Summary of A tutorial of the free-energy framework for modelling perception and learning

Marco Casari

Introductio

Single variable

Multiple variable

Canalusia

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University of Turin

Complex system in neuroscience, 12 December 2023

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• Predictive coding model of Rao and Ballard.

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Introduction

1. Prior predictions are compared to stimuli and the model parameters are updated considering prediction errors, features corresponding to receptive fields in the the primary sensory cortex are learned.

. Predictive coding model of Rao and Ballard

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- Predictive coding model of Rao and Ballard.
- Free-energy model of Friston.

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Introduction

1. Prior predictions are compared to stimuli and the model parameters are updated considering prediction errors, features corresponding to receptive fields in the the primary sensory cortex are learned.

. Predictive coding model of Rao and Ballard

2. Weight stimuli by their noise, learn features using their covariance, implement attentional modulation changing the variance of attended features.



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. Predictive coding model of Rao and Ballard Introduction Hebbian learning

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- Predictive coding model of Rao and Ballard.
- Free-energy model of Friston.
- Hebbian learning.

- 1. Prior predictions are compared to stimuli and the model parameters are updated considering prediction errors, features corresponding to receptive fields in the the primary sensory cortex are learned.
- 2. Weight stimuli by their noise, learn features using their covariance, implement attentional modulation changing the variance of attended features.
- 3. Synaptic strenght is changed proportionally to activities of pre-synaptic and post-synaptic neurons.

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Predictive coding model of Rao and Ballard.

- Free-energy model of Friston.
- Hebbian learning.
- Free energy minimization.

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. Predictive coding model of Rao and Ballard

- 1. Prior predictions are compared to stimuli and the model parameters are updated considering prediction errors, features corresponding to receptive fields in the the primary sensory cortex are learned.
- 2. Weight stimuli by their noise, learn features using their covariance, implement attentional modulation changing the variance of attended features.
- 3. Synaptic strenght is changed proportionally to activities of pre-synaptic and post-synaptic neurons.
- 4. Minimization of free energy can be seen as the base of many theories of perception.

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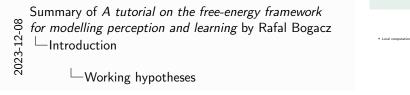
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Working hypotheses

Local computation.



1. The state of a neuron is determined only by the synaptic weight and the state of its input neurons.

Working hypotheses

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Local computation.

Local plasticity.

Working hypotheses

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· Local plasticity.

Working hypotheses

1. The state of a neuron is determined only by the synaptic weight and

the state of its input neurons.

2. Synaptic plasticity depends only on the activities of pre-synaptic and post-synaptic neurons.

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Working hypotheses

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- Local computation.
- Local plasticity.
- Basic neuronal computation.

- 1. The state of a neuron is determined only by the synaptic weight and the state of its input neurons.
- 2. Synaptic plasticity depends only on the activities of pre-synaptic and post-synaptic neurons.
- 3. The state of a neuron is the result of the application of a monotonic function to the linear combination of states and synaptic weights of input neurons.

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Exact solution of the inference problem

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Learning relation between variable and stimulus

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Recover local plasticity

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Conclusion

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☐ Conclusion

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