

# Deep Learning with PyTorch

Essential Excerpts

Eli Stevens  
Luca Antiga



MANNING





***Deep Learning with PyTorch***  
***Essential Excerpts***

Eli Stevens and Luca Antiga

**Manning Author Picks**

Copyright 2019 Manning Publications  
To pre-order or learn more about this book go to [www.manning.com](http://www.manning.com)

For online information and ordering of this and other Manning books, please visit [www.manning.com](http://www.manning.com). The publisher offers discounts on these books when ordered in quantity.

For more information, please contact

Special Sales Department  
Manning Publications Co.  
20 Baldwin Road  
PO Box 761  
Shelter Island, NY 11964  
Email: [Erin.Twohey.corp-sales@manning.com](mailto:Erin.Twohey.corp-sales@manning.com)

©2019 by Manning Publications Co. All rights reserved.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by means electronic, mechanical, photocopying, or otherwise, without prior written permission of the publisher.

Many of the designations used by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in the book, and Manning Publications was aware of a trademark claim, the designations have been printed in initial caps or all caps.

⊗ Recognizing the importance of preserving what has been written, it is Manning's policy to have the books we publish printed on acid-free paper, and we exert our best efforts to that end. Recognizing also our responsibility to conserve the resources of our planet, Manning books are printed on paper that is at least 15 percent recycled and processed without the use of elemental chlorine.

 Manning Publications Co.  
20 Baldwin Road Technical  
PO Box 761  
Shelter Island, NY 11964

Cover designer: Leslie Haimes

ISBN: 9781617297120  
Printed in the United States of America  
1 2 3 4 5 6 7 8 9 10 - EBM - 24 23 22 21 20 19

# *contents*

---

## **1 Introducing deep learning and the PyTorch library 1**

- 1.1 What is PyTorch? 2
- 1.2 What is this book? 2
- 1.3 Why PyTorch? 3
- 1.4 PyTorch has the batteries included 10

## **2 It starts with a tensor 15**

- 2.1 Tensor fundamentals 18
- 2.2 Tensors and storages 22
- 2.3 Size, storage offset, and strides 24
- 2.4 Numeric types 30
- 2.5 Indexing tensors 31
- 2.6 NumPy interoperability 31
- 2.7 Serializing tensors 32
- 2.8 Moving tensors to the GPU 34
- 2.9 The tensor API 35

## **3 Real-world data representation with tensors 39**

- 3.1 Tabular data 40
- 3.2 Time series 49
- 3.3 Text 54
- 3.4 Images 60
- 3.5 Volumetric data 63

**4 The mechanics of learning 67**

- 4.1 Learning is parameter estimation 70
- 4.2 PyTorch’s autograd: Backpropagate all things 83

**5 Using a neural network to fit your data 101**

- 5.1 Artificial neurons 102
- 5.2 The PyTorch nn module 110
- 5.3 Subclassing nn.Module 120

*index* 127

## *about the authors*

---

Eli Stevens has worked in Silicon Valley for the past 15 years as a software engineer, and the past 7 years as Chief Technical Officer of a startup making medical device software.

Luca Antiga is co-founder and CEO of an AI engineering company located in Bergamo, Italy, and a regular contributor to PyTorch.