Die Nutzung eines Image Signal Prozessors (ISP) zur Bildvorverarbeitung

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Die Nutzung eines Image Signal Prozessors (ISP) zur Bildvorverarbeitung

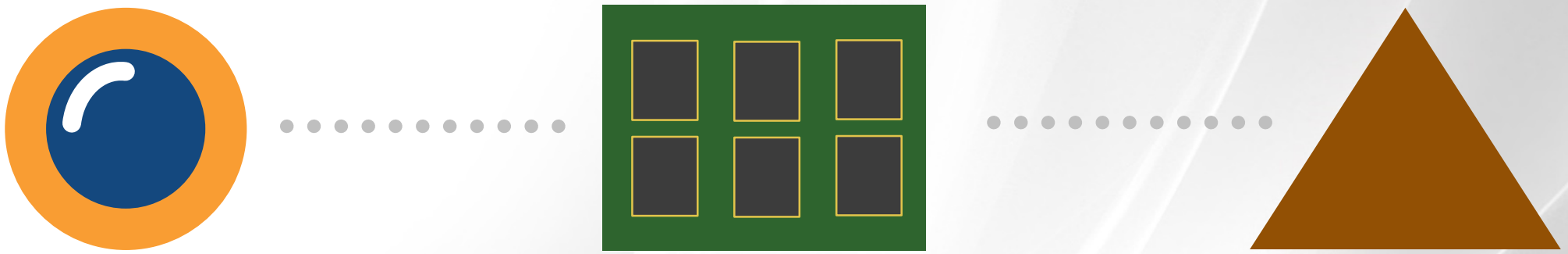
OK, is the last presentation of the day…

Agenda

1. Image signal processors: pre-processing and more
2. ISP concepts in industrial and consumer applications
3. New approaches
4. Summary & Outlook

Vision System

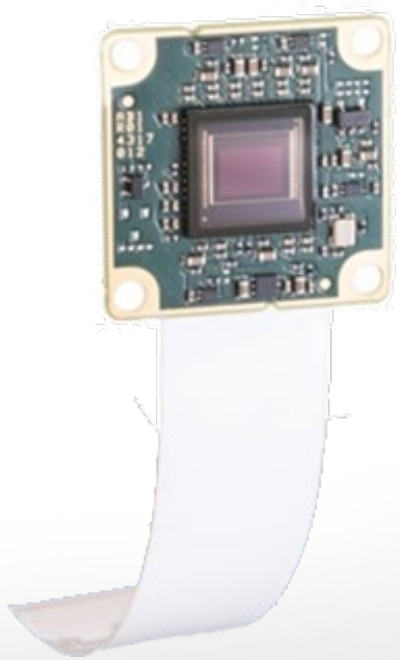
Basic elements



Vision	Host	Application
Image Acquisition	Processing	Software

Image signal processing

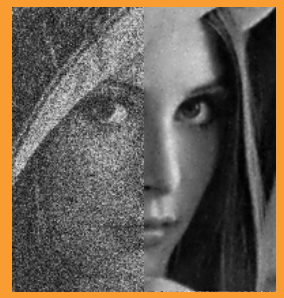
Pre-processing



The image pre-processing is performed in an Image signal processor (ISP)

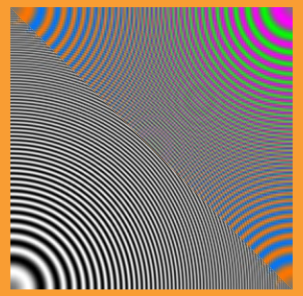
De-Bayering

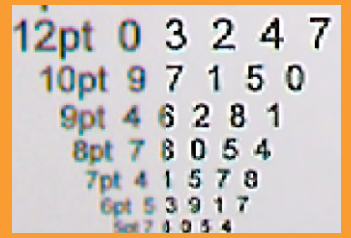
(1 color per pixel
→ 3 colors per pixel)



De-Noising

Interpolations and corrections of sensor errors





sharpening (image improvements)

Image signal processing

Defect pixel correction	De-Bayering	Antialiasing	Demosaic
(auto) white balancing	Dynamic range correction	Gamma correction	Fixed pattern noise correction
Noise reduction	Lens correction	Sharpening	
Color space conversion	Pixel format conversion	Bit depth conversion	
Compression	Image stabilization	Water marking	

Image signal processors

Overview of technical implementations

FPGA

- Flexible
- Lowest NRE
- Easy fixable

ASIC

- High performance
- Application optimized
- Low cost

SoC with ISP

- High performance
- System optimized
- Lowest cost

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Machine Vision setup

Image sensor

FPGA

Image pre-processing

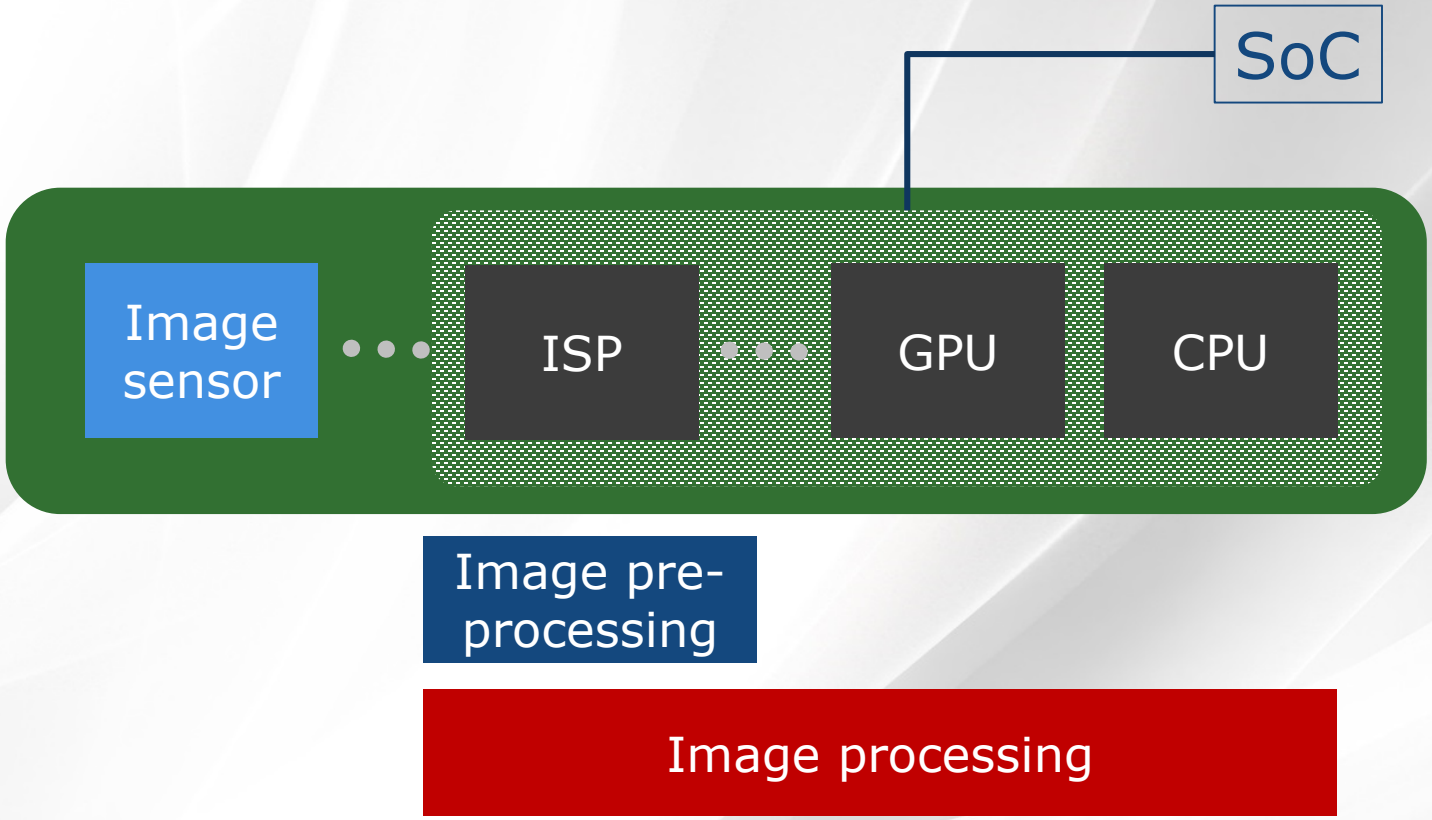
GPU

CPU

Image processing

Consumer Vision system setup

Cell phone camera



Consumer Vision system setup

Requirements

Comparison professional / consumer products

Professional Vision Systems

Consumer vision systems

Metrologically precise

Nice images / an image at all

Costs

Comparison professional / consumer products

Professional Vision Systems

Consumer vision systems

System costs (BOM)

Development costs

Characteristics

Comparison professional / consumer products

Professional Vision Systems

Consumer vision systems

Flexibility

System optimization

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Utilizing a Mobile Processor with ISP

Qualcomm Snapdragon 820

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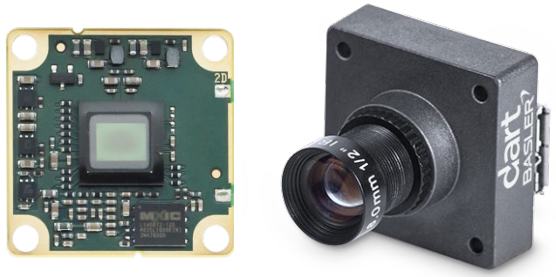
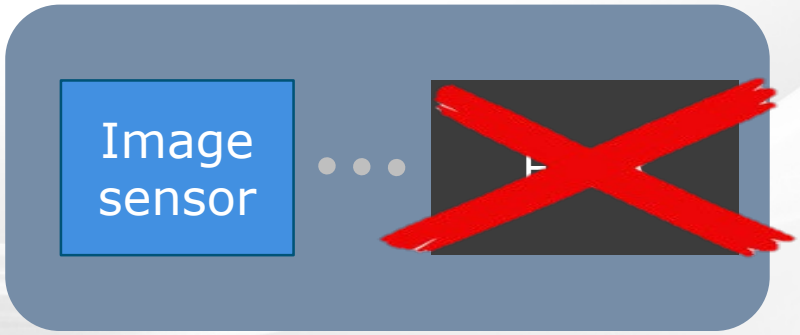
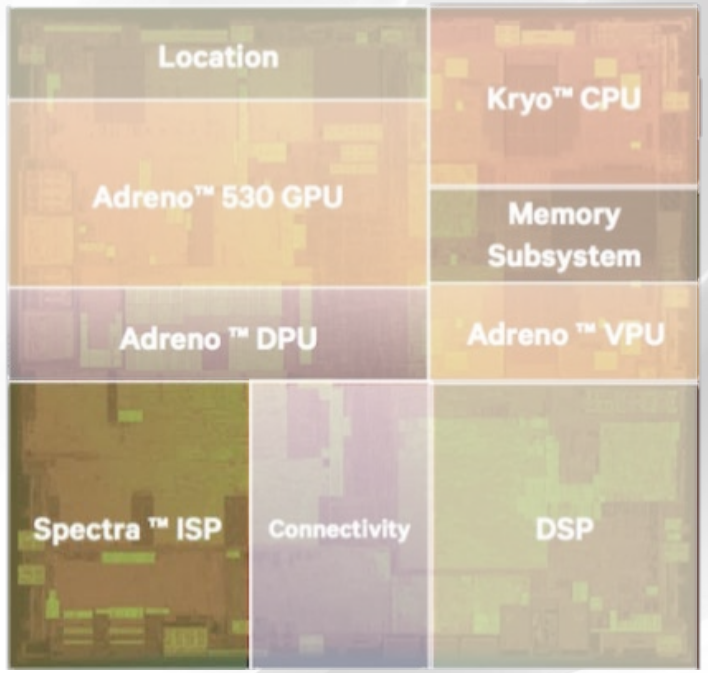






Utilizing a Mobile Processor with ISP

Qualcomm Snapdragon 820

+ system cost
+ system optimization
- flexibility

camera parts

Image sensor

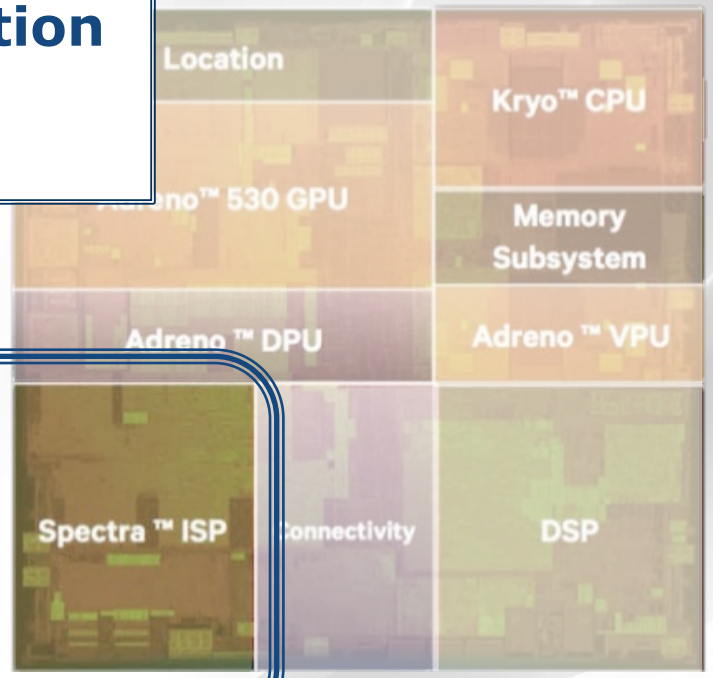
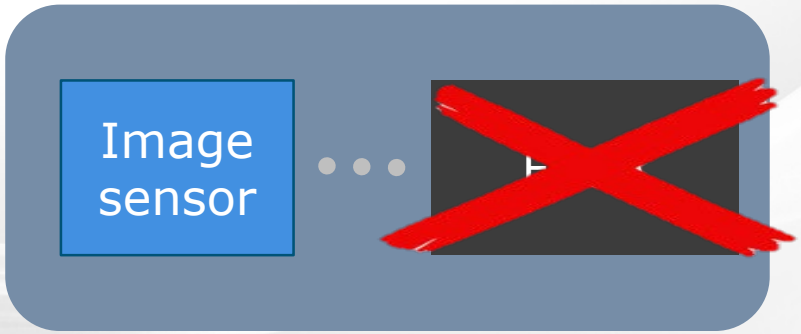


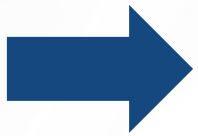
Image pre-processing

Utilizing an ASIC

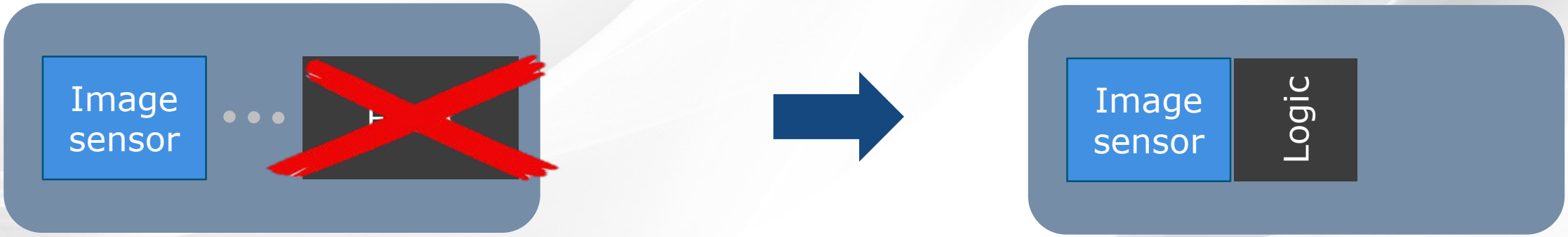
+ system cost

- flexibility





Utilizing in-image-sensor logic



Minimization of requirements

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Summary & Outlook

The processing set-up and the utilized processors in a Computer Vision System can be very divers

When Machine Vision System use consumer products principles,

- system costs can be reduced
- set-up can be optimized
- for the price of decresed flexibility

The gap between Machine Vision and consumer products will be further closed as well as the number of different set-ups

Further information

Combining an ISP and Vision Processor to Implement Computer Vision
Embedded Vision Academy
https://www.embedded-vision.com/platinum-members/embedded-vision-alliance/embedded-vision-training/documents/pages/isp-plus-vision

Was ist Bildverarbeitung?
Basler Vision Campus
https://www.baslerweb.com/de/vision-campus/kamera-technologie/was-ist-bildverarbeitung/

The Image Signal Processor (ISP)
Understanding Camera Optics & Smartphone Camera Trends, A Presentation by Brian Klug
https://www.anandtech.com/show/6777/understanding-camera-optics-smartphone-camera-trends/4

Questions & Answers