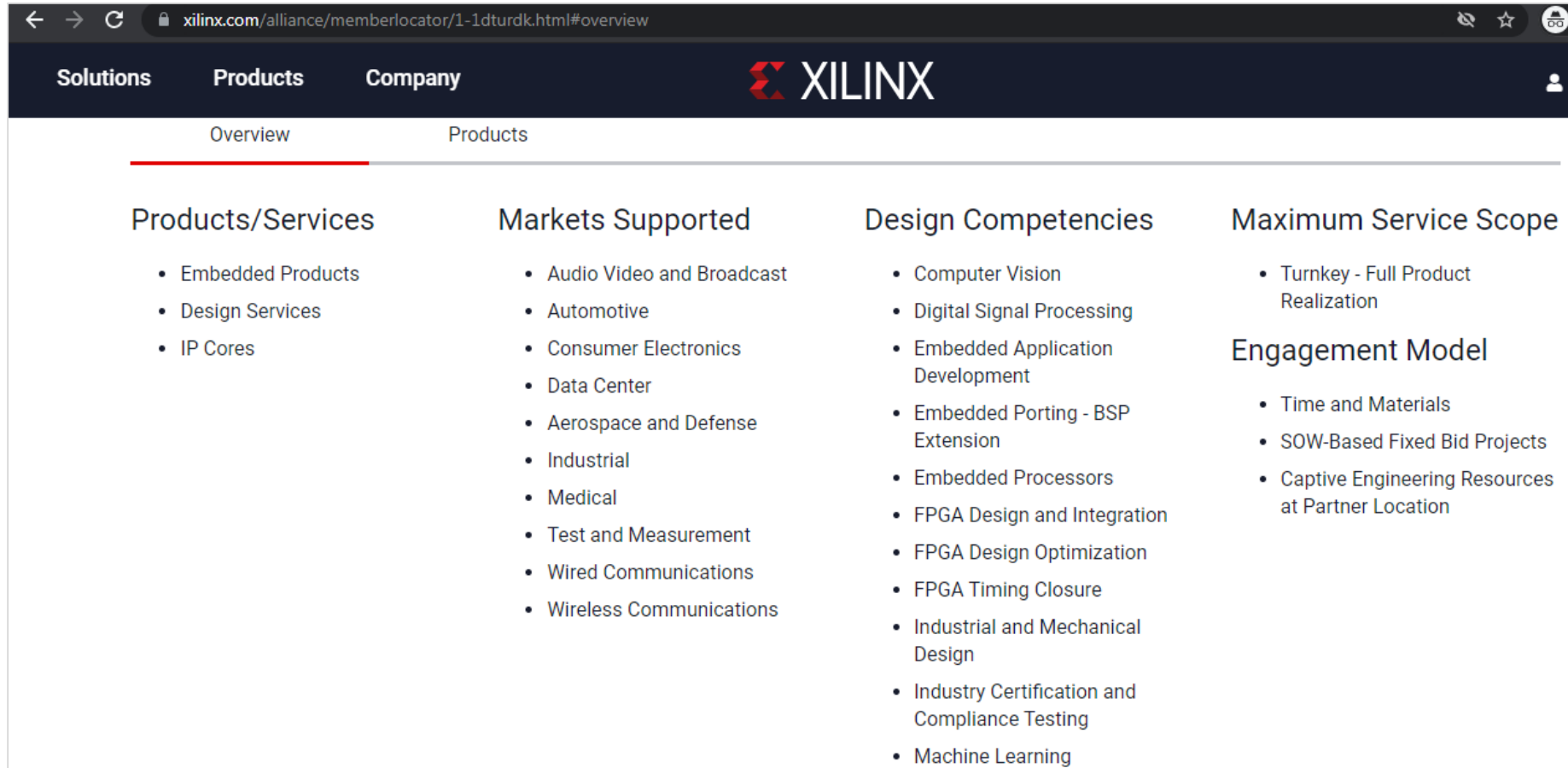
Our IP Portfolio: 25+ IP cores available for customers



The screenshot displays the Xilinx Alliance Member Locator interface. The URL in the browser is xilinx.com/alliance/memberlocator/1-1dturdk.html#products. The navigation bar includes 'Solutions', 'Products', and 'Company', with the XILINX logo. A sidebar on the left shows 'Product Type' with filters for 'IP Cores' (7 results) and 'Embedded Products' (1 result). The main content area lists IP cores with details:

- 13 Different Cryptographic Hash Functions Core**
Vendor: Logictronix Technologies Pvt. Ltd
Alliance Member
This IP core is bundle of 13 different SHA-3 competitor cryptographic hash functions originally s NIST hash competition.All these cores are fully pipelined & deliver 35.7GBps throughput.
- ANPR Solution**
Vendor: Logictronix Technologies Pvt. Ltd
Alliance Member
License Plate detection and recognition solution is targeted solution for private parking, public p smart city applications.
- Auto Contrast Enhancement (ACE) IP Core**
Vendor: Logictronix Technologies Pvt. Ltd
Alliance Member
Auto Contrast Enhancement details. This IP is targeted for thermal camera streams.
- SIMD-512 Hash Core**
Vendor: Logictronix Technologies Pvt. Ltd
Alliance Member
SIMD Core is cryptographic hash function IP core with fully pipelined architecture and it is optimized to run at 600Mhz in VU9P & VU13P. It is designed to operate on 512 bits of input and output.
- Thermal Color Profile (ThCP)**
Vendor: Logictronix Technologies Pvt. Ltd
Alliance Member
Thermal Color Profile (ThCP) IP core is the infrastructure IP for processing thermal camera streams from thermal camera sensors as CMOS. It generate thermo-graphic color profile of human & animal etc.
- HAMSI-512**
Vendor: Logictronix Technologies Pvt. Ltd
Alliance Member
The HAMSI IP Core is a fully pipelined architecture with very high throughput and initiation interval of 1 running at 600Mhz. It is one of SHA-3 candidate in NIST hash function competition.
- Non-Uniform Correction (NUC)-IP Core**
Vendor: Logictronix Technologies Pvt. Ltd
Alliance Member
Non-Uniform Correction (NUC) IP core takes the thermal camera streams and process it by using filtering functionality as FPN. The application of this IP is on Thermal Imaging, Machine Vision etc.
- SHAvite-3**
Vendor: Logictronix Technologies Pvt. Ltd
Alliance Member
SHAvite-3 Core is hash function core running at very high 35.7 GBps throughput with fully pipelined architecture .It is optimized to run at high frequency of 600Mhz in VU9P & VU13P.

Our Design Services: details

A screenshot of a web browser displaying the Xilinx website. The browser's address bar shows the URL "xilinx.com/alliance/memberlocator/1-1dturdk.html#overview". The website's navigation bar includes "Solutions", "Products", and "Company" links, with the Xilinx logo and a user profile icon on the right. Below the navigation bar, there are two tabs: "Overview" (which is selected and underlined in red) and "Products". The main content area is divided into four columns: "Products/Services", "Markets Supported", "Design Competencies", and "Maximum Service Scope". Each column contains a list of services or markets. The "Maximum Service Scope" column also includes a section titled "Engagement Model" with its own list of items.

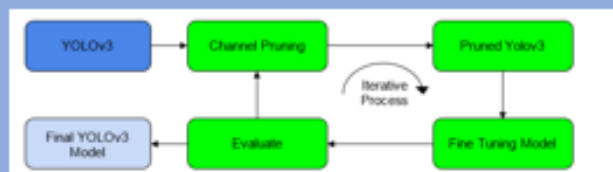
XILINX			
Overview		Products	
Products/Services	Markets Supported	Design Competencies	Maximum Service Scope
<ul style="list-style-type: none">• Embedded Products• Design Services• IP Cores	<ul style="list-style-type: none">• Audio Video and Broadcast• Automotive• Consumer Electronics• Data Center• Aerospace and Defense• Industrial• Medical• Test and Measurement• Wired Communications• Wireless Communications	<ul style="list-style-type: none">• Computer Vision• Digital Signal Processing• Embedded Application Development• Embedded Porting - BSP Extension• Embedded Processors• FPGA Design and Integration• FPGA Design Optimization• FPGA Timing Closure• Industrial and Mechanical Design• Industry Certification and Compliance Testing• Machine Learning	<ul style="list-style-type: none">• Turnkey - Full Product Realization <p>Engagement Model</p> <ul style="list-style-type: none">• Time and Materials• SOW-Based Fixed Bid Projects• Captive Engineering Resources at Partner Location

LogicTronix Xilinx IP Page: [Link](#)

Our White Paper and Resources

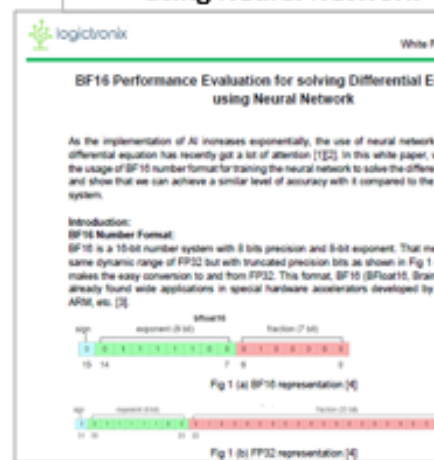
Some of Our White-Paper's

WPL053 on "Pruning Neural Network models



Model	Global threshold (Pruning ratio)	Input Size	GFL	Model Size	Accuracy	Throughput
License Plate Original YOLOv3	-	512*512	98.1	245.5 MB	99	42.96
		640*640	154	154.687	45.97	
		960*960	347	348.046	42.43	
License Plate Pruned Model 1st Iteration	0.5	512*512	25.1	112.5 MB	99	42.83
		640*640	39.1	61.662	45.61	
		960*960	88.1	138.739	44.93	
License Plate Pruned Model 2nd Iteration	0.5	512*512	11.1	246.3	99	77.61
		640*640	17.1	154.549	76.96	
		960*960	39.1	347.736	62.26	

WPL061: BF16 Performance Evaluation for solving Differential Equations using Neural Network



Harnessing GPU Tensor Cores for Fast FP16

White Paper-WPL063

Introduction:

In order to test the performance of FP16 compared to FP32 and FP64 in the area of solving linear equations, we experimented with different combinations with precision. The test was performed in NVIDIA RTX 2070 Super GPU which consists of 320 tensor cores. One of our main targets was to get compare the performance accuracy of mixed precision including fp64 and without including fp64. For that we used mixed precision library available in magma where FP-16 TC (Tensor Core Version) was used together with fp64 arithmetic. They

Resources

White-Paper

1. White-Paper on "Pruning Neural Network for Inferencing on Vitis-AI/DNNK & FPGA", LogicTronix-WPL053: [PDF Link](#) [Read-Now]
2. White-Paper on "BF16 Performance Evaluation for solving Differential Equations using Neural Network", WPL061: [PDF Link](#) [Read-Now]

Reference Tutorials: Machine Learning Acceleration

1. Deepthi DNNK [Vitis-AI] Tutorial for Ultra96: [PDF Link](#)
2. YoloV3-tiny: Darknet to Caffe with Xilinx DNNK : [PDF Link](#)
3. DPU TRD for ZCU104: [Web Link](#)
4. DPU(3.0) TRD for ZCU106: [Web Link](#)
5. MobileNetSSD with Xilinx DPU and DNNK [June, 2019]: [PDF Link](#)
6. Caffe Installation on Ubuntu 2016.4 [for CPU and GPU]: [PDF Link](#)

Reference Tutorials: Computer Vision

1. Video Mixer feature Implementation on Zynq FPGA: [PDF Link](#)
2. Sobel Vivado HLS Kernel using AXI full interface: [PDF Link](#)

Reference Tutorials: Petalinux Development

Reference Tutorials: Petalinux Development

1. Petalinux Development with the Custom VIVADO Project [LED Controller Project]: [PDF Link](#)
2. Installing Vmware Workstation Pro in Windows: [PDF Link](#)
3. Installing Petalinux on Ubuntu or CentOS: [PDF Link](#)

Reference Tutorials: Debugging and Verification

1. XADC Implementation and Debug Verification on Xilinx 7 Series FPGA- Reference Guide: [PDF Link](#)

Reference Tutorials: VIVADO/Vitis and Linux

1. Installing VIVADO on Linux Distros- Ubuntu/RedHat/CentOS: [PDF Link](#)
2. Installing Vitis 2019.2 on Linux: [Video Tutorial Link](#)

Reference Tutorials: FreeRTOS Development [Git Project]

1. Creating multi-task application on FreeRTOS : [Git Project](#)
2. Creating Software timer for each Thread : [Git Project](#)

Reference Tutorials: Gstreamer Application Development [Git Project]

1. Creating Embedded Linux project with Petalinux : [Git Project](#)

Satisfied Clients

LogicTronix Team has done very well job on Computer Vision and Machine Learning with FPGA
-Besma, Video Analytics Company, USA

LogicTronix has good skills on VIVADO, Xilinx FPGAs and Computer Vision
-Anh Nguyen, ODM, Vietnam

LogicTronix made very good work on Video Processing and FreeRTOS development
-Andre, Video Processing System Product Company, San Francisco, USA

"LogicTronix help me on Creating Thermal Imaging and Profiling Work easier"
-Ros, Video Solution Company, Moscow, Russia

Team have good expertise on architectural design for AI Processor
-Xu ling, AI Processor Design Company, Beijing, China

"LogicTronix is very good at high throughput and latency centric design"
-David, Crypto ASIC Design Company, San Francisco, USA

Our Collaborators and Partners

❖ Our Collaborators

- Sitlab AB, Sweden and Sitlab UK
- Excelpoint Singapore: specialized on marketing solutions based on FPGA, Machine Learning for different industries
 - Having distribution network at Asia Pacific-APAC region
- iWave India: Specialized on designing and manufacturing production grade FPGA boards.

❖ Our Partner

- Xilinx

❖ Partner in Network:

- Avnet
- Design Gateway, Thailand
- PLC2, Germany
- Mikrotron, Germany
- CuDes-Technology Brokerage Firm, USA

Team Details: *FPGA and ML Acceleration*

Team Size on FPGA and ML Acceleration : 13 Engineers

❖FPGA Engineer-10

- 2 Engineer with 5+ years of experience
 - With skillset on FPGA design with Verilog/VHDL, VIVADO/Vitis Flow, Machine Learning Acceleration on FPGA, Petalinux Development for embedded development, Gstreamer based UI development for Embedded applications, FreeRTOS etc.
- 3 Engineer with 3+ years of experience
 - With skillset on Computer/Thermal/Medical/Machine Vision and Video Processing with FPGA, VHDL/Verilog design methodology, implementing algorithms on low latency and high performance design methodology
- 3 Engineer with 2+ years of experience
 - Experience with signal processing, video processing , FPGA design with MATLAB/System Generator, VIVADO and Vitis
- 2 engineer with 1+ year of experience:
 - With skillset on computer vision based implementations

❖Machine Learning Acceleration Engineer- 3

- ML team has experience from 2 years to 4 years.
 - Expertise on Tensorflow/Pytorch/Caffe/Darknet and Xilinx Vitis AI flow.
 - Skillset on Machine Learning for Computer Vision, Reinforcement learning for prediction type of workloads/problems.
 - Implementing custom CNN and Neural Networks on GPU/CPU and FPGA Platforms [Xilinx MPSoC].
 - Quantization and pruning of Neural Network to increase the “model performance”.

Thank you!

Contact: info@logictronix.com