

Introduction

2023-12-08

Summary of *A tutorial on the free-energy framework for modelling perception and learning* by Rafal Bogacz

└ Introduction

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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.

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

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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.

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- Hebbian learning.

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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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- Hebbian learning.
- Free energy minimization.

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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- └ Hypotheses

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

- Local computation.

Exact solution of the inference problem

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- Single variable model

- Exact solution of the inference problem

Approximated solution of the inference problem



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└ Single variable model

└ Approximated solution of the inference problem



Neural implementation

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- └ Single variable model

- └ Neural implementation

Learning model parameters

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- Learning model parameters

Learning relation between variable and stimulus



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- Summary of *A tutorial on the free-energy framework for modelling perception and learning* by Rafal Bogacz
 - Single variable model
 - Free energy framework

- └ Single variable model
 - └ Free energy framework

- Free energy framework

Multiple variables model

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- └ Multiple variables model

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Learning parameters

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- └ Learning parameters

Hierarchical structure implementation

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- Multiple variables model

- └ Hierarchical structure implementation

Recover local plasticity

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- Multiple variables model

- └ Recover local plasticity

Conclusion

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