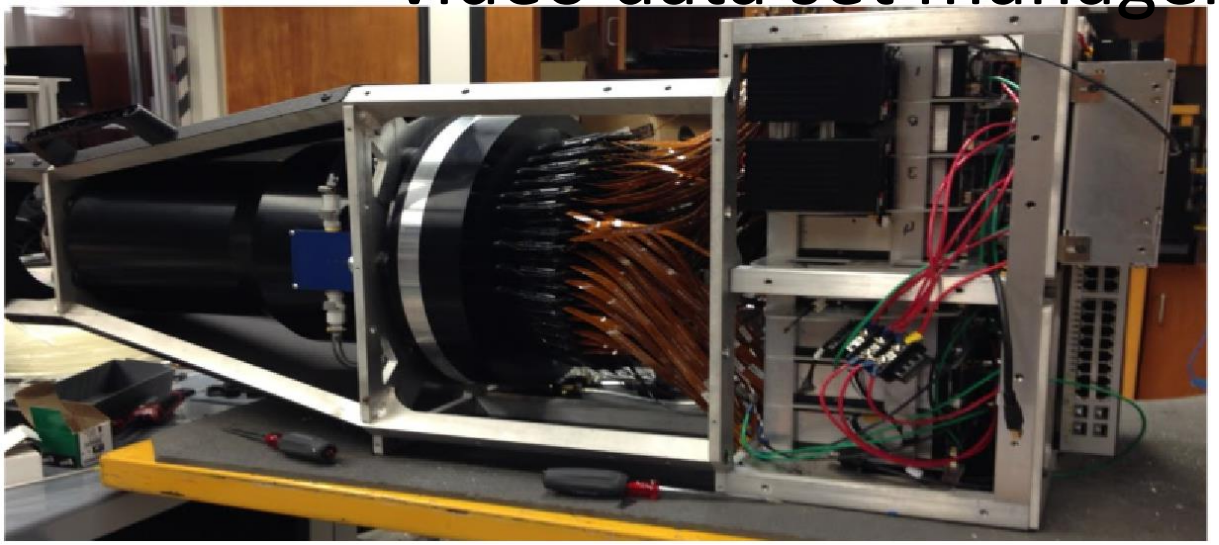
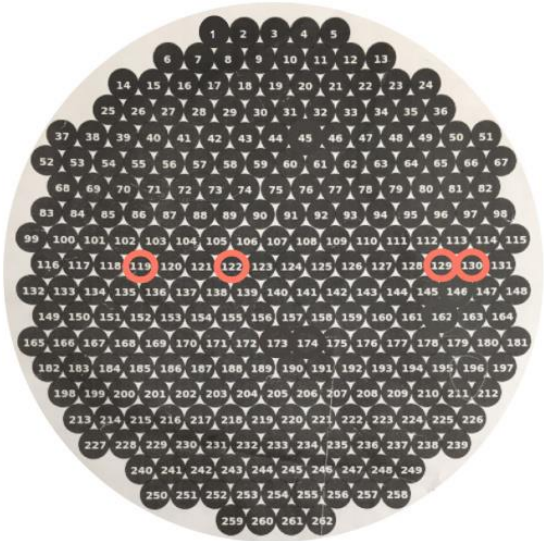
A Visual Cortex for Array CamerasVfor Imaging

Electronic Imaging 2024

David Brady and the Arizona Camera Lab
djbrady@arizona.edu

The Arizona Camera Lab is Experienced in large video data set management.





262 12 megapixel sensors
3.1 gigapixels sensed
37 GB/s sensor bandwidth

Microcamera array

Patrick Llull, Lauren Bange, Zachary Phillips, Kyle Davis, Daniel L. Marks, David J. Brady, "Characterization of the AWARE 40 wide-field-of-view visible imager," Optica **2,** 1086-1089 (2015);
https://www.osapublishing.org/optica/abstract.cfm?uri=optica-2-12-1086

Data rendering

Camera Head with Raw Video Data Output

+

Computer Server Cluster For Storage, Processing, and Video Output

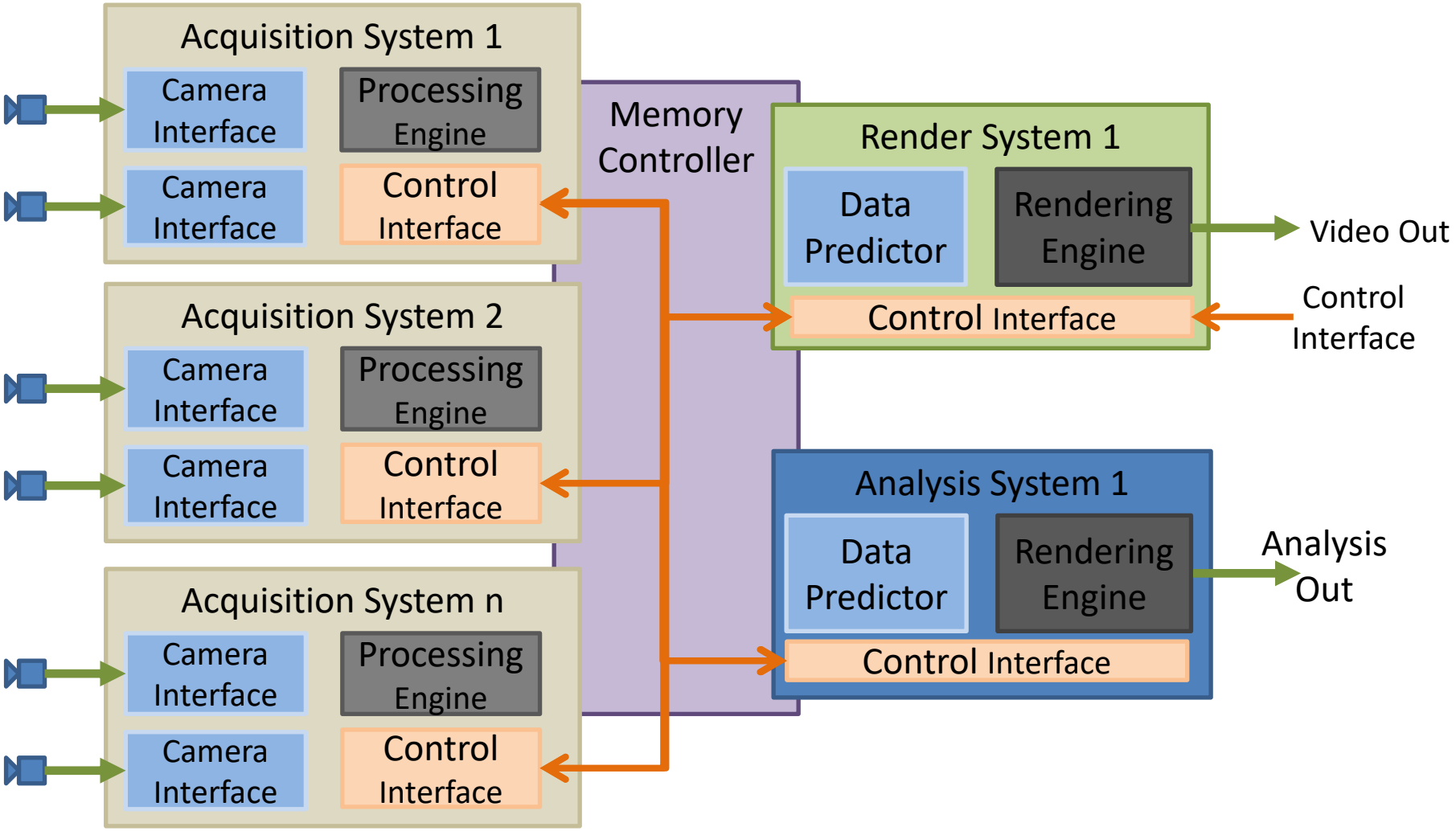
Operational power
~10 KW/ gigapixel

~10 microJ/pixel
>90% of power in renderint

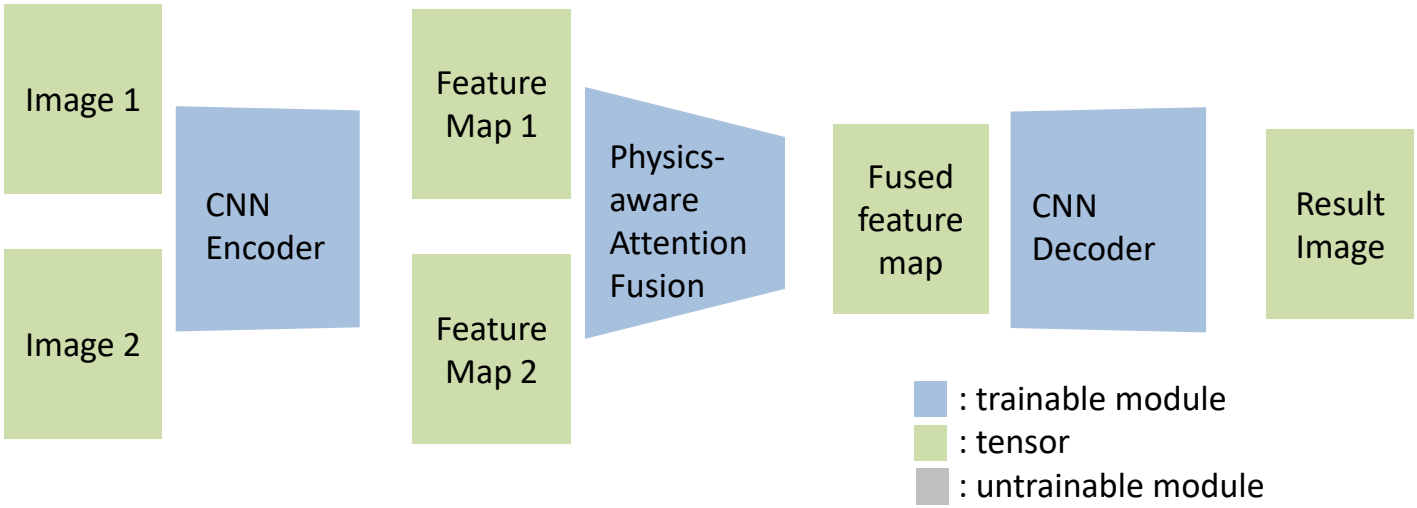
Capture <1 microJ/pixel

No compression/decompression
direct rendering

Camputer Architecture



architecture for parallel video data analysis

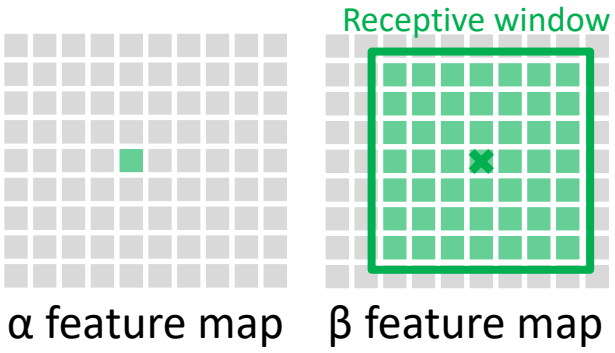


•Minghao Hu, Zongliang Wu, Qian Huang, Xin Yuan, David Brady.

Sampling for Snapshot Compressive Imaging. *Intell Comput.* 2023;2:0038.DOI:10.34133/icomputing.0038

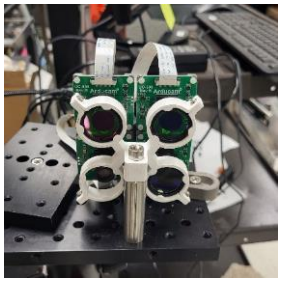
Windowed Attention Image Fusion

- 4x spatial downscale/upscale introduced to encoder/decoder
- Semi-synthetic training dataset:
  combine real captured data and simulated sampling process

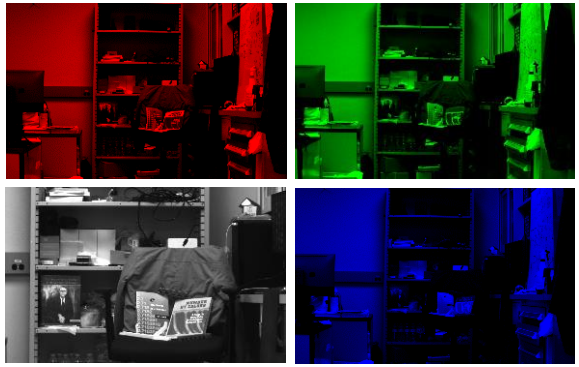


PAT: RGBW four-camera system

- R + G + B + W. Different focal length, different exposure time.
- Calibrated, epipolar receptive field
- Exposure separately controlled



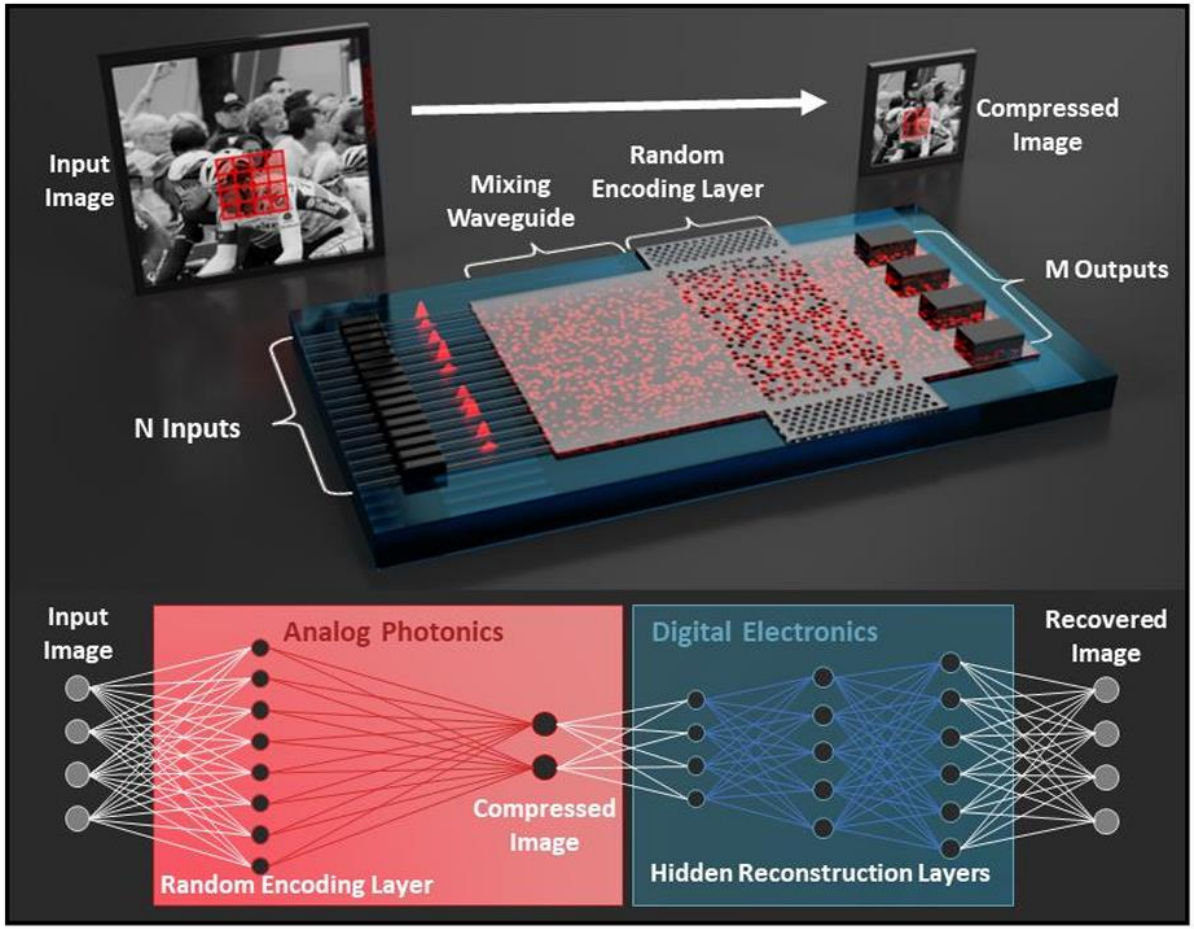
Array camera



RGBW measurements

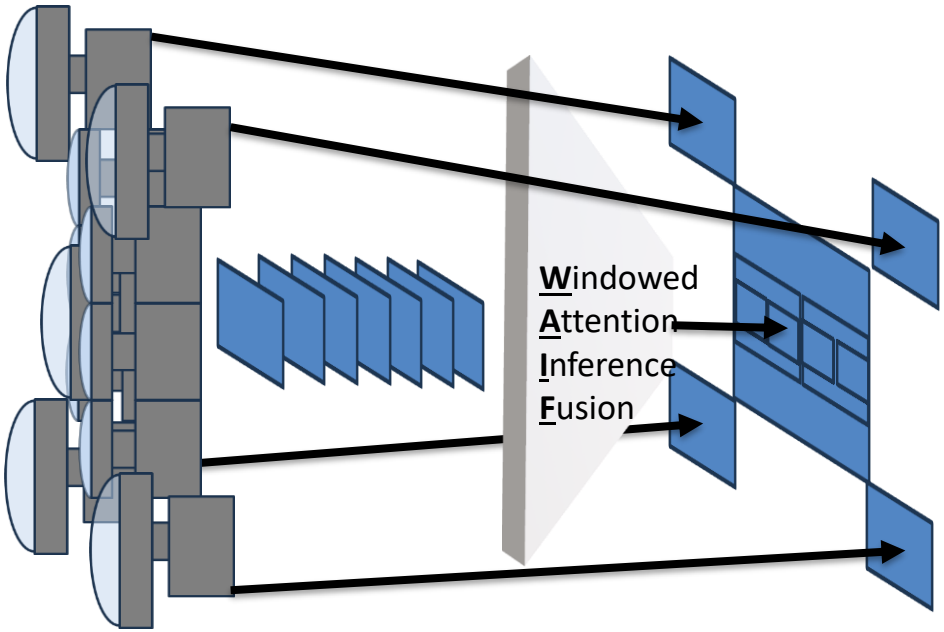
WAIF fusion result

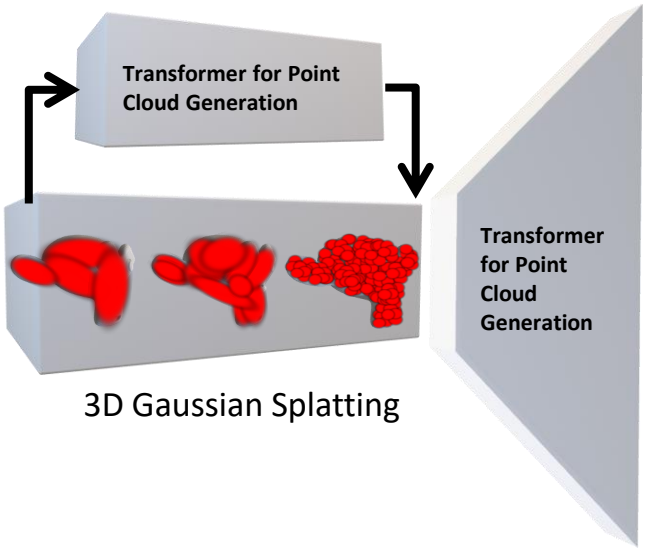
Photonic Encoding



Wang, Xiao, Brandon Redding, Nicholas Karl, Christopher Long, Zheyuan Zhu, Shuo Pang, David Brady, and Raktim Sarma. "Integrated Photonic Encoder for Terapixel Image Processing." *arXiv preprint arXiv:2306.04554* (2023).

Video Stream integration





Arizona Camera Lab