ALAVLSI: attend-to-learn and learn-to-attend with analogue, neuromorphic VLSI
Coordinator: Jochen Braun

- General architecture for attention and learning
- Implement with multi-chip analogue VLSI
- Classification of dynamic perceptual objects (optical flow, speech)

Feature spaces → Saliency network ← Associative network

- Performance on natural stimuli (visual & auditory) comparable to human observers
- Spiking networks for saliency and for associative memory
- Software and hardware implementations of SN and AN (analogue VLSI with AER communication)
- Feature space optimized for efficient and sparse representation of natural stimuli
- Natural and synthetic stimuli of low dimensionality but rich perceptual content
Neurodynamic modelling of attention and control

Two Competitive Networks Mutually Biased through Intermodular Connections

Biasing Specific Features
VISUAL SEARCH

Search a „Rose“

Top-Down Bias
(Rose)

WinJer Rose

IT

V1-V4

Winner Location

WinJer Location

Two Competitive Networks Mutually Biased through Intermodular Connections

Inhibitory Pool

Excitatory Pool

AMPA

NMDA

GABA

AMPA

NMDA

GABA

Mutually biased coupling

I_i^E

I_i^A

I_i

I_i^P
Giacomo Indiveri, ETH Zurich

Saliency with analogue, neuromorphic VLSI
Max number of patterns \[ p \mu \frac{n_0 \log(N \sqrt{n_s})}{\Lambda_{\text{min}}} \] deterministic

\[ p \mu N^2 \] stochastic

Dynamics of the synaptic efficacy

Synaptic transition probability vs \((\gamma_{\text{pre}}, \gamma_{\text{post}})\)

Dynamics of the (hidden) internal synaptic variable

Working memory

Selective activity at ~8Hz

Reverberation still not sufficient

Spontaneous activity at ~2Hz

No stimulus selective activity

Working memory with Hebbian, spike-driven synapses

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Bruno Olshausen, UC Davis
Sparse coding of natural stimuli

Learned space-time-basis functions (200, 12 x 12 x 7)
Training set: nature documentary

Competitive interaction between basis functions
Vision: transparent superposition of continuously changing visual objects

Audition: superposition of human speech, animal vocalisations, etc