FOR DEEP LEARNING ACCELERATORS

Things Intelligented by DEEPX

CEO Lokwon Kim

FOR DEEP LEARNING ACCELERATORS

DEEPX MISSION | AI of Things

DEEPX

Artificial Intelligence

For AI Everywhere

DEEPX

DEEPX's Disruptive Innovation

Power Consumption

300W ~

Price Range

$1,500
$5,000
$30,000

NVIDIA

DEEPX

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Power Consumption

Est.
2W ~ 3W

Price Range

Under $100

NVIDIA GPU VS **DEEPX NPU**

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Disruptive Innovation | "IT'S REAL"

NVIDIA Model: Tesla V100 16GB

- Price: Approx. $3,000
- Power Consumption: 300W

DEEPX

https://youtu.be/V3f8ZRe-KfY?t=58

DEEPX's Flagship Model : DX-M1

- **Price: Approx. $70**
- **Power Consumption: 3~5W**

DEEPX

https://youtu.be/V3f8ZRe-KfY?t=58

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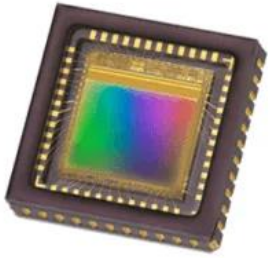
Extreme Case: Ultra Low Power NPU

Custom NPU Architecture

Intelligent CMOS Image Sensor

- **Face Detection Function NPU**
  - ✓ **Lower than 10mW**
  - ✓ **Always-on Function**



Face ID

Always-on Smart CIS

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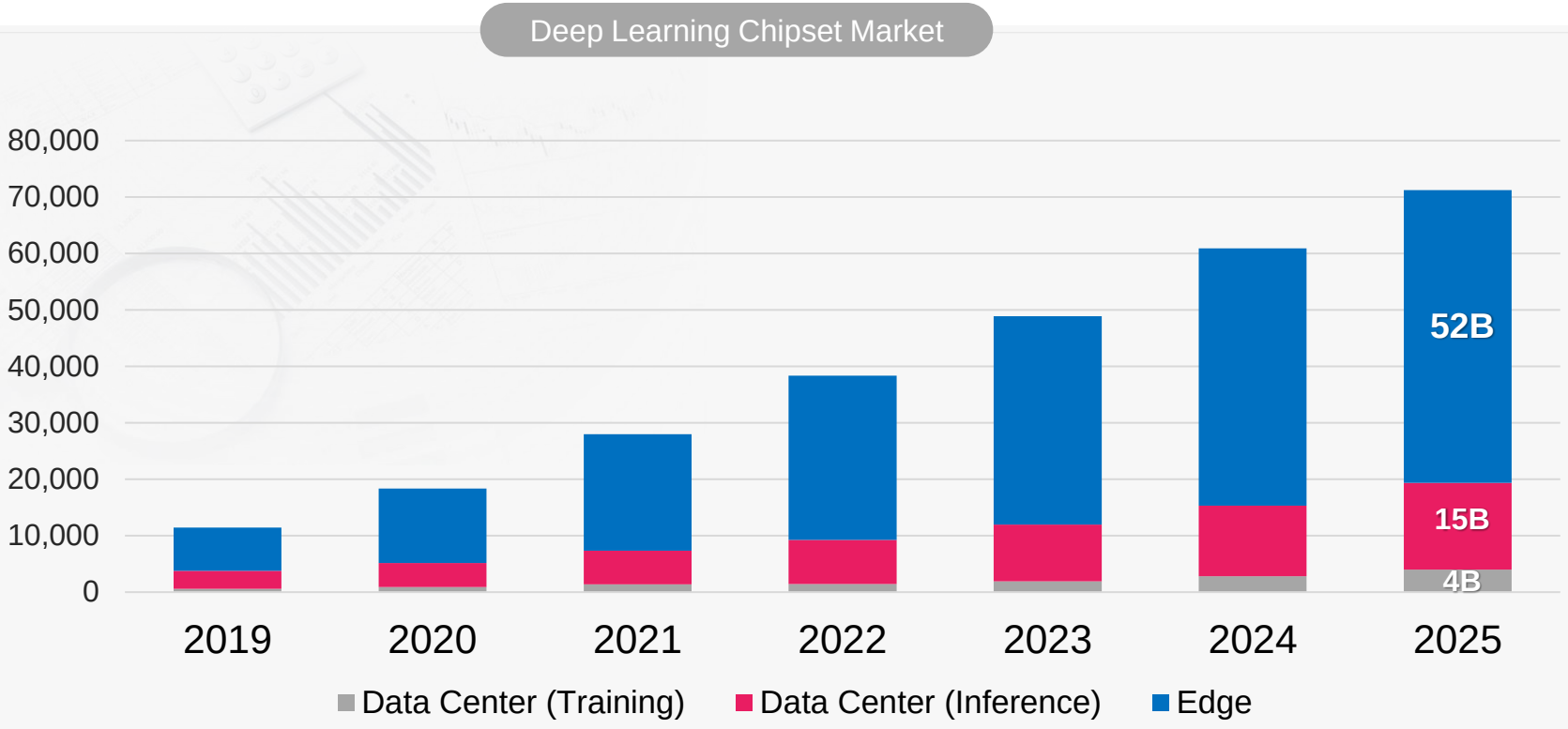
Market Overview

The AI Chipset market reached $11B in 2019 and reaching $71B by 2025.



Source : Omdia (前TRACTICA)

FOR DEEP LEARNING ACCELERATORS

DEEPX VISION

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Super intelligence civilization

DEEPX NPU Competitive Advantage

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DEEPX's Key Differentiators

* OD | Object Detection * IC | Image Classification * Seg | Segmentation

World Leading
State-of-the-art DNN Algorithms

+ Transformer Model (ViT, Segformer etc.)

- ✓ densnet
- ✓ googlenet
- ✓ mnasnet
- ✓ mobileNet
- ✓ ResNet
- ✓ SSD
- ✓ Yolov3, v4, v5, v7
- ✓ EfficientNet/Det
- ✓ BiseNet
- ✓ ShelfNet
- ✓ PIDNet
- ✓ SFA3D

More CNN Based SOTA Models (Model Zoo: > 170 models)

The World's First
AI Accuracy Technology

	Model	FP32 NVIDIA	INT8 HAILO	INT8 DEEPX
OD*	MobileNet SSD	23	22.2	22.6
	Yolov4	49.6	41.55	49.3
	Yolov5m	44.1	39.12	43.7
	YoloXs	40.3	37.47	**41.1**
	Yolo7m	51.0	N/A	50.9
IC*	MobileNetv1	71.48	70.13	**72.42**
	ResNet50	75.94	74.69	**75.95**
	EfficientNet-B0	77.52	76.96	**77.62**
Seg*	BiseNet	75.19	N/A	**75.97**
	PIDNet	78.76	N/A	**78.79**
	DeepLabv3+	72.07	N/A	**72.37**

The World's best
Power/Performance Efficiency

Company	Model	TOPS/W Resnet-50	FPS/TOPS Resnet-50
DEEPX	DX-M1	**Over 10**	**60**
HAILO	Hailo-8	8.6	47
MYTHIC	M-1108	8.8	25
Qualcomm	SD888	4.47	26
quadric	Q16	4.0	25
NVIDIA	Xavier NX	1.8	17
intel	Myriad X	0.7	29
ARM	Ethos-N77	5.0	Unknown

Popular AI Algorithms Support (Object Detection)

DEEPX
Link: https://youtu.be/sgGzYd5Cpa4

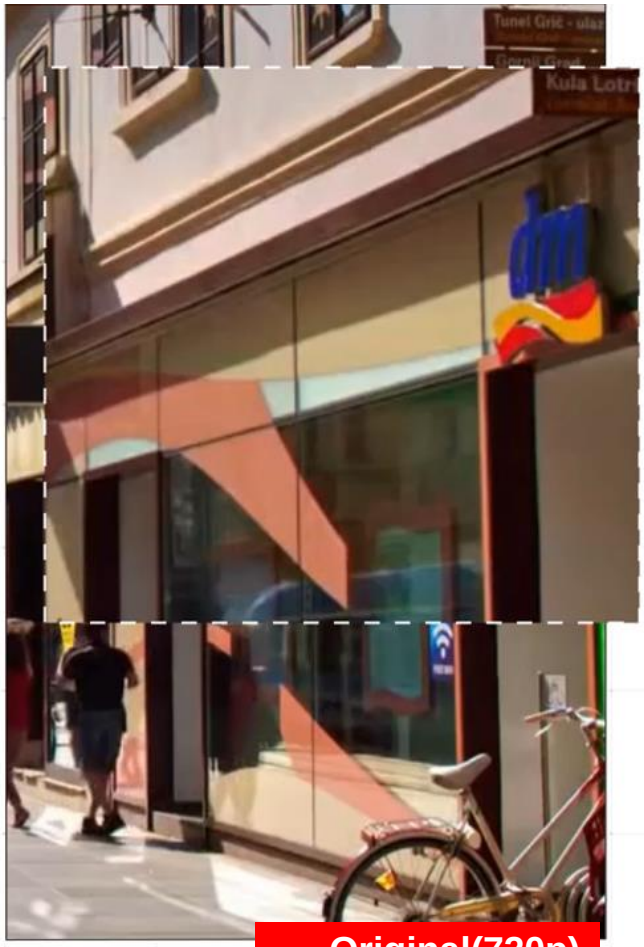
Popular AI Algorithms Support (Segmentation)

DEEPX
Link: https://youtu.be/V3f8ZRe-KfY

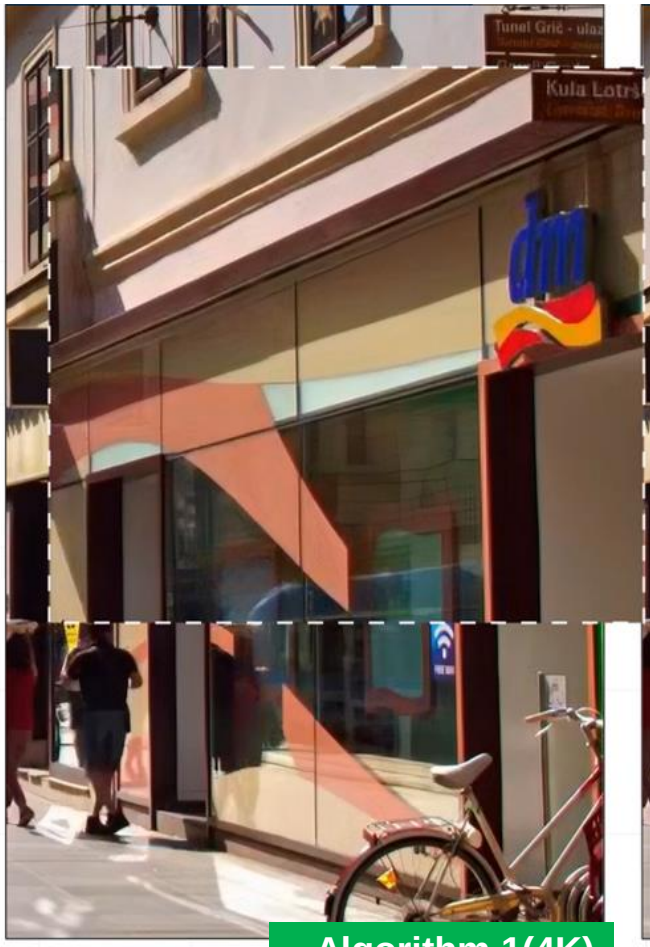
DEEPX

Popular AI Algorithms Support (Super Resolution)

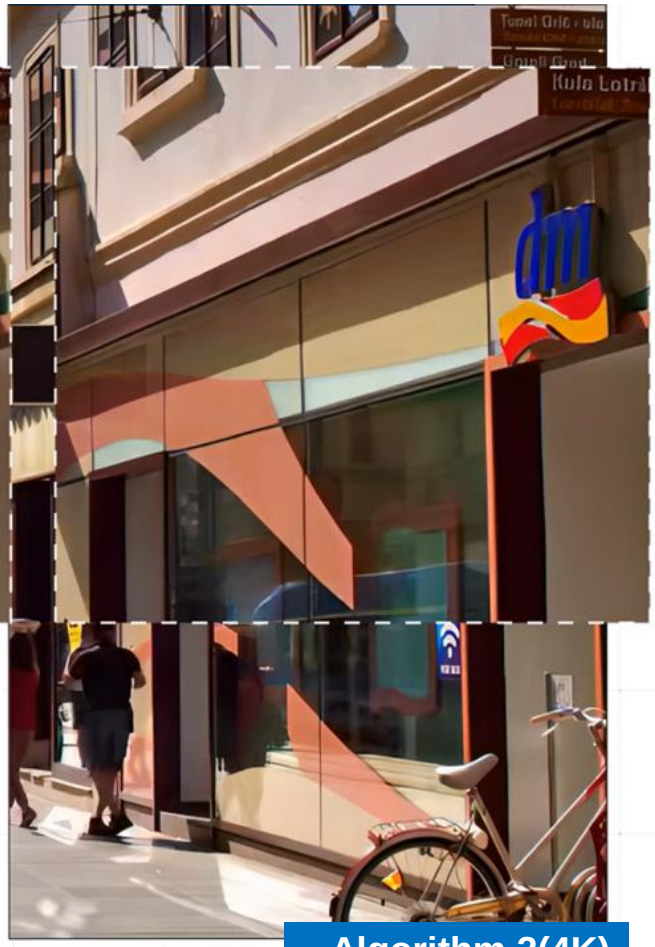
DEEPX



Original(720p)



Algorithm 1(4K)



Algorithm 2(4K)

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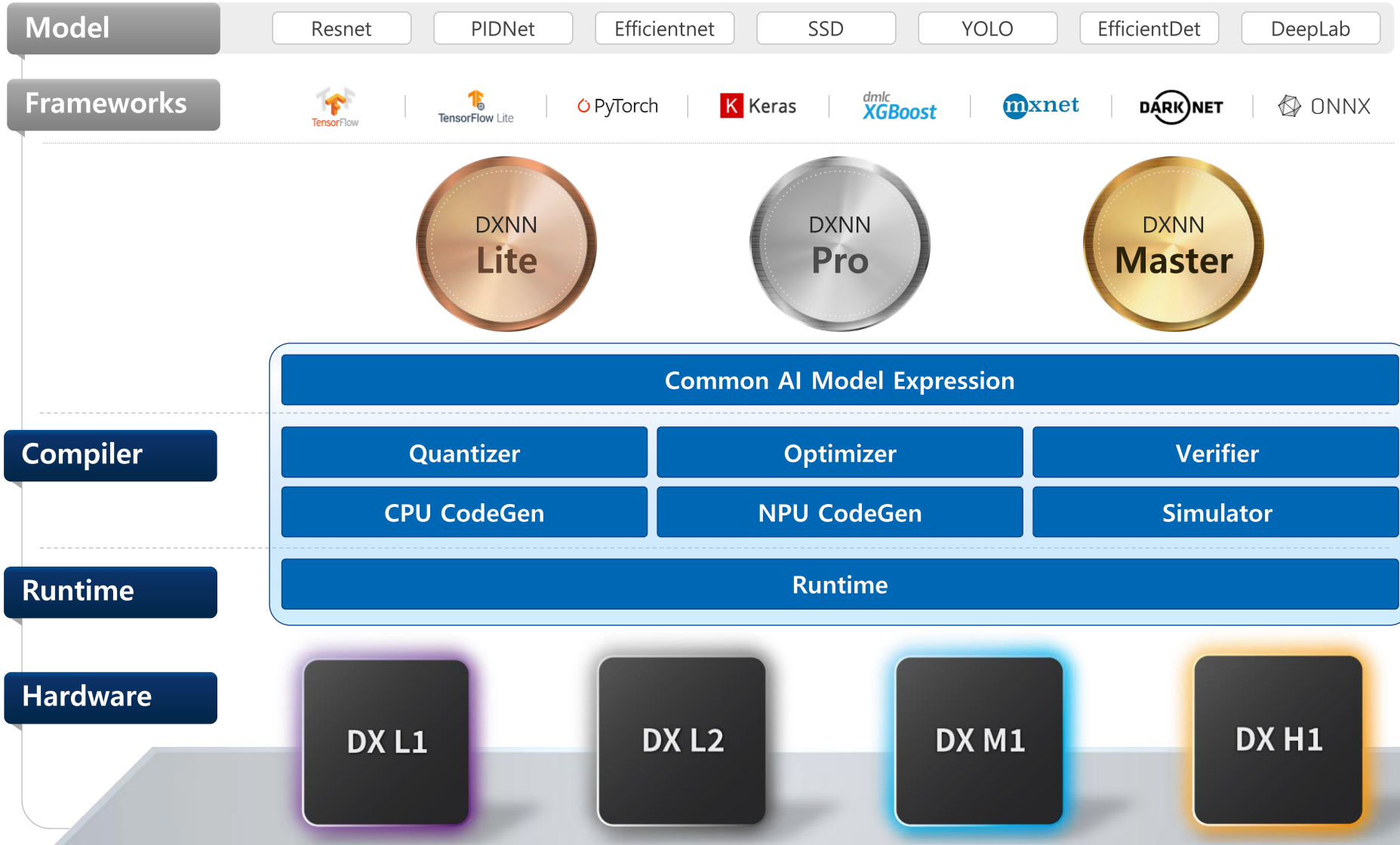
DXNN™ – DEEPX NPU Software (SDK)



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IP Strategy

✓ Patents

01 **More than 147+ Patents for NPU tech**

02 Constantly developing fundamentals of NPU

✓ Patent Portfolio

01 **Planning to file for more than 20 patents per year** (PCT, KR, US)

AI Applications	AI Memory Architecture	AI VISION/ISP	NPU	SoC	AR/VR Applications	Total
22	30	18	61	10	6	**147**

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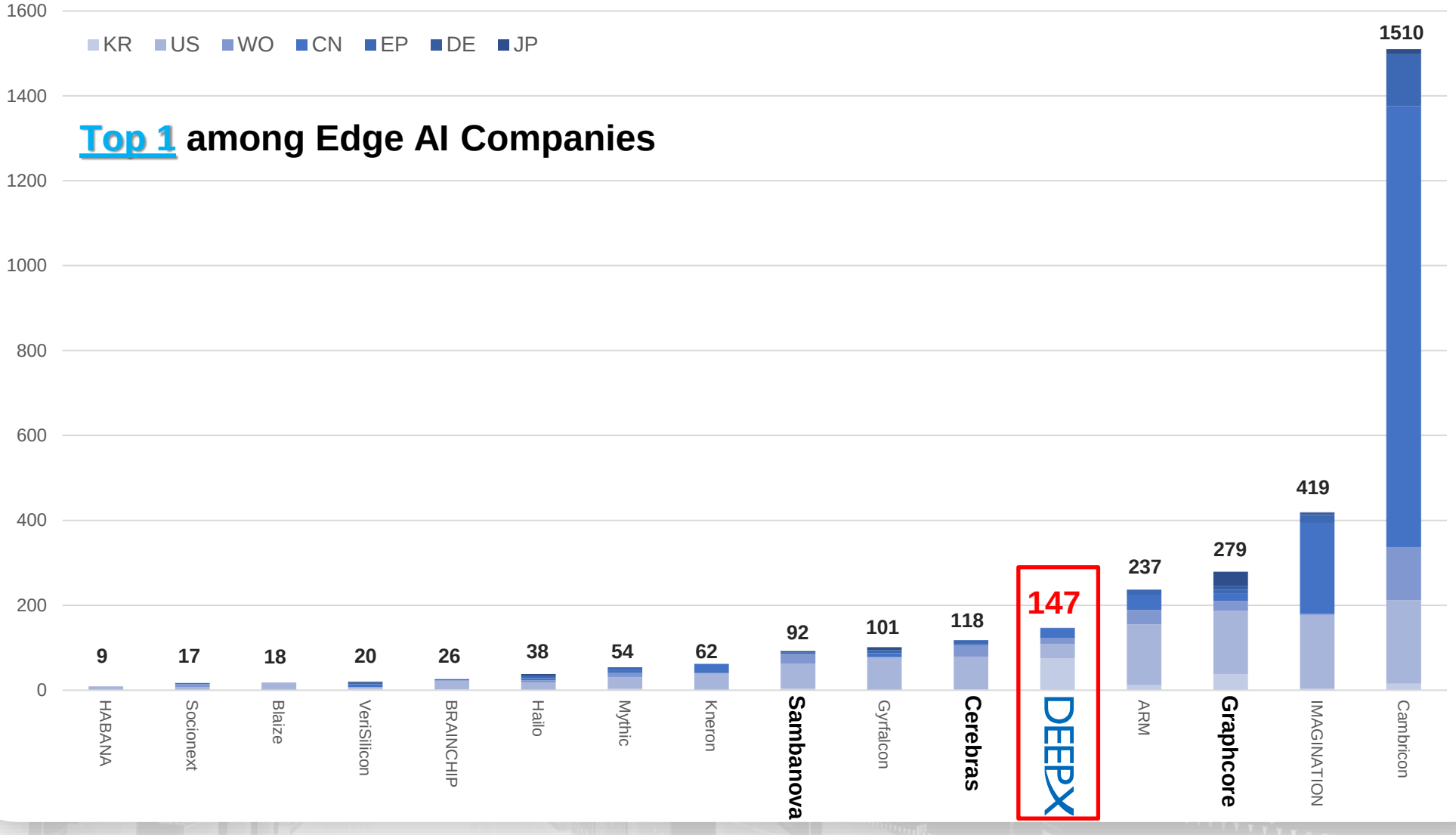
World-wide NPU patent status (2022.12)



Business Model

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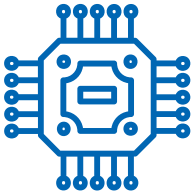
Business Area

01



SoC ASIC

Provide DEEPX NPU embedded commercial AI chips

02

Custom NPU IP Licensing

Provide one of the most efficient NPU design IPs for Strategical Partners

03

Custom SoC Design Service

Provide fully specialized custom SoC based on DEEPX NPU

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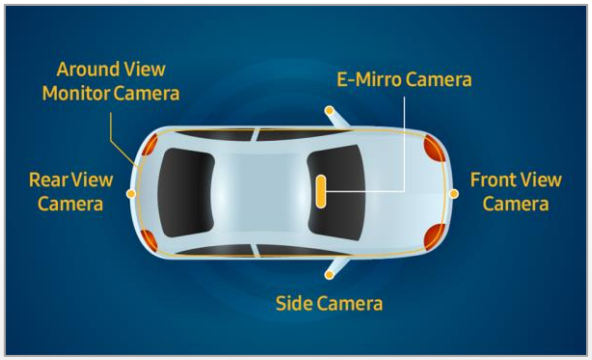
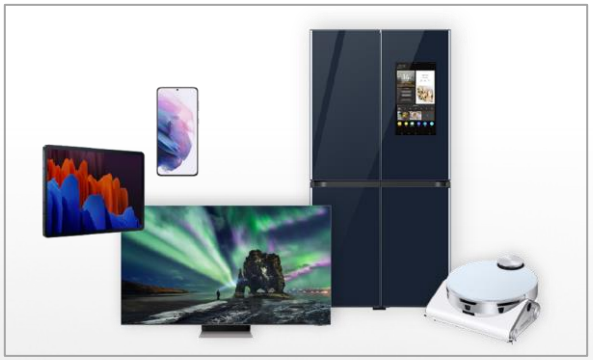
Target Market

Smart Camera Module

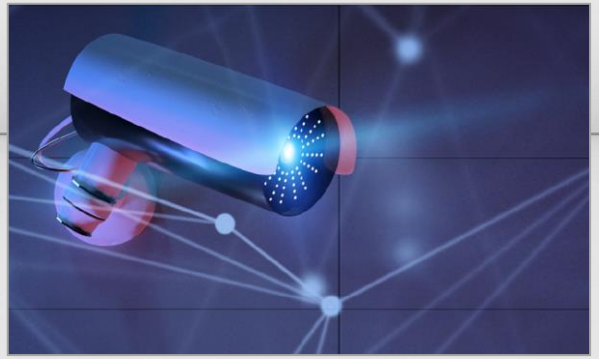
Automotive



Consumer Electronics



Surveillance System



Edge Computing

Smart Mobility / Drone

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Intelligent Vision Sensor / Smart Camera

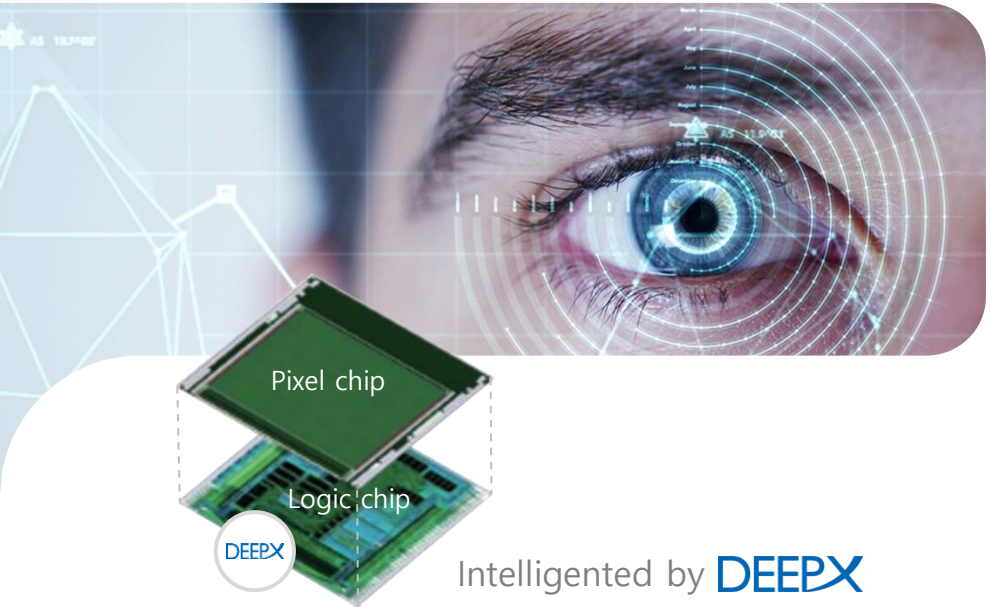

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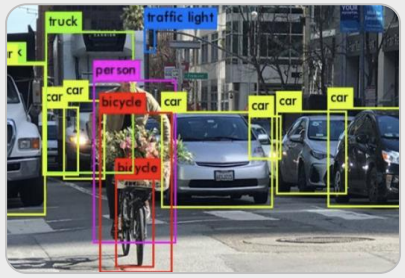
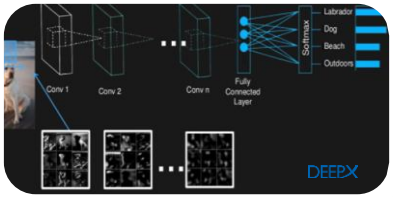
Image Enhancement



Perception

01 Zero Latency

- ✓ Offline Processing
- ✓ Not Dependent on Network condition



02 Low Power & Low Cost

- ✓ Simplified image data processing
- ✓ **Cost-effective Image Sensor** (Smartphone)

03 Versatility

- ✓ **Retail Solution** (Security, Check-out till, Self-Kiosk System, Customer behavior analysis…)

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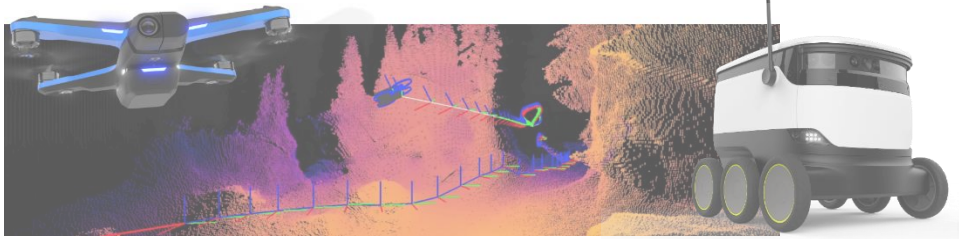
Smart Mobility



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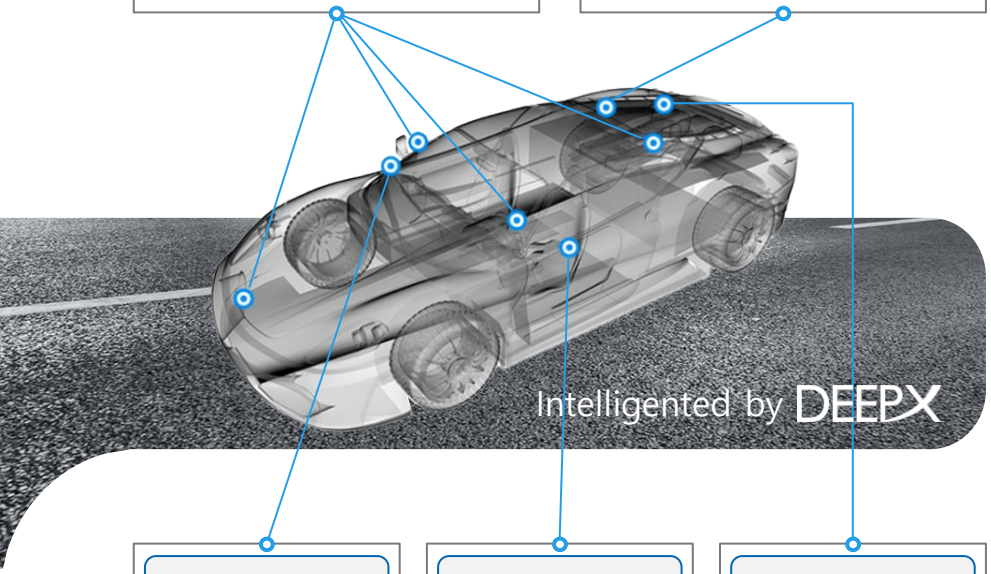
View Camera

Image & Dynamic Vision Sensor

Driver Monitoring

Neural Processing Unit Image & Vision Sensor



Infotainment

Display Driver IC Touch & Motion Sensor

eMirror

Display Driver IC Image Sensor

Self-Driving Car

Neural Processing Unit Secure IC Memory

01 Self-Driving Cars

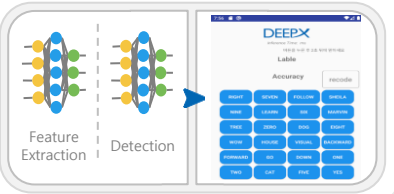
- ✓ NPU IP for Object Detection Solution
- ✓ Sensor Fusion for Lidar/Radar Sensor

02 Smart Features

- ✓ Compact Infotainment Solution
- ✓ Driver Monitoring
- ✓ Side View Camera Solution

03 Voice-Command

- ✓ Cost-effective NPU based Voice Recognition Technology



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Always on Hearable & Keyword command

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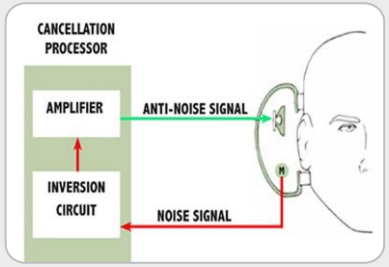
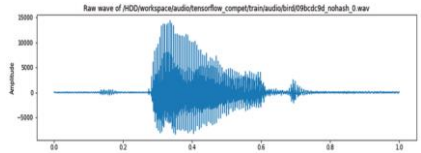


Adaptive Noise Cancelling

Always-on low-power silicon

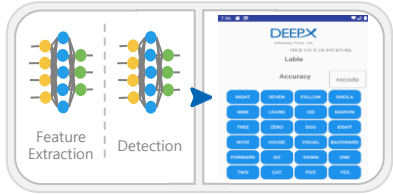
01 CNN based Voice Signal Processing

- ✓ Offline Processing
- ✓ Not Dependent on Network condition



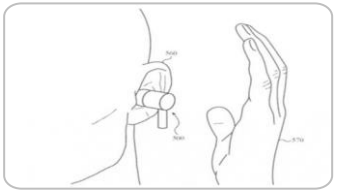
02 Voice-Command

- ✓ Cost-effective NPU based Voice Recognition Technology



03 Various AI Applications Support

- ✓ Gesture Detection, Sleep Aid, In-Ear detection, Voice recognition, Healthcare etc...



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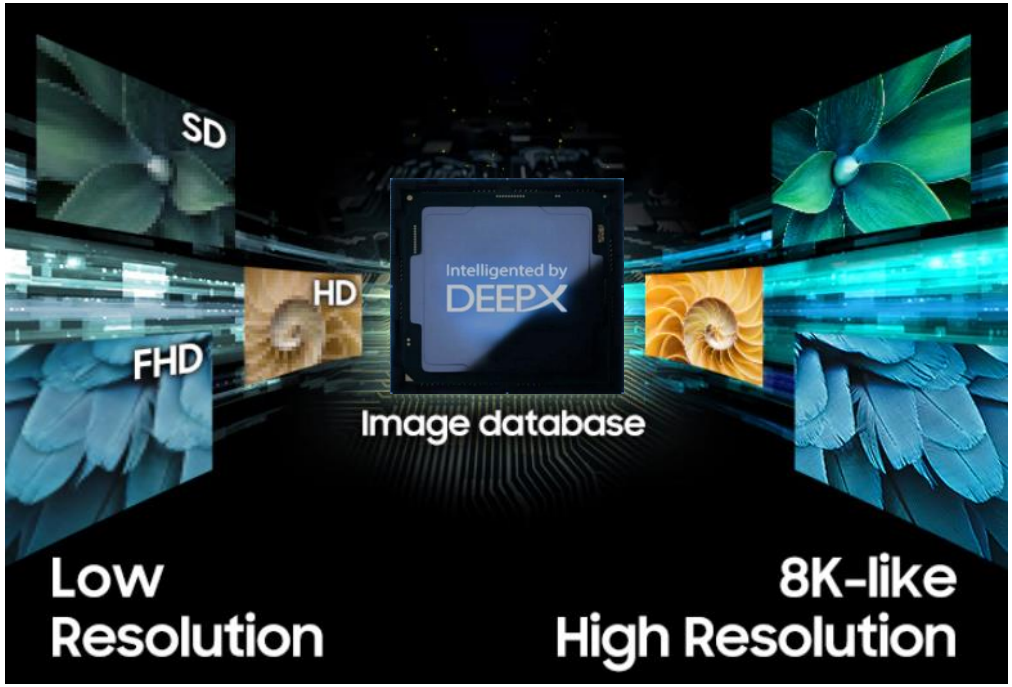
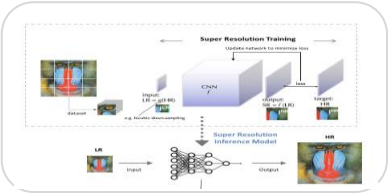
NPU based Super Resolution Technology



01 DEEPX Super Resolution

- ✓ DNN Trained with real world video data
- ✓ DEEPX SR Inference Model



02 DEEPX Silicon

- ✓ Routing lightweight SR on chip
- ✓ **Low Power & Low Cost**

03 LR ➡ 8K

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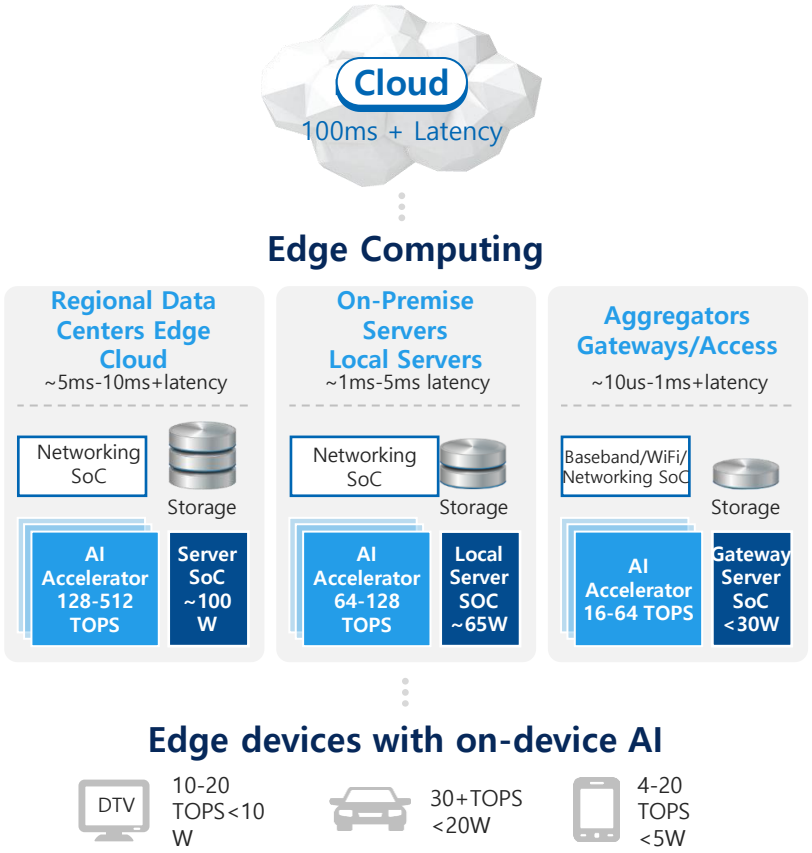
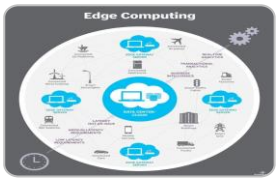
Smart Computing (Edge Computing)



01 Decentralized AI computing

- ✓ Low Latency
- ✓ Saving Bandwidth and cost of building Servers

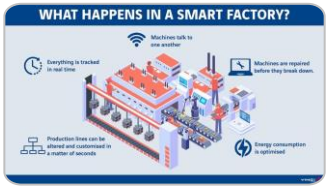


02 Extensive Horizontal Market

Manufacturing · Retail · Transportation · Farming

03 Versatility

- ✓ **Monitoring and detection systems, Increase Efficiency**



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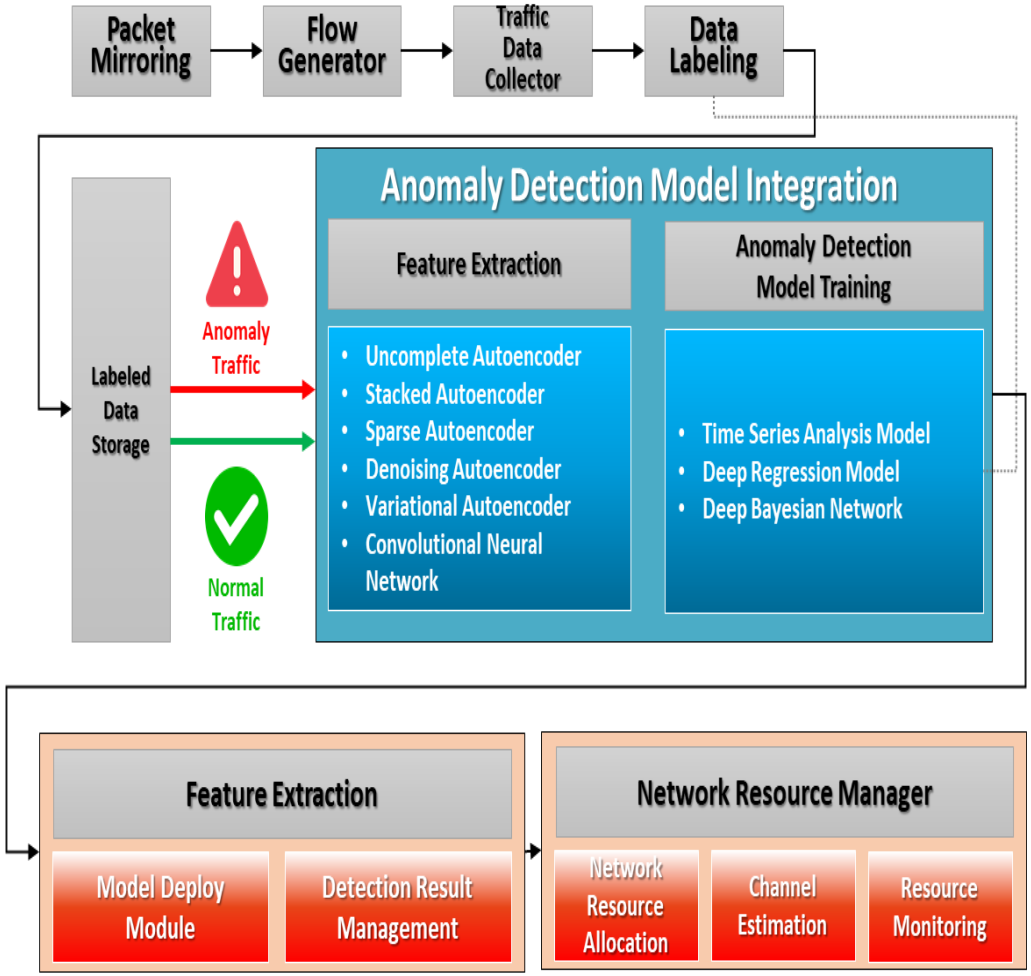
Internet Intrusion Detection

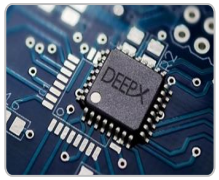


01 Handling the various types of attacks

- ✓ Define anomaly data
- ✓ Detect Combinational types of attacks
- ✓ Converting anomaly traffic into graphics

02 Power/Performance Efficiency

- ✓ CNN based Algorithms Support
- ✓ Best In Class AI Accuracy (like GPU)
- ✓ The most power efficient NPU



03 Versatility

- ✓ **Support any devices connected to Internet (IoT)**

DEEPX

Product Roadmap (2023)

01 DX-M1

- Performance: 200eTOPS**
- Type: Accelerator
- Features: PCIe Gen3, ARM CPU LPDDR5
- Launching Date: 23.2Q

02 DX-H1

- Performance: 1,600eTOPS**
- Type: Accelerator
- Features: PCIe Gen3, ARM CPU LPDDR5
- Launching Date: 23.2Q

03 DX-L1

- Performance: 12eTOPS**
- Type: Application Processor
- Features: RISC-V CPU, ISP, LPDDR4, Video Codec
- Launching Date: 23.2Q

04 DX-L2

- Performance: 38eTOPS**
- Type: Application Processor
- Features: RISC-V CPU, ISP, LPDDR4, Video Codec
- Launching Date: 23.2Q

** A performance metric equivalent to GPU's TOPS

DEEPX

Value Chain & Product Portfolio

DX-H Series

DX-M Series

DX-L Series

DX L1 | DX L2 | DX M1

<3Chip Solutions>

<Module Solutions>

DEEPX Supply Chain Management

1 Design IP	2 Back-End Design	3 Foundry	4 Package	5 Distribution
ARM	GAON CHIPS	SAMSUNG	Amkor Technology	CoAsia
CEVA	ASICLAND	tsmc	HANA MICRON	MOUSER ELECTRONICS
SYNOPSYS	CoAsia Electronics Corp			

DEEPX Blitz-Scaling Strategy

Toward the most customer centric company

01 Investors **(Series A&B $25Mil)**

CAPSTONE SHINHAN BANK KDB

02 NPU developments

- Preparing the first NPU chip fabrication in 2022
- **Demonstrated the first version of basic NPU (mid 2019)**

03 Achievements

- **100+ Patents** for NPU technology
- Government funds for NPU technology (ca.$30Mil)

04 International Business

- Established a branch in Silicon Valley (2018.8)

DEEPX

Founder

Background

2007	· KETI (Alternative Military Service)
2007 - 2011	· Ph.D. in EE at UCLA
2008 - 2009	· Broadcom (Intern)
2010	· IBM T.J. Watson Research (Visiting)
2011 - 2014	· Cisco Systems
2014 - 2017	· Apple

Research Achievement

01 · 100+ Patents

02 · 10+ IEEE/ACM transactions journal paper (including Nature Astronomy)

Pioneer in NPU since 2010

ACM Transactions on
Reconfigurable Technology and Systems (TRETS)

A Fully Pipelined FPGA Architecture of a Factored Restricted Boltzmann Machine Artificial Neural Network

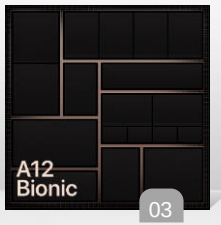
LOK-WON KIM, Cisco Systems
SAMEH ASAAD and RALPH LINSKER, IBM T. J. Watson Research Center

are present across multiple types of input. We obtain (in simulation) a 100-fold acceleration (vs. CPU software) for an fRBM having N = 256 units in each of its four groups (two input, one output, one intermediate group of units) running on a Virtex-6 LX760 FPGA. Many of the architectural features we implement are applicable not only to fRBMs, but to basic RBMs and other ANN algorithms more broadly.

Developed the world first edge NPU

01

02



03

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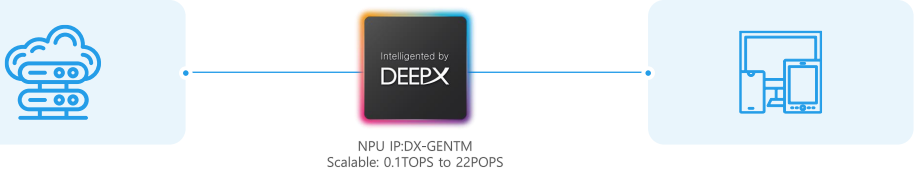
The era of AI will create new and diverse applications embedded in things.

BRING AI FROM CLOUD TO EDGE EDVICE

Cloud Datacenter | DEEPX NPU & SW | Edge Devices



NPU IP:DX-GENTM
Scalable: 0.1TOPS to 22POPS

WORLD TOP PERFORMANCE AI PROCESSOR

1. S-O-T-A AI Algorithms Support
2. GPU Liked AI Accuracy
3. Ratio of Effective Power to Performance

PRODECT ROADMAP

DX-H1

Performance	18POPS
Process	Samsung Foundry 5nm
Launching Data	23.3Q

DX-M1

Performance	23TOPS
Process	Samsung Foundry 5nm
Launching Data	23. 2Q

DX-L2

Performance	6.4TOPS
Process	Samsung Foundry 14nm
Launching Data	23. 2Q

DX-L1

Performance	2.4TOPS
Process	Samsung Foundry 28nm
Launching Data	23. 2Q

LEADERSHIP

CEO/FOUNDER

- ✓ Apple, Cisco Systems, IBM, Broadcom
- ✓ PhD in EE at UCLA
- ✓ 100+ Patens for NPU Technology

Head of R&D

- ✓ Former Project Director at Samsung Electronics
- ✓ PhD in EE at Georgia Tech

Head of Business

- ✓ Former US Branch President at COASIA
- ✓ Samsung LSI ASIC Sales +20 years (US/EU)