Predictive Coding and Biologically Plausible Neural Networks

Bachelorthesis

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Abstract

Contents

1 Introduction **3**

2 Backpropagation **3**

3 Biological constraints **3**

4 LIF Neuron model **3**

5 Stacked Autoencoders **3**

6 Predictive Coding **3**

7 Conclusion **3**

1 Introduction

2 Backpropagation

3 Biological constraints

4 LIF Neuron model

Derivation of spiking rate as function of input current.

$$V(t) = (V(0) - j)e^{-t/t_{RC}} + j$$

$$1 = -je^{-t/t_{RC}} + j$$

$$1 - j = -je^{-t/t_{RC}}$$

$$\frac{1-j}{j} = -e^{-t/t_{RC}}$$

$$\frac{1}{j} - 1 = -e^{-t/t_{RC}}$$

$$1 - \frac{1}{j} = e^{-t/t_{RC}}$$

$$\log(1 - \frac{1}{j}) = \frac{-t}{t_{RC}}$$

$$t = -t_{RC}\log(1 - \frac{1}{j})$$

$$r = \frac{1}{-t_{RC}\log(1 - \frac{1}{j})}$$

[1]

5 Stacked Autoencoders

6 Predictive Coding

7 Conclusion

References

[1] Eric Hunsberger and Chris Eliasmith. Spiking deep networks with lif neurons, 2015.