

Machine Learning

Resources and References

Machine learning crash course (self paced) (MLCC)

Secure | <https://developers.google.com/machine-learning/crash-course/logistic-regression/calculating-a-probability>

Machine Learning Crash Course

OVERVIEW COURSE EXERCISES GLOSSARY

Introduction
IP Prerequisites and Prework

ML Concepts

- Introduction to ML (3 min)
- Framing (15 min)
- Descending into ML (20 min)
- Reducing Loss (50 min)
- First Steps with TF (50 min)
- Generalization (15 min)
- Training and Test Sets (25 min)
- Validation (40 min)
- Representation (55 min)
- Feature Crosses (70 min)
- Regularization: Simplicity (40 min)
- Logistic Regression (20 min)
- Classification (90 min)
- Regularization: Sparsity (45 min)
- Introduction to Neural Nets (55 min)
- Training Neural Nets (40 min)
- Multi-Class Neural Nets (50 min)
- Embeddings (80 min)

ML Engineering

- Production ML Systems (3 min)
- Static vs. Dynamic Training (7 min)
- Static vs. Dynamic Inference (7 min)
- Data Dependencies (14 min)

Estimated Time: 10 minutes

Many problems require a probability estimate as output. Logistic regression is an extremely efficient mechanism for calculating probabilities. Practically speaking, you can use the returned probability in either of the following two ways:

- "As is"
- Converted to a binary category.

Let's consider how we might use the probability "as is." Suppose we create a logistic regression model to predict the probability that a dog will bark during the middle of the night. We'll call that probability:

```
p(bark | night)
```

If the logistic regression model predicts a $p(\text{bark} | \text{night})$ of 0.05, then over a year, the dog's owners should be startled awake approximately 18 times:

```
startled = p(bark | night) * nights  
18 == 0.05 * 365
```

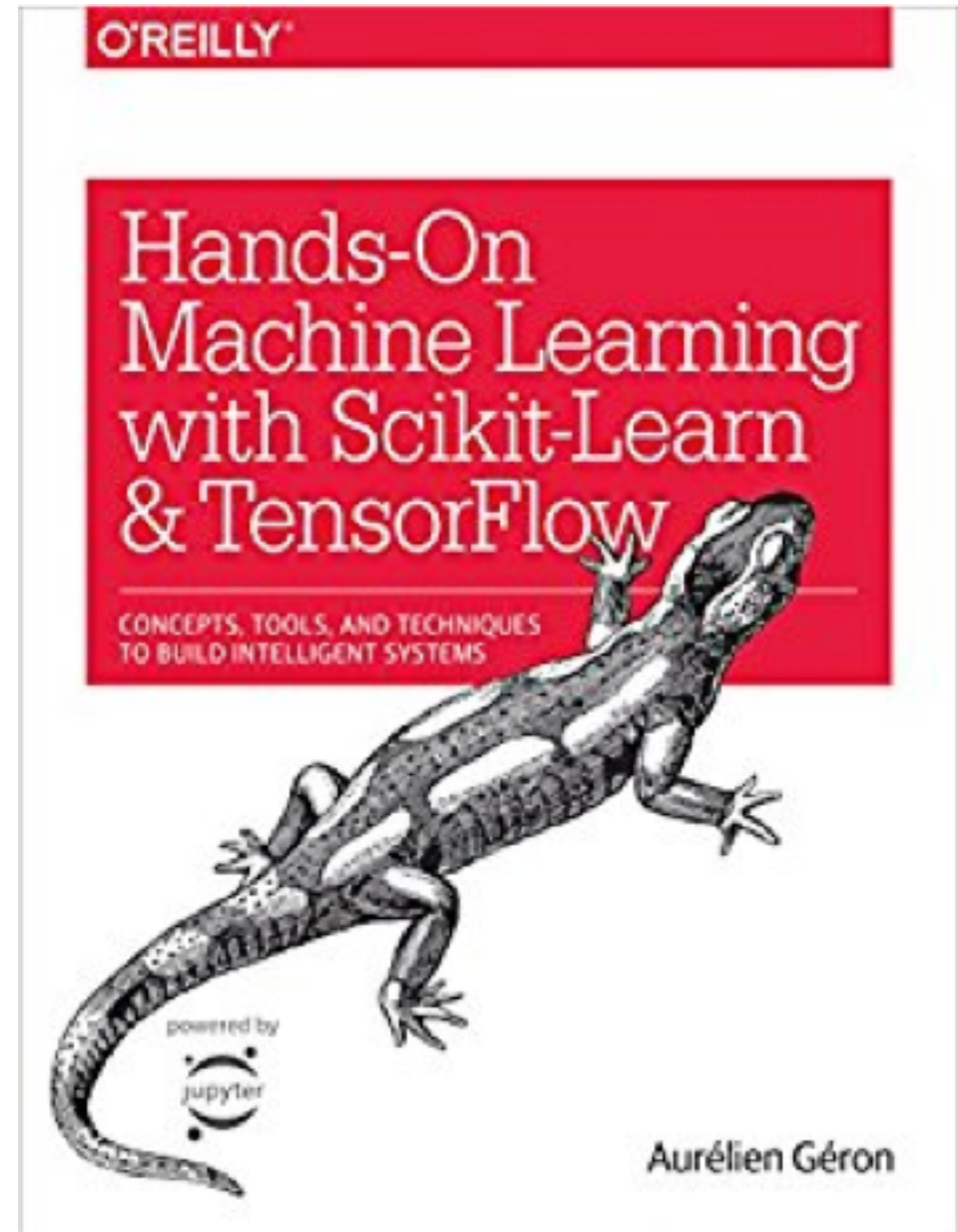
In many cases, you'll map the logistic regression output into the solution to a binary classification problem, in which the goal is to correctly predict one of two possible labels (e.g., "spam" or "not spam"). A later [module](#) focuses on that.

You might be wondering how a logistic regression model can ensure output that always falls between 0 and 1. As it happens, a **sigmoid function**, defined as follows, produces output having those same characteristics:

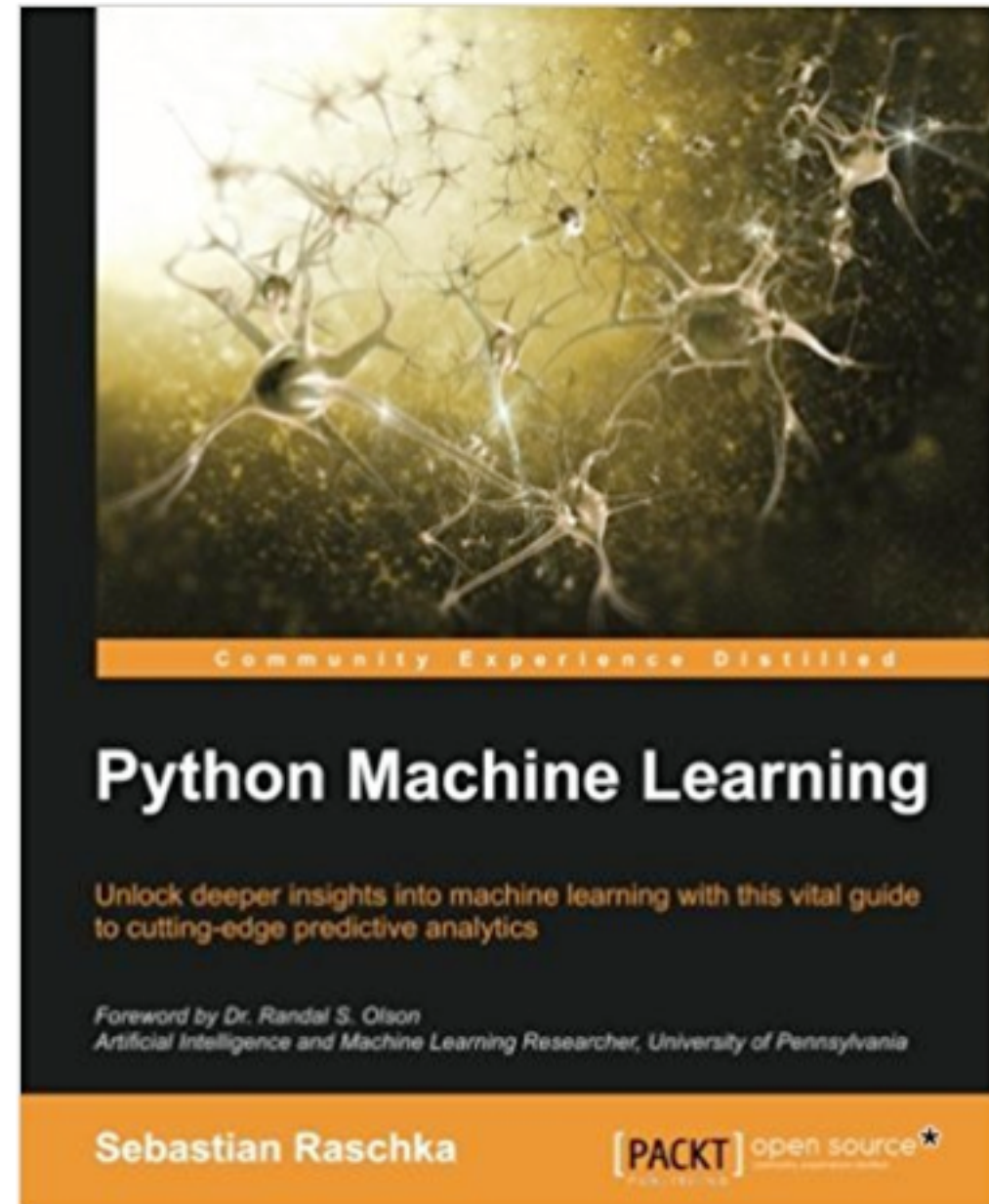
$$y = \frac{1}{1 + e^{-x}}$$

The sigmoid function yields the following plot:

Hands-On Machine Learning
with Scikit-Learn and
TensorFlow: Concepts, Tools,
and Techniques to Build
Intelligent Systems
- Aurélien Géron



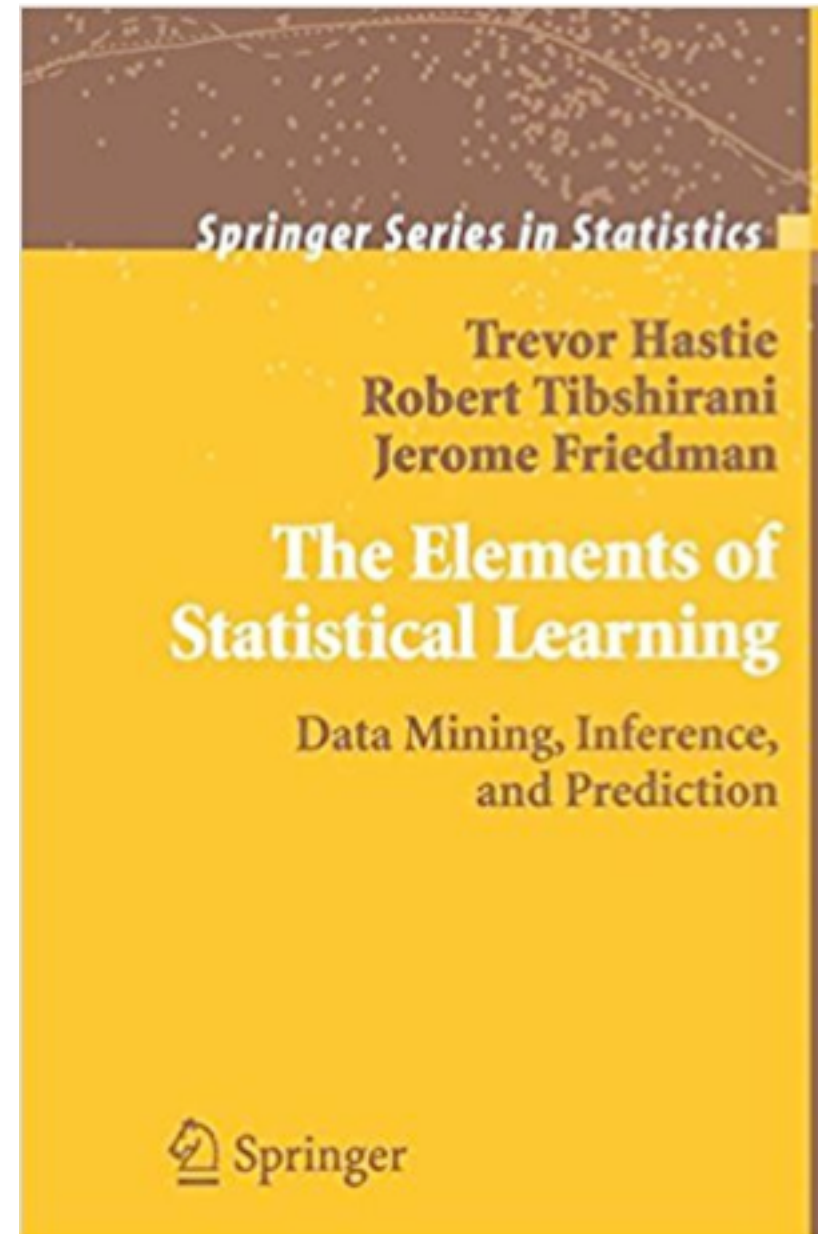
Python Machine Learning - Sebastian Raschka



Deep Learning (Adaptive
Computation and
Machine Learning series)
- Ian Goodfellow



**The Elements of
Statistical Learning:
Data Mining,
Inference, and
Prediction - Trevor
Hastie**



OpenIntro Statistics

OpenIntro Statistics

Third Edition



David M Diez
Christopher D Barr
Mine Çetinkaya-Rundel

3

Machine Learning (MOOC) - Andrew Ng (coursera.org)



Machine Learning
Stanford University

Deep Learning
(MOOC)-
Andrew Ng
(coursera.org)



Deep Learning
deeplearning.ai

Class notes from Machine Learning - Andrew Ng

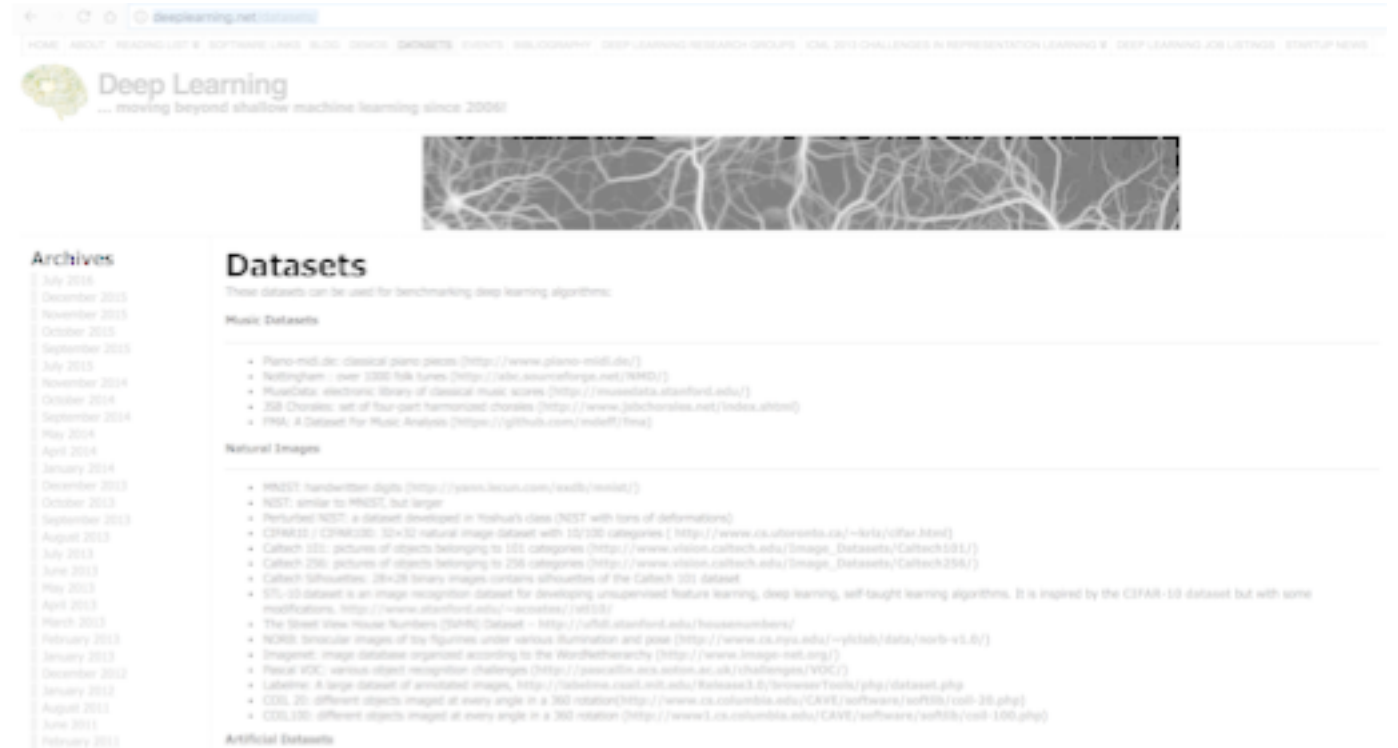
https://1drv.ms/f/s!AqPMqweMPzEegpsyjwSffQygj_En8w

CS231n: Convolutional Neural Networks for Visual Recognition Stanford

- <http://cs231n.github.io/>
- <https://www.youtube.com/playlist?list=PL3FW7Lu3i5JvHM8ljYj-zLfQRF3EO8sYv>

Dataset for Deep Learning

<http://deeplearning.net/datasets/>



The screenshot shows the 'Datasets' page of the Deep Learning website. The header features the 'Deep Learning' logo with the tagline '... moving beyond shallow machine learning since 2006!'. Below the header is a decorative image of a neural network. The main content area is divided into two columns. The left column, titled 'Archives', lists dates from July 2016 down to February 2011. The right column, titled 'Datasets', contains a sub-header 'These datasets can be used for benchmarking deep learning algorithms:' followed by two sections: 'Music Datasets' and 'Natural Images'. Each section contains a list of dataset links and descriptions. The 'Artificial Datasets' section is partially visible at the bottom.

Archives

- July 2016
- December 2015
- November 2015
- October 2015
- September 2015
- July 2015
- November 2014
- October 2014
- September 2014
- May 2014
- April 2014
- January 2014
- December 2013
- October 2013
- September 2013
- August 2013
- July 2013
- June 2013
- May 2013
- April 2013
- March 2013
- February 2013
- January 2013
- December 2012
- January 2012
- August 2011
- June 2011
- February 2011

Datasets

These datasets can be used for benchmarking deep learning algorithms:

Music Datasets

- Piano-midi.de: classical piano pieces (<http://www.piano-midi.de/>)
- Nottingham: over 1000 folk tunes (<http://folk.ics.surrey.ac.uk/NOTMIDI/>)
- MusoData: electronic library of classical music scores (<http://musodata.stanford.edu/>)
- 258 Chordex: set of four-part harmonized chorales (<http://www.johncornelissen.net/index.shtml>)
- YMA: A Dataset for Music Analysis (<https://github.com/ymlaff/fma>)








Natural Images

- MNIST: handwritten digits (<http://www.ylex.com/mnist/>)
- NIST: similar to MNIST, but larger
- Perturbed NIST: a dataset developed in Yoshua's class (NIST with tons of deformations)
- CIFAR-10 / CIFAR-100: 32x32 natural image dataset with 10/100 categories (<http://www.cs.toronto.edu/~kriz/cifar.html>)
- Caltech 101: pictures of objects belonging to 101 categories (http://www.vision.caltech.edu/Image_Datasets/Caltech101/)
- Caltech 256: pictures of objects belonging to 256 categories (http://www.vision.caltech.edu/Image_Datasets/Caltech256/)
- Caltech Siftoutlines: 28x28 binary images contains sifto outlines of the Caltech 101 dataset
- STL-10 dataset is an image recognition dataset for developing unsupervised feature learning, deep learning, self taught learning algorithms. It is inspired by the CIFAR-10 dataset but with some modifications. (<http://www.stanford.edu/~acoates/stl10/>)
- The Street View House Numbers (SVHN) Dataset - (<http://ufll.stanford.edu/housenumbers/>)
- NORO: binocular images of toy figures under various illumination and pose (<http://www.cs.toronto.edu/~yichao/data/noro-v1.0/>)
- ImageNet: image database organized according to the WordNet hierarchy (<http://www.image-net.org/>)
- Pascal VOC: various object recognition challenges (<http://www.eecs.utoronto.ca/~kviskay/pascal/VOC/>)
- Caltech101: A large dataset of annotated images. (<http://caltech101.csail.mit.edu/Release3.0/browsers/Tools.php?dataset.php>)
- COIL 20: different objects imaged at every angle in a 360 rotation (<http://www.cs.columbia.edu/CAVE/software/softlib/coil-20.php>)
- COIL 100: different objects imaged at every angle in a 360 rotation (<http://www1.cs.columbia.edu/CAVE/software/softlib/coil-100.php>)

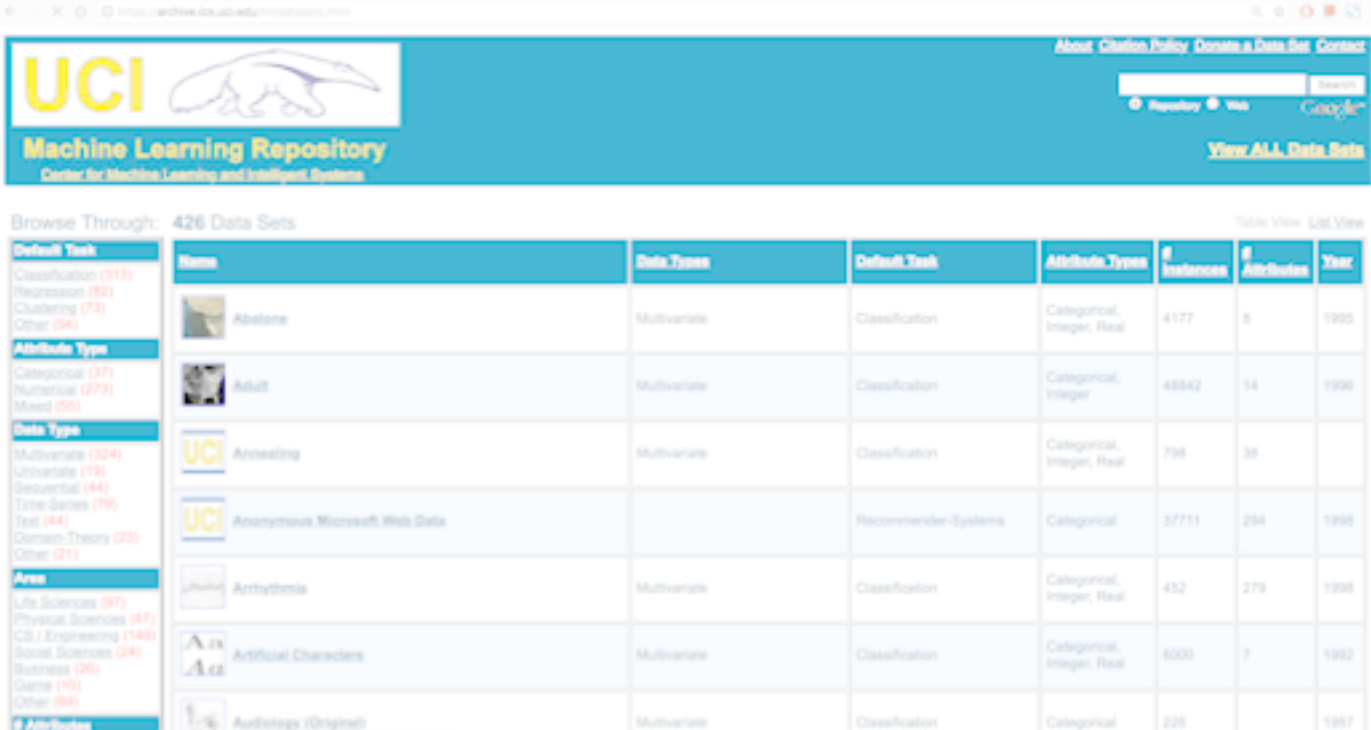
Artificial Datasets

Kaggle machine learning competition Kaggle.com







Secure | <https://www.kaggle.com/competitions>

15 Active Competitions		
	2018 Data Science Bowl Find the nuclei in divergent images to advance medical discovery <i>Featured</i> - 14 days to go - % biology	\$100,000 3,268 teams
	Google Cloud & NCAA® ML Competition 2018-Men's Apply Machine Learning to NCAA® March Madness® <i>Featured</i> - 8 hours to go - % basketball	\$50,000 934 teams
	TalkingData AdTracking Fraud Detection Challenge Can you detect fraudulent click traffic for mobile app ads? <i>Featured</i> - a month to go - %	\$25,000 2,072 teams
	iMaterialist Challenge (Furniture) at FGVC5 Image Classification of Furniture & Home Goods. <i>Research</i> - 2 months to go - %	\$2,500 141 teams
	Google Landmark Retrieval Challenge Given an image, can you find all of the same landmarks in a dataset? <i>Research</i> - 2 months to go - % image data	\$2,500 101 teams
	Google Landmark Recognition Challenge Label famous (and not-so-famous) landmarks in images <i>Research</i> - 2 months to go - % image data	\$2,500 192 teams
	ImageNet Object Detection Challenge Identify and label everyday objects in images <i>Research</i> - 10 years to go - % image data, object detection	Knowledge 0 teams

UCI machine learning repo for datasets



The screenshot shows the UCI Machine Learning Repository website. The header includes the UCI logo, the text "Machine Learning Repository", and a navigation bar with links like "About", "Privacy Policy", "Donate a Data Set", and "Contact". A search bar is also present. Below the header, there's a section "Browse Through: 426 Data Sets" with a "Table View" link. A table lists various datasets with columns for Name, Data Types, Default Task, Attribute Types, # Instances, # Attributes, and Year. The table includes datasets like Abalone, Adult, Annealing, Anonymous Microsoft Web Data, Arrhythmia, Artificial Characters, and Audiology (Original).

Name	Data Types	Default Task	Attribute Types	# Instances	# Attributes	Year
 Abalone	Multivariate	Classification	Categorical, Integer, Real	4177	8	1995
 Adult	Multivariate	Classification	Categorical, Integer	48842	14	1996
 Annealing	Multivariate	Classification	Categorical, Integer, Real	796	38	
 Anonymous Microsoft Web Data		Recommender Systems	Categorical	37711	294	1998
 Arrhythmia	Multivariate	Classification	Categorical, Integer, Real	452	279	1998
 Artificial Characters	Multivariate	Classification	Categorical, Integer, Real	6000	7	1992
 Audiology (Original)	Multivariate	Classification	Categorical	226		1987

Blogs of AI, ML

- <https://machinelearningmastery.com/blog/>
- <https://blog.algorithmia.com/>
- <https://aitopics.org/search>
- <https://machinelearnings.co/>
- <https://chatbotmagazine.com/>
- <https://chatbotslife.com/>
- <http://www.33rdsquare.com/>
- <https://openai.com/blog>
- <https://intelligence.org/blog/>
- <https://www.reddit.com/r/artificial/>
- <https://aitopics.org/search>
- <https://machinelearnings.co/>
- <https://www.artificial-intelligence.blog/>

- [Allen Institute for Artificial Intelligence](#)
- <https://www.reddit.com/r/singularity/>
- <http://research.baidu.com/>
- <https://www.artificiallawyer.com/>
- <http://www.expertsystem.com/blog/>
- <https://aws.amazon.com/blogs/gi>
- <https://medium.com/ai-roadmap-institute>
- <https://deepmind.com/blog/>
- <https://www.inbenta.com/en/blog/>
- <https://blog.clarifai.com/>
- <https://www.datarobot.com/blog/>
- <https://medium.com/archieai>
- <https://www.singularityweblog.com/blog/>
- <https://iris.ai/blog/>
- <https://blogs.nvidia.com/>

More References

- [Machine Learning Lecture Notes from MIT](#)
 - [Challenges in Machine Learning and Data Mining](#)
 - [Introduction to Statistical Learning](#)
 - [Machine Learning Slides from Edx](#)
 - [Matrix Cookbook](#)
 - [Deep Learning Book](#)
 - [Michael Nielsen's tutorials](#)
 - [Convolutional Neural Network for Visual Recognition](#)
-
- [Basic Derivative Formula](#)
 - [Oxford University Deep learning Course Material](#)
 - [Deep Learning Mind Map](#)
 - [MIT Course - Deep Learning for Self Driving Car](#)
 - [CS231n: Convolutional Neural Networks for Visual Recognition](#)
 - [Artificial Intelligence - A modern approach](#)
 - [Mathematical Summary](#)
 - [Kernel functions in machine learning](#)
 - [Introduction to linear algebra](#)
 - [Jupyter Notebook](#) Tips
 - [Parallel Algorithms](#)

Research papers

The screenshot shows the arXiv.org interface for the paper "The Matrix Calculus You Need For Deep Learning" by Terence Parr and Jeremy Howard. The page is from the Cornell University Library. The URL is <https://arxiv.org/abs/1802.01528>. The paper is categorized under Computer Science > Learning. The submission date is 3 Feb 2018 (v1), and the last revised date is 6 Feb 2018 (this version, v2). The abstract states: "This paper is an attempt to explain all the matrix calculus you need in order to understand the training of deep neural networks. We assume no math knowledge beyond what you learned in calculus 1, and provide links to help you refresh the necessary math where needed. Note that you do not need to understand this material before you start learning to train and use deep learning in practice; rather, this material is for those who are already familiar with the basics of neural networks, and wish to deepen their understanding of the underlying math. Don't worry if you get stuck at some point along the way—just go back and reread the previous section, and try writing down and working through some examples. And if you're still stuck, we're happy to answer your questions in the Theory category at forums.fast.ai. Note: There is a reference section at the end of the paper summarizing all the key matrix calculus rules and terminology discussed here." The page also includes a "Download" section with links to PDF and other formats, a "Current browse context" section with links to "prev" and "next", and a "Change to browse by" section with links to "CS" and "stat.ML". There is also a "References & Citations" section with a link to "NASA ADS".

Cornell University Library

arXiv.org > cs > arXiv:1802.01528

Search in Article ID: All papers

Computer Science > Learning

The Matrix Calculus You Need For Deep Learning

Terence Parr, Jeremy Howard

Submitted on 3 Feb 2018 (v1), last revised 6 Feb 2018 (this version, v2)

This paper is an attempt to explain all the matrix calculus you need in order to understand the training of deep neural networks. We assume no math knowledge beyond what you learned in calculus 1, and provide links to help you refresh the necessary math where needed. Note that you do not need to understand this material before you start learning to train and use deep learning in practice; rather, this material is for those who are already familiar with the basics of neural networks, and wish to deepen their understanding of the underlying math. Don't worry if you get stuck at some point along the way—just go back and reread the previous section, and try writing down and working through some examples. And if you're still stuck, we're happy to answer your questions in the Theory category at forums.fast.ai. Note: There is a reference section at the end of the paper summarizing all the key matrix calculus rules and terminology discussed here.

Comments: PDF version of mobile/web friendly version [this link \(v2\)](https://arxiv.org/pdf/1802.01528v2.pdf)

Subjects: Learning (cs.LG); Machine Learning (stat.ML)

Cite as: arXiv:1802.01528 [cs.LG]
or [arXiv:1802.01528v2](https://arxiv.org/abs/1802.01528v2) [cs.LG] for this version

Submission history

From: Terence Parr ([new email](mailto:terence.parr@cornell.edu))
[v1] Mon, 5 Feb 2018 17:37:59 GMT (43445.0)
[v2] Tue, 6 Feb 2018 17:35:28 GMT (43945.0)

Which authors of this paper are endorsers? | [Disable MathJax](#) (What is MathJax?)

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cs.LG

[prev](#) | [next](#) | [new](#) | [recent](#) | [1802](#)

Change to browse by:

cs

stat.ML

References & Citations

- NASA ADS

Bookmark [arXiv:1802.01528v2](#)

Articles on deep learning

[Understanding Neural Network: A beginner's guide](#)

[Artificial Neural Network \(ANN\) in Machine Learning](#)

[30 Free Courses: Neural Networks, Machine Learning, Algorithms, AI](#)

[Building Convolutional Neural Networks with Tensorflow](#)

[A simple neural network with Python and Keras +](#)

[Implementing a Neural Network from Scratch in Python](#)

[Neural Networks: Crash Course On Multi-Layer Perceptron](#)

[Understanding Neural Networks with TensorFlow Playground](#)

[Making data science accessible – Neural Networks](#)

[Must Know Tips/Tricks in Deep Neural Networks](#)

[An Introduction to Implementing Neural Networks using TensorFlow](#)

[Yet another introduction to Neural Networks](#)

[Matrix Multiplication in Neural Networks](#)

[Neural Networks: The Backpropagation algorithm in a picture](#)

[Accelerating Convolutional Neural Networks on Raspberry Pi](#)

[The Unreasonable Effectiveness of Recurrent Neural Networks](#)

[Book: Neural Networks and Statistical Learning](#)

[Neural Networks as a Corporation Chain of Command](#)

[Recurrent neural networks, Time series data and IoT](#)

[Predicting Car Prices Using Neural Network](#)

[Beyond Deep Learning – 3rd Generation Neural Nets](#)

[Use Neural Networks to Find the Best Words to Title Your eBook](#)

Image Dataset for object detection

Dataset	Description
https://github.com/openimages/dataset	Open Images is a dataset of ~9 million URLs to images that have been annotated with image-level labels and bounding boxes spanning thousands of classes
http://cocodataset.org/#home	Image segmentation on household items
https://hci.iwr.uni-heidelberg.de/node/6132	Dataset image segmentation on traffic lights
http://www.cvlibs.net/datasets/kitti/	Computer vision for autonomous car
https://cs.stanford.edu/~roozbeh/pascal-context/	Semantic segmentation task by providing annotations for the whole scene
http://host.robots.ox.ac.uk/pascal/VOC/index.html	Object class recognition. Images are originally from flickr.

Computer Vision Reading Group

www.cs.ubc.ca/nest/lci/cvrg/

Computer Vision Reading Group

To **subscribe** to the mailing list for talk announcements, send a message to majordomo@cs.ubc.ca with the words **subscribe cvrg-l** in the body.

A list of upcoming papers can be found [below](#). To be added to the schedule contact **Bicheng Xu** (bichengx@cs.ubc.ca).

Upcoming presentations

Date	Presenter	Paper or topic
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Finished presentations, 2018

Date	Presenter	Paper or topic
Apr. 6	Candice	What have we learned from deep representations for action recognition? [link]
Mar. 23	Gursimran	A Simple Neural Network Module for Relational Reasoning [link]
Mar. 2	Polina	Inferring Semantic Layout for Hierarchical Text-to-Image Synthesis [link]
Feb. 16	Suhail	AttnGAN [link] Generative Adversarial Text to Image Synthesis [link]
Feb. 9	Borna	Mask R-CNN [link]
Feb. 2	Bicheng	Teaching Machines to Describe Images via Natural Language Feedback [link]
Jan. 26	Aineza	Is it hard to say I don't know?
Jan. 19	Bo Zhao	Inferring and Executing Programs for Visual Reasoning [link]

<http://www.cs.ubc.ca/nest/lci/cvrg/>