

Neural Networks and Deep Learning

Neural Networks and Deep Learning is a free online book. The book will teach you about:

- Neural networks, a beautiful biologically-inspired programming paradigm which enables a computer to learn from observational data
- Deep learning, a powerful set of techniques for learning in neural networks

Neural networks and deep learning currently provide the best solutions to many problems in image recognition, speech recognition, and natural language processing. This book will teach you many of the core concepts behind neural networks and deep learning.

For more details about the approach taken in the book, [see here](#). Or you can jump directly to [Chapter 1](#) and get started.

Neural Networks and Deep Learning

What this book is about

On the exercises and problems

- ▶ Using neural nets to recognize handwritten digits
- ▶ How the backpropagation algorithm works
- ▶ Improving the way neural networks learn
- ▶ A visual proof that neural nets can compute any function
- ▶ Why are deep neural networks hard to train?
- ▶ Deep learning
- Appendix: Is there a *simple* algorithm for intelligence?
- Acknowledgements
- Frequently Asked Questions

If you benefit from the book, please make a small donation. I suggest \$5, but you can choose the amount.

Donate



Alternately, you can make a donation by sending me Bitcoin, at address

1Kd6tXH5SDAmiFb49J9hknG5pqj7KStSAX

Sponsors



Deep Learning Workstations starting at \$6,999: [learn more](#)



Deep Learning Workstations, Servers, and Laptops



Thanks to all the [supporters](#) who made the book possible, with especial thanks to Pavel Dudrenov.

Thanks also to all the contributors to the [Bugfinder Hall of Fame](#).

Resources

[Michael Nielsen on Twitter](#)

[Book FAQ](#)

[Code repository](#)

[Michael Nielsen's project announcement mailing list](#)

[Deep Learning](#), book by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

[cognitivemedium.com](#)

In academic work, please cite this book as: Michael A. Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015

Last update: Tue Jun 11 16:58:53 2019

This work is licensed under a Creative Commons Attribution-NonCommercial 3.0 Unported License. This means you're free to copy, share, and build on this book, but not to sell it. If you're interested in commercial use, please [contact me](#).



By [Michael Nielsen](#) / Jun 2019