

Optical Bistability As Neural Network Nonlinear Activation Function

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20th March 2018

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Introduction

Applying integrated photonics to artificial neural networks

Introduction

Artificial Neural Networks

Microring Resonator

ANN Simulations

Conclusion

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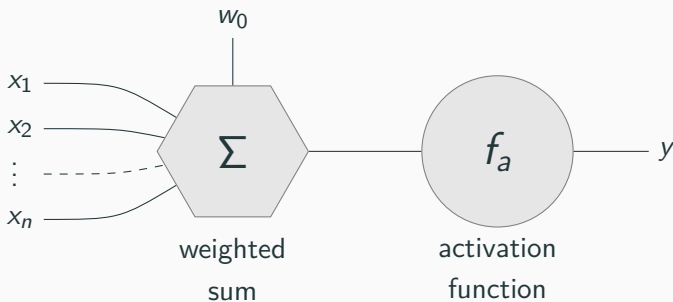
Conclusion

Artificial Neural Networks

Artificial Neural Networks are computation systems, composed by a collection of nodes that work seemingly biological neurons.

ANNs blocks

ANNs are composed by single units, *nodes*, which elaborate the information in a way loosely similar to biological neurons.



What can they do?

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ANNs can solve complex problems:

- classification
- clustering
- pattern recognition
- time series prediction

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figures/foo.png

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figures/foo.png

How do they work?



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ANNs can obtain arbitrary decision regions¹

The amount of free parameters in an ANN, allow ..?

¹R. O. Duda et al., *Pattern classification*, (John Wiley & Sons, 2012)

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 - evaluate loss
 - adjust parameters
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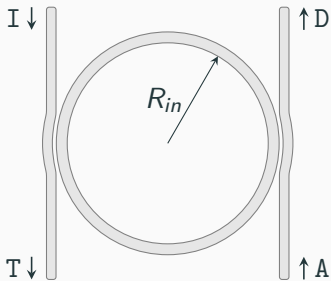
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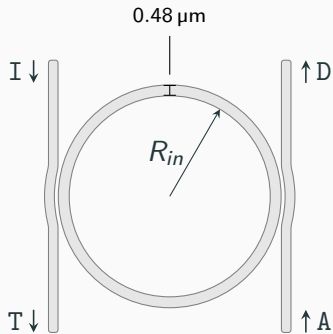
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Microring Resonator

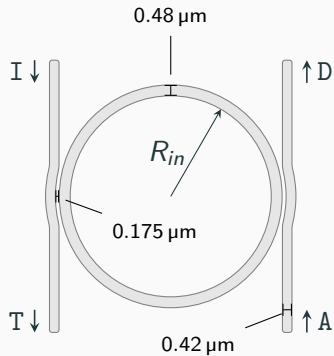
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Linear

Nonlinear

Setup

ANN Simulations

What means simulating? PyTorch library

Fundamental blocks

model ($FF[f_a]$)

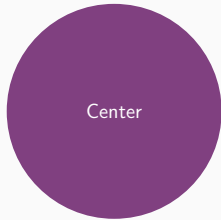
loss criteria (CEL)

weight update criteria (SGD)

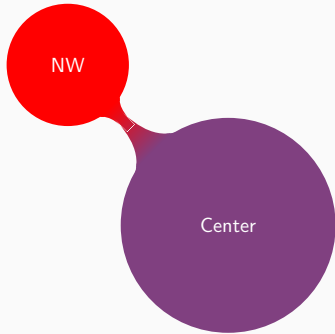
ReLU vs Sigmoid vs f_{fit}

Conclusion

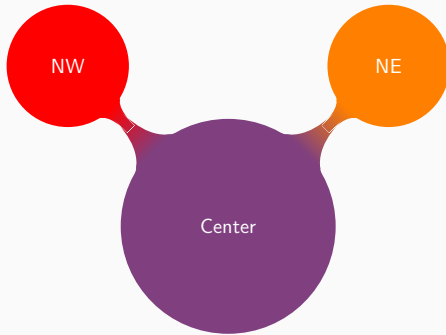
Overview Improvements Future Perspective



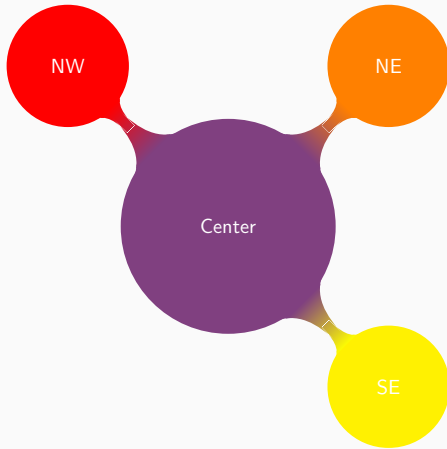
Mindmap



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