ODSC

Deep Learning Guide

The Open Data Community's Top **20** Resources

FOREWORD

So far in 2019, deep learning continues to transform the industry and wow us with its capabilities. This year alone, the research spotlight was stolen by unsupervised learning, especially in the area of NLP. Debates about the risks of publishing high-quality text generation models aside, the real stories of Google Brain's BERT and OpenAI's GPT-2 were their successive smashings of NLP benchmarks in challenging (for neural networks) domains, such as question-answering and sentence completion. Critically, these models were trained on massive corpora of unlabeled data and then simply fine-tuned to learn these specific tasks; teach an AI to read, it turns out, and it will be able to learn to answer questions about what it has read.

Several architectures, such as the cleverly-named RoBERTa, subsequently improved on BERT. Transformer-XL built on BERT's capabilities by not only beating it on these benchmarks, but also in that it is autoregressive (unlike BERT), meaning it (and the inevitable techniques that build on it) can be used for language generation, time series prediction, and so on. Finally, NVIDIA continues to demonstrate an immense capacity to scale these models up and accelerate them, training a language model with 8.3B parameters, more than 5x the largest GPT-2 model that was "too dangerous to release."

Speaking of computation, in The Battle of the Frameworks, the clear winner is the community. PyTorch's popularity continued to skyrocket—as did its production-readiness, with its JIT compiler released with 1.0 in October of last year—and TensorFlow continued to become more user-friendly, with eager execution becoming default in 2.0. Keras continues to be beloved, with many of the most popular ODSC tutorials (see list below) written in Keras. But, assuming deep learners continue to want to learn new frameworks, in a year everyone will be using JAX (or Julia) and by 2022 everything we're currently using will be lost to history (except PyTorch).

On the strictly research side, deep learning continues to conquer games of increasing complexity—for DeepMind, Starcraft, and for OpenAI, DOTA 2. Here, supervised learning with training data generated through self-play won the day. Interestingly, transformers haven't caught on for these problems yet, with tried-and-true LSTMs doing the trick.

What will the next year bring? I don't know, but if past trends continue, whatever comes will be cleverly named.

Seth Weidman
Data Scientist, Facebook

Contents

10 TOP OPEN DATA SCIENCE BLOGS

In the past two years, we have published over 400 articles on data science. Deep learning is an increasingly common and well-recieved topic in our community. Here are our 10 most-read deep learning blogs.

Visualizing Your Convolutional Neural Network Predictions With Saliency Maps, *Nathaniel Jermain*

Explore neural network predictions with saliency maps and read an example application for a ConvNet used to estimate the age of fish from their scales.

Read it here.
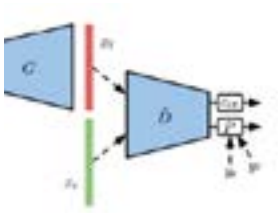
Best Deep Learning Research of 2019 So Far,
Daniel Gutierrez

It's been an impressive year for deep learning research! Here are some of the best papers we've found.

Read it here.
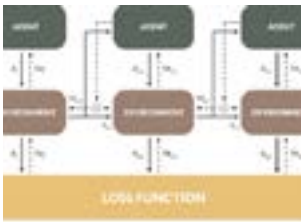
Reinforcement Learning vs. Differentiable Programming,
Mike Innes

This article shows what differentiable programming can bring to some simple but classic control problems where we would normaly use reinforcement learning. DP-based models not only learn far more effective contral strategies than RL, but also train orders of magnitutde faster.

Read it here.

Deep Learning with Reinforcement Learning,
Daniel Gutierrez

You hear of both these terms frequently in the data science world. How do you combine deep learning with reinforcement learning for the best results?
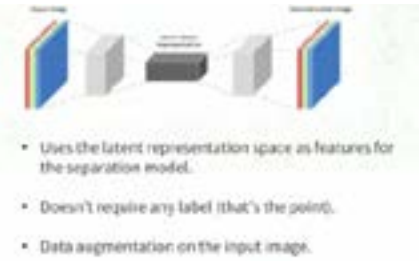
Read it here.
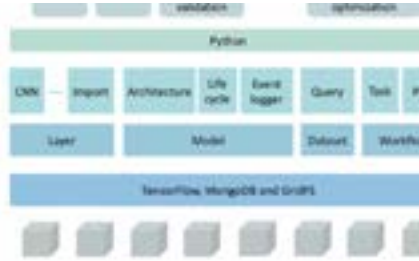
TensorLayer for Developing Complex Deep Learning Systems, *Daniel Gutierrez*

Learn about TensorLayer, a modular Python wrapper library for TensorFlow which allows data scientists to create complex deep learning systems quicker.

Read it here.

Create your First Face Detector in Minutes Using Deep Learning, *Ralabs*

Creating a face-detecting system isn't as difficult as you may think. In fact, you can make one in minutes by using deep learning. This article explains how.
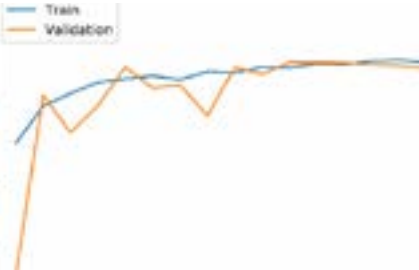
Read it here.

Mail Processing with Deep Learning: A Case Study
Paxtyn Merten

Learn how one U.K. team automated mail processing with deep learning to quickly and efficiently sort letters sent in the mail.
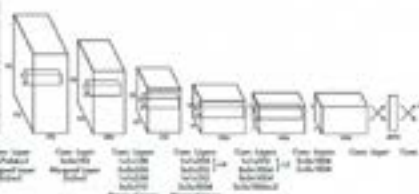
Read it here.

Getting to Know Keras for New Data Scientists,
Daniel Gutierrez

Keras is an easy-to-use Python library for developing deep learning models. Here we lay out what you should know as you get up to speed.

Read it here.

Building a Custom Convolutional Neural Network in Keras, *Nathaniel Jermain*

In this article, we walk through building a custom convolutional neural network to classify images without relying on pre-trained models.

Read it here.

Overview of the YOLO Object Detection Algorithm, *Daniel Gutierrez*

We review the YOLO (You Only Look Once) real-time object detection algorithm, which is one of the most effective object detection algorithms.

Read it here.

10 TOP TALKS FROM ODSC CONFERENCES

Out of 300+ talks from ODSC conferences in 2019, here are the 10 top-rated sessions covering deep learning.

Pavel Shkadzko
Sematics Engineer at Gini GmbH, Europe 2018

Neural Networks for Information Extraction from Financial Documents

An explination of the evolution of the neural network architectures used for information extraction, the reason we have dropped some of them at certain points, as well as the pros and cons of each architecture used.

Watch here.

Stephanie Kim
Senior Developer Solutions Engineer at Algorithmia, West 2018

Exploring the Deep Learning Framework: PyTorch

This talk objectively looks at PyTorch and why it might be the best fit for your deep learning needs. We also look at use cases that will showcase why you might want to consider using TensorFlow instead.

Watch here.

Yong Tang
Director of Engineering at MobileIron, East 2019

Deep Learning for Real-Time Streaming Data with Kafka and TensorFlow

This discusses the KafkaDataset module in TensorFlow, which processes Kafka streaming data directly to TensorFlow's graph. Combined with Kafka streaming itself, this module removes the need to have an intermediate data processing infrastructure.

Watch here.

Wojciech Samek
Head of Machine Learning Group, Europe 2018

Towards Interpretable Deep Learning

Learn from Dr. Wojciech Samek as he covers a general technique, layer-wise relevance propagation (LRP), for interpreting DNNs by explaining their predictions.

Watch here.

Lukas Biewald
Founder of Weights & Biases, East 2018

Deep Learning Techniques for Vision

This course teaches students with little knowledge of deep learning the skills to comfortably build vision models with Keras and TensorFlow.

Watch here.

Gabriela de Queiroz
Founder of R-Ladies, West 2018

Deep Learning in R with Keras

Through a series of examples, you will learn how to use Keras; how to run, track, compare, and visualize models; and finally, how to share your models and reports without leaving the RStudio IDE (set of integrated tools designed to help you be more productive with R).

Watch here.

Seth Weidman
Senior Data Scientist at Facebook, East 2019

Deep Learning from Scratch

In this tutorial, Seth Weidman presents a step-by-step explanation of neural networks, implementing them from scratch in NumPy, while showing both diagrams that explain how they work and the math that explains why they work.

Watch here.

Pramit Choudhary
Lead Data Scientist at H2O.ai, West 2018

Model Evaluation in the Land of Deep Learning

In this video, you will learn how to enable class-discriminative visualizations for computer vision/NLP problems when using convolutional neural networks (CNN) and an approach to help enable transparency of CNN's.

Watch here.

Garrett Hoffman
Director of Data Science at StockTwits, East 2018

Deep Learning Methods for Text Classification

Let's review some deep learning methods that are used for text classification. We will work through a live example using Python and TensorFlow, and finish up with some practical considerations for applying these methods to different business problems.

Watch here.

Oliver Gindele
Head of Machine Learning at Datatonic, Europe 2018

Deep Learning for Recommender Systems

In this talk, Oliver discusses how some of these novel models can be implemented in the machine learning framework TensorFlow, starting from a collaborative filtering approach and extending it to more complex deep recommender systems.

Watch here.

FROM THE EXPERTS:

What do leading data scientists think about the state of deep learning?

Generative Adversarial Networks (GANs) started a revolution in DL around 5 years ago, and the importance of GANs this year continued to advance. An important characteristic of GANs is their nature of learning—unsupervised. The broad range of use-cases of GANs have put the technology at the center of many technological and also sociological conversations. They can generate high-quality images, enhance photos, generate images from text, convert images from one domain to another, create a younger and older version of a person's facial image, and much more. On the dark side, we've seen implementations like DeepFakes which is based on GANs. DeepFakes (and more recently DeepNude) created a sensation as people speculated about the downsides of this technology. But for AI researchers, GANs represented a major breakthrough. This technology has the potential to be scary, but it is up to us to use it for social good.

Technology designed for addressing the need for "explainable AI" will mature in the balance of 2019 and into 2020. New companies are already leading the pack with state-of-the-art solutions, see Kyndi, simMachines, and DarwinAI. There is a lack of trust surrounding the black box challenge of machine learning. Why is the machine making this decision? On what basis is this decision being made? There is a certain level of risk involved if you are making important business choices by betting on a machine's decisions that you don't thoroughly understand. This is where the demand for explainable AI originates.

Daniel Gutierrez
Data Science Writer and Consultant

"Don't fall into the trap of trying to apply deep learning in industry when logistic regression would suffice. Although working on personal projects with new and exciting algorithms is fun, at work you'll want to balance the effort required with the ROI when recommending approaches/methodology to solve a problem. The trade-off between effort and ROI is lessening as new packages and techniques are being introduced, but many companies still have a lot of catching up to do in terms of data maturity.

Kristen Kehrer
Founder, Data Moves Me LLC
Instructor, UC Berkely Ext.
Data Science/Machine Learning SME, Emeritus Institute of Management

I think the best way to learn modeling skills is to build a variety of models on new data sets. Learn by failing, researching, and adapting.

Nate Jermain
OpenDataScience.com Staff Writer, Consultant

It is necessary to have a clear understanding of deep learning limitations. Need to overcome the "black box" or opacity problem. The deep learning algorithms deal with large numbers of data points to identify correlations/patterns and are not easily traced.

Kate Strachnyi
Data Visualization Specialist - Story by Data

Cheap commodity deep learning hardware should be mature enough to make it available to more researchers and data scientists.

Yong Tang
Director of Engineering at MobleIron

Open Data Science
HIGHLIGHTS

Blog with the
MOST TRAFFIC:
Mail Processing with Deep Learning: A Case Study, *Paxtyn Merten*

70,000
subscriptions to our weekly newsletter

#1
blog on @ODSC Medium:
Best Deep Learning Research of 2019 So Far, *Daniel Gutierrez*

Learn.AI course with the
HIGHEST ENROLLMENT:
Deep Learning Using PyTorch, *Soumith Chintala*
Watch here

Letter from the Editor

My first exposure to the world of machine learning and deep learning was a few years ago during my time at MIT Professional Education, where I worked in marketing to promote many of their short programs. The breadth of their offerings was impressive, but it was their courses with Vivienne Sze and Regina Barzilay that intrigued me the most.

Machine learning and deep learning were both completely new to me. My only knowledge of data science was being able to do some basic sentiment analysis in R during my time as a graduate student at Boston University. Aside from that, I knew the terms, but that was it—they were terms under the AI umbrella to me. Now that I've been with ODSC for over a year, however, I see that "Machine Learning" and "Deep Learning" are umbrellas in their own right.

Deep learning fascinates me. As a former psychology major and almost-psychologist, the concept of neural networks are compelling. Although I find that there's an art to content curation that makes understanding the brain quite useful, such as contemplating human motivation or the repercussions of media use, my (albeit now-limited) psych knowledge is only applicable at that level. The emerging field of study, rapidly growing in breadth and depth, is called deep learning for a reason—just like the brain, AI has layers and priorities. We're only going deeper from here!

Additionally, deep learning is incredibly reflective of how far we've come with technology. The amount of computational power required to run DL initiatives is impressive, and thus we need specialized computers and data centers to handle it. In my place of work, I sit near another company that uses ML and DL on a regular basis, and I'll hear their computers from across the office when they're running an overnight algorithm. If my laptop had emotions, it would feel inadequate in comparison.

I appreciate how involved DL engineers are with academia—even the working data scientists still reads papers for fun. I've spoken to a few practitioners who will print out papers and leave them in their bags to read on public transport or during lunch breaks. I suppose it's expected in a field that's so research-oriented. Now, if only us marketing professionals could be so engaged with research and academia.

I hope that the resources provided in this guide prove to be helpful to you, your organization, your friends, and whoever else's interests might be piqued. Each writer and speaker in this guide is an expert, and I'm sure that the insights they provide will enhance your knowledge and practice of deep learning.

-Alex Landa, ODSC Content Manager

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There are many ways you can engage with the Open Data Science Community today!

Webinars
We offer free webinars several times a month, covering a variety of topics. **Follow this page** to learn more about upcoming webinars.

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ODSC East 2020

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2020 ODSC Events
East: April 13-17
India: September 9-12
Europe: September 14-18
West: October 26-30

Meetups
We hold meetups in 37 cities around the world, designed to convene data scientists for education, networking, and even a little fun. **See upcoming events here.**

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