

DIVE INTO DEEP LEARNING

<https://d2l.ai>

Aston Zhang

as Amazon. Ph.D. in Computer Science from University of Washington. His research interests include deep learning, Bayesian nonparametrics, kernel methods, statistical modeling, and scalable algorithms. He is a program committee member for AAAI, and a program committee member [reviewer] for ICML, NeurIPS, ICLR, KDD, SIGIR, WSDM, and WWW.

GTC 2020 Instructor-Led Tutorial

research spans both machine learning methods and their social impact, with a concentration on deep learning for time series data and sequential decision making. This work addresses diverse application areas, including medical diagnosis, dialogue systems, and product recommendation. He founded the Approximately Correct blog (approximatelycorrect.com).

Mu Li

Principal Scientist at Amazon. Visiting Assistant Professor of UC Berkeley. Ph.D. from the Computer Science Department of Carnegie Mellon University. Before joining Amazon, he was the CTO of Marianas Labs, an artificial intelligence startup. He also served as a Fellow at the Institute of Deep Learning at Facebook, author papers, which span theory (FOCS), machine learning (NeurIPS, ICML), applications (CVPR, KDD), and operating systems (OSDI).

Rachel Hu Applied Scientist

VP/Distinguished Scientist at Amazon. Ph.D. in Computer Science from University of Erlangen-Nuremberg, Germany. He held faculty positions at the International University, UC Berkeley, and Carnegie Mellon University. He has published over 200 papers, 5 books and his work is cited over 100,000 times. His research interests include deep learning, Bayesian nonparametrics, kernel methods, statistical modeling, and scalable algorithms.

This is the preview version (v0.7) of Dive into Deep Learning, whose content and style will be improved in the future official publication. Please visit the book website <https://d2l.ai> for an updated version.



Outline

DEEP LEARNING

<https://d2l.ai>

Aston Zhang

Senior Scientist at Amazon. Ph.D. in Computer Science from University of Illinois at Urbana-Champaign. His research interests include deep learning and applications. He has served as program committee member (co-chair) or committee member (reviewer) for ICML, NeurIPS, ICLR, KDD, SIGIR, WWW, and WWW.

- Intro to Deep Learning

- Fundamental of Convolutional Neural Network

- Intro to Nature Language Processing (NLP)

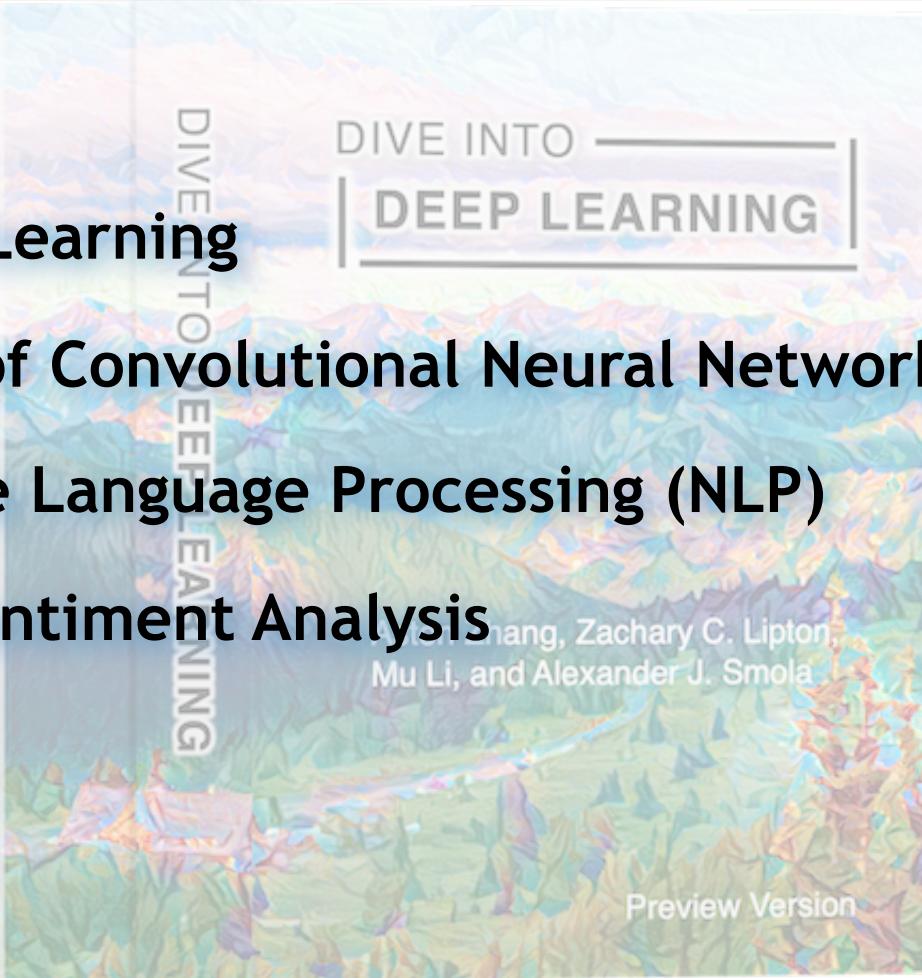
- TextCNN on Sentiment Analysis

Zhang, Zachary C. Lipton,
Mu Li, and Alexander J. Smola

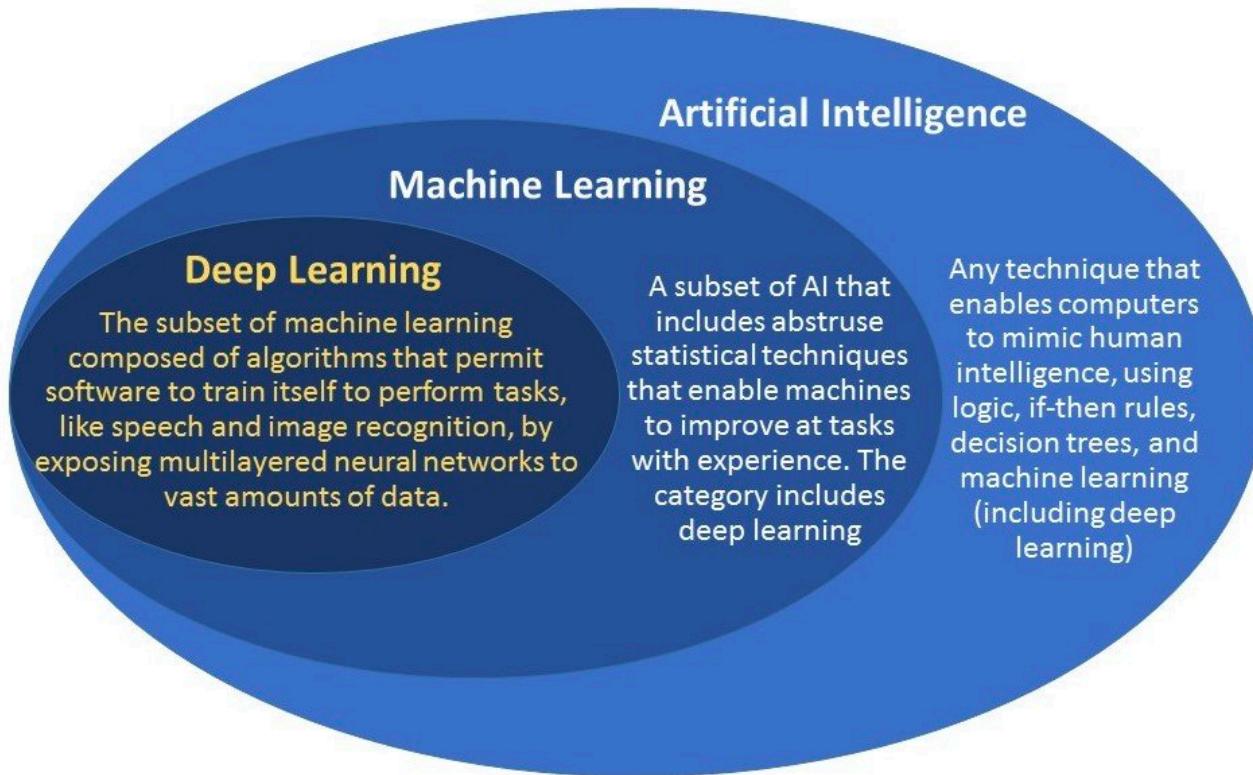
- Q & A

Alexander J. Smola
Principal Scientist at Amazon. Ph.D. in Computer Science from University of Technology, Germany. He held faculty positions at the Australian National University, UC Berkeley, and Carnegie Mellon University. He has published over 200 papers, 5 books and his work is cited over 100,000 times. His research interests include deep learning, Bayesian nonparametrics, kernel methods, statistical modeling, and scalable algorithms.

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Deep Learning in Context



<https://www.geospatialworld.net/blogs/difference-between-ai%EF%BB%BF-machine-learning-and-deep-learning/>



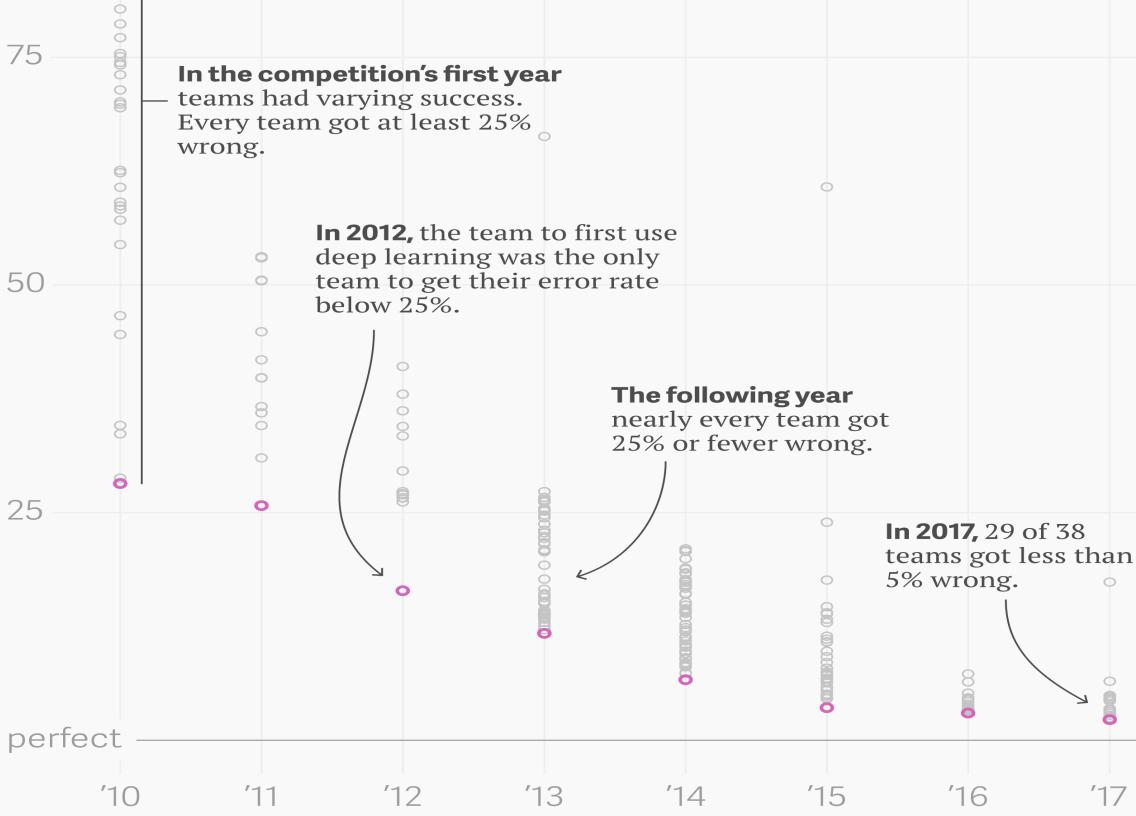
Why Deep Learning?



<http://www.image-net.org/>



Why Deep Learning?



Yanofsky, Quartz

<https://qz.com/1034972/the-data-that-changed-the-direction-of-ai-research-and-possibly-the-world/>

aws

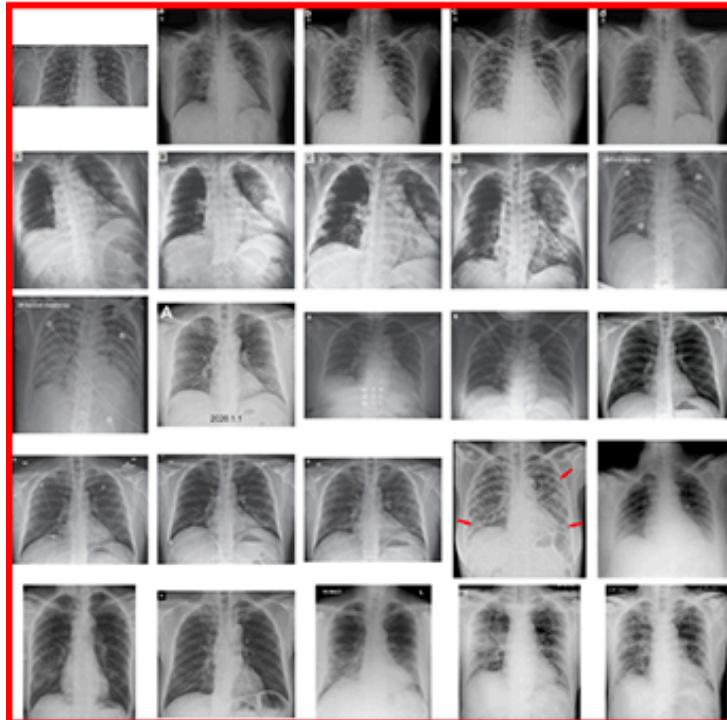
Deep Learning Application Domains



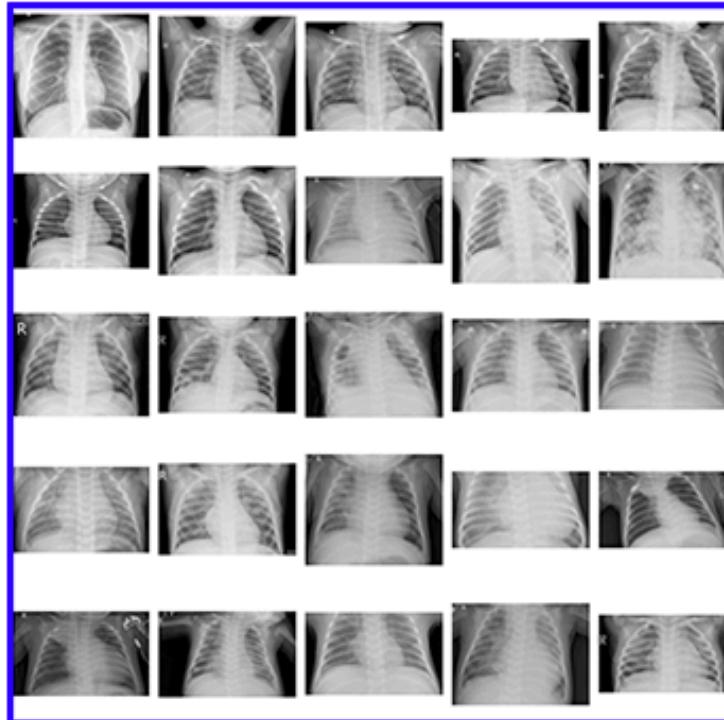
- Text Documents
 - Images/Videos
 - Bio/Medical Data
 - Satellites Data

Image Classification

COVID-19 +

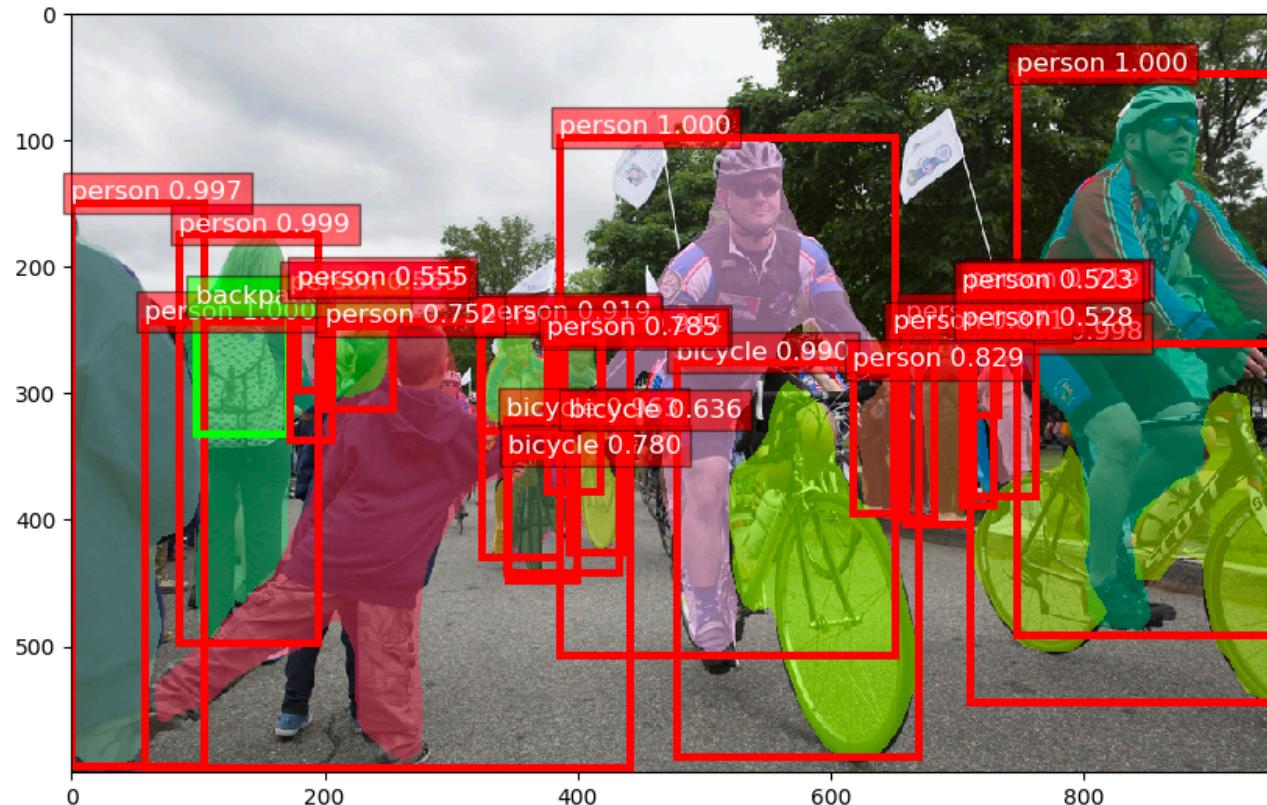


COVID-19 -



<https://www.pyimagesearch.com/2020/03/16/detecting-covid-19-in-x-ray-images-with-keras-tensorflow-and-deep-learning/>

Detect and Segment Objects



https://gluon-cv.mxnet.io/build/examples_instance/demo_mask_rcnn.html

Style Transfer



<https://github.com/zhanghang1989/MXNet-Gluon-Style-Transfer/>



Style Transfer



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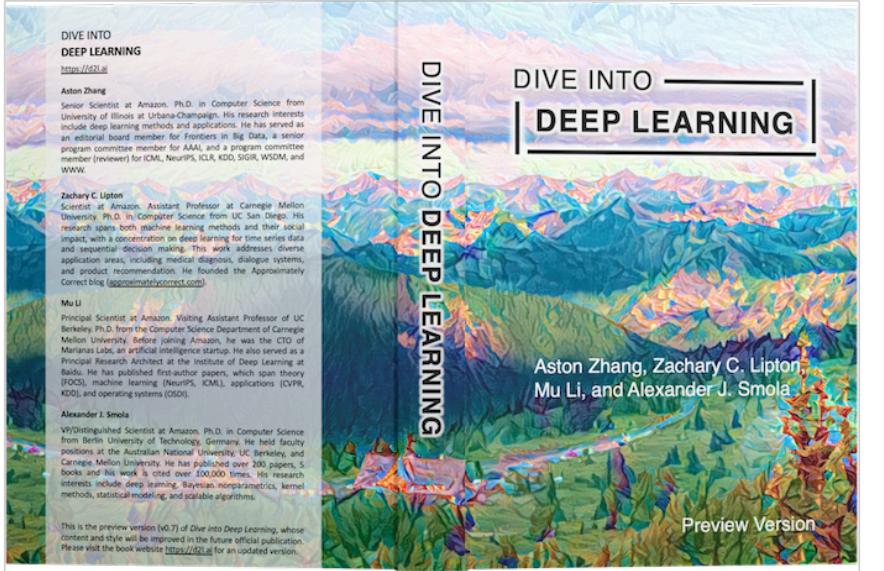
Synthesize Faces



Karras et al, arXiv 2019

aws

D2L Book

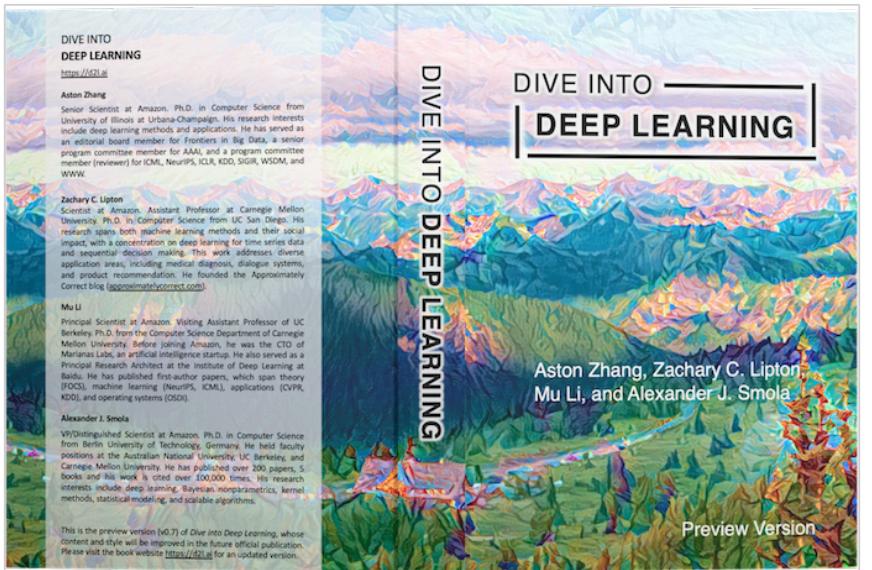


Dive Into Deep Learning is an excellent text on deep learning and deserves attention from anyone who wants to learn why deep learning has ignited the AI revolution – the most powerful technology force of our time.

— Jensen Huang,
President and CEO of Nvidia



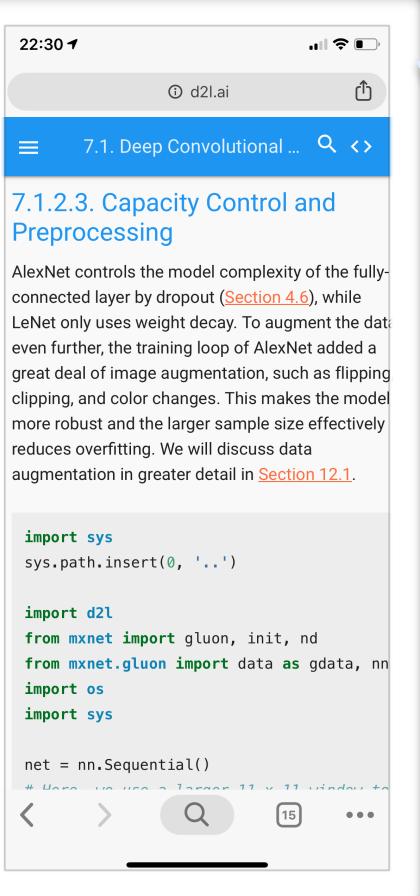
D2L Book



- 150+ runnable Jupyter Notebooks from model architectures to applications (CV, NLP, etc.)
- Adopted as a textbook or reference book at UC Berkeley, CMU, MIT, and 70+ universities worldwide
- Wide theoretical coverage: statistics, optimization, machine learning basics, GPU parallel training, etc.
- Berkeley class (slides, videos at courses.d2l.ai)
- Multilingual content EN, ZH (in progress: KO, JA, FR, TR)



Multiple Formats & Devices



A screenshot of a mobile device displaying a Jupyter Notebook page from d2l.ai. The page title is "7.1. Deep Convolutional ...". The section "7.1.2.3. Capacity Control and Preprocessing" is visible, along with some text about AlexNet's capacity control. Below the text is a snippet of Python code using mxnet.gluon.

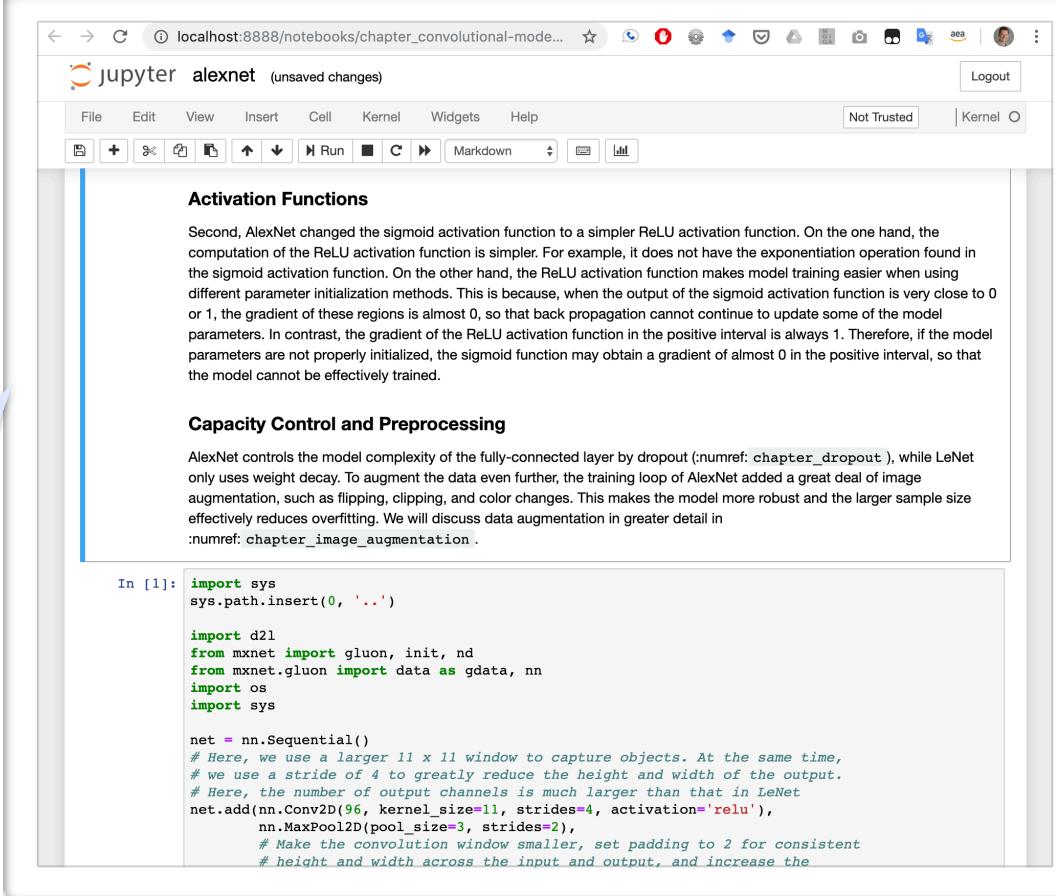
```
import sys
sys.path.insert(0, '...')

import d2l
from mxnet import gluon, init, nd
from mxnet.gluon import data as gdata, nn
import os
import sys

net = nn.Sequential()
```

Mobile friendly

Jupyter Notebook



A screenshot of a desktop browser window showing a Jupyter Notebook titled "alexnet" (unsaved changes). The notebook interface includes a toolbar with File, Edit, View, Insert, Cell, Kernel, Widgets, Help, and a "Not Trusted" button. The main content area displays two sections: "Activation Functions" and "Capacity Control and Preprocessing", both containing text and code snippets. A code cell at the bottom contains the same Python code as the mobile version.

Activation Functions

Second, AlexNet changed the sigmoid activation function to a simpler ReLU activation function. On the one hand, the computation of the ReLU activation function is simpler. For example, it does not have the exponentiation operation found in the sigmoid activation function. On the other hand, the ReLU activation function makes model training easier when using different parameter initialization methods. This is because, when the output of the sigmoid activation function is very close to 0 or 1, the gradient of these regions is almost 0, so that back propagation cannot continue to update some of the model parameters. In contrast, the gradient of the ReLU activation function in the positive interval is always 1. Therefore, if the model parameters are not properly initialized, the sigmoid function may obtain a gradient of almost 0 in the positive interval, so that the model cannot be effectively trained.

Capacity Control and Preprocessing

AlexNet controls the model complexity of the fully-connected layer by dropout ([:numref: chapter_dropout](#)), while LeNet only uses weight decay. To augment the data even further, the training loop of AlexNet added a great deal of image augmentation, such as flipping, clipping, and color changes. This makes the model more robust and the larger sample size effectively reduces overfitting. We will discuss data augmentation in greater detail in [:numref: chapter_image_augmentation](#).

```
In [1]: import sys
sys.path.insert(0, '...')

import d2l
from mxnet import gluon, init, nd
from mxnet.gluon import data as gdata, nn
import os
import sys

net = nn.Sequential()
```

```
# Here, we use a larger 11 x 11 window to capture objects. At the same time,
# we use a stride of 4 to greatly reduce the height and width of the output.
# Here, the number of output channels is much larger than that in LeNet
net.add(nn.Conv2D(96, kernel_size=11, strides=4, activation='relu'),
        nn.MaxPool2D(pool_size=3, strides=2),
        # Make the convolution window smaller, set padding to 2 for consistent
        # height and width across the input and output, and increase the
```

Open Source

d2l-ai / d2l-en

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Code Issues 7 Pull requests 8 Actions Security Insights

Dive into Deep Learning: an interactive deep learning book with code, math, and discussions, based on the NumPy interface.
<https://d2l.ai>

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astonzhang Update README.md ● Latest commit 7143d28 8 minutes ago

.github Update PULL_REQUEST_TEMPLATE.md

chapter_appendix-mathematics-f... Typo fixes across repository (#730)

chapter_appendix-tools-for-deep... polish sagemaker

chapter_attention-mechanisms Typo fixes across repository (#730)

chapter_computational-performan... Typo fixes across repository (#730)

chapter_computer-vision Typo fixes across repository (#730)

chapter_convolutional-modern Typo fixes across repository (#730)

chapter_convolutional-neural-net... Typo fixes across repository (#730)

chapter_deep-learning-computati... Typo fixes across repository (#730)

chapter_generative-adversarial-n... Typo fixes across repository (#730)

Github:
Active Development

PDF

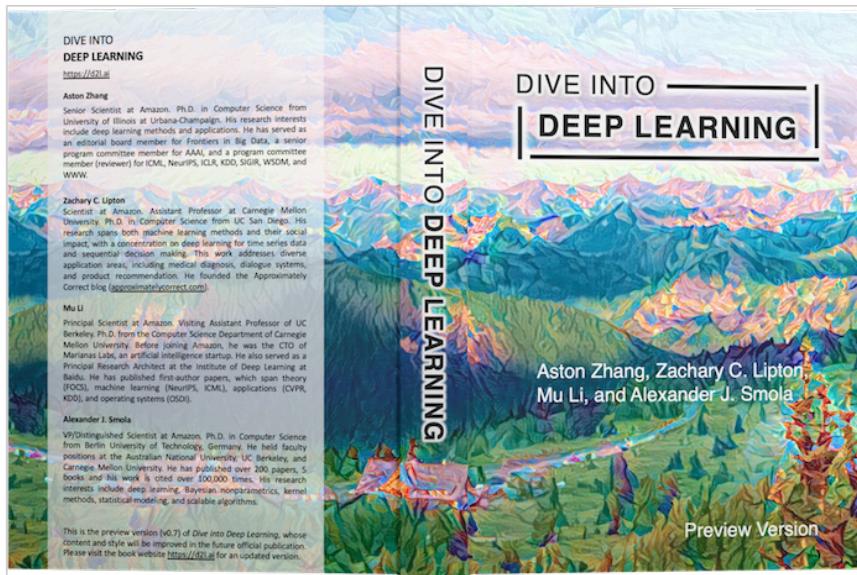
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Dive into Deep Learning
Release 0.7

Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola

STAT 157, Spring 19		Syllabus
Syllabus		
Assignments		Date Topics
		1/22 Logistics, Software, Linear Algebra
Projects	▼	1/24 Probability and Statistics (Bayes Rule, Sampling Naive Bayes, Sampling)
Units	▼	1/29 Gradients, Chain Rule, Automatic differentiation
FAQ		1/31 Linear Regression, Basic Optimization
		2/5 Likelihood, Loss Functions, Logistic Regression, Information Theory
		2/7 Multilayer Perceptron
		2/12 Model Selection, Weight Decay, Dropout
		2/14 Numerical Stability, Hardware
		2/19 Environment
		2/21 Layers, Parameters, GPUs
		2/26 Convolutional Layers

Gluon Ecosystem



[GluonCV](#)
Computer Vision

[GluonNLP](#)
Natural Language

[GluonTS](#)
Time Series Prediction

[DGL](#)
Deep Learning on Graphs

[TVM](#)
Deep Learning Compiler

[MXNet](#)
Imperative & Symbolic

