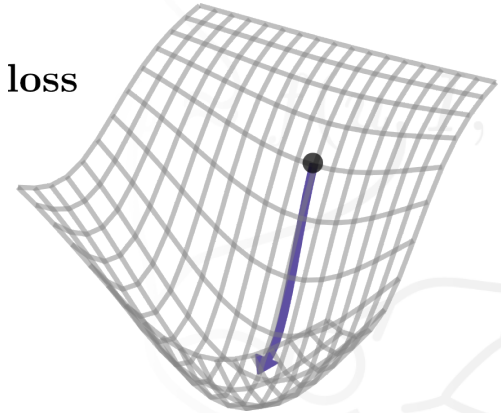
Weight transport through spike timing for robust local gradients

Gradient descent on a loss function



$$\Delta \mathbf{W} \propto -\nabla_{\mathbf{W}} \mathcal{L}$$

Timo Gierlich, PhD student @ NeuroTMA Lab

University of Bern, Department of Physiology
Heidelberg University, Kirchhoff-Institute for Physics

NeuroTMA Lab

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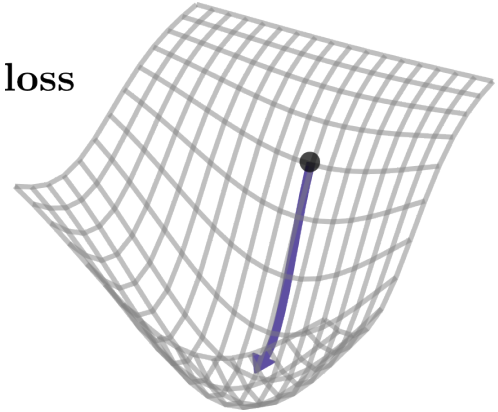
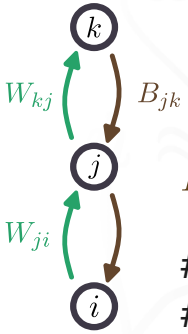


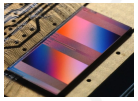
$$\Delta \mathbf{W} \propto -\nabla_{\mathbf{W}} \mathcal{L}$$

... leads to symmetry constraints on weights!



$$B_{jk} = W_{kj}$$

#backprop
#weight-sleep



→ Weight transport problem!

Timo Gierlich, PhD student @ NeuroTMA Lab

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NeuroTMA Lab

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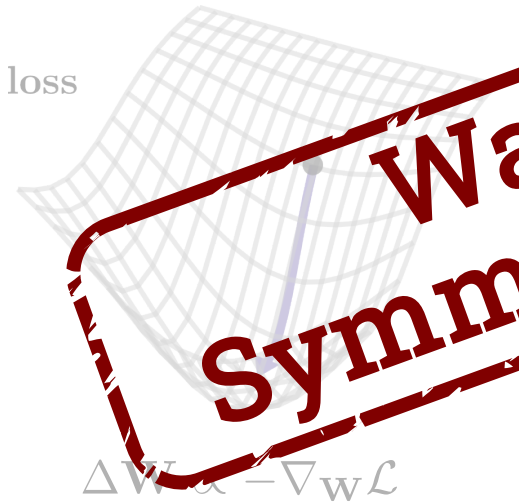

Wanted: Symmetrization!

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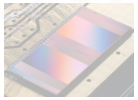

$\Delta W_{ij} \propto -\nabla_{W} \mathcal{L}$

→ Weight transport problem!

Timo Gierlich, PhD student @ NeuroTMA Lab

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NeuroTMA Lab

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Gradient descent on a loss function...

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loss

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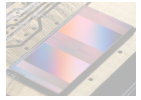

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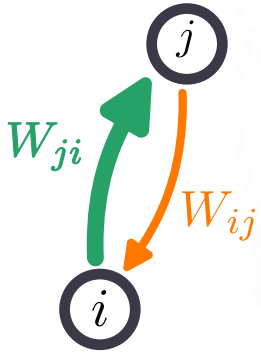
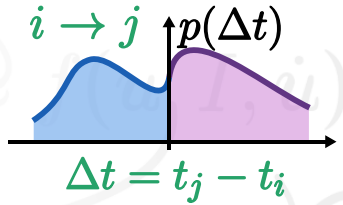
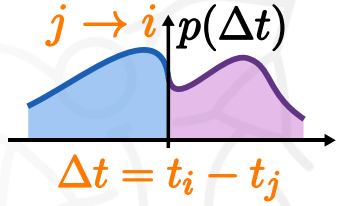
Spike timing statistics







Timo Gierlich, PhD student @ NeuroTMA Lab

University of Bern, Department of Physiology
Heidelberg University, Kirchhoff-Institute for Physics

NeuroTMA Lab

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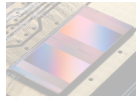

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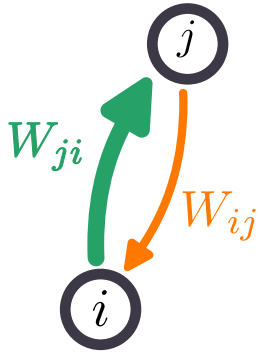
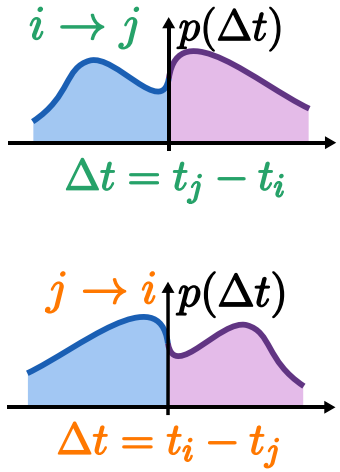
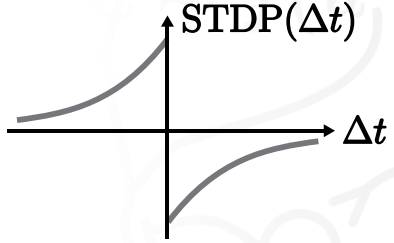




and anti-Hebbian STDP...



Timo Gierlich, PhD student @ NeuroTMA Lab

University of Bern, Department of Physiology
Heidelberg University, Kirchhoff-Institute for Physics

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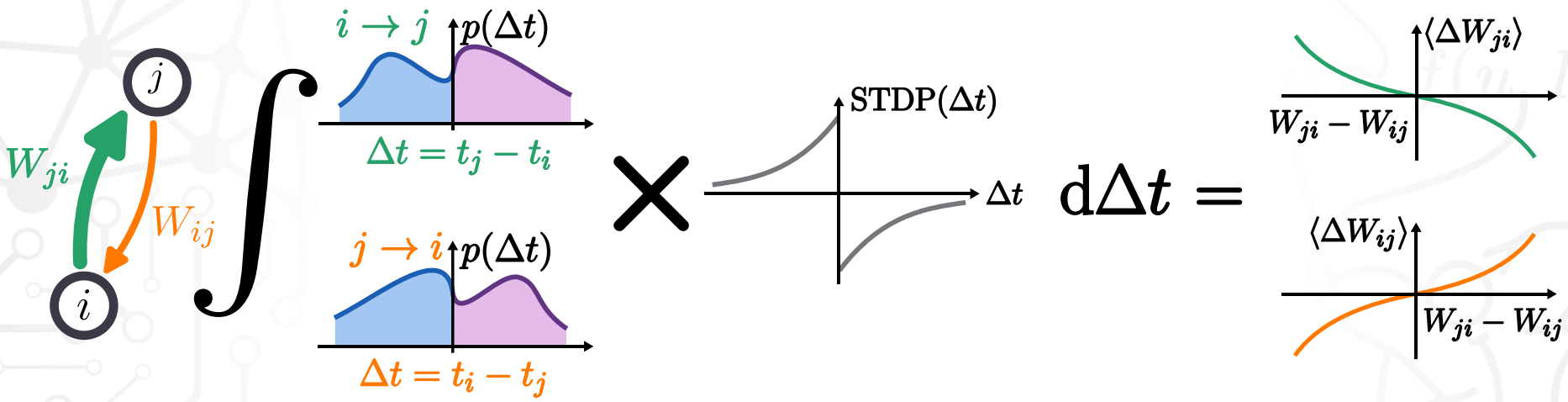
Weight transport through spike timing for robust local gradients

Spike timing statistics...

and anti-Hebbian STDP...

S = Spike-based
A = Alignment
L = Learning



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NeuroTMA Lab

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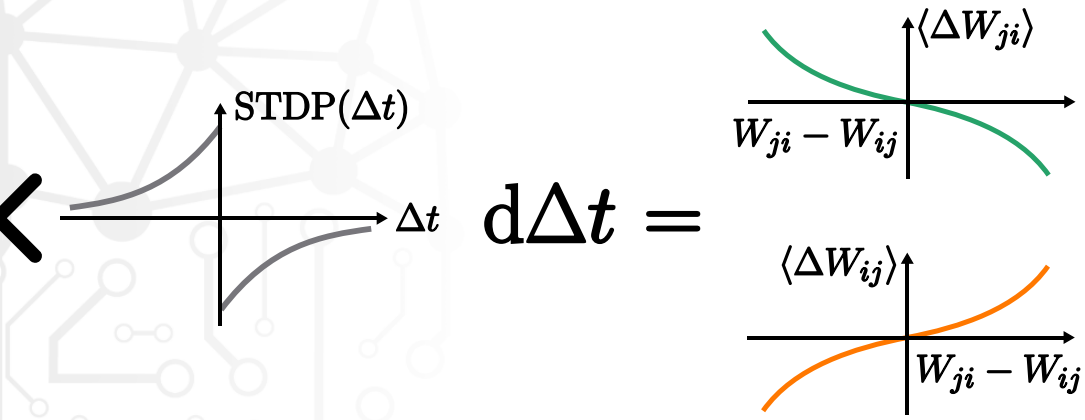
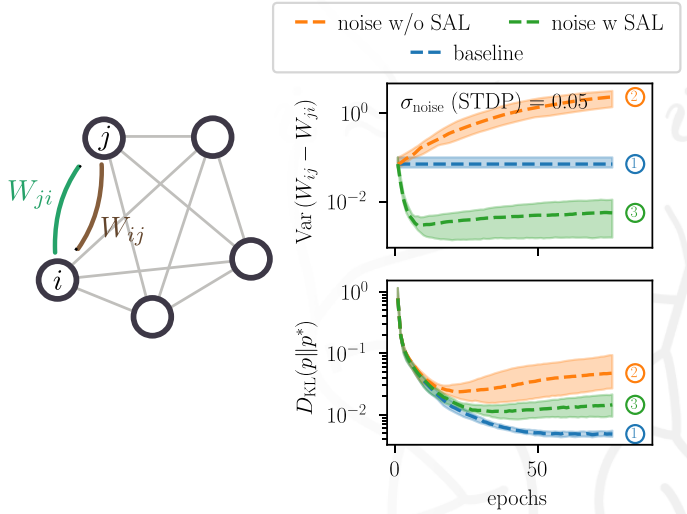


Use case 1: Generative spiking networks for Bayesian computing



Timo Gierlich, PhD student @ NeuroTMA Lab
University of Bern, Department of Physiology
Heidelberg University, Kirchhoff-Institute for Physics

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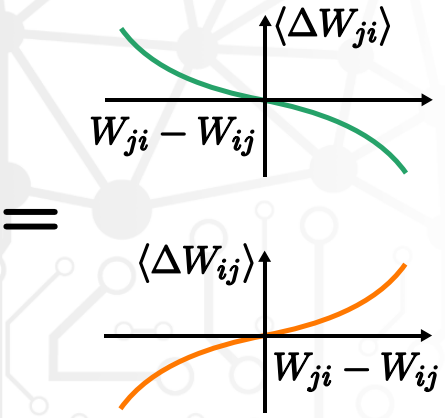

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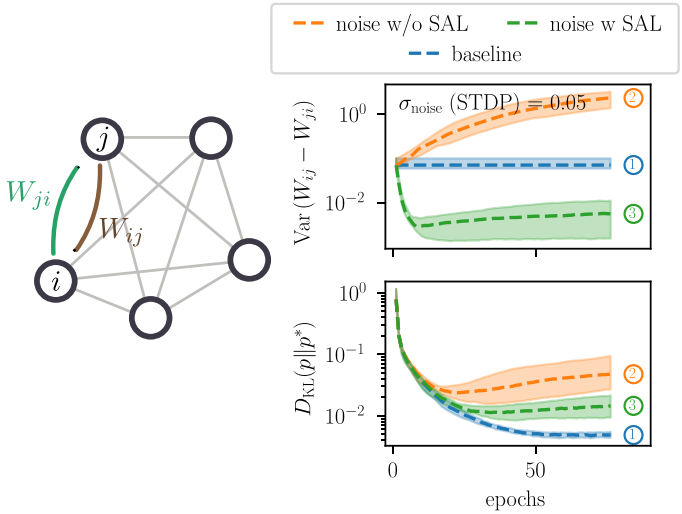
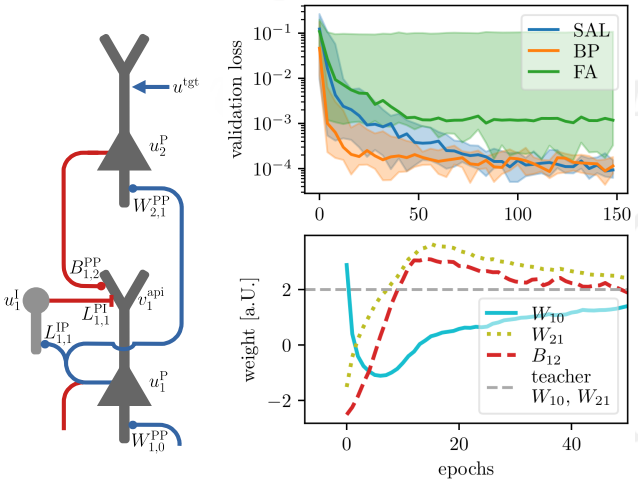


Use case 2: Error transport over layers of cortical microcircuits



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University of Bern, Department of Physiology
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