Comparison of semiconducting and superconducting hardware for optoelectronic neuromorphic systems

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Abstract

Contents

1 Introduction

2 Device requirements for neuromorphic systems

3 Light Sources

4 Detectors

5 Interconnection network and fan-out

6 Synaptic circuits and weighting

7 Dendrites and fan-in

8 Neural integration and threshold

9 Transmitter driver circuits

10 Time constants and subthreshold oscillations

11 Biasing

12 Power consumption, cooling, and system considerations

13 Notes

[1] Differences between neural and digital optical communication:

- neural: mux/demux not required
- neural: high power optical signals not necessary (nor tolerable)
- neural: not point to point, one to many
- neural: asynchronous, no clock, no phase-locked loop, no clock recovery on receive
- neural: 1s and 0s not equally common; signals are sparse
- neural: TIA + limiting amplifier + decision circuit likely uses too much power
- neural: noise is more tolerable, decision circuit still potentially useful
- neural: speed can be much lower, as demonstrated by biology
- neural: with lower light levels, light-source driver circuits don't need to deliver as much current
- multi-chip partitioning required for digital due to high speed and sensitivity to timing jitter, multi-chip not tolerable for neural (cannot have multiple chips for each neuron) Tx and Rx amplifiers cannot remain in isolation ([1] pg. 5)

other notes:

- in conventional optical communication systems, package parasitics limit speed. optoelectronic integration crucial for overcoming this limitation ([1] pg. 5)

14 Acknowledgements

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A Appendix One

Appendix One

References

[1] B. Razavi. *Design of Integrated Circuits for Optical Communications*. Wiley, second edition edition, 2012.