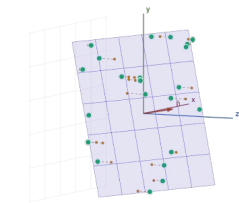


EventShiftFlow

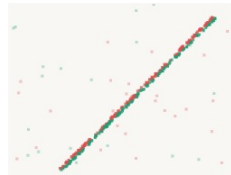
Low power event-camera motion estimation using <2kB of memory.

How can we estimate flow on size-, weight- and power-constrained platforms?

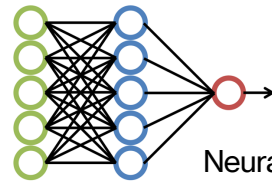
Typical methods involve...



Plane-fitting



Contrast maximization



Neural networks



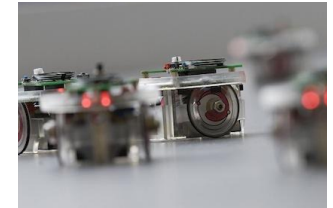
Resource intensive

We target resource-constrained platforms



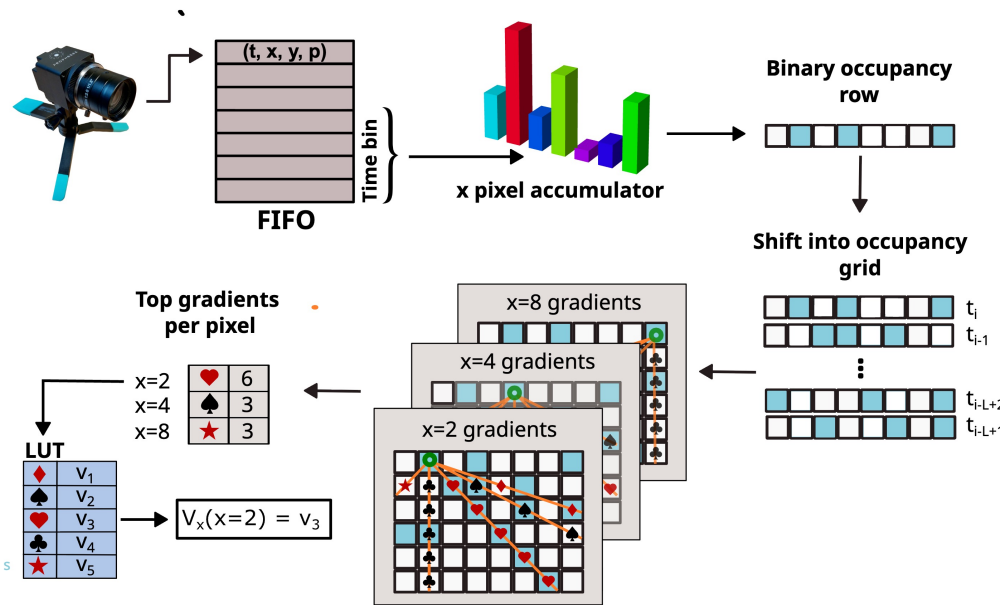
Microdrones

Swarms



Always-on motion-triggered perception

Bitvector-based approach to capture diagonal spacetime traces



Implemented on FPGA



Xilinx Artix-7

Parallelism, Low Latency, Low Power, Deterministic execution, ASIC Pathway.

Resource Estimates

Estimates for a **240 x 180 pixel** sensor with the EventShiftFlow pipeline:

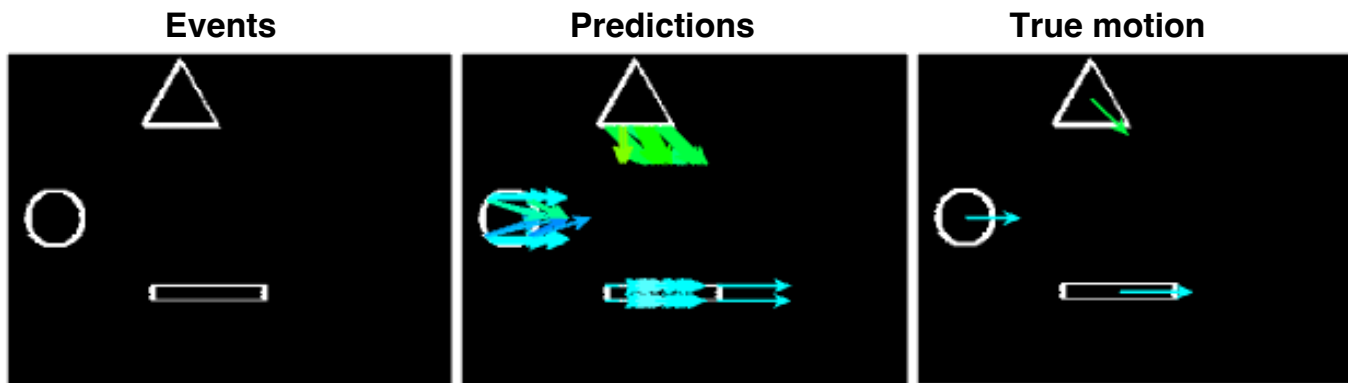
Scales linearly with width

Component	Bits or Units	Notes
Occupancy grid	3,840 bits	$240 \times 16 \times 1$ -bit FFs
Event counters	1,920 bits	240×8 -bit counters
Score accumulators	155 bits	31×5 -bit (per lane)
Step counters	124 bits	31×4 -bit (per lane)
Comparator tree	5 stages	$\lceil \log_2(31) \rceil$
Total (x axis)	~6,100 bits	< 1 kB
Total (both axes)	~13,000 bits	< 2 kB

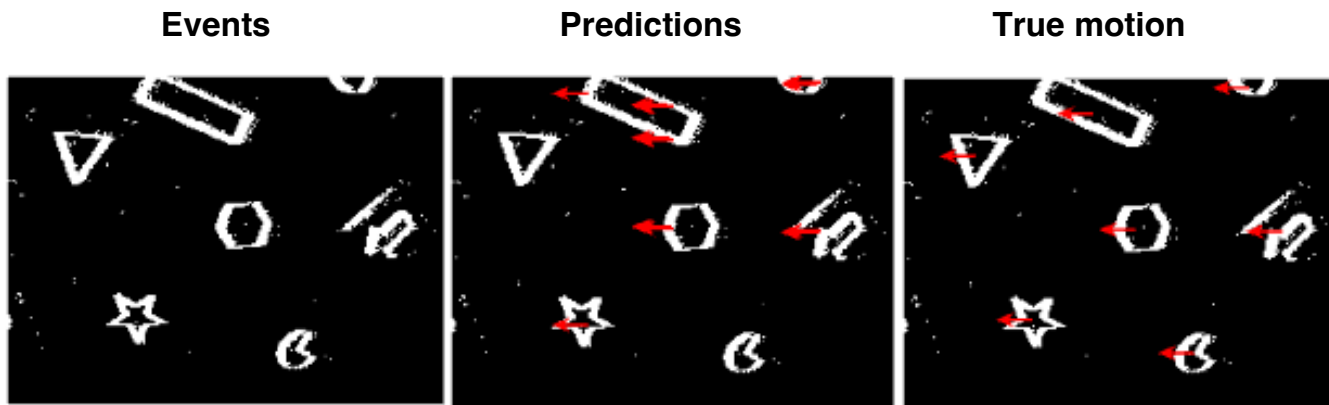
For a **346 x 260** pixel sensor, EventShiftFlow both axes: 15.3kbits = <2kB and 0 DSP units.

Comparison: EDFLOW uses 390 BRAMs (855kB) and 669 DSP units.

Simulation Results – synthetic data

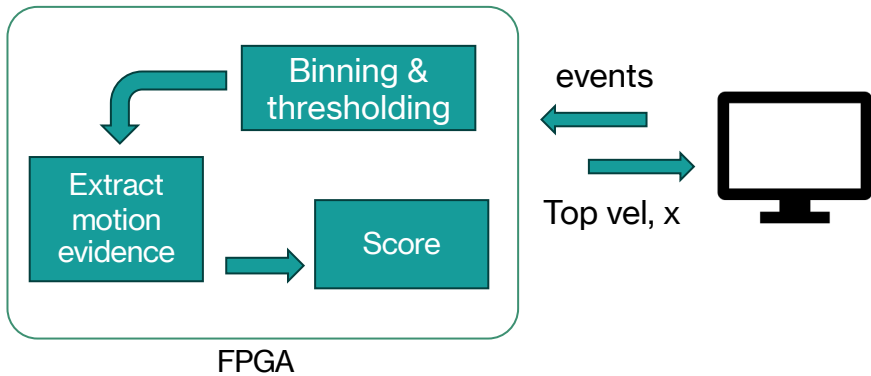


Simulation Results – real data

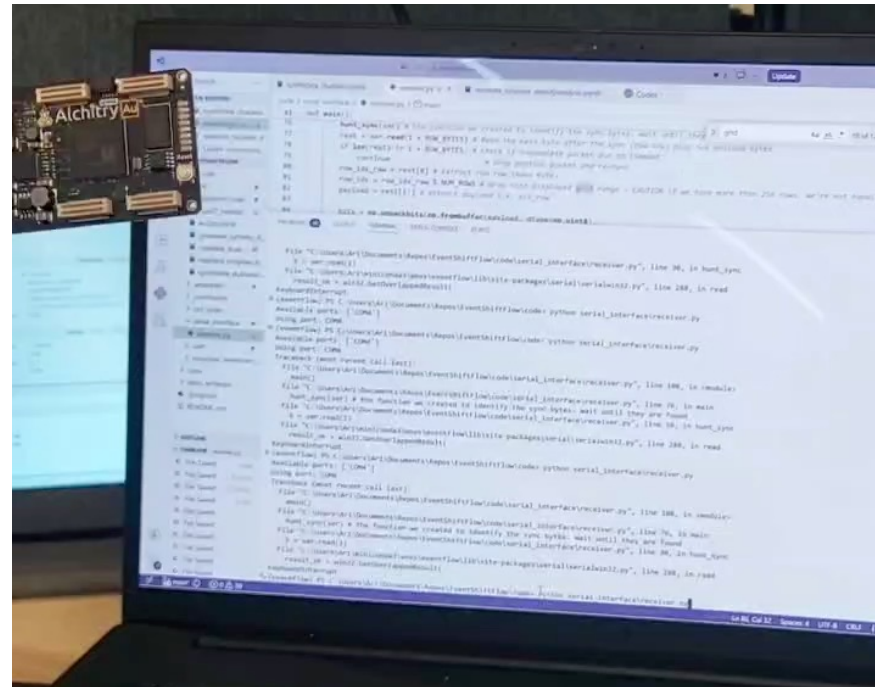


Dataset: Mueggler et al. (2017)

Current FPGA Prototype – single axis



Clock	100MHz
Slice LUTs	13,326
Slice Registers	5,517
Block RAM	0
DSP Blocks	0
Total on-chip Power	0.142 W



Next: full, adaptive 2-axis system on live events

EventShiftFlow

Towards lightweight motion perception for resource-constrained robots.

Thank you.