赛灵思工业物联网研讨会
XILINX IIoT SEMINAR

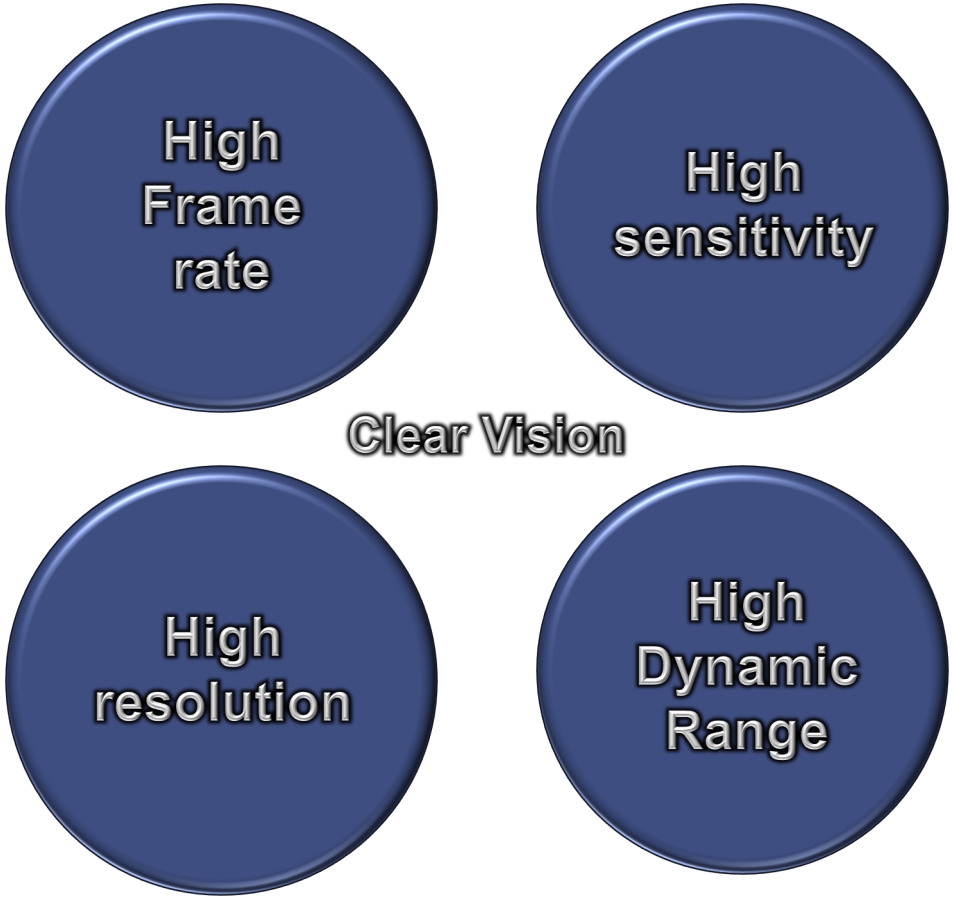
基于XILINX的 工业&医疗 影像增强IP

CORECAM®

Name 吴志鹏
Date 2019.05

XILINX

基于XILINX的 工业&医疗 影像IP



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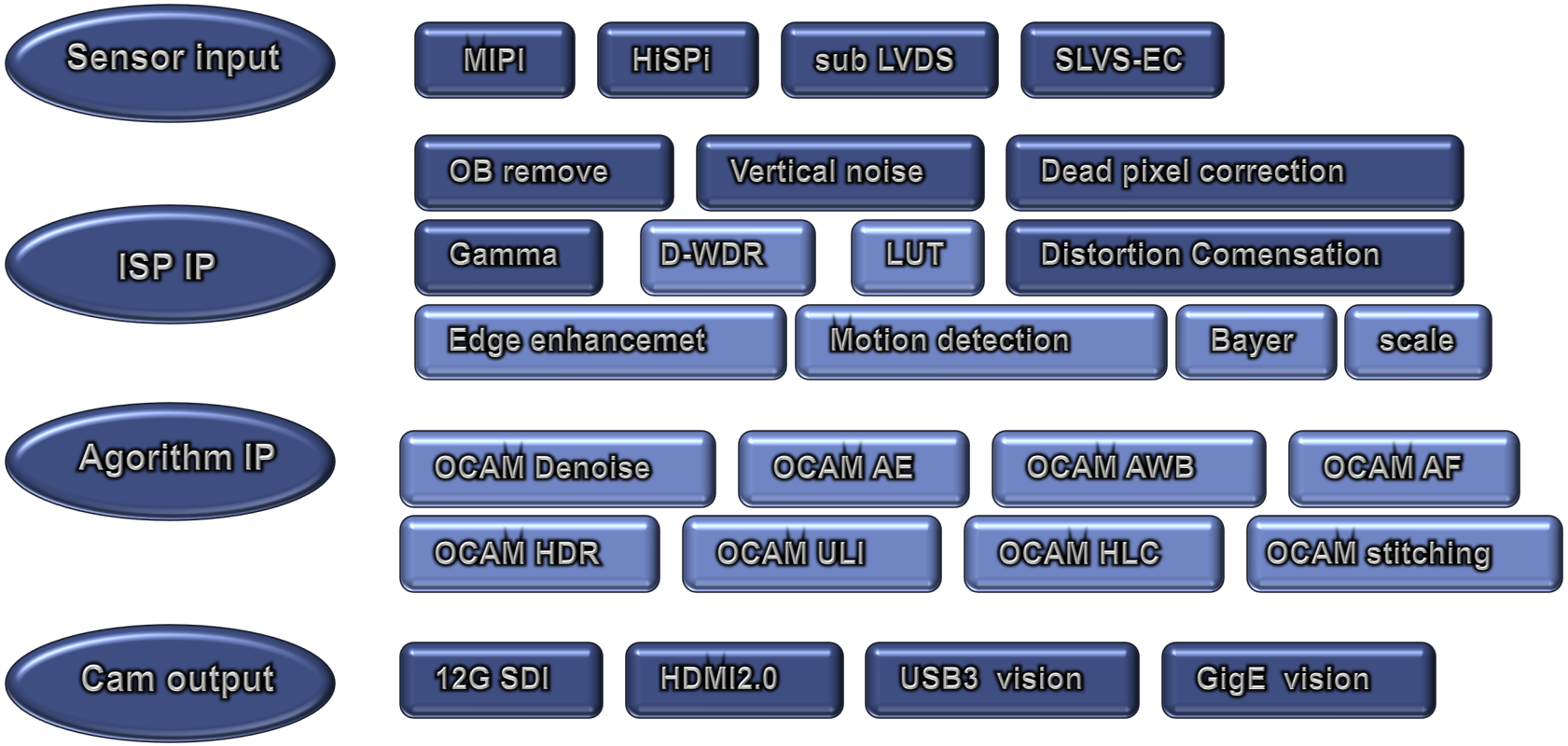
OCAM 工业&医疗 影像IP



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Target FPGA Device

OCAM IP can run on general FPGA and SOC

- Spartan
- Artix
- Kintex
- Virtex
- Zynq-7000 SoC
- Zynq UltraScale + MPSOC

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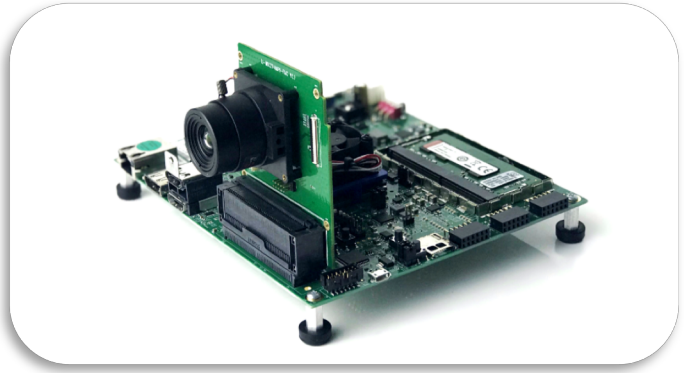
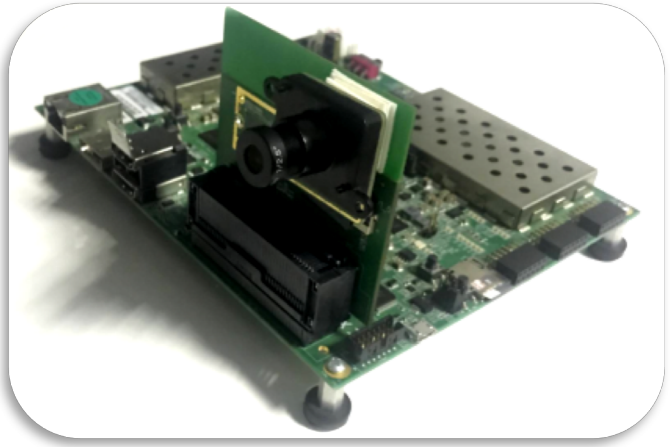
OCAM IP on XILINX





- ZCU104 Evaluation Kit

  Xilinx UltraScale+ MPSOC - XCZU7EV

  - a quad-core ARM Cotex –A53 applications processor
  - dual-core Cortex-R5 real-time processor
  - Mali-400 MP2 GPU
  - 4KP60 capable H.264/H.265 video codec
  - 16nm FinFET+ programmable logic

- IMX274 sensor Board
- AR0231-RCCB sensor Board
- XGS-12M sensor Board

Full test 4K60 on Xilinx platform

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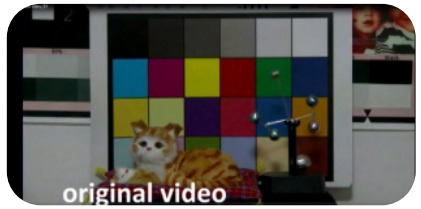
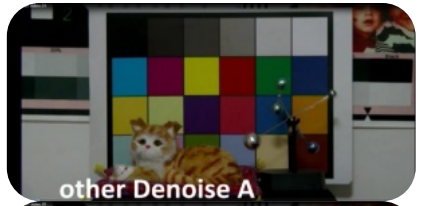
Denoise for image

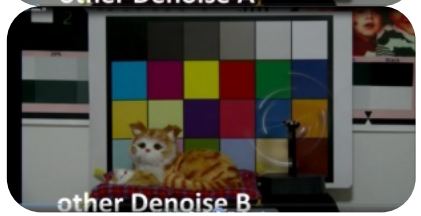
Precise motion& background area separation

Original video

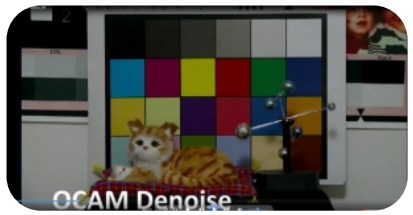


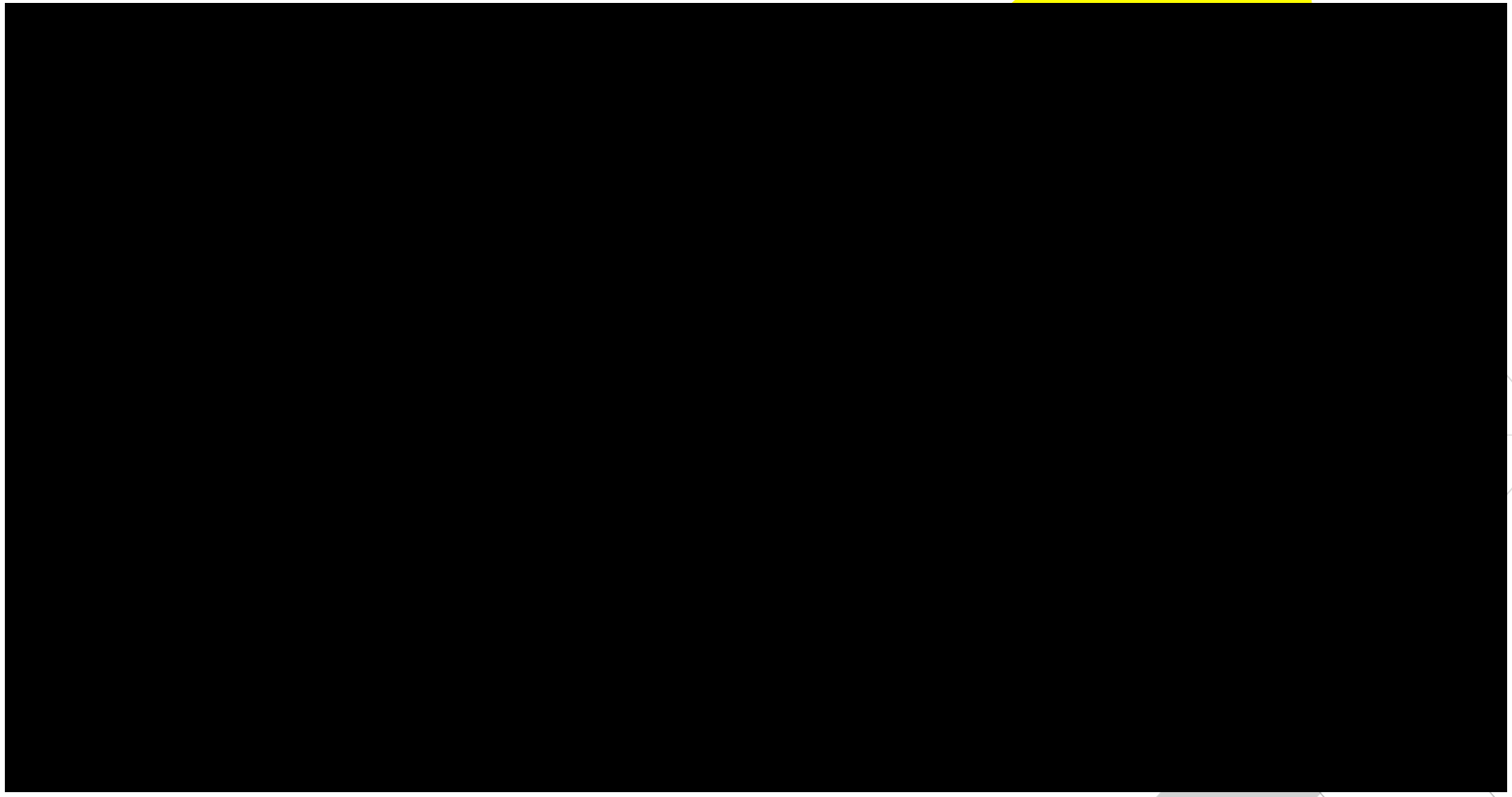
Other Denoise





OCAM Denoise





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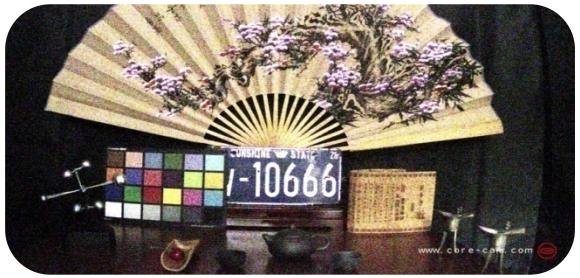
Ultra low illumination for image

- super-3D denoise技术
- 超低照度下的精准信息还原



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Ultra low illumination for image

- 路测对比、 相同的测试场景

- 右侧为海康DS-2DF8237I5W-AW； 左侧为使用OCAM ISP的IPC效果

- OCAM IP在低照度下的优秀的噪声表现、精准的色彩还原、良好的强光抑制效果

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HDR for image

- Different from WDR, physically increase the dynamic range
- The acquired HDR technology is strongly correlated with the sensor characteristics

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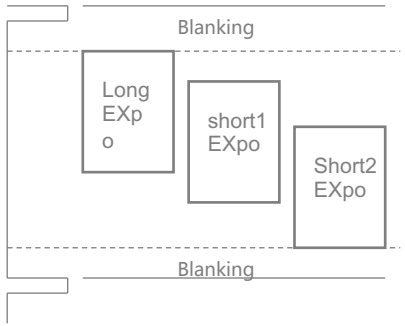
HDR characteristic sensor

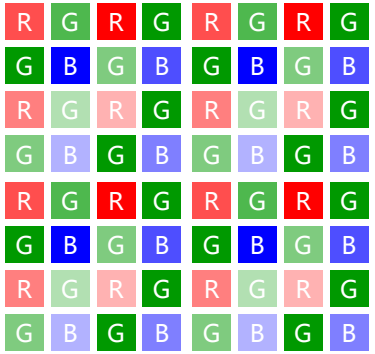
DOL



DOL - 'Quasi-simultaneous' outputs multiple frames of images with different exposure times. After receiving multiple frames of images, the ISP can perform image fusion to generate HDR images

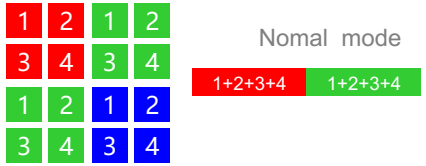
The maximum long exposure time is not wasted, and accessible ISP output frame number, and the fluency is not reduced. Second, the exposure end time difference is very short, and there is almost no defect of the motion boundary

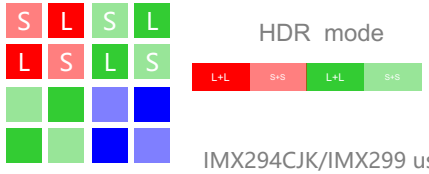
SMC



IMX214 uses this technology

QBC





IMX294CJK/IMX299 uses this technology

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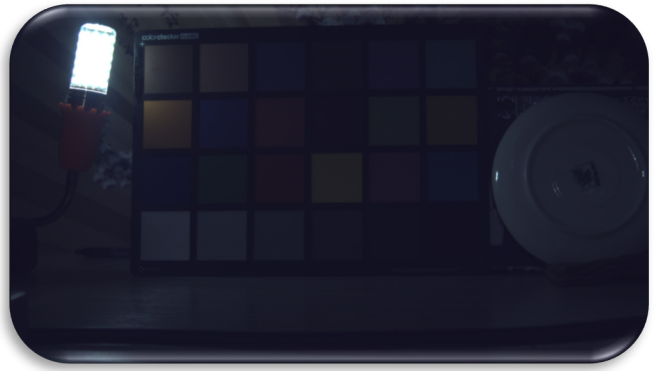
DOL HDR for image



- 曝光比高至256x【48dB】
- 精准的亮度融合、噪声抑制

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High Light Compensation for image

- Eliminate the effects of the luminance and chrominance domains

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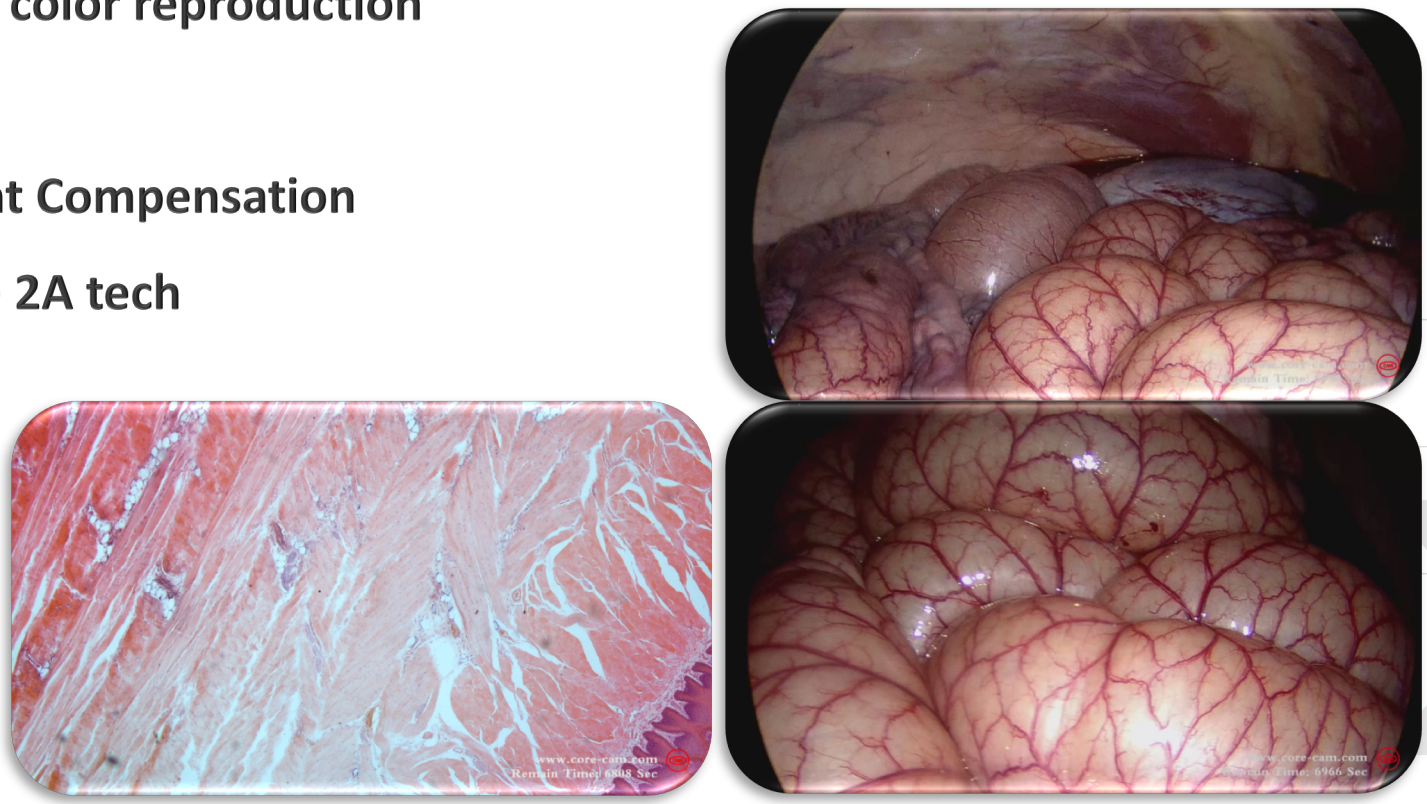
LUT for Medical image

- Accurate color reproduction
- sWDR
- High Light Compensation
- Adaptive 2A tech



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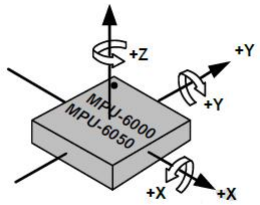
EIS for Medical image

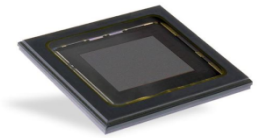


MotionData → Kalman filter

Global_MotionPath_Coarse

Global_MotionPath_Fine

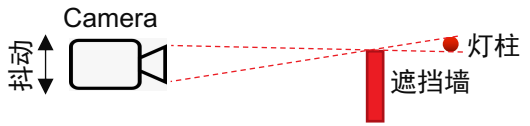
(Subpixel)



ImageData → L-K optical flow tracker → Vibration Detection → Affine Model → Image Synthesis → Stabilized Video

不能解决的问题：

透视闪烁：随着Camera抖动，“灯柱“ 在图像中时有时无



能解决的问题：

1. **悬臂Camera去抖。**
2. **手持Camera去抖。**
3. **根据运动速度选择最优的曝光时间，减轻运动模糊。**

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Flexible AE customization

Backlight

Black Background

Stability

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Adaptable AWB

Light Blue

Pink

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Stable AF

Tracking

Focus stable

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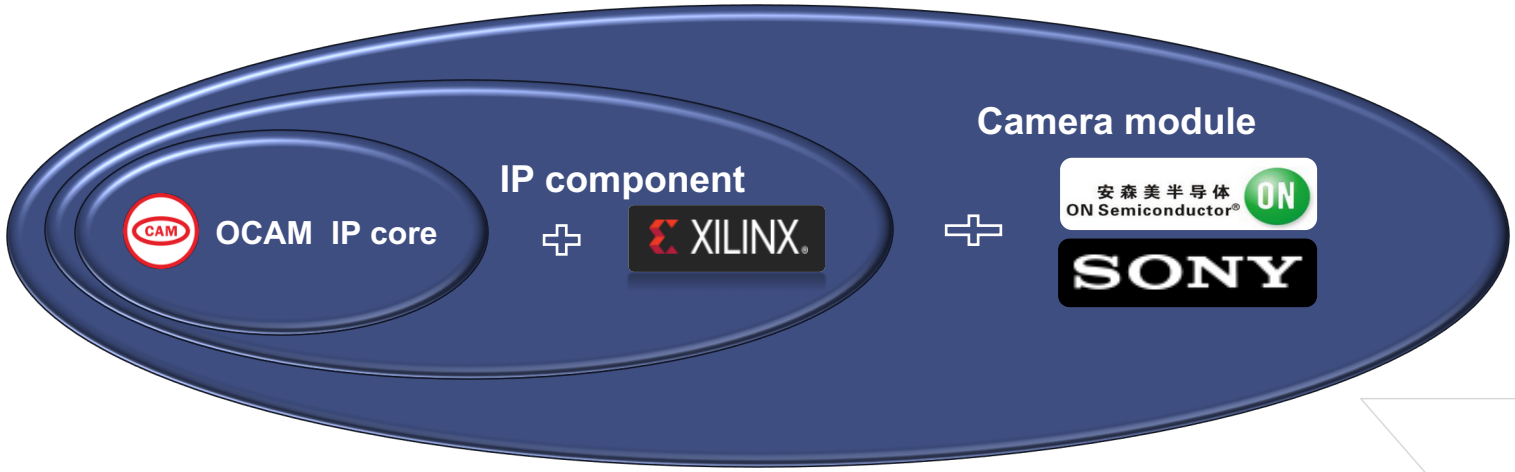
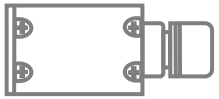
OCAM's next Step Based on XILINX





Industrial and machine vision

Medical camera

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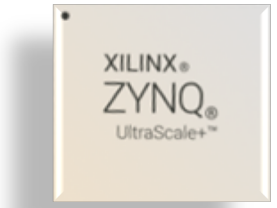
OCAM's next Step Based on XILINX



MPSOC

Cortex-A53

Video Codec
4K * 2K
H.264/265

GPU
Mali-400 MP2

OCAM ISP x
OCAM mAI
OCAM codec x

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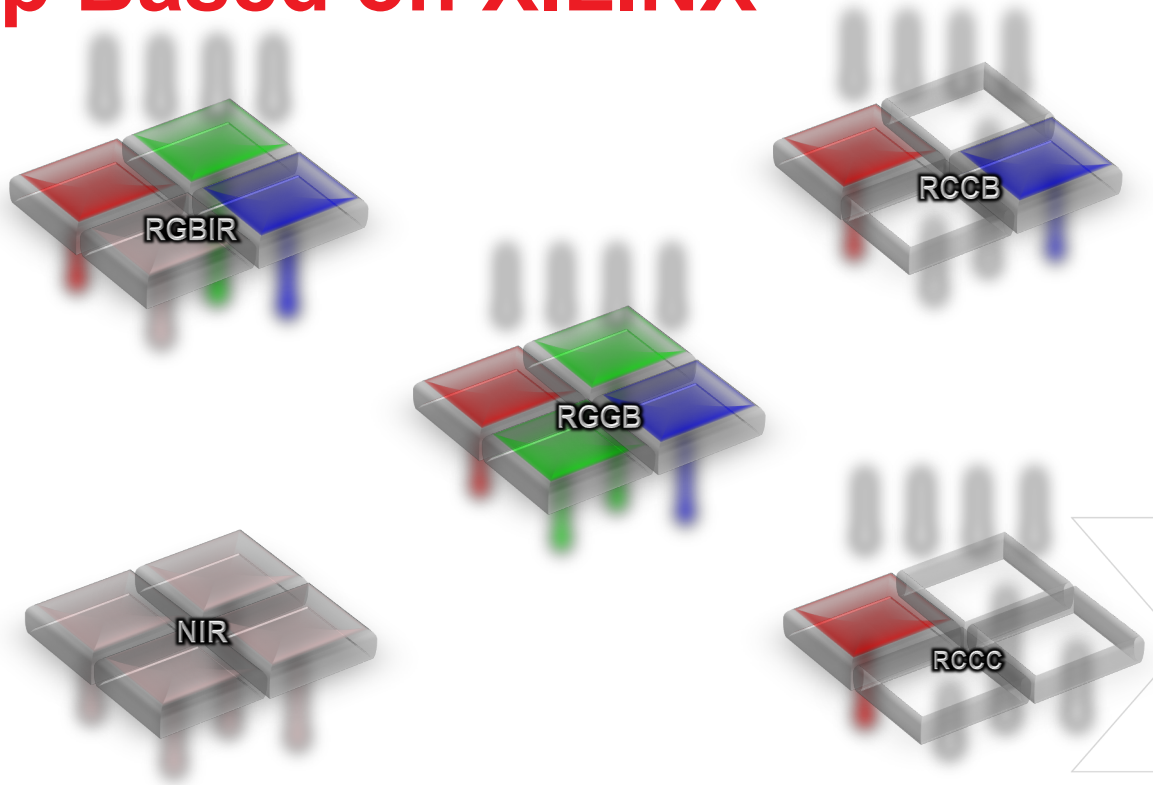
OCAM's next Step Based on XILINX

OCAM ISP x
OCAM mAI
OCAM codec x



- clear vision
- more light throughput than RGGB
- more than eye

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OCAM's next Step Based on XILINX

Video Cross-linking

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OCAM & Others

	Other ISP IP Company	Other ISP of ASIC	OCAM
SoftCore operating mode	On-chip RAM, Restricted by space, Cause strategy is simple.	/	Off-chip RAM, 3A & image share the DDR, Rich strategy.
Auto Exposure	Monitor global brightness, Sensitive to changes in the scene, Especially in Overexposed scene .	Various types of data statistics module is simple, AE effect is not good	Monitor area & global brightness, High adaptive . Excellent data statistics module, AE effect is good.
Auto Wbalance	Large area monochrome scene: bad color reduction	Various types of data statistics module is simple, AWB effect is not good	Large area monochrome scene: Accurate color recovery Excellent data statistics module, AWB effect is good.
Auto Denoise & ISP	Simple bayer & enhancement algorithm :Loss of sharpness and fine texture, Removal of large particles noise effect is poor	Unable to customize	Excellent edge retention ; Adapt to all kinds of scenes , such as Mutl-Cam、video mosaic、Special resolution.
Other	Nomal Color gamut reduction module. Suitable sensor species less.	AF tuning cycle is longer. Interface type less	3-D Color gamut reduction. Rich interface adapter for all types of sensor; Short development cycle. Rich interface adapter.

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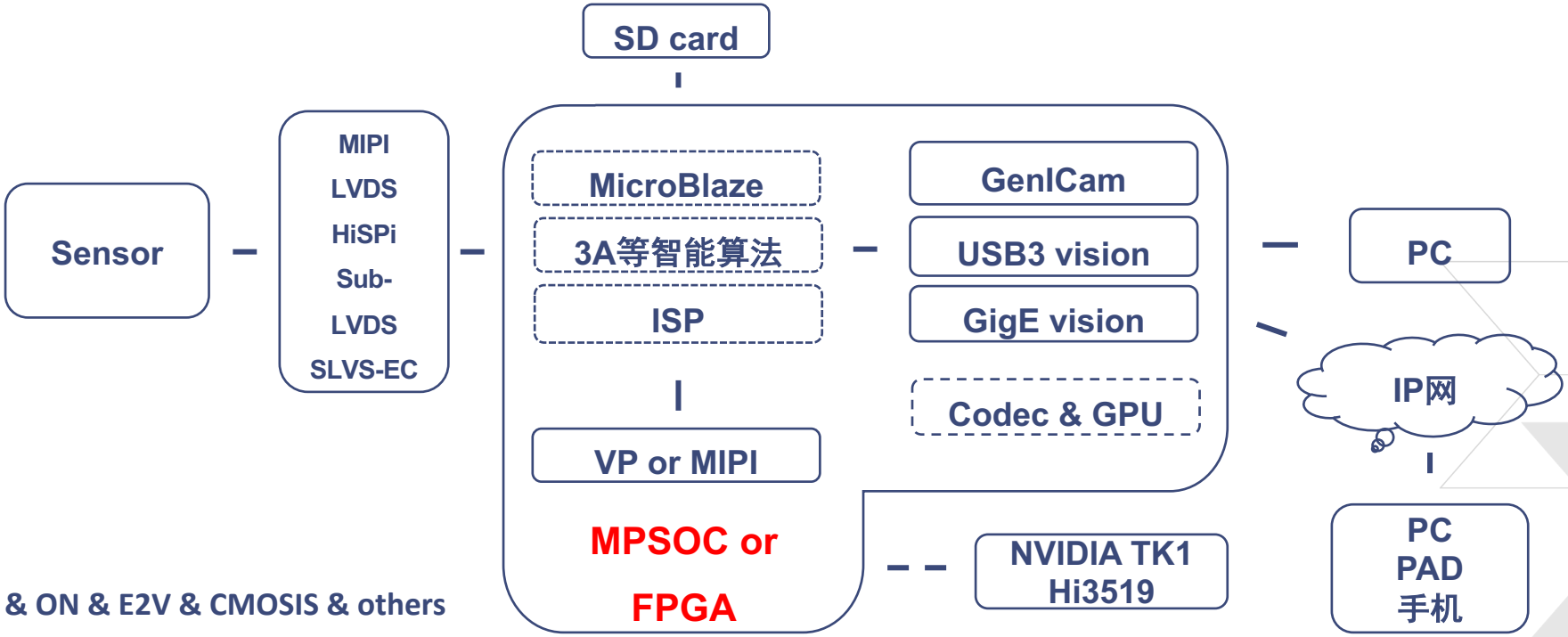
OCAM IP for Industry & Medical



- Sony & ON & E2V & CMOSIS & others
- VGA & 2M & 8M * 25M & 47.5M & 65M & others
- MIPI & LVDS & HiSPi & sub-LVDS & SLVS-EC & others

AI & MV tool 客户自有

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OCAM IP Resource

CAM spec	Latency < 0.5 frame				
	LUT【K】	RAM【M36K】	DSP48	Memory flow	Memory capacity
1080P60	40.8	119.5	94	6Gbps	24MB
Microblaze	9.1	14	3	1Gbps	16MB
MIG	17	27.5	0	0	0
ISP	12.8	75.5	91	5Gbsp	8MB
HDMI1.4 TX	1	2	0	0	0

CAM spec	Latency < 0.5 frame				
	LUT【K】	RAM【M36K】	DSP48	Memory flow	Memory capacity
2160P60	52.2	185.5	173	21Gbps	48MB
Microblaze	9.1	14	3	1Gbps	16MB
MIG	17	27.5	0	0	0
ISP	22.6	139	170	20Gbsp	32MB
HDMI2.0 TX	2	4	0	0	0

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OCAM IP core list

IP module	remarks
MIPI/CSI	MIPI IN & OUT
HiSPi	Commonly used ON/Aptina sensor
LVDS/sub LVDS	Commonly used SONY/CMOSIS/ON sensor
SLVS-EC	Commonly used SONY sensor
3G/6G/12G-SDI	SDI Video OUT
HDMI1.4/2.0	HDMI Video OUT
USB3.0 【USB vision】	UVC & USB vision
GigE vision	GigE vision
OSD	/
Bayer-L	Normal Bayer Conversion
Bayer-H	Super Bayer Conversion for edge and color
OCAM Edge-Enhance	Clear vision & 2D Denoise
OCAM 3D-L	3D-Denoise,for Normal illumination
OCAM 3D-H	3D-Denoise,for Low illumination
OCAM D-gain	/

IP module	remarks
OCAM WDR	Matching with Low illumination
OCAM HDR	large illumination difference
OCAM Pre-filter	for Low illumination
OCAM E-ptz-L	Limited - range
OCAM E-ptz-H	Full - range
OCAM Gamma	/
OCAM Color-Matrix	/
OCAM Exposure	/
OCAMW-balance	/
OCAM-Focus	/
OCAM-Guide	/
OCAM-Sync	/
OCAM-ULI	Ultra low illumination camera
OCAM-HLC	Highlight Compensation

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Adaptable.
Intelligent.

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