whISPPer: Enhancing MemPool to make an Open and General-Purpose Image Signal Processor

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The challenge
- Computer vision
- Augmented reality
- Computational photography
- …and many more

Image Signal Processors (ISPs)
- Highly parallel architectures
- Domain-specific instructions
- Domain-specific processing models
- Closed source

The playground: MemPool & Snitch
- Highly parallel (256 rv32ima Snitch cores)
- Efficiently solves L1 cache sharing
- General-purpose
- High bare-metal programmability
- Open-source

Snitch ISA DSP extension & whISPPer accelerator
Selected instructions for image processing; implementation optimized for area/performance, targeting massive replication in MemPool

Extended load/store addressing modes
- Post-increment load/store instructions with register offset

whISPPer makes MemPool up to 4.6x faster and 3.8x more energy efficient

Results

CONTRIBUTIONS
1. Snitch DSP ISA extension: whISPPer accelerator for efficient image processing in MemPool
2. Open-source framework for Snitch ISA extensions development and support
3. Closing the gap; parallel, general-purpose, open-source, time- and power-efficient image processing