VISIONARY.AI

Cutting Through the Noise
Bringing the EV72 to a New Kind of Image Signal Processor

Benny Munitz

8 Sep 2022

Intro to Visionary.ai

The Company

- Israeli startup – Founded Dec 2020
- Already in revenue
- The tech world is very engaged
- Consumer production in Q1 2023

What We Do

AI based video image enhancement

- De-noiser
- Software ISP

My Contact Details

- Benny Munitz – VP Business development
- Benny@visionary.ai

What We’re Going to talk About

- Image sensors – markets and challenges
- The old devil called noise
- A Software Image Signal processor
- The tech
- Synergies with the Synopsys ecosystem

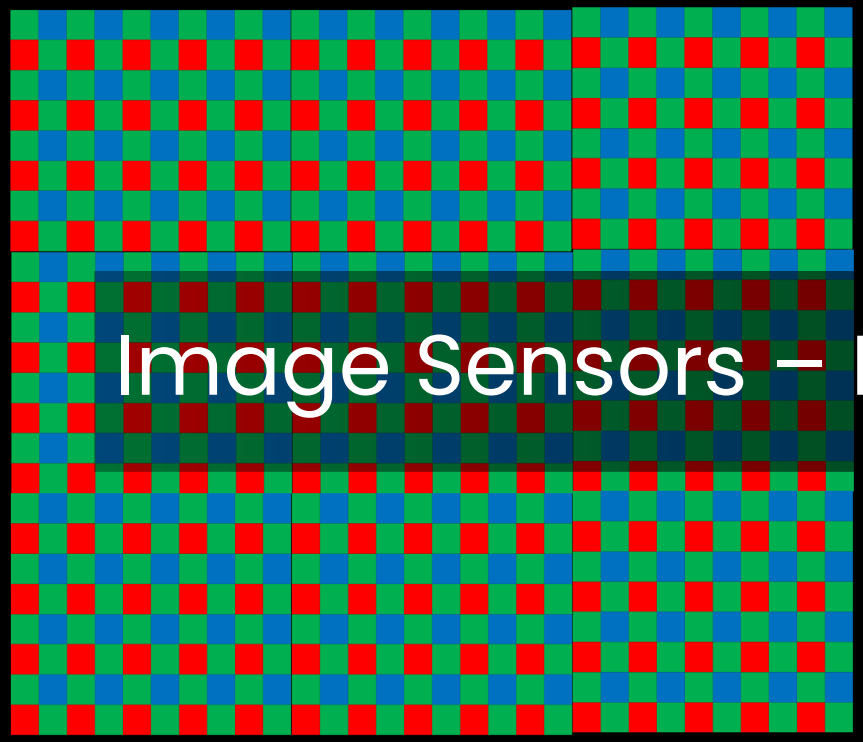


Image Sensors – Markets and Challenges

The Opportunity - Society Relies on Billions of Image Sensors

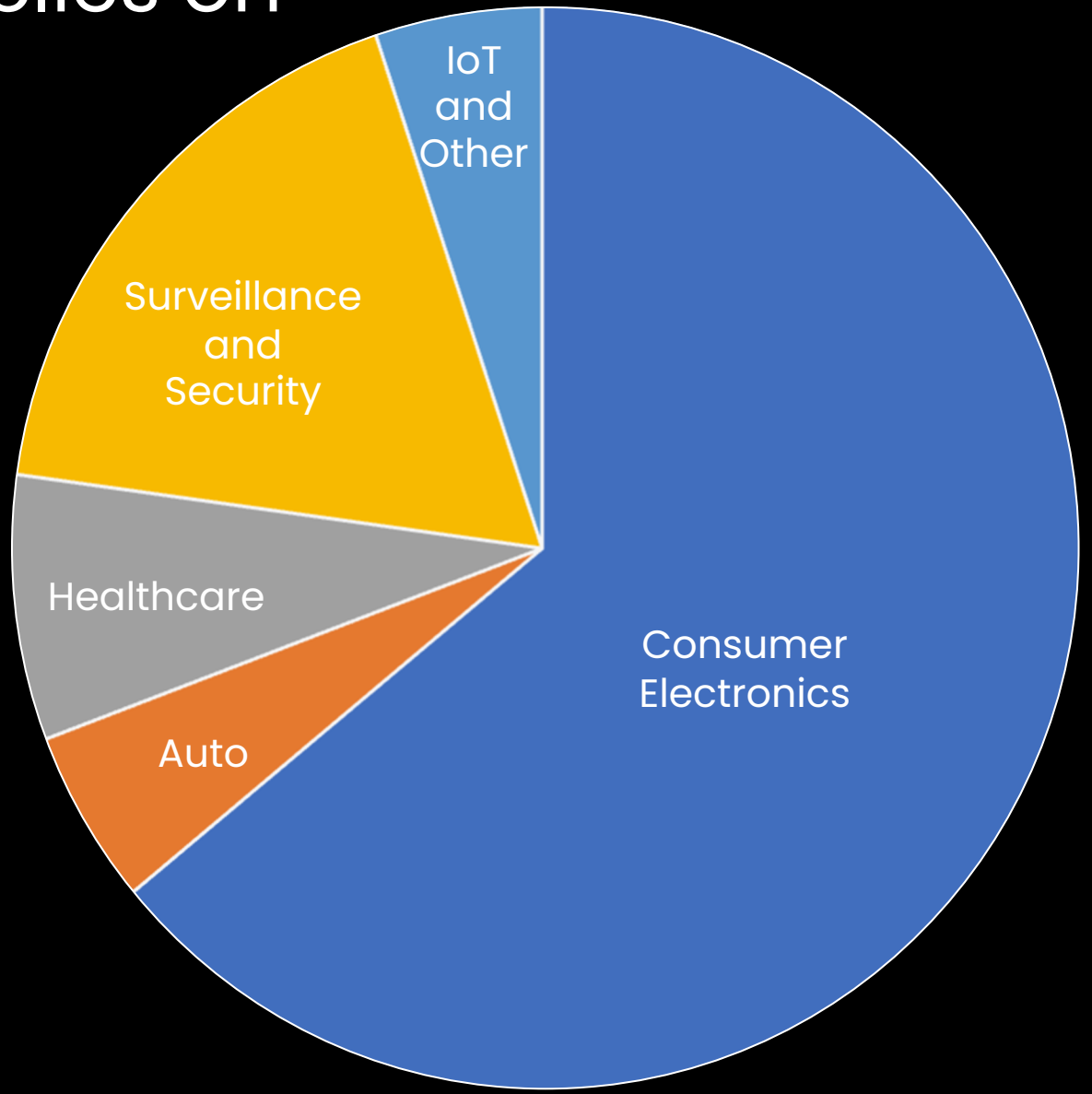
Over 7 Billion manufactured each year.

A $22 Billion market growing at 8.4%* per year.

Every sensor needs an image signal processor.

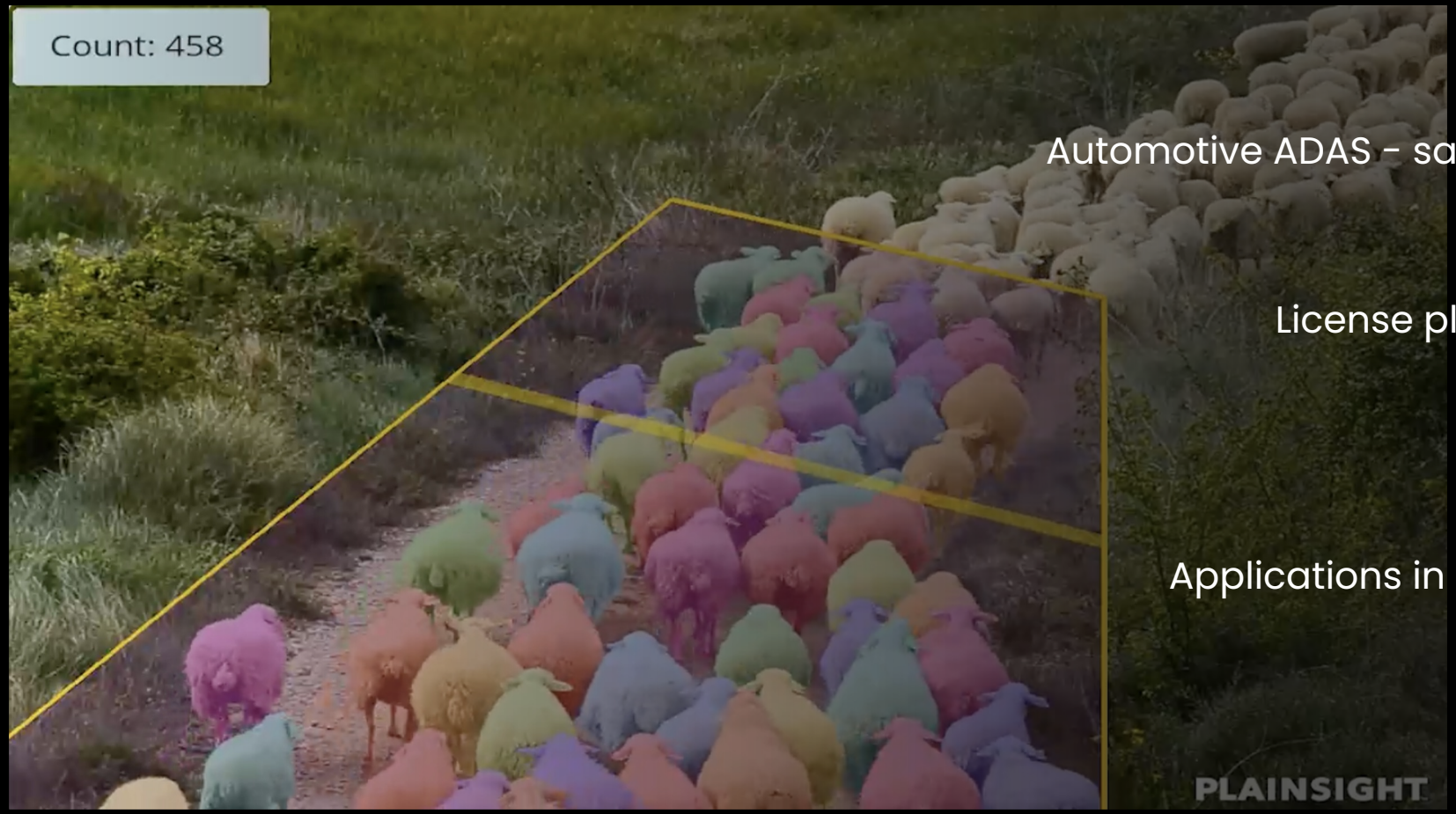
85% of sensors could benefit from better performance in poor lighting.

*Source: Fortune Business



Premium Mobile - Driving Consumer Experience Expectations

Machine Vision - Mass Adoption



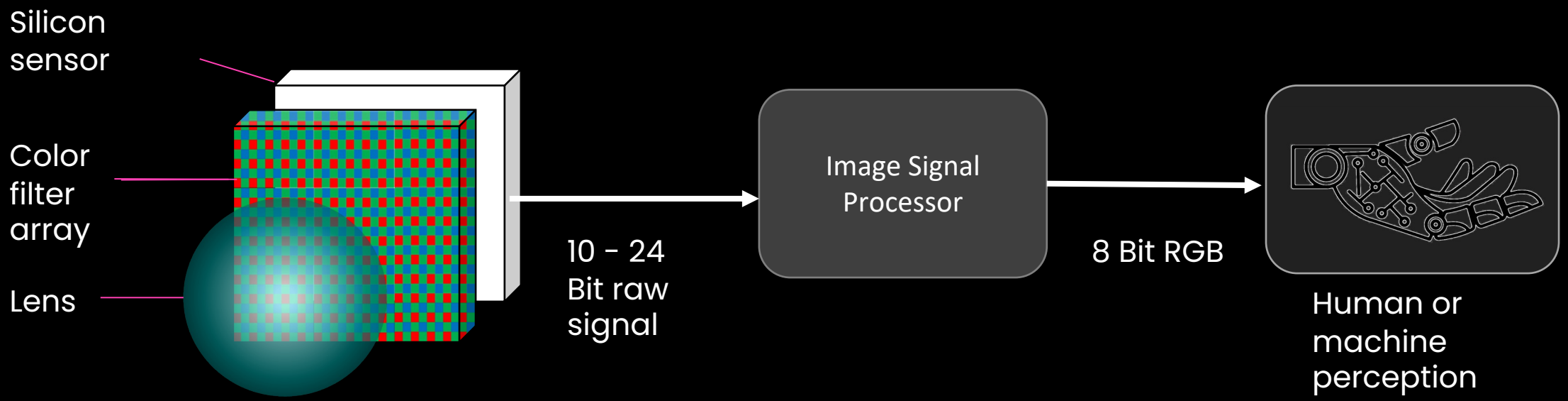
Automotive ADAS - safety regs cannot be met without vision

License plate recognition and smart cities

Smart CCTV - intruder or cat?

Applications in agriculture and food production

The Classic Image Pipeline



The Old Devil Called Noise

Noise - The Enemy of the Image

Multiple sources of noise.

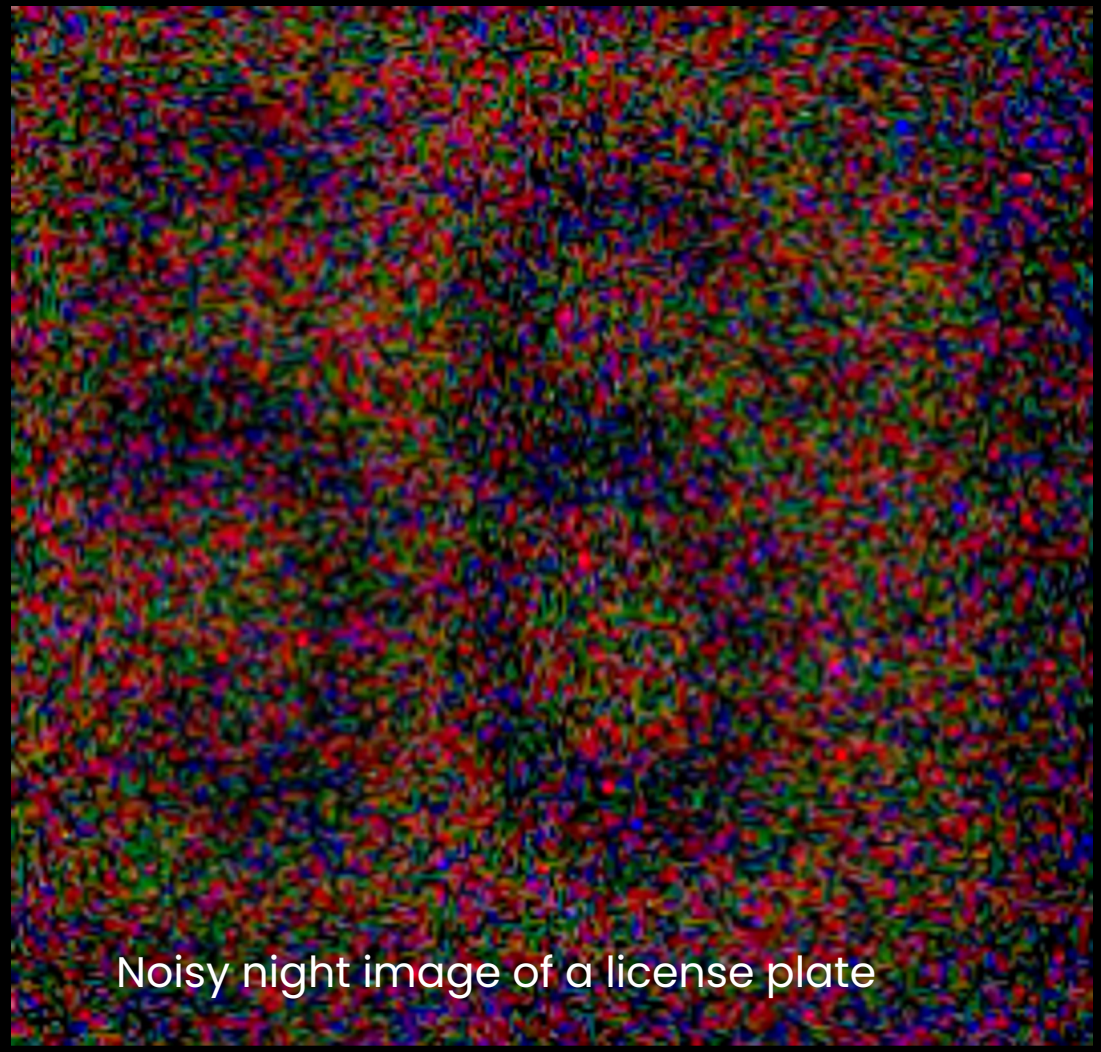
- Worse at low light (few photons per pixel)
- Gets worse with heat (thermally generated noise)

Reduces effectiveness of machine vision

ISP auto-adjusts gain rather than show noise

Two Choices:

- Increase Signal
- Reduce noise



Noisy night image of a license plate

Improving signal to noise– the $10 Billion way

More signal - Increase the size of the sensor. 14.2 M. (14ft).

Less noise - Freeze the sensor to -447K (7 Kelvin)

Noise - The key to unlocking degrees of freedom for designers

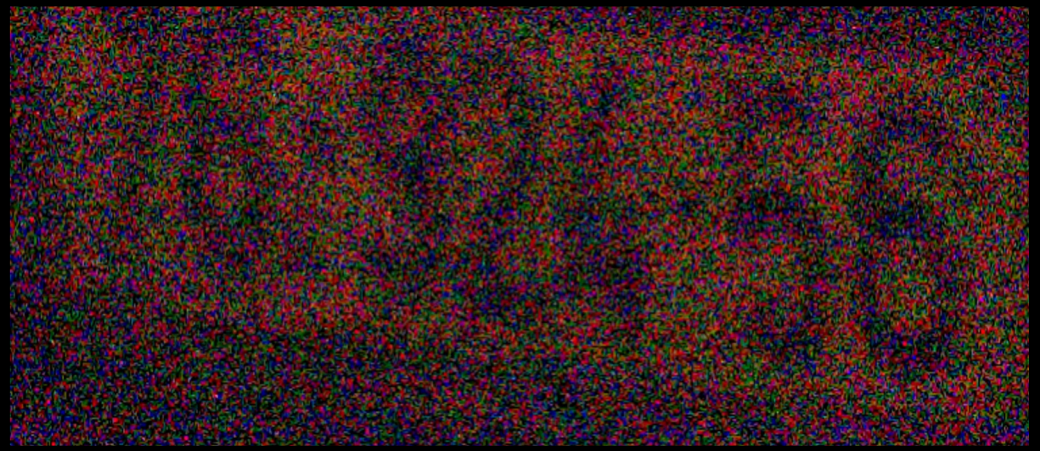
If you address noise, you can improve design parameters like:

- Low light performance
- Dynamic range performance
- Sensor size
- Frame Rate
- Sensor cost
- Illumination

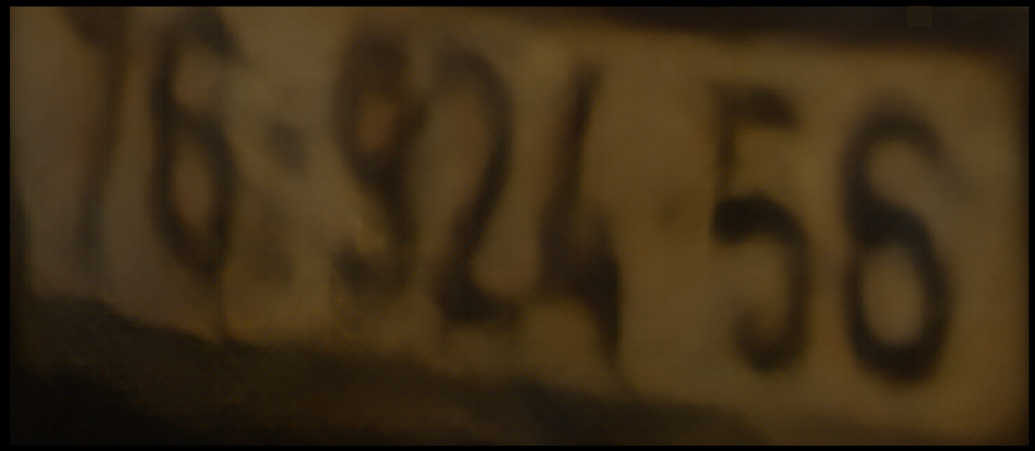
The AI way - DNN revolutionizing denoising as well…

DNN based denoising doesn’t map well to HW + pace of innovation is enormous → Keep it SW

Example 1 – License Plate Recognition for Smart City



Night images are too noise for computer recognition of license plates. Conventional technology would require additional illumination, driving energy consumption and light pollution



Visionary.ai removes noise. License plate can be read at night with no additional illumination

Example 2 – Computer Vision Object Detection

More objects detected and higher detection confidence

Example 3 - Filming In the Desert at Night

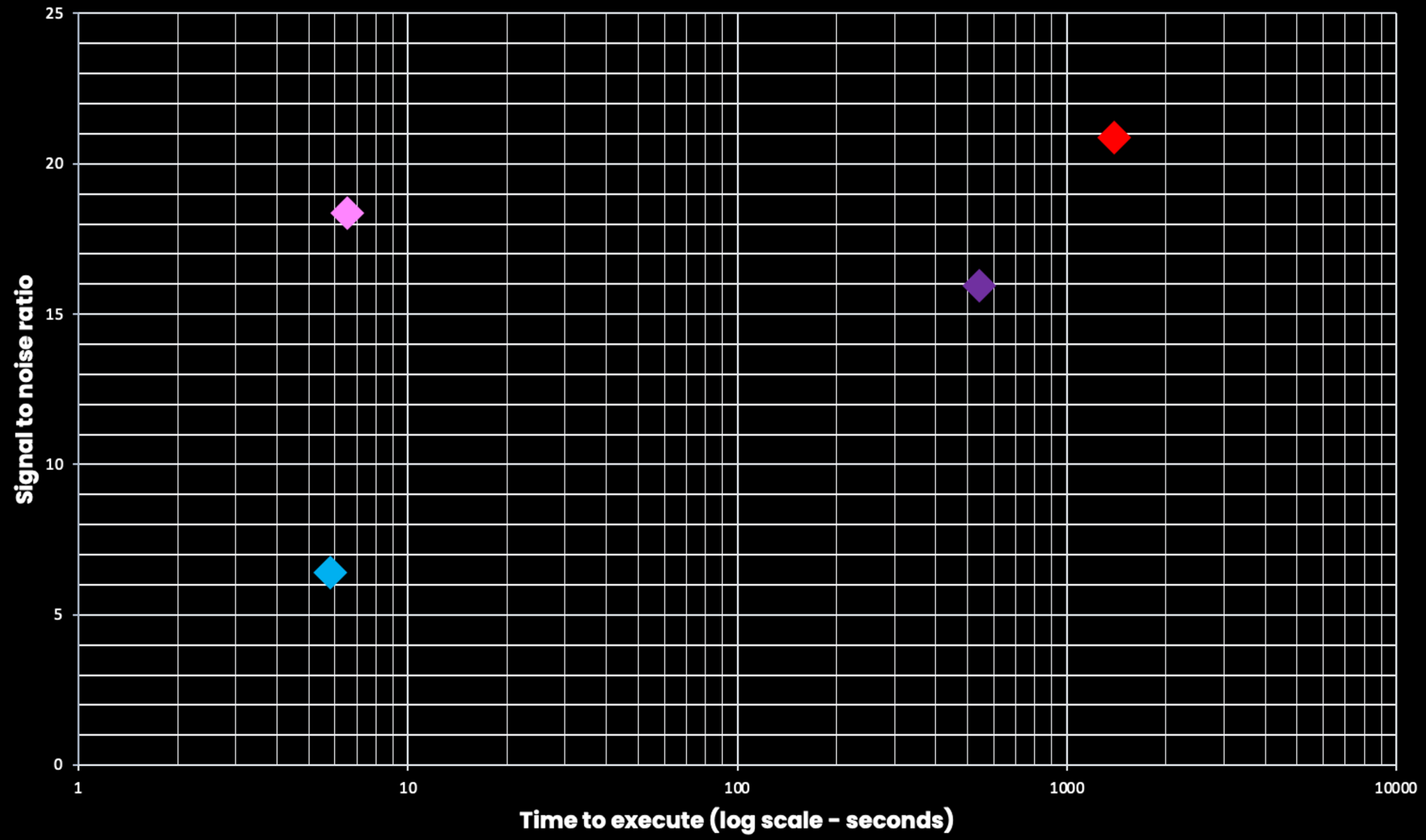
Video camera footage – default settings.

Image gain could be increased but also amplifies the noise.

Visionary.ai removes the noise, in real time.

A Closer Look

Benchmarks vs Leading Denoising Algorithms



Non-real-time noise performance vs time to execute, at 0.2 Lux, 6000 Kelvin.

- Visionary.ai
- Guided Filtering
- BM3D
- Restormer

De-Noising must not damage Image Sharpness

(Note: -1 means that value could not be calculated due to low performance)

	3000 Kelvin / 0.2 lux	6000 Kelvin / 0.2 lux
mtf30 BM3D	0.248772	0.23652
mtf30 Guided Filtering	-1	-1
mtf30 Restormer	0.251703	0.221795
mtf30 Visionary.ai	0.234336	0.227869
mtf50 BM3D	0.172759	0.200379
mtf50 Guided Filtering	0.040672	-1
mtf50 Restormer	0.123717	0.149752
mtf50 Visionary.ai	0.160527	0.175771
snr BM3D (dB)	16.57699	15.94446
snr Guided Filtering (dB)	6.668835	6.392871
snr Restormer (dB)	21.04031	20.86975
snr Visionary.ai (dB)	18.77891	18.34508

Slightly sharper, slightly more noise than Restormer, in less than 1/200 of the time to execute.

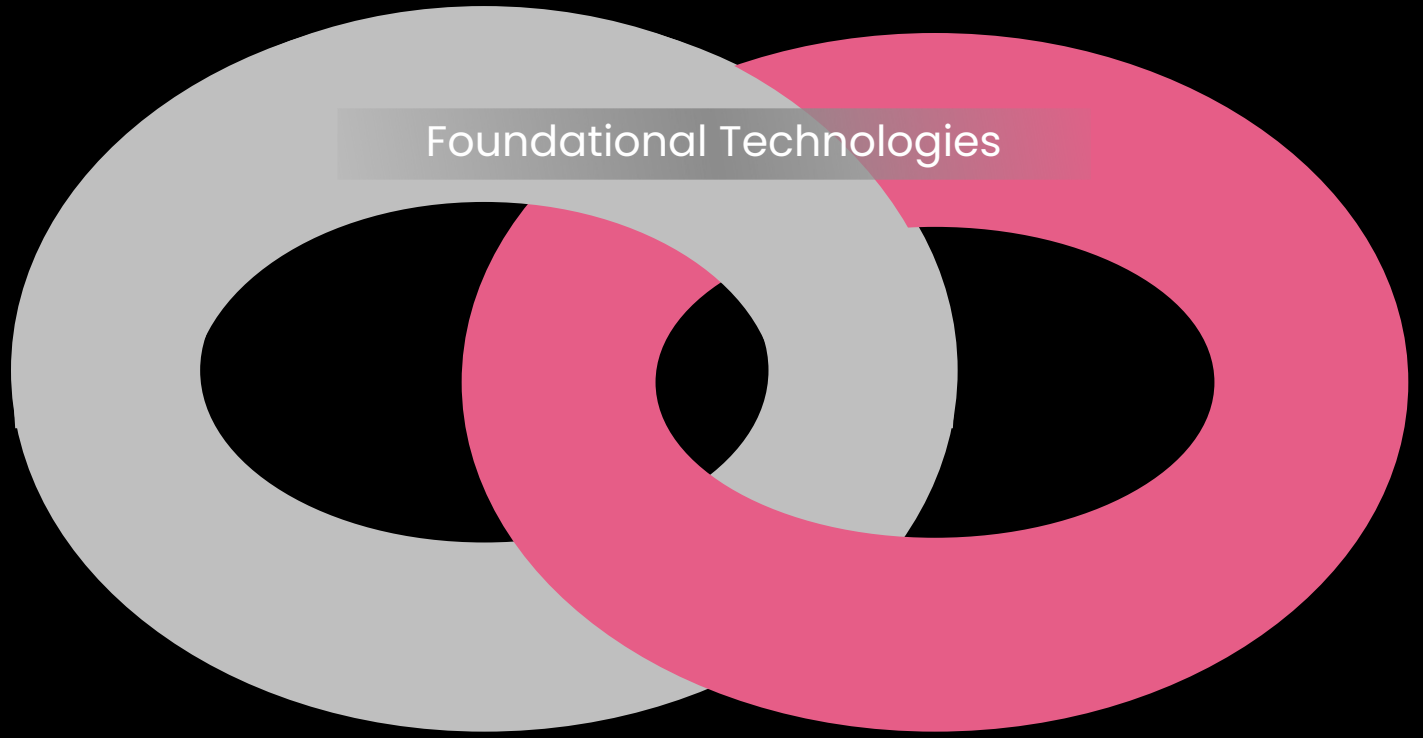
The Software Image Signal Processor

The hardware ISP vs Software ISP

	Hardware ISP	Visionary.ai Software ISP
High Dynamic Range	Exposure based	Exposure + Denoise + AI
AI capable	Very few	Yes
Flexible and updateable	**No**	**Yes**
ISP tuning – Typical Duration	>2 Months	1 Week
Power Efficiency	Good	OK

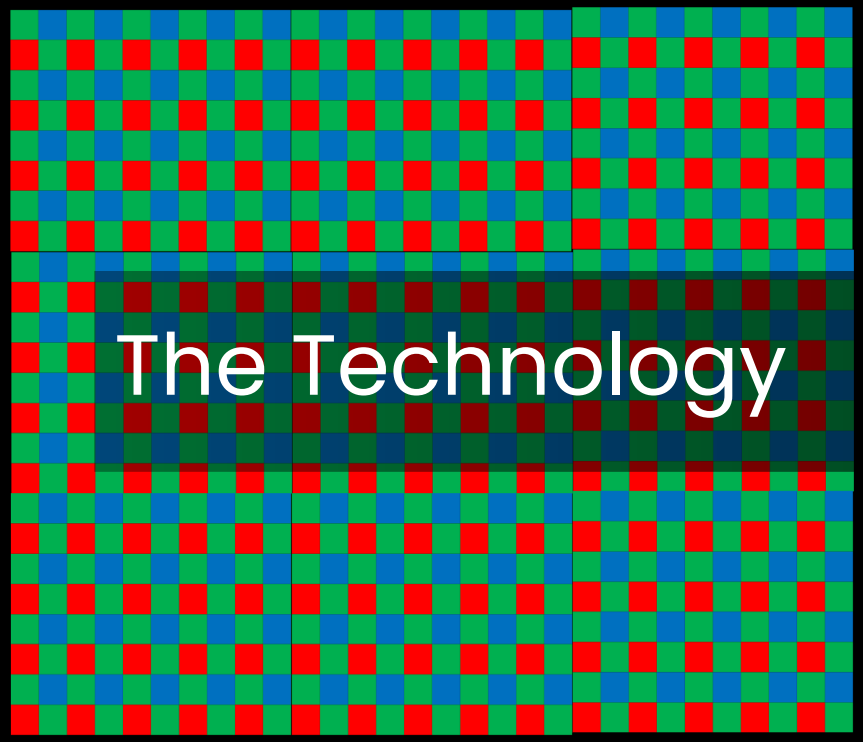
A Pipeline of Image Enhancement Features built on the foundations of a software ISP and a AI denoiser

- True Night Vision
- Auto-Framing
- HDR
- ... and more



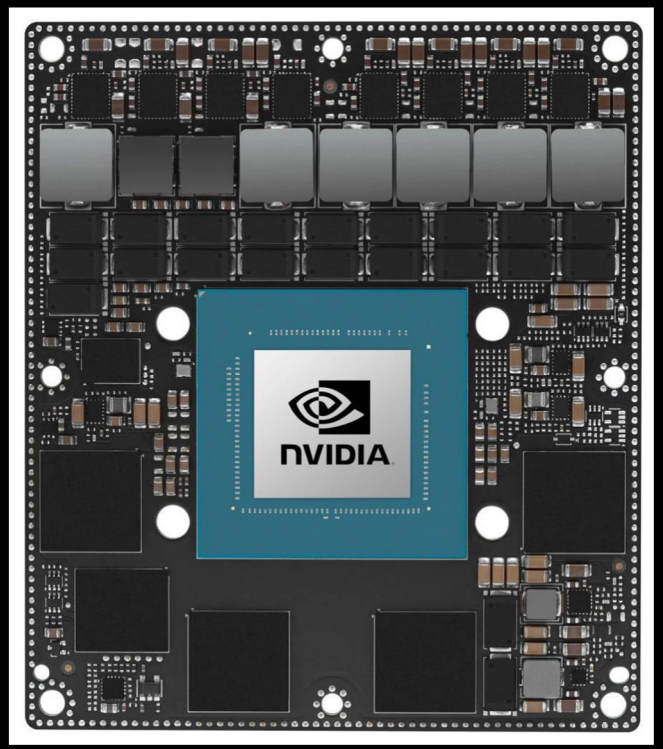
Artificial Intelligence De-noiser

Software Image Signal Processor

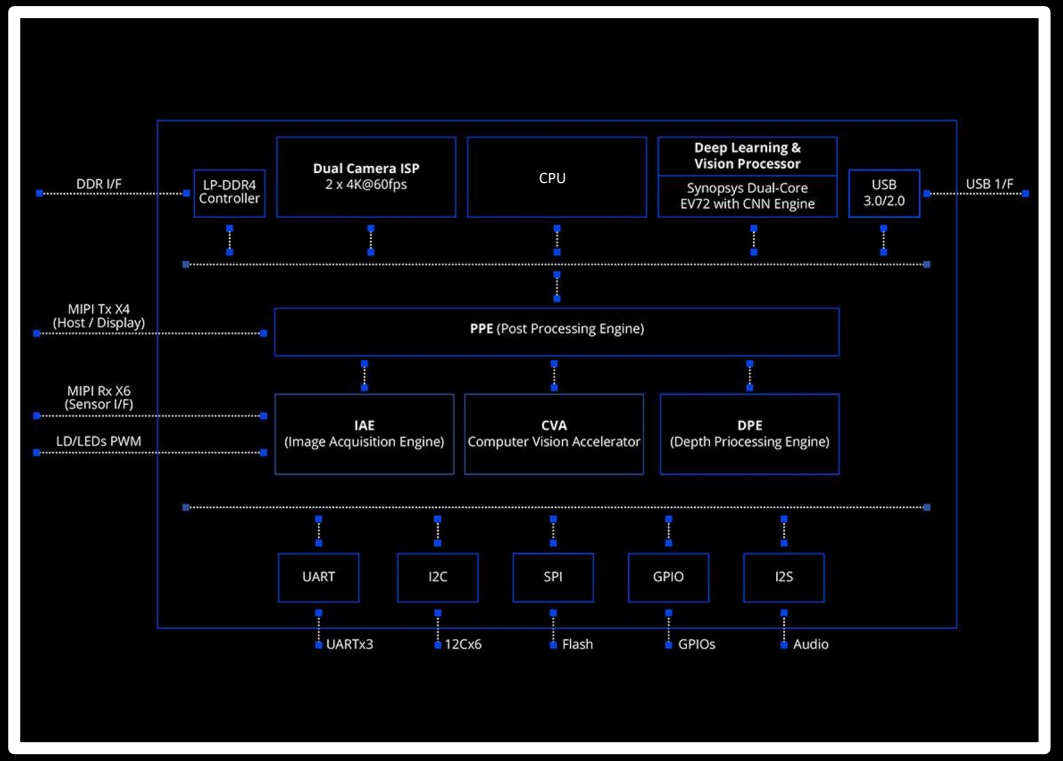

The Technology

Out of the Box on Synopsys

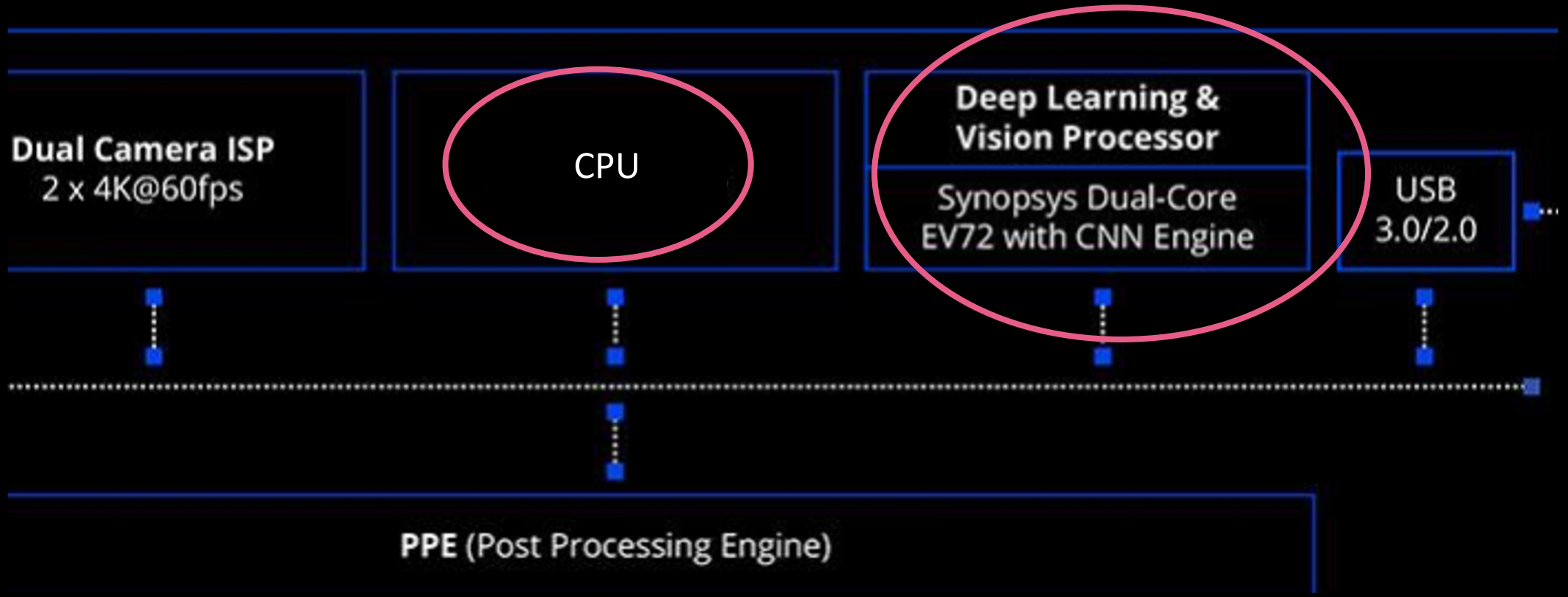
Initial algorithm development and demo on Nvidia Jetson

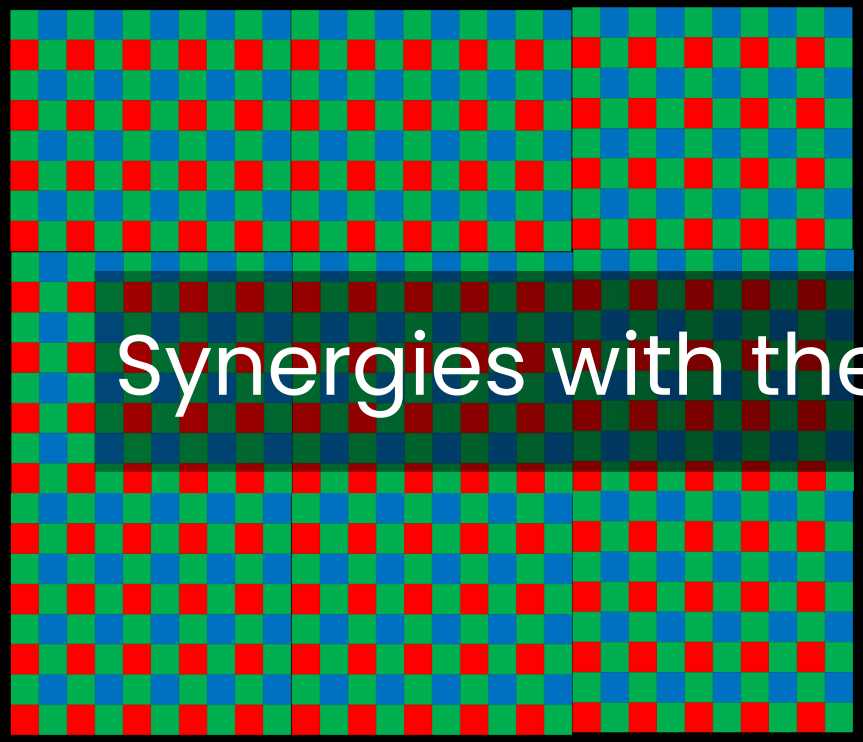


Production implementation on Inuitive N4100 with Synopsys ARC™ EV72



Running on Synopsys EV72 - Simple porting to the NXP6





Synergies with the Synopsys Ecosystem

Opportunities for a new generation of Silicon

AI in real time vision enhancement will become mainstream in the next 5 to 10 years.

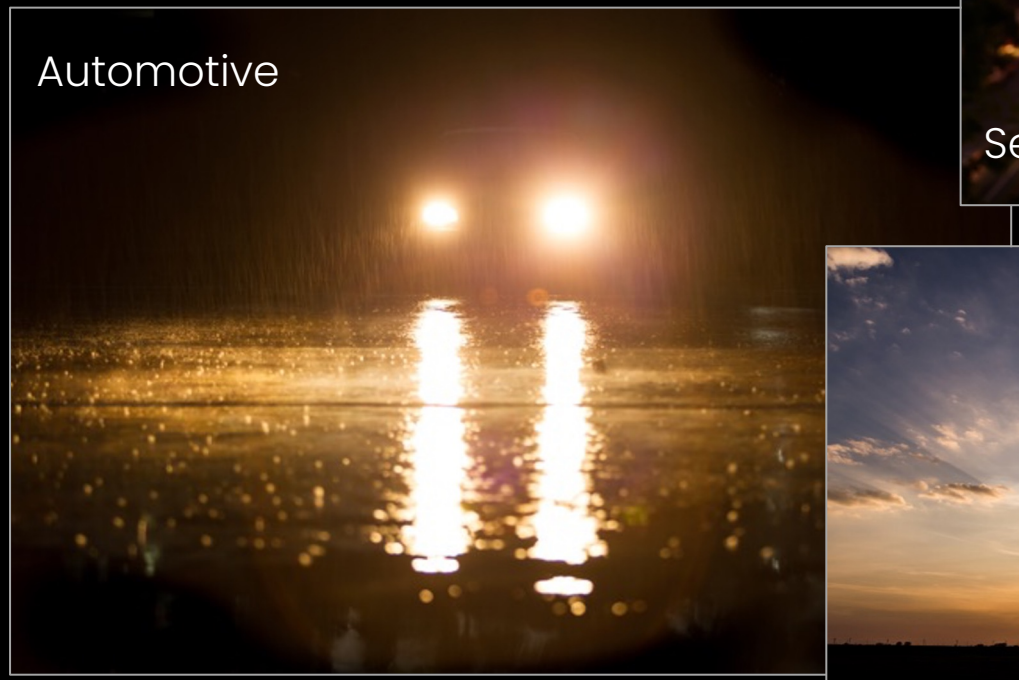
The industry needs a choice of cost effective silicon.

The workload is much less than you might expect. We can discuss in detail under NDA

Opportunities to Build Software ISPs into your SOC

The ARC ecosystem can now deliver SOCs with flexible, adaptable ISPs for all vision projects.

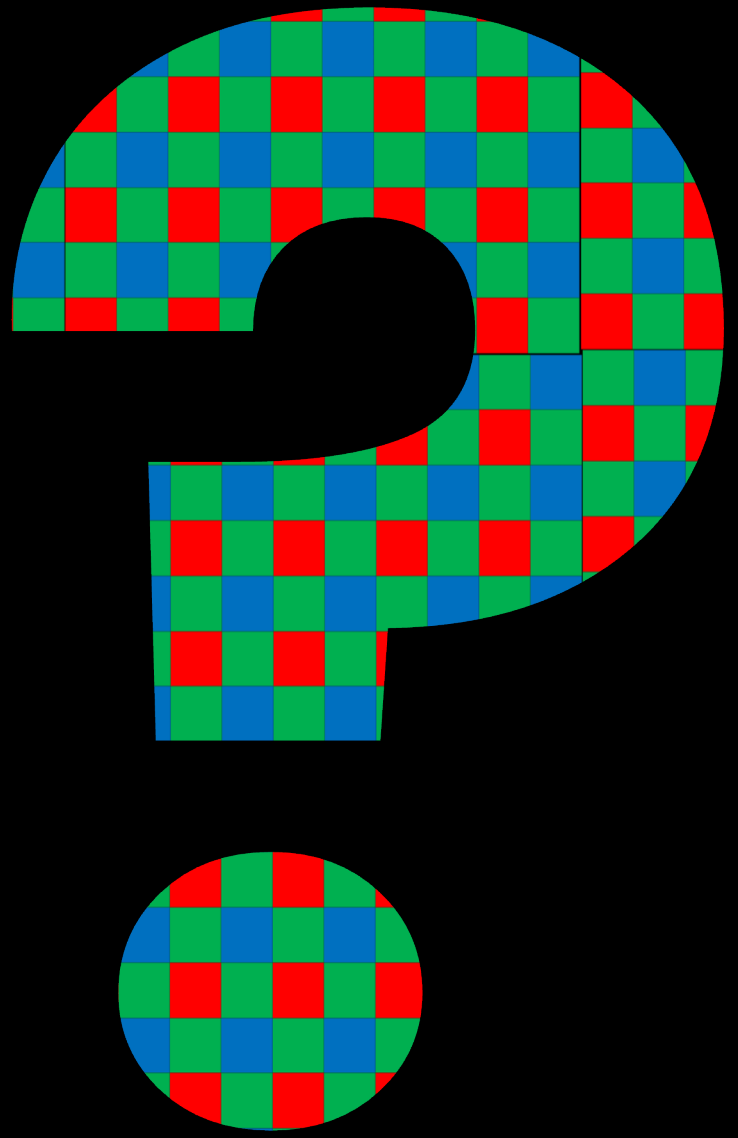
Software ISPs on Synopsys – For Fast Growth Sectors



See The Demo Here Today

Link to video of demo

Thankyou !!



Questions?

VISIONARY.AI

Bring out the best in your camera