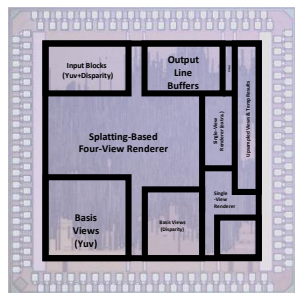


Vision Circuits and Systems Lab (黃朝宗)

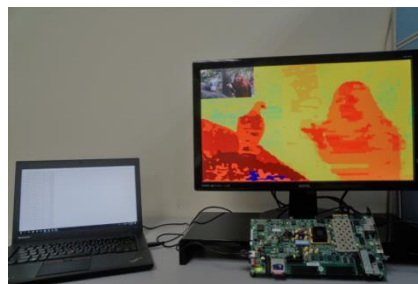
Real-Time and Power-Efficient IC

- Multi-Camera Signal Processing
- Convolutional Network Accelerator

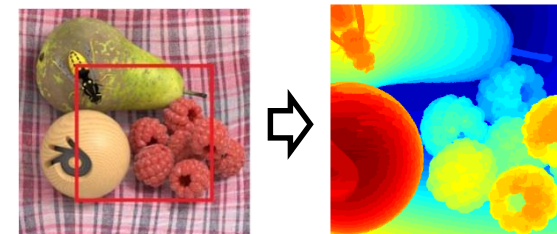
High-Quality Algorithm, Real-World Prototype



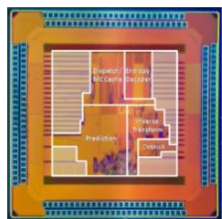
Realistic Refocusing Processor [Symp. VLSI'19]



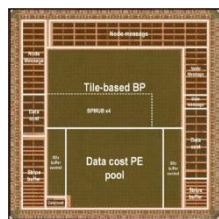
Depth Estimation Processor [ASSCC'18]



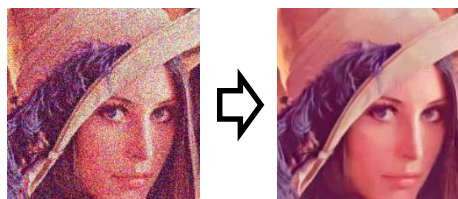
Depth Estimation Algorithm [ICCV'17 (oral); TPAMI'19]



H.265 Decoder [ISSCC'13]



Depth Estimation Processor [ISSCC'15]



Bayesian Denoising [CVPR'15; TIP'16]

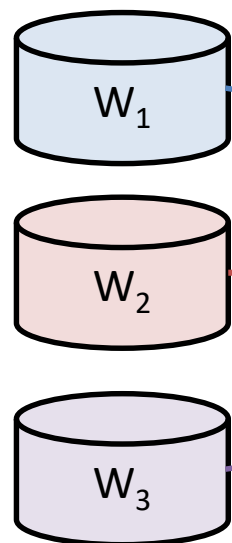


TLFR 357.6 s Proposed refocusing 1.6 s
Fast Realistic Refocusing [TIP'17]

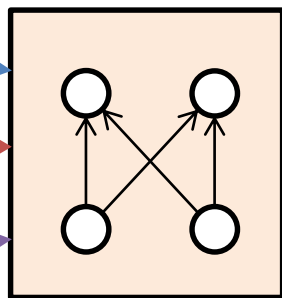
研究特色：高效能影像處理CNN加速器



Trained weights



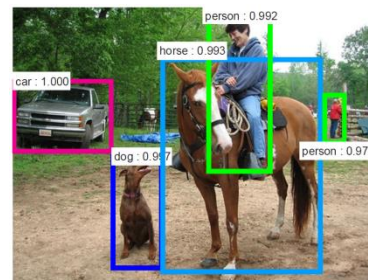
CNN Processor



影像去噪



影像
四倍超解析



物體偵測

同一份硬體只要更新參數即能
獲得不同高品質影像應用！

與一般研究針對的小圖片物體辨識應用(如ImageNet 224x224小圖片之一千種物體辨識)相比之下，擁有更立即與明顯的商業價值，且有三項主要差別：

1. 為fully convolutional neural network，需處理高畫質影像，常見之硬體實作不支援；
2. 需針對每像素給出regression輸出，常見之CNN壓縮方法將失效；
3. 比辨識用網路複雜，能向下支援辨識應用；反之，辨識用之CNN無法支援影像應用。

目前成果

高效能、
高品質、
高彈性之
CNN處理器



Super-Resolution (×4)

- SRResNet-level
- >VDSR by 0.57 dB
- Full HD 30fps



Image Denoising

- FFDNet-level
- > BM3D by 0.39 dB
- Full HD 30fps



Style Transfer

- Novel application
- Sketch, mosaic, ..
- Full HD 23fps

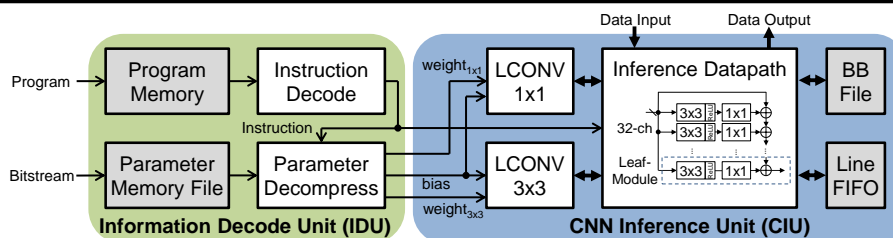


1000-object
classification
(ImageNet)

Object Recognition

- ResNet-18-level
- Top-1 accuracy 69.7%
- 1344 object/s

技術包含：
CNN網路最佳化、
處理器架構最佳化、
處理器硬體實現
(RTL→Layout)



eCNN Processor

| | |
|-------------|-----------------------|
| Technology | TSMC 40 nm |
| Frequency | 250 MHz |
| Performance | 41 TOPS |
| MAC Number | 81,920 |
| Power | 6.94W @ 0.9V |
| Precision | 8-bit |
| DRAM config | DDR-400 (<1.7GB/s) |