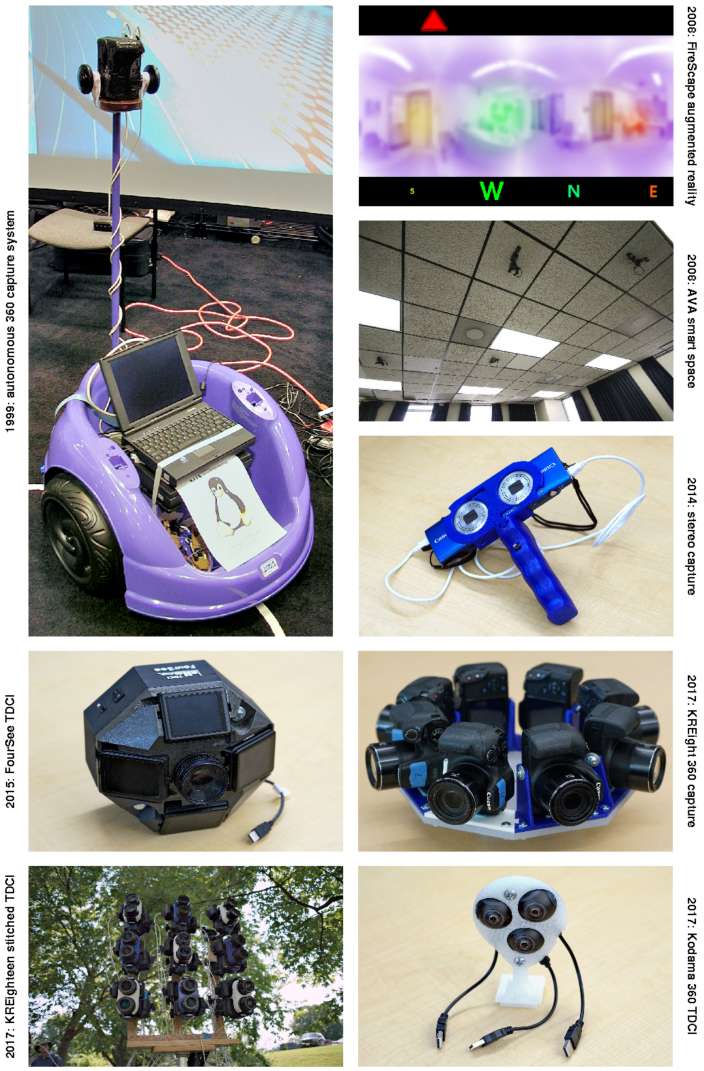
Cameras As Computing Systems



Cameras are computers. Camera arrays are parallel computers... even a single camera contains a multi-core processor and specialized hardware to speed-up operations like JPEG compression and correction of various lens defects. We regularly reprogram both groups of cameras and individual cameras to do unusual things, especially Canon PowerShots using CHDK (Canon Hack Development Kit).

At Electronic Imaging 2018, we'll be talking about the lessons we've learned from building a wide variety of multi-cameras between 1999 and 2017. If you were at SC99, you might remember the one in the upper left, which displayed live on a Linux-cluster video wall in our research exhibit.

For us, **computational photography** isn't just about image processing after an image has been captured – it's about making all aspects of the camera system work better together, from improving how the camera is controlled to capture images to making the in-camera processing of image data more effective.

Postprocessing of images is part of this too... but we're still thinking about the camera. For example, at EI2017, we published ***Refining raw pixel values using a value error model to drive texture synthesis***, which was all about post-capture processing of raw images – to literally improve the raw data itself. That improves *all* renderings, as you can see in the before(left)/after(right) comparison above. The full paper is freely available at: **`https://doi.org/10.2352/ISSN.2470-1173.2017.13.IPAS-084`**

Even for that work, one of our goals is to embed the algorithms in the camera – and we would love to be working with camera makers as well as camera users. Our cameras as computers work has included single-shot anaglyph capture and processing as an alternative to plenoptics, characterization of and algorithms processing OOF PSF (Out-Of-Focus Point Spread Function), ISO-less exposure control, GP (Genetic Programming) to create image filters, repair of Fuji "white orbs" and Sony ARW compression artifacts, and a large body of work establishing TDCI (Time Domain Continuous Imaging) frameless imaging.

Want To Know More? We have been publishing most of our work in this area at IS&T Electronic Imaging, and you'll find many of our papers there. However, **`http://aggregate.org/`** is our primary WWW site, and you'll see lots more there and under **`http://aggregate.org/DIT/`**

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