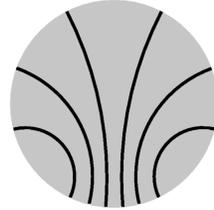




Heidelberg University



Kirchhoff-Institute for Physics



Electronic Vision(s)

Stochastic inference with spiking neural networks

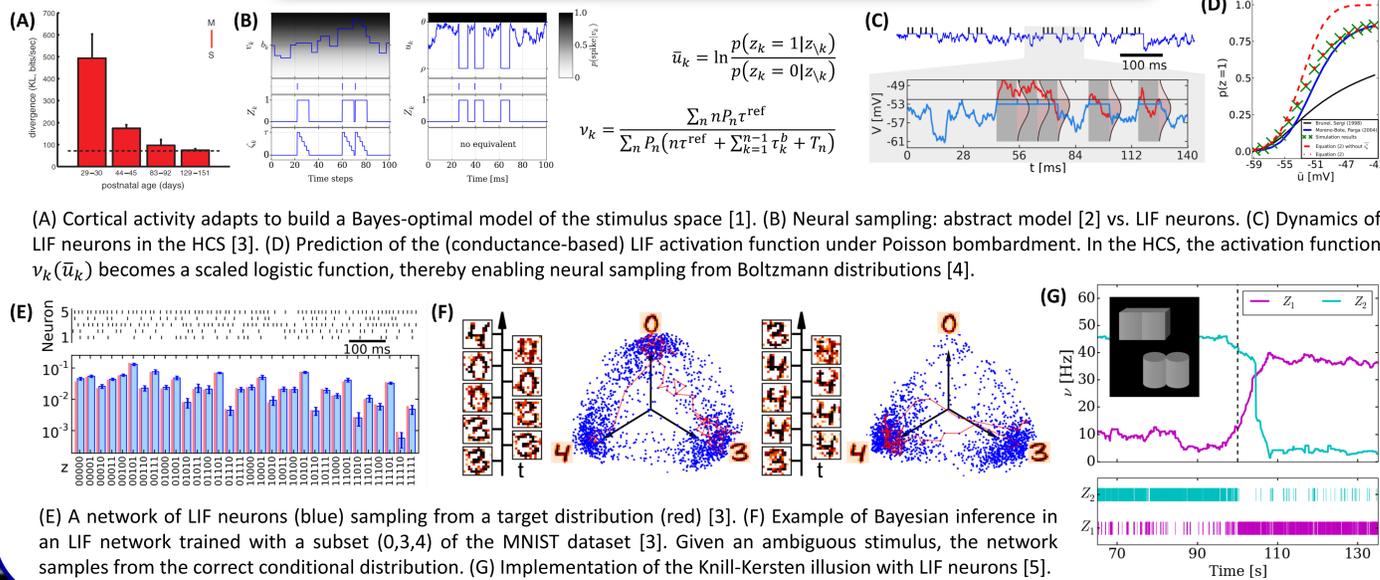
Mihai A. Petrovici*, Luziwei Leng*, Oliver Breitwieser*, David Stöckel*, Ilja Bytschok, Roman Martel, Johannes Bill, Johannes Schemmel, Karlheinz Meier

Brainscales Scales

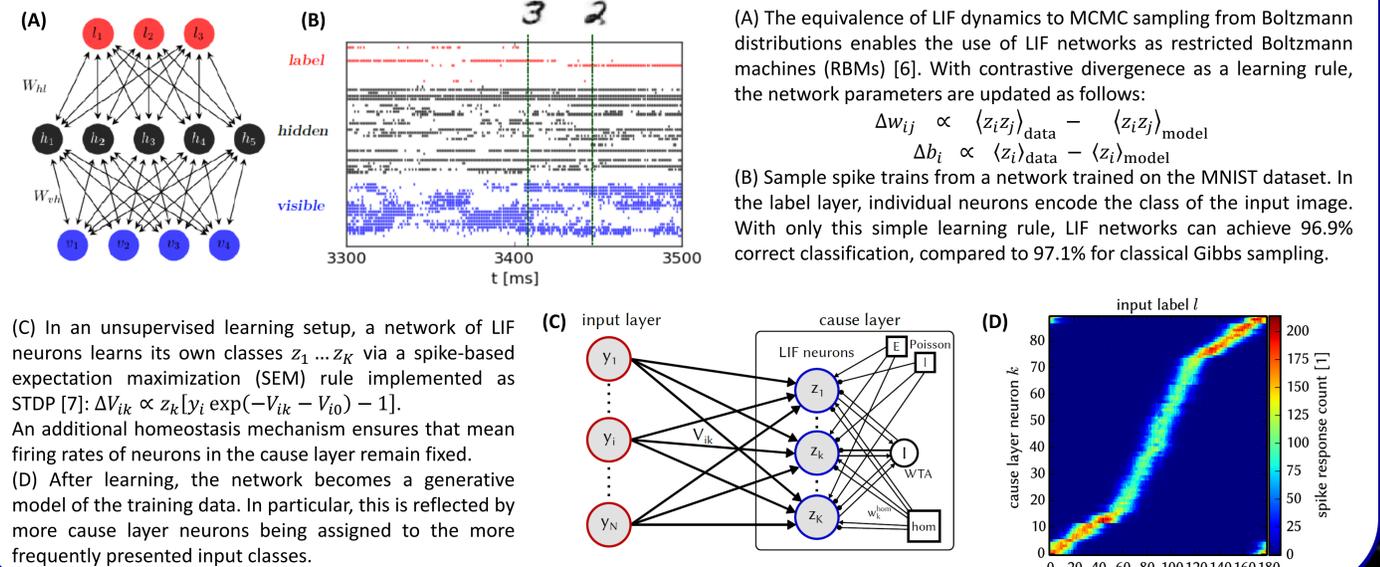


The Manfred Stärk Foundation

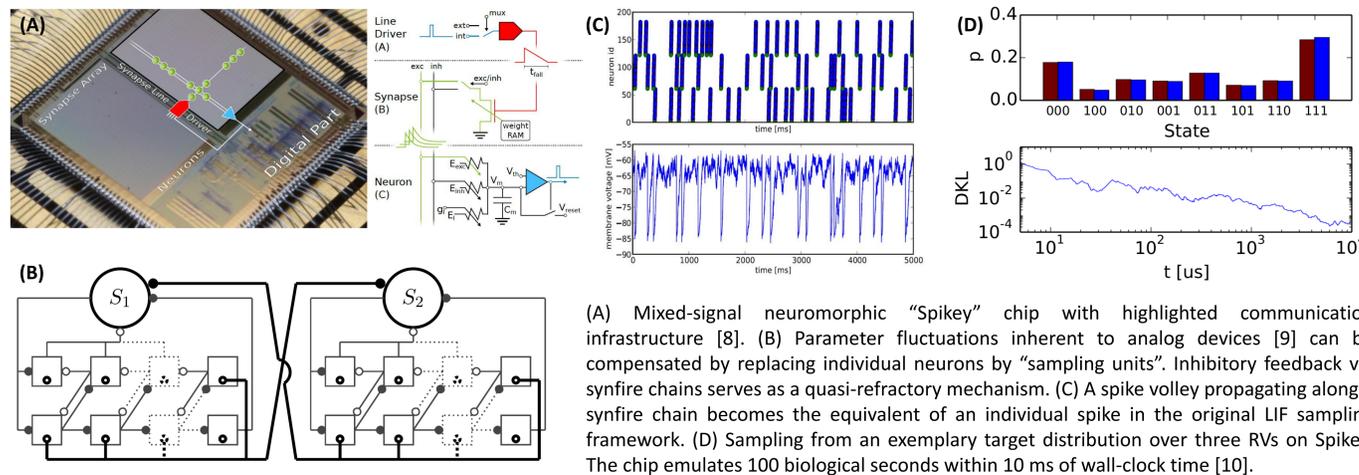
LIF sampling in the high-conductance state



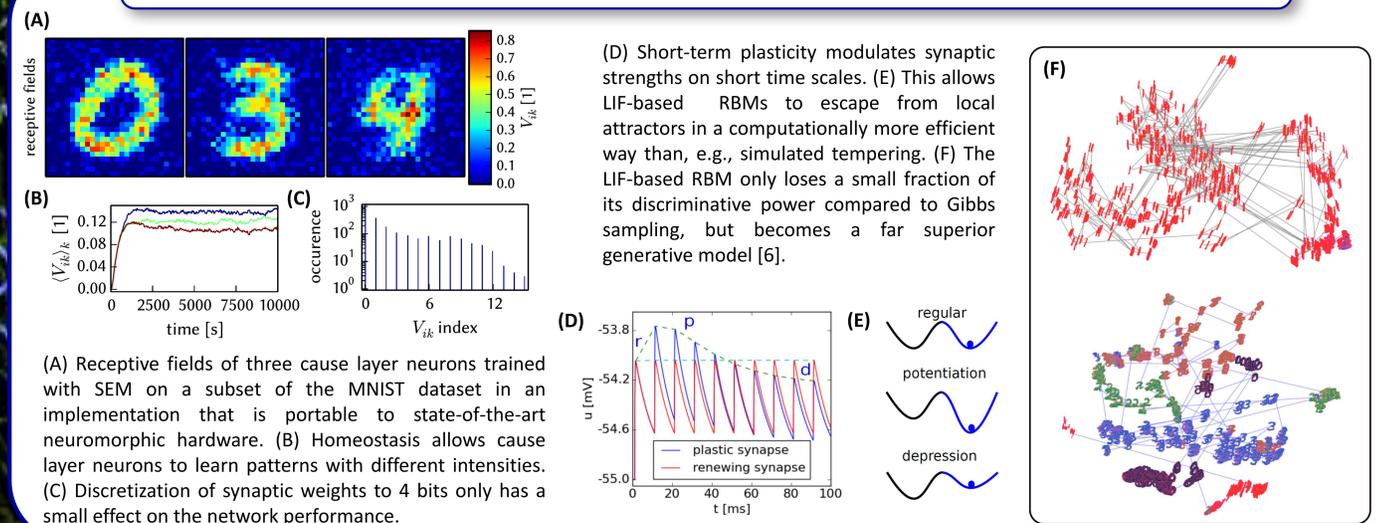
Supervised & unsupervised learning in spiking networks



Neuromorphic implementation



Spike-based plasticity in generative & discriminative models



[1] Berkes, P., Orban, G., Lengyel, M. & Fiser, J. (2011). Spontaneous cortical activity reveals hallmarks of an optimal internal model of the environment. *Science* 331.

[2] Buesing, L., Bill, J., Nessler, B., & Maass, W. (2011). Neural dynamics as sampling: a model for stochastic computation in recurrent networks of spiking neurons. *PLoS Comput. Biol.*, 7(11).

[3] Petrovici, M. A.*, Bill, J.*, Bytschok, I., Schemmel, J., & Meier, K. (2013). Stochastic inference with deterministic spiking neurons. *arXiv preprint arXiv:1311.3211*.

[4] Petrovici, M. A., Bytschok, I., Bill, J., Schemmel, J. & Meier, K. (2015). The high-conductance state enables neural sampling in networks of LIF neurons. *24th Annual Computational Neuroscience Meeting (CNS)*.

[5] Probst, D.*, Petrovici, M. A.*, Bytschok, I., Bill, J., Pecevski, D., Schemmel, J., & Meier, K. (2015). Probabilistic inference in discrete spaces can be implemented into networks of LIF neurons. *Frontiers in computational neuroscience*, 9.

[6] Leng, L*, Petrovici, M. A.*, Martel, R., Bytschok, I., Breitwieser, O., Bill, J., Schemmel, J. & Meier, K. (2015). Spiking neural networks as superior generative and discriminative models. *Cosyne 2016*.

[7] Nessler, B., Pfeiffer, M., Büsing, L. & Maass, W. (2013). Bayesian computation emerges in generic cortical microcircuits through spike-timing-dependent plasticity. *PLoS Comput Biol*, 9(4)

[8] Pfeil, T.*, Grübl, A.*, Jeltsch, S.*, Müller, E.*, Müller, P.*, Petrovici, M. A.*. Schmuker, M.*, Brüderle, D., Schemmel, J., & Meier, K. (2013). Six networks on a universal neuromorphic computing substrate. *Frontiers in neuroscience*, 7.

[9] Petrovici, M. A., Vogginger, B., Müller, P., Breitwieser, O., Lundqvist, M., Müller, L., Ehrlich, M., Destexhe, A., Lansner, A., Schüffny, R., Schemmel, J. & Meier, K. (2014). Characterization and compensation of network-level anomalies in mixed-signal neuromorphic modeling platforms. *PLoS ONE*, 9(10).

[10] Petrovici, M. A.*, Stöckel, D.*, Bytschok, I., Bill, J., Pfeil, T., Schemmel, J. & Meier, K. (2015). Fast sampling with neuromorphic hardware. *Advances in Neural Information Processing Systems (NIPS) 2015*.