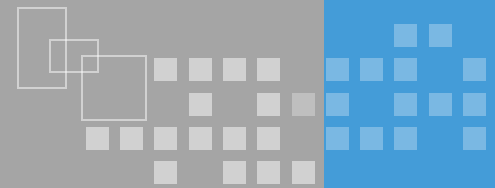


Jetson Nano HW/SW

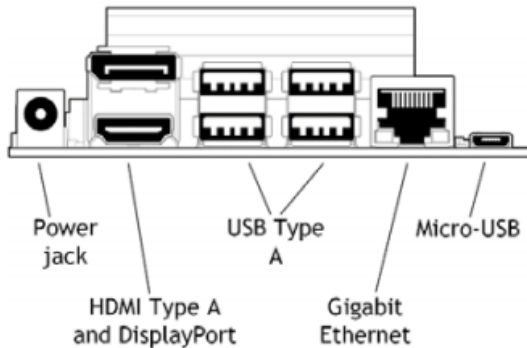
조영혁

노다시스템

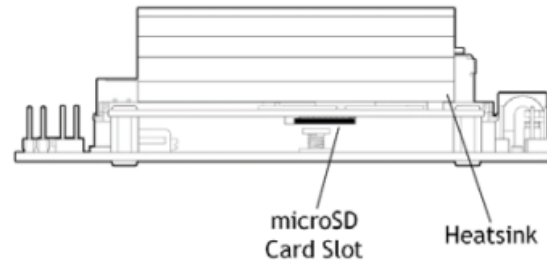
Jetson Nano HW



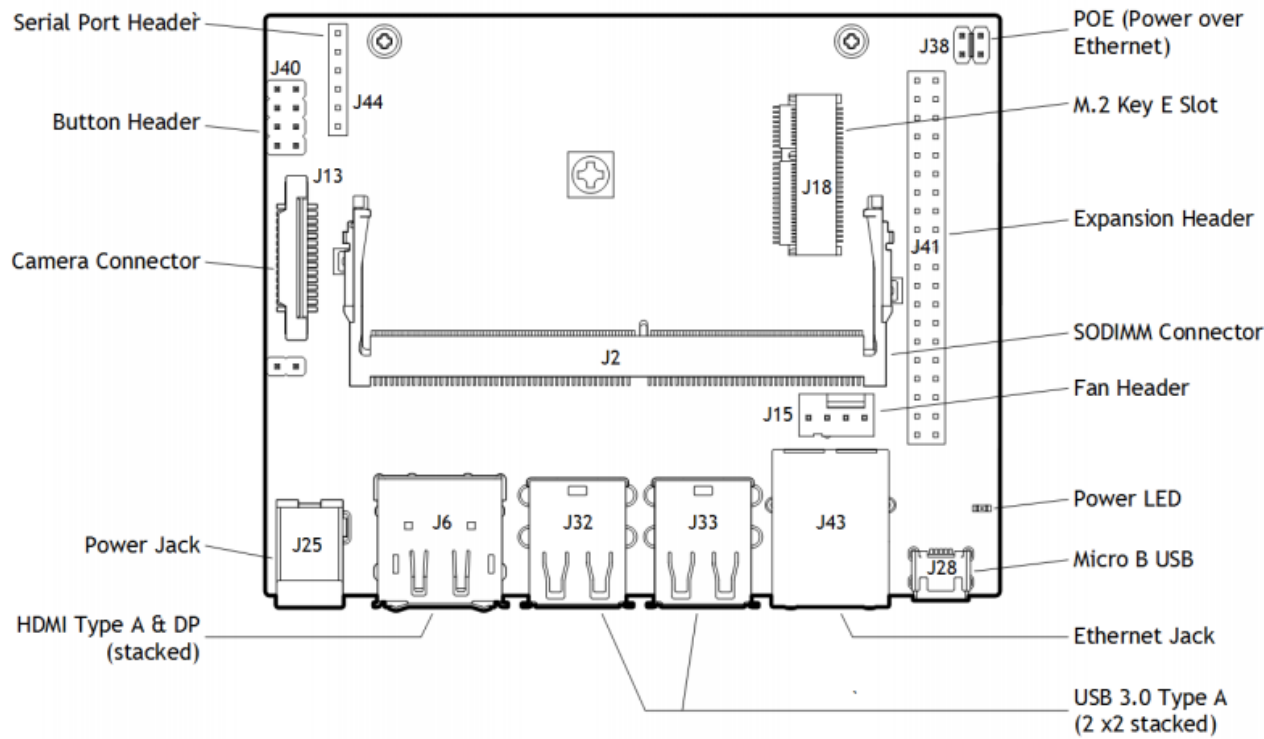
Front View



Rear View



Top View

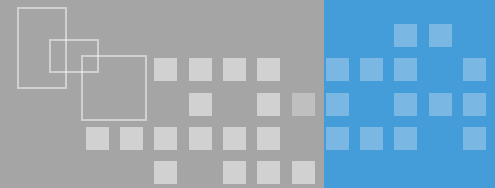


- [J6] HDMI and DP connector
- [J13] Camera connector; enables use of CSI cameras or stack. Raspberry Pi Camera Module V2
- [J18] M.2 Key E connector wireless networking, PCIe x1, USB 2.0, UART, I2S, I2C
- [J32 and J33] are each a stack of two USB 3.0 Type A connectors.
- [J41] 40-pin expansion header GPIO, I2C, UART etc
- [J43] RJ45 connector for gigabit Ethernet.
- [J44] 3.3V serial port header; provides access to the UART console.

Jetson Nano



- Jetson Nano CPU Module
 - 128-core Maxwell GPU
 - Quad-core Arm A57 processor @ 1.43 GHz
 - System Memory – 4GB 64-bit LPDDR4 @ 25.6 GB/s
 - Storage – microSD card slot (devkit) or 16GB eMMC flash (production)
 - Video Encode – 4K @ 30 | 4x 1080p @ 30 | 9x 720p @ 30 (H.264/H.265)
 - Video Decode – 4K @ 60 | 2x 4K @ 30 | 8x 1080p @ 30 | 18x 720p @ 30 (H.264/H.265)
 - Dimensions – 70 x 45 mm
- Baseboard
 - 260-pin SO-DIMM connector for Jetson Nano module.
 - Video Output – HDMI 2.0 and eDP 1.4 (video only)
 - Connectivity – Gigabit Ethernet (RJ45) + 4-pin PoE header
 - USB – 4x USB 3.0 ports, 1x USB 2.0 Micro-B port for power or device mode
 - Camera I/F – 1x MIPI CSI-2 DPHY lanes compatible with Leopard Imaging LI-IMX219-MIPI-FF-NANO camera module and Raspberry Pi Camera Module V2
 - Expansion
 - M.2 Key E socket (PCIe x1, USB 2.0, UART, I2S, and I2C) for wireless networking cards
 - 40-pin expansion header with GPIO, I2C, I2S, SPI, UART signals
 - 8-pin button header with system power, reset, and force recovery related signals
 - Misc – Power LED, 4-pin fan header
 - Power Supply – 5V/4A via power barrel or 5V/2A via micro USB port; optional PoE support
 - Dimensions – 100 x 80 x 29 mm



JETSON NANO DEVKIT SPECS



PROCESSOR

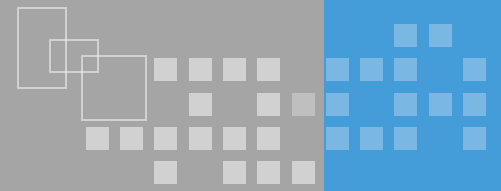
CPU	64-bit Quad-core ARM A57 @ 1.43GHz
GPU	128-core NVIDIA Maxwell @ 921MHz
Memory	4GB 64-bit LPDDR4 @ 1600MHz 25.6GB/s
Video Encoder	4Kp30 (4x) 1080p30 (2x) 1080p60
Video Decoder	4Kp60 (2x) 4Kp30 (8x) 1080p30 (4x) 1080p60

INTERFACES

USB	(4x) USB 3.0 A (Host) USB 2.0 Micro B (Device)
Camera	MIPI CSI-2 x2 (15-position Flex Connector)
Display	HDMI DisplayPort
Networking	Gigabit Ethernet (RJ45, PoE)
Wireless	M.2 Key-E with PCIe x1
Storage	MicroSD card (16GB UHS-1 recommended minimum)
40-Pin Header	UART SPI I2C I2S Audio Clock GPIOs
Power	5V DC (μUSB, Barrel Jack, PoE) - 5W 10W
Size	80x100mm

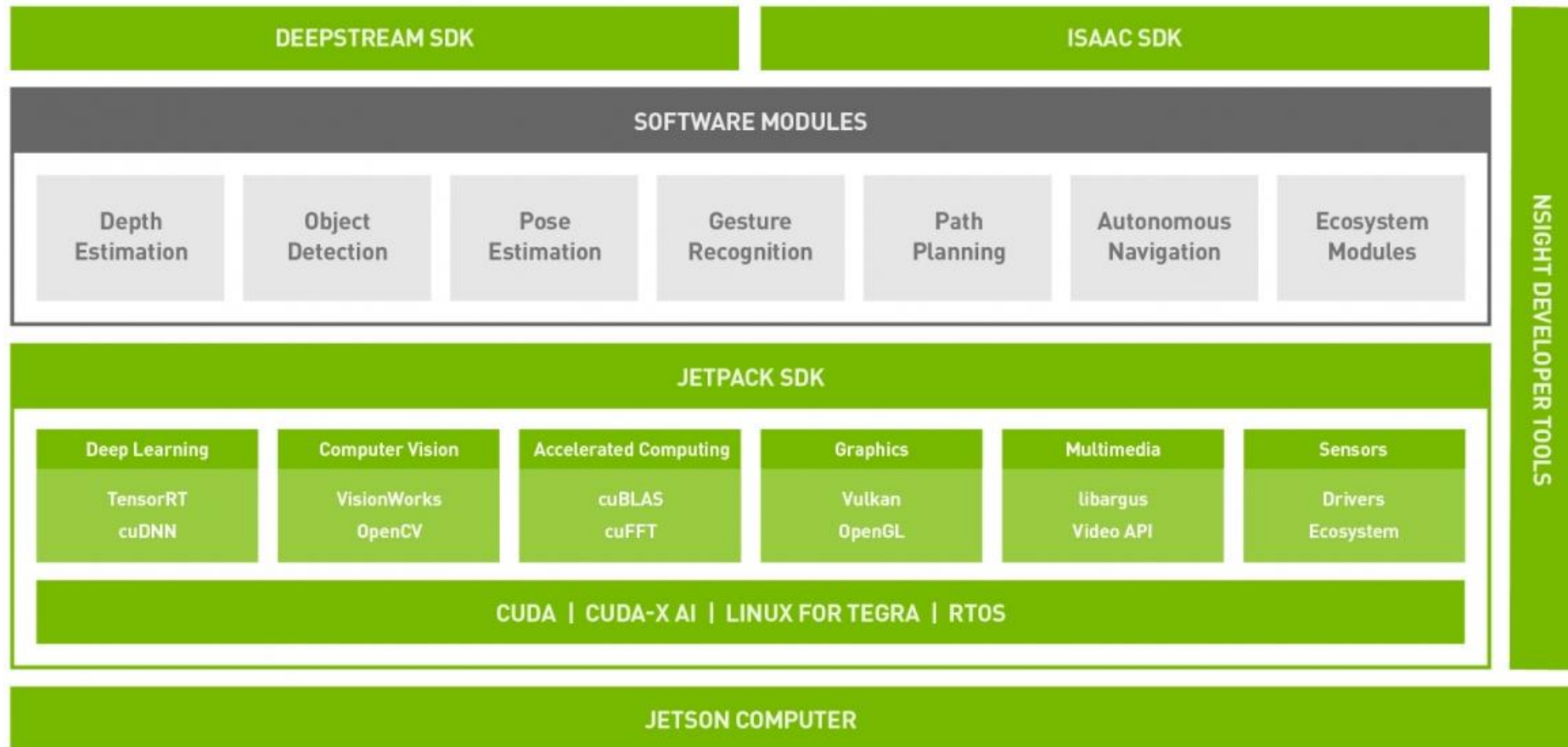
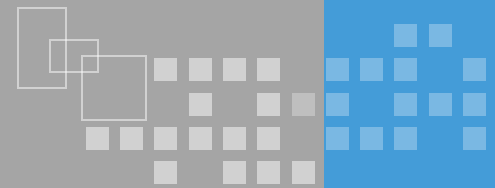
Jetson Nano

	#엔비디아 #젝스나노	#라즈베리파이4
CPU	쿼드 코어 ARM® Cortex®-A57 MPCore 프로세서	Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
GPU	NVIDIA CUDA® Maxwell™ (128개 코어)	Broadcom VideoCore VI
MEMORY	4GB 64비트 LPDDR4	1, 2, 4GB 64비트 LPDDR4 (옵션사항)
DISPLAY	HDMI 2.0 또는 DP1.2 eDP 1.4	2x micro-HDMI (up to 4Kp60)
CAMERA	1x MIPI CSI-2 DPHY lanes	2-lane MIPI CSI camera port
VIDEO 인코딩/디코딩	H.264/H.265 (4Kp30) H.264/H.265 (4Kp60, 2x 4Kp30)	H264(1080p30) H.265(4Kp60), H.264(1080p60)
CONNECTIVIT Y	기가비트 이더넷 (WLAN, Bluetooth 없음)	기가비트 이더넷 (2.4 + 5GHz WLAN, Bluetooth 5.0, BLE)
I/O	(3x) I2C, (2x) SPI, UART, I2S, GPIOs	
크기	80x100mm	56x85mm

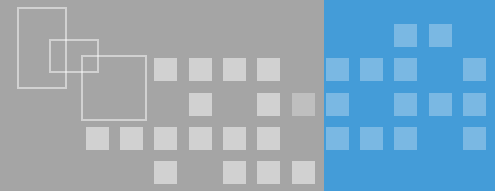


Software

Jetson Nano



- JetPack SDK is the most comprehensive solution for building AI applications.
- It bundles Jetson platform software including TensorRT, cuDNN, CUDA Toolkit, VisionWorks, Streamer, and OpenCV, all built on top of L4T with LTS (Long Term Support) Linux kernel.
- Jetson modules run Linux with NVIDIA® Tegra® Linux Driver Package (**L4T**), which provides the Linux kernel, bootloader, NVIDIA drivers, flashing utilities, sample filesystem, and more for the Jetson platform.



Nsight Developer Tool

- TensorRT : 딥 러닝 추론 엔진
- 딥스트림 SDK(DeepStream SDK) : 딥 러닝을 활용한 동영상 분석 애플리케이션의 고 성능 개발을 손쉽게 할 수 있도록 만든 라이브러리.
- cuDNN(CUDA® Deep Neural Network library) : cuDNN은 엔비디아 CUDA 딥 뉴럴 네트워크 라이브러리
- Visionworks : a software development package for computer vision (CV) and image processing

VisionWorks includes the following primitives:

IMAGE ARITHMETIC

- Absolute Difference
- Accumulate Image
- Accumulate Squared
- Accumulate Weighted
- Add / Subtract / Multiply +
- Channel Combine
- Channel Extract
- Color Convert +
- CopyImage
- Convert Depth
- Magnitude
- MultiplyByScalar
- Not / Or / And / Xor
- Phase
- Table Lookup
- Threshold

FLOW & DEPTH

- Median Flow
- Optical Flow [LK] +
- Semi-Global Matching
- Stereo Block Matching
- IME Create Motion Field
- IME Refine Motion Field
- IME Partition Motion Field

GEOMETRIC TRANSFORMS

- Affine Warp +
- Warp Perspective +
- Flip Image
- Remap
- Scale Image +

FILTERS

- BoxFilter
- Convolution
- Dilation Filter
- Erosion Filter
- Gaussian Filter
- Gaussian Pyramid
- Laplacian3x3
- Median Filter
- Scharr3x3
- Sobel 3x3

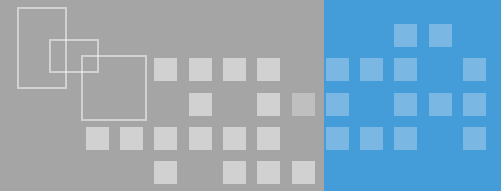
FEATURES

- Canny Edge Detector
- FAST Corners +
- FAST Track +
- Harris Corners +
- Harris Track
- Hough Circles
- Hough Lines

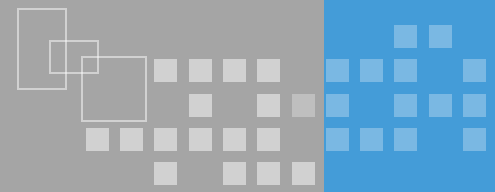
ANALYSIS

- Histogram
- Histogram Equalization
- Integral Image
- Mean Std Deviation
- Min Max Locations

Jetson Nano



JetPack component	Sample locations on reference filesystem
<u>TensorRT</u>	/usr/src/tensorrt/samples/
<u>cuDNN</u>	/usr/src/cudnn_samples_<version>/
<u>CUDA</u>	/usr/local/cuda-<version>/samples/
<u>Multimedia API</u>	/usr/src/tegra_multimedia_api/
<u>VisionWorks</u>	/usr/share/visionworks/sources/samples/ /usr/share/visionworks-tracking/sources/samples/ /usr/share/visionworks-sfm/sources/samples/
<u>OpenCV</u>	/usr/share/OpenCV/samples/



THANK YOU

Suggestions Questions