Using S40 to build mobile robot vision

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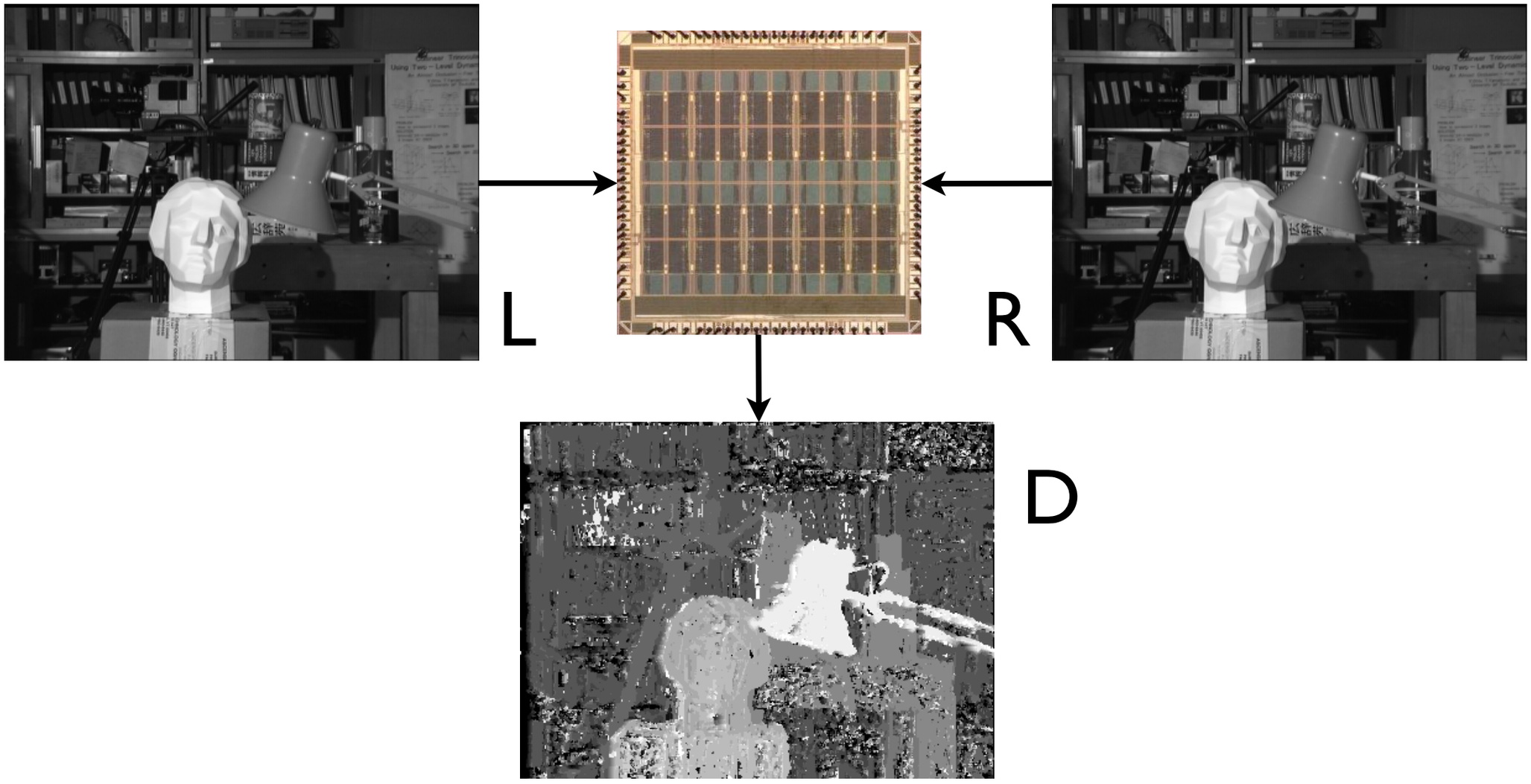
The Goal is

To make machine visual depth perception, using two images captured from slightly different viewpoints as an input.



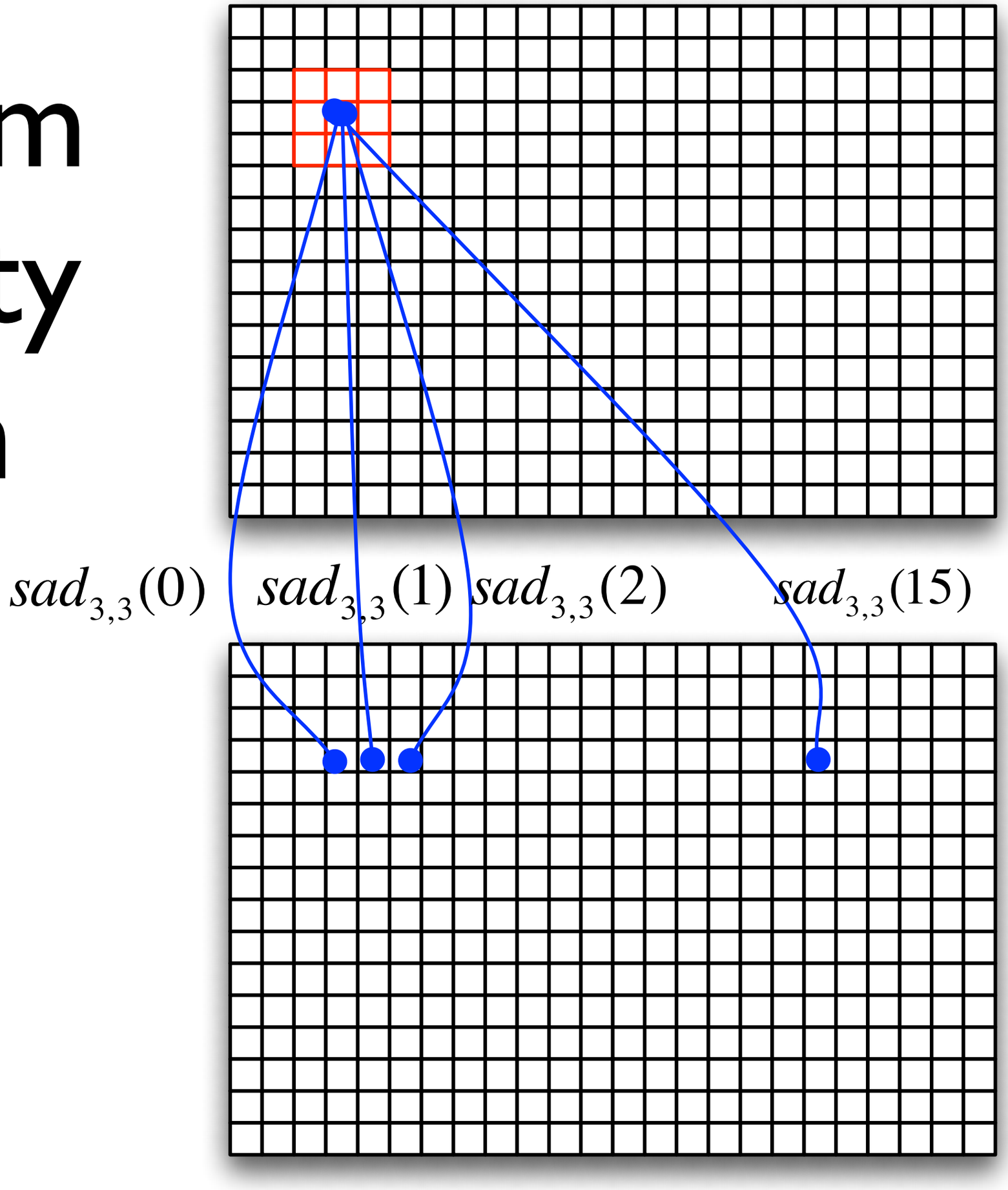
The Algorithm is

Minimum disparity search, using SAD (Summ of Absolute Differences) as similarity measure

$$sad_{x,y}(k) = \sum_{i=x-\frac{w-1}{2}}^{x+\frac{w-1}{2}} \sum_{j=y-\frac{w-1}{2}}^{y+\frac{w-1}{2}} \left| l_{i,j} - r_{i+k,j} \right|$$

$$d_{x,y} := \{n \mid \forall k : sad_{x,y}(n) \leq sad_{x,y}(k)\}$$

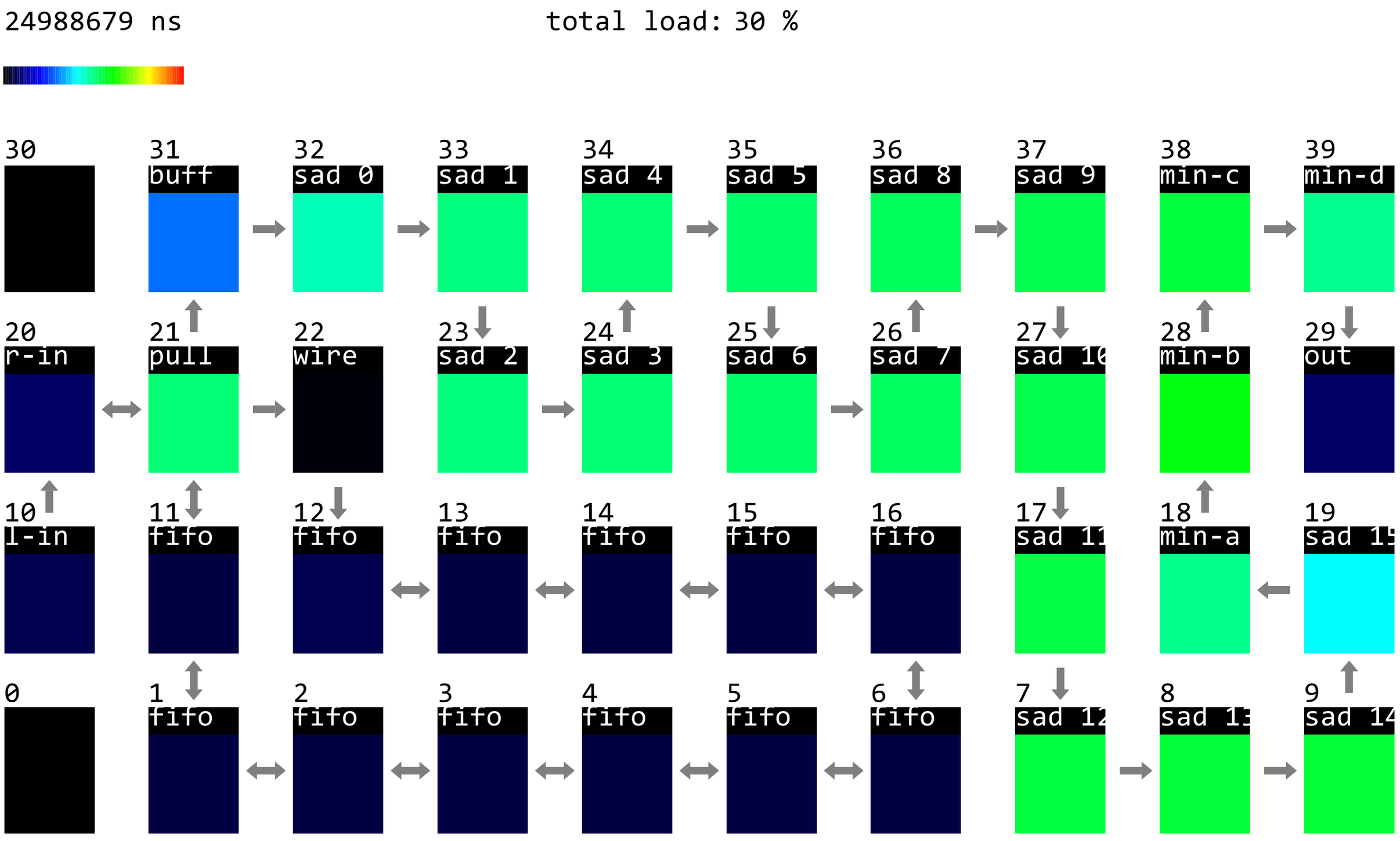
Minimum Disparity Search



Required modules:

- Input driver
- Output driver
- Storage for 2x2 input pixel lines (FIFOs)
- 16 SAD calculators
- ARG MIN module

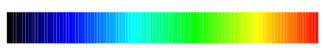
Application Map

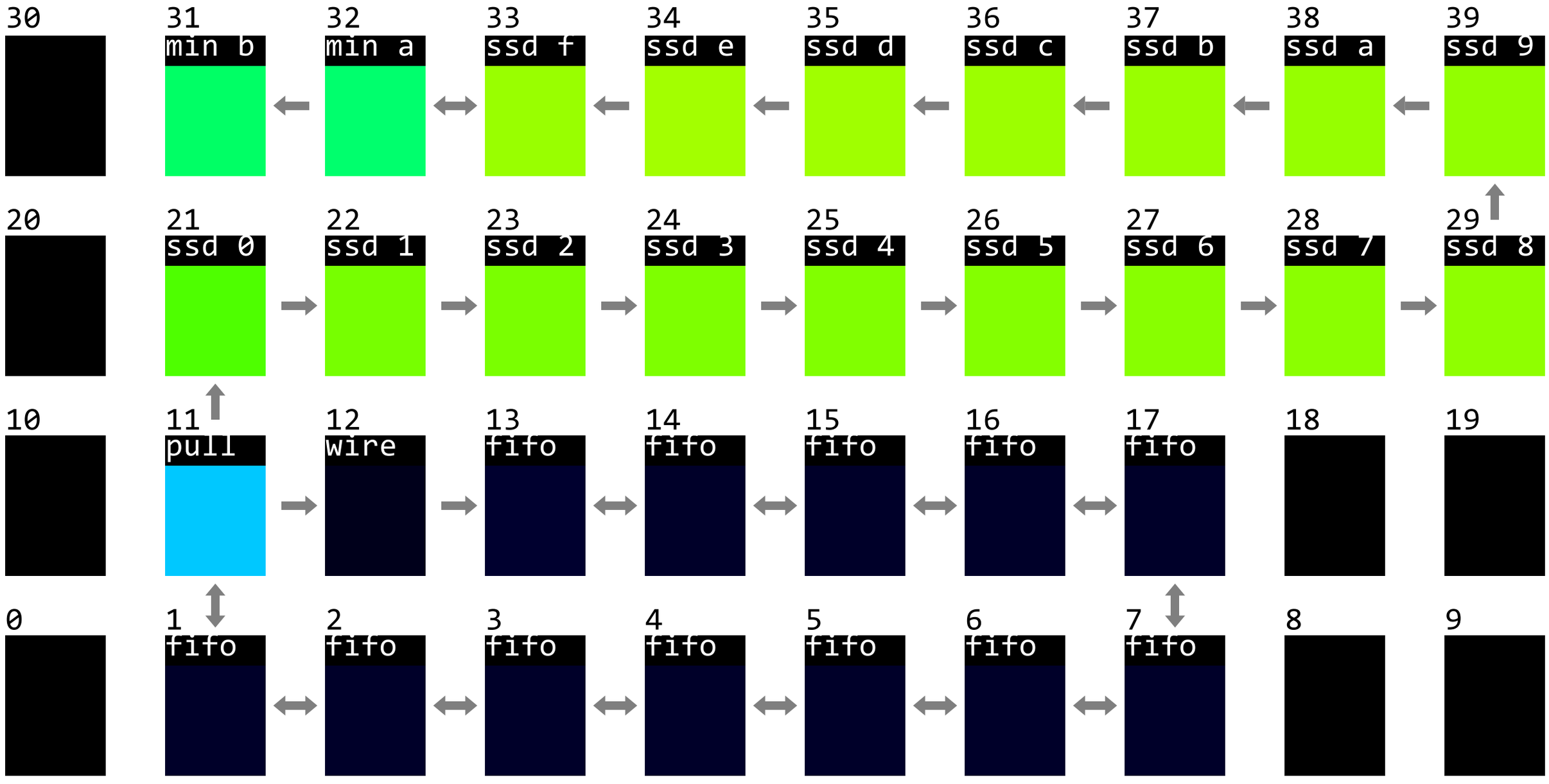


SSD Map

41140283 ns

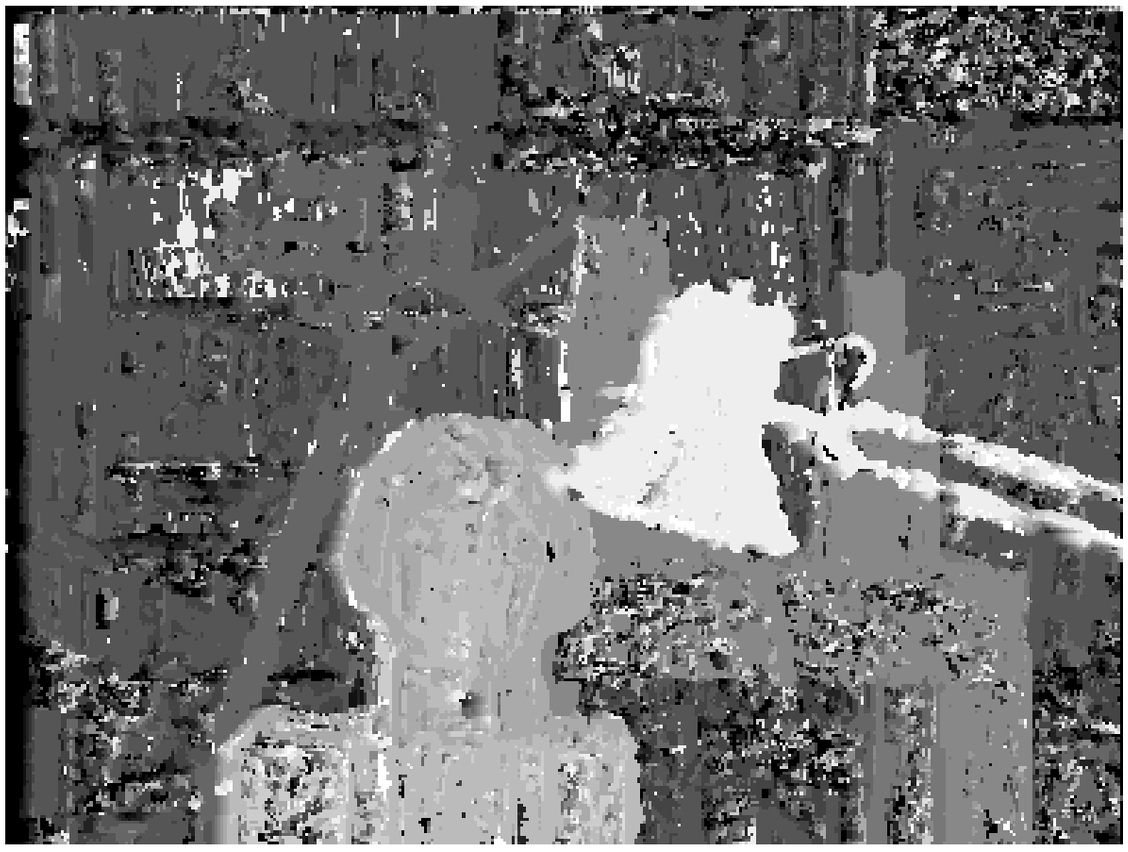
total load: 32 %



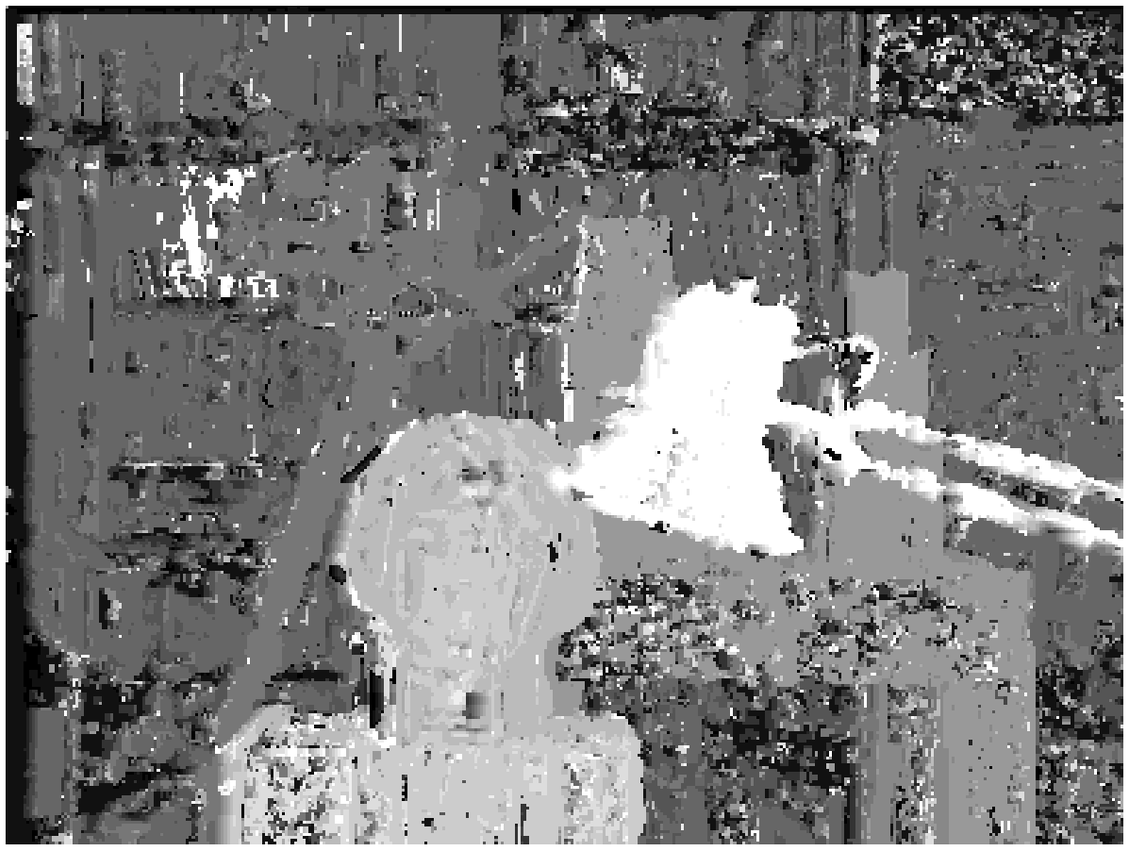


SAD vs SSD

SAD



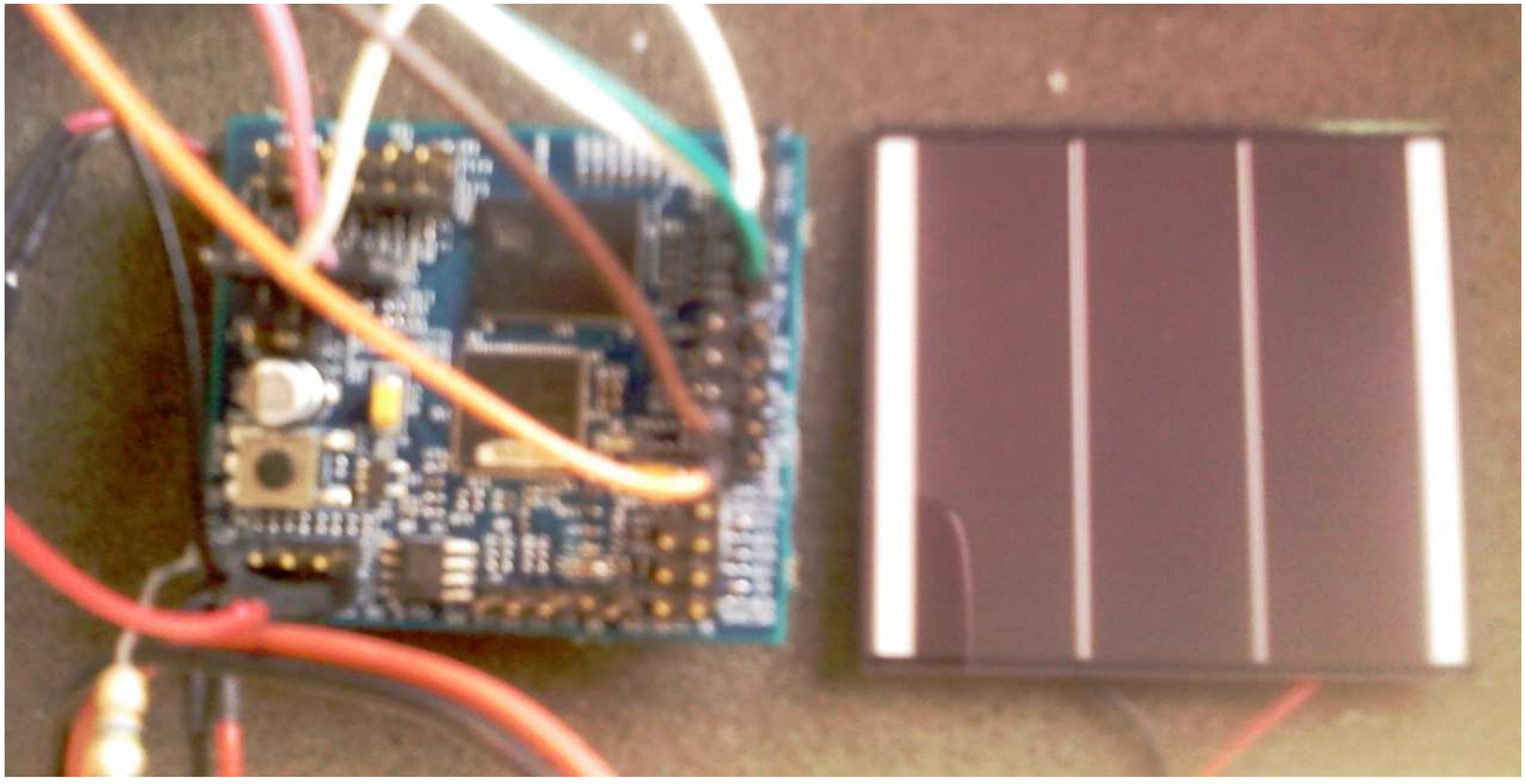
SSD



Comparison

Algorithm	Platform	Size	FPS	Power (Watt)	Efficiency (Pix/J)
SSD	CSX 700	640x480	160	9	5.4 e6
SSD	S40	384x288	15	0.080	20.7 e6
SAD	S40	384x288	25	0.075	36.9 e6

Prototype board and Sanyo AM-5308 Amorphous Solar Cell (117mW with Vop=1.9V and Iop=61.5mA)



Intelligent Vehicles