Autonomy in Spatial Computing

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Networked devices are filling our environment...
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How do we program aggregates robustly?
Amorphous Medium

- Continuous space & time
- Infinite number of devices
- See neighbors' past state

Approximate with:
- Discrete network of devices
- Signals transmit state
Why use continuous space?

- Simplicity
- Scaling & Portability
- Robustness

2000 devices

150 devices
(def gradient (src) ...)
(def distance (src dst) ...)
(def dilate (src n)
  (\(<= (gradient src) n\))
(def channel (src dst width)
  (let* ((d (distance src dst))
         (trail (\(<= (+ (gradient src)\)
                      (gradient dst))
                 d)))
  (dilate trail width)))
Key Ideas

- Many networks are spatial computers
- Continuous-space geometric programs are simple, scalable, and robust
- Proto compiles global descriptions into approximate local implementations
- Emergent behaviors can be engineered with by modulating regions