A Tour of Machine Learning Algorithms

by **Jason Brownlee** on November 25, 2013 in **Machine Learning Algorithms**

In this post, we take a tour of the most popular machine learning algorithms.

It is useful to tour the main algorithms in the field to get a feeling of what methods are available.

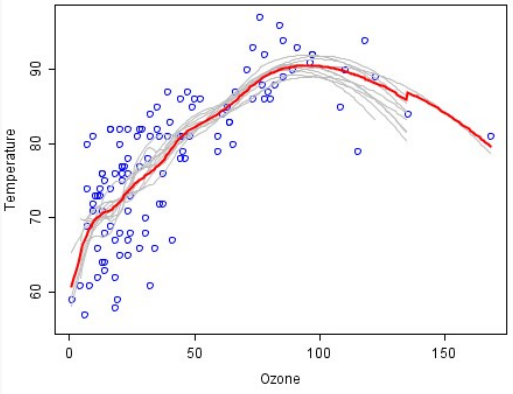
There are so many algorithms available that it can feel overwhelming when algorithm names are thrown around and you are expected to just know what they are and where they fit.

I want to give you two ways to think about and categorize the algorithms you may come across in the field.

- The first is a grouping of algorithms by the **learning style**.
- The second is a grouping of algorithms by **similarity** in form or function (like grouping similar animals together).

Both approaches are useful, but we will focus in on the grouping of algorithms by similarity and go on a tour of a variety of different algorithm types.

After reading this post, you will have a much better understanding of the most popular machine learning algorithms for supervised learning and how they are related.



A cool example of an ensemble of lines of best fit. Weak members are grey, the combined prediction is red.
Plot from Wikipedia, licensed under public domain.

Algorithms Grouped by Learning Style

There are different ways an algorithm can model a problem based on its interaction with the experience or environment or whatever we want to call the input data.

It is popular in machine learning and artificial intelligence textbooks to first consider the learning styles that an algorithm can adopt.

There are only a few main learning styles or learning models that an algorithm can have and we'll go through them here with a few examples of algorithms and problem types that they suit.

This taxonomy or way of organizing machine learning algorithms is useful because it forces you to think about the roles of the input data and the model preparation process and select one that is the most appropriate for your problem in order to get the best result.

Let's take a look at three different learning styles in machine learning algorithms:

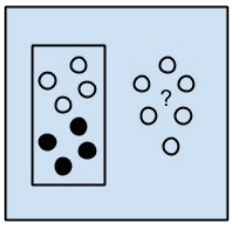
1. Supervised Learning

Input data is called training data and has a known label or result such as spam/not-spam or a stock price at a time.

A model is prepared through a training process in which it is required to make predictions and is corrected when those predictions are wrong. The training process continues until the model achieves a desired level of accuracy on the training data.

Example problems are classification and regression.

Example algorithms include Logistic Regression and the



Supervised Learning Algorithms

Back Propagation Neural Network.

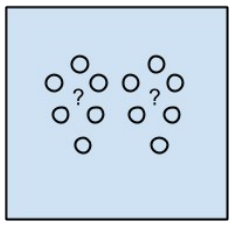
2. Unsupervised Learning

Input data is not labeled and does not have a known result.

A model is prepared by deducing structures present in the input data. This may be to extract general rules. It may be through a mathematical process to systematically reduce redundancy, or it may be to organize data by similarity.

Example problems are clustering, dimensionality reduction and association rule learning.

Example algorithms include: the Apriori algorithm and k-Means.



Unsupervised Learning Algorithms

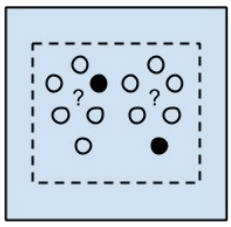
3. Semi-Supervised Learning

Input data is a mixture of labeled and unlabelled examples.

There is a desired prediction problem but the model must learn the structures to organize the data as well as make predictions.

Example problems are classification and regression.

Example algorithms are extensions to other flexible methods that make assumptions about how to model the unlabeled data.



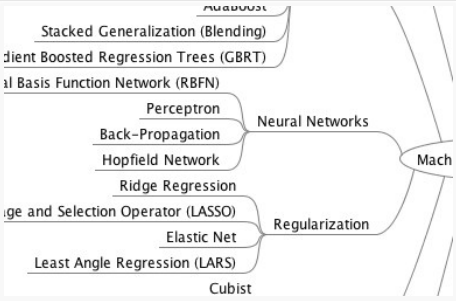
Semi-supervised Learning Algorithms

Overview

When crunching data to model business decisions, you are most typically using supervised and unsupervised learning methods.

A hot topic at the moment is semi-supervised learning methods in areas such as image classification where there are large datasets with very few labeled examples.

Get your FREE Algorithms Mind Map



Sample of the handy machine learning algorithms mind map.

I've created a handy mind map of 60+ algorithms organized by type.

Download it, print it and use it.

Download For Free

Also get exclusive access to the machine learning algorithms email mini-course.

Algorithms Grouped By Similarity

Algorithms are often grouped by similarity in terms of their function (how they work). For example, tree-based methods, and neural network inspired methods.

I think this is the most useful way to group algorithms and it is the approach we will use here.

This is a useful grouping method, but it is not perfect. There are still algorithms that could just as easily fit into multiple categories like Learning Vector Quantization that is both a neural network inspired method and an instance-based method. There are also categories that have the same name that describe the problem and the class of algorithm such as Regression and Clustering.

We could handle these cases by listing algorithms twice or by selecting the group that subjectively is the “best” fit. I like this latter approach of not duplicating algorithms to keep things simple.

In this section, I list many of the popular machine learning algorithms grouped the way I think is the most intuitive. The list is not exhaustive in either the groups or the algorithms, but I think it is representative and will be useful to you to get an idea of the lay of the land.

Please Note: There is a strong bias towards algorithms used for classification and regression, the two most prevalent supervised machine learning problems you will encounter.

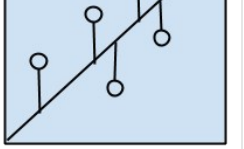
If you know of an algorithm or a group of algorithms not listed, put it in the comments and share it with us. Let’s dive in.

Regression Algorithms

Regression is concerned with modeling the relationship between variables that is iteratively refined using a measure of error in the predictions made by the model.

- Your First Model for Time Series Forecasting

Regression methods are a workhorse of statistics and have been co-opted into statistical machine learning. This may be confusing because we can use regression to refer to the class of problem and the class of algorithm. Really, regression is a process.



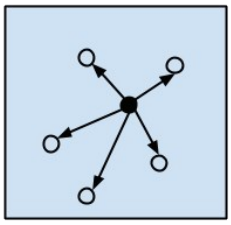
Regression Algorithms

The most popular regression algorithms are:

- Ordinary Least Squares Regression (OLSR)
- Linear Regression
- Logistic Regression
- Stepwise Regression
- Multivariate Adaptive Regression Splines (MARS)
- Locally Estimated Scatterplot Smoothing (LOESS)

Instance-based Algorithms

Instance-based learning model is a decision problem with instances or examples of training data that are deemed important or required to the model.



Instance-based Algorithms

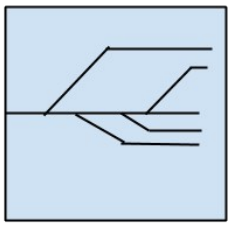
Such methods typically build up a database of example data and compare new data to the database using a similarity measure in order to find the best match and make a prediction. For this reason, instance-based methods are also called winner-take-all methods and memory-based learning. Focus is put on the representation of the stored instances and similarity measures used between instances.

The most popular instance-based algorithms are:

- k-Nearest Neighbor (kNN)
- Learning Vector Quantization (LVQ)
- Self-Organizing Map (SOM)
- Locally Weighted Learning (LWL)

Regularization Algorithms

An extension made to another method (typically regression methods) that penalizes models based on their complexity, favoring simpler models that are also better at generalizing.



Regularization Algorithms

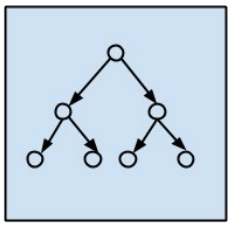
I have listed regularization algorithms separately here because they are popular, powerful and generally simple modifications made to other methods.

The most popular regularization algorithms are:

- Ridge Regression
- Least Absolute Shrinkage and Selection Operator (LASSO)
- Elastic Net
- Least-Angle Regression (LARS)

Decision Tree Algorithms

Decision tree methods construct a model of decisions made based on actual values of attributes in the data.



Decision Tree Algorithms

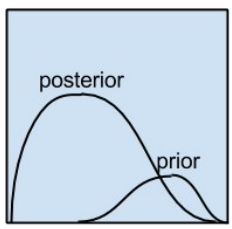
Decisions fork in tree structures until a prediction decision is made for a given record. Decision trees are trained on data for classification and regression problems. Decision trees are often fast and accurate and a big favorite in machine learning.

The most popular decision tree algorithms are:

- Classification and Regression Tree (CART)
- Iterative Dichotomiser 3 (ID3)
- C4.5 and C5.0 (different versions of a powerful approach)
- Chi-squared Automatic Interaction Detection (CHAID)
- Decision Stump
- M5
- Conditional Decision Trees

Bayesian Algorithms

Bayesian methods are those that explicitly apply Bayes' Theorem for problems such as classification and regression.



Bayesian Algorithms

The most popular Bayesian algorithms are:

- Naive Bayes
- Gaussian Naive Bayes
- Multinomial Naive Bayes
- Averaged One-Dependence Estimators (AODE)
- Bayesian Belief Network (BBN)
- Bayesian Network (BN)

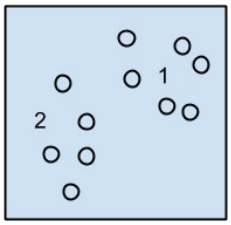
Clustering Algorithms

Clustering, like regression, describes the class of problem and the class of methods.

Clustering methods are typically organized by the modeling approaches such as centroid-based and hierarchal. All methods are concerned with using the inherent structures in the data to best organize the data into groups of maximum commonality.

The most popular clustering algorithms are:

- k-Means
- k-Medians
- Expectation Maximisation (EM)
- Hierarchical Clustering



Clustering Algorithms

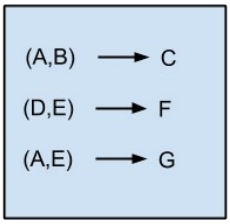
Association Rule Learning Algorithms

Association rule learning methods extract rules that best explain observed relationships between variables in data.

These rules can discover important and commercially useful associations in large multidimensional datasets that can be exploited by an organization.

The most popular association rule learning algorithms are:

- Apriori algorithm
- Eclat algorithm



Association Rule Learning Algorithms

Artificial Neural Network Algorithms

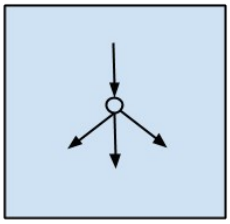
Artificial Neural Networks are models that are inspired by the structure and/or function of biological neural networks.

They are a class of pattern matching that are commonly used for regression and classification problems but are really an enormous subfield comprised of hundreds of algorithms and variations for all manner of problem types.

Note that I have separated out Deep Learning from neural networks because of the massive growth and popularity in the field. Here we are concerned with the more classical methods.

The most popular artificial neural network algorithms are:

- Perceptron
- Back-Propagation
- Hopfield Network
- Radial Basis Function Network (RBFN)


Artificial Neural Network Algorithms

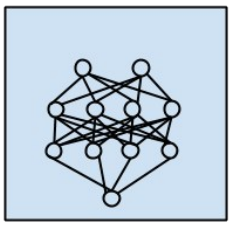
Deep Learning Algorithms

Deep Learning methods are a modern update to Artificial Neural Networks that exploit abundant cheap computation.

They are concerned with building much larger and more complex neural networks and, as commented on above, many methods are concerned with semi-supervised learning problems where large datasets contain very little labeled data.

The most popular deep learning algorithms are:

- Deep Boltzmann Machine (DBM)
- Deep Belief Networks (DBN)
- Convolutional Neural Network (CNN)
- Stacked Auto-Encoders

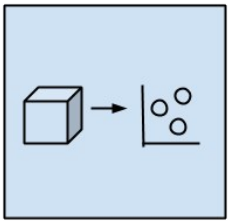

Deep Learning Algorithms

Dimensionality Reduction Algorithms

Like clustering methods, dimensionality reduction seek and exploit the inherent structure in the data, but in this case in an unsupervised manner or order to summarize or describe data using less information.

This can be useful to visualize dimensional data or to simplify data which can then be used in a supervised learning method. Many of these methods can be adapted for use in classification and regression.

- Principal Component Analysis (PCA)
- Principal Component Regression (PCR)
- Partial Least Squares Regression (PLSR)
- Sammon Mapping
- Multidimensional Scaling (MDS)
- Projection Pursuit
- Linear Discriminant Analysis (LDA)
- Mixture Discriminant Analysis (MDA)

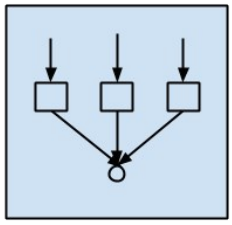

Dimensional Reduction Algorithms

- Quadratic Discriminant Analysis (QDA)
- Flexible Discriminant Analysis (FDA)

Ensemble Algorithms

Ensemble methods are models composed of multiple weaker models that are independently trained and whose predictions are combined in some way to make the overall prediction.

Much effort is put into what types of weak learners to combine and the ways in which to combine them. This is a very powerful class of techniques and as such is very popular.



Ensemble Algorithms

- Boosting
- Bootstrapped Aggregation (Bagging)
- AdaBoost
- Stacked Generalization (blending)
- Gradient Boosting Machines (GBM)
- Gradient Boosted Regression Trees (GBRT)
- Random Forest

Other Algorithms

Many algorithms were not covered.

For example, what group would Support Vector Machines go into? Its own?

I did not cover algorithms from specialty tasks in the process of machine learning, such as:

- Feature selection algorithms
- Algorithm accuracy evaluation
- Performance measures

I also did not cover algorithms from specialty subfields of machine learning, such as:

- Computational intelligence (evolutionary algorithms, etc.)
- Computer Vision (CV)
- Natural Language Processing (NLP)
- Recommender Systems
- Reinforcement Learning
- Graphical Models
- And more…

These may feature in future posts.

Further Reading

This tour of machine learning algorithms was intended to give you an overview of what is out there and some ideas on how to relate algorithms to each other.

I've collected together some resources for you to continue your reading on algorithms. If you have a specific question, please leave a comment.

Other Lists of Algorithms

There are other great lists of algorithms out there if you're interested. Below are few hand selected examples.

- List of Machine Learning Algorithms: On Wikipedia. Although extensive, I do not find this list or the organization of the algorithms particularly useful.
- Machine Learning Algorithms Category: Also on Wikipedia, slightly more useful than Wikipedias great list above. It organizes algorithms alphabetically.
- CRAN Task View: Machine Learning & Statistical Learning: A list of all the packages and all the algorithms supported by each machine learning package in R. Gives you a grounded feeling of what's out there and what people are using for analysis day-to-day.
- Top 10 Algorithms in Data Mining: Published article and now a book (Affiliate Link) on the most popular algorithms for data mining. Another grounded and less overwhelming take on methods that you could go off and learn deeply.

How to Study Machine Learning Algorithms

Algorithms are a big part of machine learning. It's a topic I am passionate about and write about a lot on this blog. Below are few hand selected posts that might interest you for further reading.

- How to Learn Any Machine Learning Algorithm: A systematic approach that you can use to study and understand any machine learning algorithm using "algorithm description templates" (I used this approach to write my first book).
- How to Create Targeted Lists of Machine Learning Algorithms: How you can create your own systematic lists of machine learning algorithms to jump start work on your next machine learning problem.
- How to Research a Machine Learning Algorithm: A systematic approach that you can use to research machine learning algorithms (works great in collaboration with the template approach listed above).
- How to Investigate Machine Learning Algorithm Behavior: A methodology you can use to understand how machine learning algorithms work by creating and executing very small studies into their behavior. Research is not just for academics!
- How to Implement a Machine Learning Algorithm: A process and tips and tricks for implementing machine learning algorithms from scratch.

How to Run Machine Learning Algorithms

Sometimes you just want to dive into code. Below are some links you can use to run machine learning algorithms, code them up using standard libraries or implement them from scratch.

- How To Get Started With Machine Learning Algorithms in R: Links to a large number of code examples on this site demonstrating machine learning algorithms in R.
- Machine Learning Algorithm Recipes in scikit-learn: A collection of Python code examples demonstrating how to create predictive models using scikit-learn.
- How to Run Your First Classifier in Weka: A tutorial for running your very first classifier in Weka (**no code required!**).

Final Word

I hope you have found this tour useful.

Please, leave a comment if you have any questions or ideas on how to improve the algorithm tour.

Update #1: Continue the discussion on HackerNews and reddit.

Update #2: I've added a bunch more resources and more algorithms. I've also added a handy mind map that you can download (see above).

About Jason Brownlee

Jason Brownlee, Ph.D. is a machine learning specialist who teaches developers how to get results with modern machine learning methods via hands-on tutorials.
View all posts by Jason Brownlee →

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204 Responses to *A Tour of Machine Learning Algorithms*

Bruce December 20, 2013 at 5:10 pm #

REPLY

What about reinforcement learning algorithms in algorithm similarity classification? There is also one called Gibbs algorithm under Bayesian Learning

jasonb December 26, 2013 at 8:34 pm #

REPLY

Good point bruce, I left out those methods. Would you like me to write a post about reinforcement learning methods?

Jason's fan August 22, 2015 at 6:39 am #

REPLY

Yes!!!!

P.S. Please :0

Bk vasan August 19, 2017 at 10:02 am #

REPLY

Jason,
I enjoy your blog and your writing style of explaining a complex topic in simple

terms.
I have one request. Do you have a cheat sheet in choosing the right algorithm. I would like to know when to use what ML algorithm as a starters guideline?
Thank you,
Bk

Jason Brownlee August 20, 2017 at 6:04 am #

Choosing the “right” algorithm for a problem is a process: http://machinelearningmastery.com/a-data-driven-approach-to-machine-learning/

Rajat July 21, 2016 at 5:21 pm #

REPLY

Hello Jason,hope u r fine!

How can we make a recommender system with the help of Neural network

&

how to implement Collaborative filtering with Neural network

sam February 17, 2017 at 6:09 pm #

REPLY

What is the difference between a classifier and algorithm? Both r same?

Jason Brownlee February 18, 2017 at 8:36 am #

REPLY

Hi Sam,

An algorithm is a procedure. Like learning a tree from data. The outcome of an algorithm is a model or a classifier, like the tree used to make predictions.

Beat Tödtli August 3, 2017 at 10:14 pm #

Then I don’t quite understand the listing of both Back-Propagation and Hopfield Network under the title of “Artificial Neural Network Algorithms”. Back-Propagation is clearly a training algorithm, whereas a Hopfield Network is probably a classifier?

Nice post!

Jason Brownlee August 4, 2017 at 7:01 am #

That is fair. Rather than backprop we should list MLP.

Sameer July 28, 2017 at 6:21 am #

REPLY

Yes Please
Release a ebook on reinforcement learning and Unsupervised Deep learning too . You are awesome Jason. You made things very simple for us to understand this difficult concepts .

Jason Brownlee July 28, 2017 at 8:36 am #

REPLY

Thanks for the suggestion Sameer.

qnaguru February 17, 2014 at 5:46 pm #

REPLY

Where do newbies (with no analytics/stats background) start learning about this algorithms? And more so how does one use them with Big Data tools like Hadoop?

jasonb February 19, 2014 at 8:44 am #

REPLY

Hi qnaguru, I’d recommend starting small and experimenting with algorithms on small datasets using a tool like Weka. It’s a GUI tool and provides a bunch of standard datasets and algorithms out of the box.

I’d suggest you build up some skill on small datasets before moving onto big data tools like Hadoop and Mahout.

swainjo June 9, 2014 at 6:24 pm #

REPLY

qnaguru,

I would recommend the Coursera courses.

I would also read a couple of books to give you some background into the possibilities and limitations. Nate Silver; The Signal and The Noise & Danial Kahneman; Thinking Fast and Slow.

Ismo May 20, 2014 at 2:50 am #

REPLY

The best written one I have found is: “The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition”. However you probably need to have some background on maths/stats/computing before reading that (especially if you are planning to implement them too). For general algorithms implementation I recommend reading also “Numerical Recipes 3rd Edition: The Art of Scientific Computing”.

jasonb May 23, 2014 at 8:01 am #

REPLY

I’m a huge fan of Numerical Recipes, thanks for the book refs.

William May 23, 2014 at 1:37 am #

REPLY

Not a single one for recommender systems?

jasonb May 23, 2014 at 8:02 am #

REPLY

I would call recommender a higher-order system that internally is solving regression or classification problems. Do you agree?

Jon May 23, 2014 at 2:47 am #

REPLY

genetic algorithms seem to be dying a slow death these days (discussed previously https://news.ycombinator.com/item?id=7712824)

jasonb May 23, 2014 at 8:01 am #

REPLY

It’s a good point. Computers are fast enough that you can enumerate the search space faster than a GA can converge (at least with the classical toy problems).

Alex May 23, 2014 at 8:47 am #

REPLY

I enjoyed this post but I think that this is a misinformed statement. Genetic Algorithms are most useful in large search spaces (enumerating here would be impossible, were talking about spaces that could be 10^100) and highly complex non-convex functions. Modern algorithms are much more sophisticated than the simple techniques used in the 80s e.g. (http://en.wikipedia.org/wiki/CMA-ES) and (http://en.wikipedia.org/wiki/Estimation_of_distribution_algorithm). Here is a nice fun recent application:
http://www.cc.gatech.edu/~jtan34/project/learningBicycleStunts.html

Jason Brownlee August 22, 2015 at 4:39 pm #

REPLY

Thanks Alex, you can also check out my 2011 book of algorithm recipes titled Clever Algorithms: Nature-Inspired Programming Recipes. In it I cover 5 different estimation of distribution algorithms and 10 different evolutionary algorithms.

Vinícius May 23, 2014 at 6:29 am #

REPLY

Hi guys, this is great! What about recommendation systems? I’m fascinated about, how netflix, amazon and others websites can recommend items based on my taste.

jasonb May 23, 2014 at 8:00 am #

REPLY

Good point.
You can break a recommender down into a classification ore regression problem.

Rixi July 12, 2014 at 10:52 am #

REPLY

True, or even use rule induction like Apriori…

mycall May 26, 2014 at 3:50 pm #

REPLY

Where does imagination lie? Would it be a Unsupervised Feedback Learning? Maybe its Neural Deep Essemble Networks. I presume dreaming = imagination while sleeping, hence daydreaming is imagining of new learning algorithms 🙂

Jason Brownlee August 22, 2015 at 4:41 pm #

REPLY

This is too deep for me @mycall

vas May 27, 2014 at 5:28 am #

REPLY

I lot of people swear by this chart for helping you narrow down which machine learning approach to take: http://scikit-learn.org/stable/_static/ml_map.png. It doesn't seem to cover all the types you list in your article. Perhaps a more thorough chart would be useful.

Jason Brownlee August 22, 2015 at 4:41 pm #

REPLY

Thanks for the link vas!

Rizwan Mian, PhD September 2, 2017 at 6:58 am #

REPLY

Thanks for sharing and is posted on my wall. Useful but not exhaustive. missing some topics: preprocessing including feature selection, NLP

Nevil Nayak May 27, 2014 at 7:22 am #

REPLY

Thid is great. I had always been looking for "all types" of ML algorithms available. I enjoyed reading this and look forward to further reading

Jason Brownlee August 22, 2015 at 4:41 pm #

REPLY

You're very welcome @Nevil.

UD May 30, 2014 at 12:42 am #

REPLY

This is nice and useful…I have been feeling heady with too much data and this kinda gives me a menu from which to choose what all is on offer to help me make sense of stuff 🙂 Thanks

Jason Brownlee August 22, 2015 at 4:43 pm #

REPLY

That is a great way to think about @UD, a menu of algorithms.

Tim Browning May 30, 2014 at 4:15 am #

REPLY

You might want to include entropy-based methods in your summary. I use relative-entropy based monitoring in my work to identify anomalies in time series data. This approach has a better recall rate and lower false positive rates when tested with synthetic data using injected outliers. Just an idea, your summary is excellent for such a high level conceptual overview.

Bhaskar January 9, 2015 at 7:27 am #

REPLY

HI Tim
Can you give me some reference from which I can learn about relative-entropy based monitoring ?

Jason Brownlee August 22, 2015 at 4:44 pm #

REPLY

Thanks @Tim, I'll add a section on time series algorithms I think.

Vincent June 9, 2014 at 7:50 pm #

REPLY

Hi,

Thank's for this tour, it is very useful ! But I disagree with you for the LDA method, which is in the Kernel Methods. First of all, by LDA, do you mean Linear Discriminant Analysis ? Because if it's not, the next parts of my comment are useless :p

If you are talking about this method, then you should put KLDA (which stand for Kernel LDA) and not simply LDA. Because LDA is more a dimension reduction method than a kernel method (It finds the best hyperplane that optimize the Fisher discriminant in order to project data on it).

Next, I don't know if we can view the RBF as a real machine learning method, it's more a mapping function I think, but it is clearly used for mapping to a higher dimension.

Except these two points, the post is awesome ! Thank's again.

Jason Brownlee August 22, 2015 at 4:45 pm #

REPLY

Thanks @Vincent, I'll look into moving the algorithms around a bit in their groupings.

Rizwan Mian, PhD September 2, 2017 at 7:03 am #

REPLY

@Vincent, I think he mentions Radial Based Network or RBN, which is artificial neural network (ANN) that uses radial basis functions [1]. Jason is correct in placing it under ANN classification.

[1] https://en.wikipedia.org/wiki/Radial_basis_function_network

Rémi June 10, 2014 at 8:50 pm #

REPLY

Great post, but I agree with Vincent. Kernel Methods are not machine learning methods by themselve, but more an extension that allows to overcome some difficulties encountered when input data are not linearly separable. SVM and LDA are not Kernel-based, but their definition can be adapted to make use of the famous kernel-trick, giving birth to KSVM and KLDA, that are able to separate data linearly in a higher-dimensional space. Kernel trick can be applied to a wide variety of Machine learning methods:
– LDA
– SVM
– PCA
– KMeans
and the list goes on…

Moreover, I don't think that RBF can be considered a machine learning method. It is a kernel function used alongside the kernel trick to project the data in a high-dimensional space. So the listing in "Kernel methods" seems to have a typing error :p

Last point, don't you think LDA could be added to the "Dimensionality Reduction" category ? In fact, it's more an open question but, mixture methods (clustering) and factor analysis could be considered "Dimensionality Reduction methods" since data can be labeled either by it's cluster id, or its factors.

Thanks again for this post, giving an overview of machin learning methods is a great thing.

Jason Brownlee August 22, 2015 at 4:47 pm #

REPLY

Great comments @Rémi I'll move things around a bit.

Rizwan Mian, PhD September 2, 2017 at 7:05 am #

REPLY

I had this confusion and had to look it up.
– Radial Based Function (RBF) can be used as a kernel
– Radial Based Network (RBN) is a artificial neural network that uses radial basis functions

Pranav Waila June 10, 2014 at 9:24 pm #

REPLY

Hi qnaguru, I have collected some nice reference books to start digging Machine learning. I would suggest you to start with "Introduction to statistical learning" and after that you can look into "The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition", "Probabilistic Machine Learning by David Barber".

Dean Abbott July 3, 2014 at 9:48 am #

REPLY

Very nice taxonomy of methods. Two small quibbles, both in the Decision Tree section.
1) MARS isn't a tree method, it's a spline method. You list it already in the regression group, though could even go in the regularization group. (not a natural fit in any, IMHO).
2) Random Forests is an ensemble method and sticks out a bit in the trees group. Yes, they are trees, but so is the MART (TreeNet) and some flavors of Adaboost. Since you already have an ensembles and RF is already there, I think you can safely remove it from the Trees.

Again, you've done a great job with this list. Congrats!

Dean

Jason Brownlee August 22, 2015 at 4:49 pm #

REPLY

Thanks Dean, I'll take your comments on board.

sravan August 6, 2014 at 8:41 pm #

REPLY

Greate article. my knowledge in Machne learning is improving in bredth not in depth.how should i improve my learning.i have done some real time implementations with Regression analysis.and Random forest.and also i am atteding coursera courses.how would

i get real time experience on ML R with Hadoop.

Iale November 23, 2014 at 9:16 pm #

REPLY

Thanks Mr.Brownly for your useful guide.Where can we find the implementations of all of these algorithms?I've installed weka but it doesnot have some of these algorithms

Jason Brownlee November 24, 2014 at 5:50 am #

REPLY

You may have to make use of other platforms like R and scikit-learn.

Were you looking for an implementation of a specific algorithm?

SHI XUDONG November 25, 2014 at 2:42 pm #

REPLY

Great Post!
I am currently learning Sparse Coding. And I have difficulty putting Sparse Coding into the categories you created.
–What is your idea about Sparse Coding?
–Which category should it belong to?

Can you provide some suggestions for learning sparse coding
— what mathematical foundations should I have?
— any good tutorial resources?
— can you suggest a learning roadmap

I am now taking convex optimization course. Is it a correct roadmap?

Lee January 13, 2015 at 8:48 pm #

REPLY

Where does ranking fit into the machine learning algorithms? Is it by any chance under some of the categories mentioned in the article? The only time I find ranking mentioned in relation to machine learn is when I specifically search for ranking, none of the machine learning articles discuss it.

Amelie February 3, 2015 at 10:41 am #

REPLY

which algorithm is the more efficient of the similarity algorithm .?

Jason Brownlee February 19, 2015 at 8:42 am #

REPLY

Assess similarity algorithms using computational complexity and empirically test them and see Amelie.

Gudi February 13, 2015 at 3:31 pm #

REPLY

What methods/algorithms are suitable for applying to trading patterns analysis. I mean looking at the trading graphs of the last 6 months (e.g. SPY). Currently, I am looking at the graphs visually. Can an algorithm come to my aid (I am currently enrolled in an online data mining course) ?

Jason Brownlee February 19, 2015 at 8:42 am #

REPLY

Sounds like a timeseries problem, consider stating out with an auto-regression.

saima May 25, 2015 at 4:23 pm #

REPLY

Hi Jason,
Its a great article. I wish if you could give a list of machine learning algorithms popular in medical research domain.

regards,
Saima Safdar

Vicc May 27, 2015 at 7:22 pm #

REPLY

Great list. Definitely cleared things up for me, Jason! I do have a question concerning Batch Gradient Descent and the Normal Equation. Are these considered Estimators?

I would love to see a post that addresses the different types of estimators / optimizers that could be used for each of these algorithms that is simple to understand. Also where does feature scaling (min max scaling & standardization) and other things fall into all of this? Are they also optimizers? So many things!

Thanks so much for spreading your knowledge!

Henry Thornton June 6, 2015 at 10:49 pm #

REPLY

Hi Jason

Intrigued by your comments above about recommendation systems ie.

“I would call recommender a higher-order system that internally is solving regression or classification problems.” and,

“You can break a recommender down into a classification or a regression problem.”

Could you please expand on your thought process? In general, I find that people talk about building or wanting a “classifier” since it is the de-jeure buzzword (and related to deep learning) when in fact, a recommender or something else will do the job. Anyway, great discussion.

Aharon Robinson June 11, 2015 at 8:53 am #

REPLY

Great stuff here Jason! Regarding your comments on 12/26, I’ll vote yes to seeing a post on reinforcement learning methods

Vijay Lingesh June 11, 2015 at 4:13 pm #

REPLY

Hi Jason,
I’m trying to implement object detection through computer vision through Machine Learning but I’m hitting a wall when trying to find a suitable approach. Can you suggest which kind of algorithm will help me? I’d like to research more on it.

Rajmohan July 16, 2015 at 3:44 pm #

REPLY

Hi.. i am working on finding the missing values by using machine learning approaches..
Any body can suggest new methods to be used..
I am a research scholar

Oren August 5, 2015 at 7:04 pm #

REPLY

Hi Jason,

just a small question: In my opinion k-NN, SVM, Naive Bayes, Decision Trees, MaxEnt (even if it’s not mentioned here) are all considered to be instance-based, isn’t it right?

Vaibhav Agarwal September 10, 2015 at 3:20 am #

REPLY

Awesome post now I know where I stand.

shani September 10, 2015 at 10:07 pm #

REPLY

i started reading and i feel i don’t succeed to understand it.
I don’t understand which algorithm is good for which type of problem.
I think that little example for each algorithm will be useful.

Gian September 22, 2015 at 11:30 pm #

REPLY

Hi,

How can I classify the support vector machines and its extensions in your list?

Stephen Thompson October 7, 2015 at 1:25 am #

REPLY

Jason: Nice addition of the simple graphic to each of the “families” of machine learning algorithms. This is a change from what I recall was a previous version of this post. The diagram helps visualize the activity of the family and thus aid developing an internal model of how the members of the family operate.

A simple but powerful effect.

Kevin Keane October 28, 2015 at 5:45 am #

REPLY

The Bayesian Algorithms graphic should be reworked. In particular,
1) the area under both density functions should integrate to one. While no scale is provided, the prior appears to integrate to a much smaller number than the posterior.
2) in general, a posterior is narrower / more concentrated than a prior given an observation.
3) (interpreting the baseline as zero density) a posterior typically concentrates the probability of the prior in a smaller range; it never “moves” probability to a range where the prior density was zero.

Alvin November 11, 2015 at 8:11 pm #

REPLY

Hi jason,

Can you recommend any algorithm to my problem below please?
I need one that does time series analysis that does Bayesian analysis too.

For test set,
I'm given data for hourly price movements for half a day, and tasked to predict for the second half of day. Clearly a time series (TS) problems.

But on top of that I'm also given information on 10 discrete factors for each day in the training and testing set.

Do you know of any algo that creates multiple TS models conditional upon the values (or bands) of the various discrete factors at the onset?

Farnaz January 6, 2016 at 5:41 pm #

REPLY

Hi Jason
Thank you very much for your sharing,I would like to know about Machine Learning methods (algorithms) which are useful in Prediction.

Lady January 11, 2016 at 9:18 pm #

REPLY

Hi Jason
I would be very grateful if you could let me know which neural network is useful for multivariate time series classification.For example, classifying patient and healthy people when we have multiple time series of each feature.

Fredrik February 22, 2016 at 11:55 pm #

REPLY

Did you find any solution for this? I have the same problem. I was thinking about convolution neural networks and use the feature space to create a heatmap image and use that as input. For example, each row in the pixel image will be a RGB value mapped from a feature and each column will be a specific time point. That way you have all multivariate time series in one image. You might need to reduce the dimensionality of the time interval though if they are very high, alternatively take partitions of the time interval in sections of the image (first 500 time points in the upper half of the image for example). I have no idea if this would work, just some thoughts…

Irq3000 January 28, 2016 at 8:03 pm #

REPLY

I have a good background in artificial intelligence and machine learning, and I must say this is a really good list, I would not have done the categories any other way, it's very close to perfection. Very pertinent information.

However, it would be nice to include Learning Style categories for reinforcement learning, genetic algorithms and probabilistic models, (but meanwhile you already mention them at the end so this gives a good pointer for the readers).

The ending links are very good, particularly the "How to Study Machine Learning Algorithms". It would be also nice to put a list of machine learning online courses (coursera, udacity, etc. – there's even a course by Geoffrey Hinton!), and links to tutorials on how to check and verify that your ML algo works well on your dataset (cross-validation, generalization curve, ROC, confusion matrix, etc.).

Also, thank's to previous commenters, your comments are also very pertinent and a good addition to the article!

Irq3000 January 28, 2016 at 8:25 pm #

REPLY

To develop my suggestion for adding Learning Style categories: I think these classes of learning algorithms should be added, since they are used more and more (albeit being less popular than the currently listed methods) and they cannot be replaced by other classes of learning, they bring their own capabilities:

– Reinforcement learning models a reward/punishment way of learning. This allows to explore and memorize the states of an environment or the actions with a way very similar on how the actual brain learns using the pleasure circuit (TD-Learning). It also has a very useful ability: blocking, which naturally allows a reinforcement learning model to only use the stimuli and information that is useful to predict the reward, the useless stimuli will be "blocked" (ie, filtered out). This is currently being used in combination with deep learning to model more biologically plausible and powerful neural networks, that can for example maybe solve the Go game problem (see Google's DeepMind AlphaGo).

– Genetic algorithms, as a previous commenter said, are best used when facing a very high dimension problem or multimodal optimizations (where you have multiple equally good solutions, aka multiple equilibriums). Also, a big advantage is that genetic algorithms are derivative-free cost optimization methods, so they are VERY generic and can be applied to virtually any problem and find a good solution (even if other algorithms may find better ones).

– Probabilistic models (eg, monte-carlo, markov chains, markovian processes, gaussian mixtures, etc.) and probabilistic graphical models (eg, bayesian networks, credal networks, markov graphs, etc.) are great for uncertain situations and for inference, since they can manipulate uncertain values and hidden variables. Graphical models are kinda close to deep learning, but they are more flexible (it's easier to define a PGM from a semantic of what you want to do than a deep learning network).

– Maybe mention at the end Fuzzy Logic, which is not a machine learning algorithm per se

but is close to probabilistic models, except that it can be seen as a superset that also allows to define a possibility value (see possibilistic logic, and the works by Edwin Jaynes).

vicky March 13, 2016 at 6:28 am #

REPLY

hi,
you have nicely illustrated the algos,thanks.

cheers,
vicky | techvicky.com

Ting April 22, 2016 at 1:11 am #

REPLY

Hi Jason,

I'm just getting started on learning about machine learning algorithms. I still need some time to digest what I've read here. My background comes from finance/investing and therefore I've been trying to learn more about how machine learning is used in investing. I come from a fundamental investing background and therefore I'm curious if you have an insight. Given there are so many algorithms (and different branches https://www.youtube.com/watch?v=B8J4uefCQMc which I thought this was an interesting video) I wanted to ask how do you know which type of branch/algorithm in machine learning would be more useful for investing?

Best,

Ting

Marc June 30, 2016 at 9:07 pm #

REPLY

Thank you for this great article.

It really helps untangling the variety of algorithm types and muddling through the complexity of this interesting field.

Jason Brownlee July 1, 2016 at 5:39 am #

REPLY

I'm glad to hear that Marc.

Jitu Rout July 1, 2016 at 3:14 pm #

REPLY

Very useful one.

Jason Brownlee July 2, 2016 at 6:18 am #

REPLY

Thanks Jitu.

RZZ July 13, 2016 at 11:49 am #

REPLY

not able to download anything. Just keeps cinfirming my subscriptions

Jason Brownlee July 13, 2016 at 11:55 am #

REPLY

Sorry to hear that. After you confirm your subscription you will be emailed the mindmap.

Perhaps check one of your other email folders?

Francis Kim July 13, 2016 at 3:41 pm #

REPLY

Great insight, thank you for the write up.

Jason Brownlee July 13, 2016 at 4:32 pm #

REPLY

You're welcome Francis.

perumahan di semarang atas July 13, 2016 at 5:07 pm #

REPLY

Excellent post. I was checking constantly this blog and I'm impressed!
Very useful information particularly the last part :
) I care for such information a lot. I was looking for this
certain information for a long time. Thank you and good luck.

Jason Brownlee July 14, 2016 at 5:49 am #

REPLY

I'm glad you found it useful.

beyond July 14, 2016 at 5:28 pm #

REPLY

Hi Jason,
I would like to know the class for SVM.

Jason Brownlee July 15, 2016 at 9:05 am #

REPLY

It does not fit neatly into this taxonomy.

diem du lich nha trang July 26, 2016 at 11:58 am #

REPLY

Appreciating the dedication you put into your site and
detailed information you offer. It's nice to come across
a blog every once in a while that isn't the same old
rehashed material. Excellent read! I've bookmarked your site and I'm including your RSS
feeds
to my Google account.

Jason Brownlee July 26, 2016 at 2:06 pm #

REPLY

Thanks.

Frank Ihle July 27, 2016 at 3:26 am #

REPLY

You listed logistic regression as an regression algorithm. I always believed method is the base of neuronal networks, and thus more a classifier than a regression algorithm.

Ben Bothur June 23, 2017 at 7:19 pm #

REPLY

I fully agree with your opinion. The outcome of a (simple) logistic regression is binary and the algorithm should be part of a classification method, like the neural networks you mentioned.

Abhishek August 6, 2016 at 2:50 am #

REPLY

Hello sir. Thank you so much for your help. But as we know Machine Learning require a strong 'Math' background. I am very interested math but, i am little bit week in that. So,I want good understandable resources for math required in Machine Learning. Thank you.

Jason Brownlee August 6, 2016 at 2:08 pm #

REPLY

I teach an approach to getting started without the theory or math understanding. By treating ML as a tool you can use to solve problems and deliver value. The deep mathematical understanding can come later if and when you need it in order to deliver better solutions.

See this post:
http://machinelearningmastery.com/how-do-i-get-started-in-machine-learning/

Vladimir August 14, 2016 at 12:00 am #

REPLY

Jason, thanks for the write-up. When it comes it supervised learning using regression analysis all examples I have found deal with simple scalar inputs and perhaps multiple features of one input. What if an input data is more complicated, say two values where one is a quadratic curve and another is a real number? I have data that consists of two pairs of values: univariate quadratic function (represented as quadratic functions or an array of points) and a real value R. Each quadratic function F rather predictably changes its skew/shape based on its real value pair R and becomes(changes) into F'. Given a new real value R', it becomes F" and so on. This is the training data and I have about thousand pairs of functions and real values. Based on a current function F and a new real value R can we predict the shape of F' using supervised learning and regression analysis? If so, what should I look out for? Any help would be much appreciated!

Irina Max August 14, 2016 at 12:07 pm #

REPLY

What about Best-subset Selection, Stepwise selection, Backward Selection as Dimension reduction?? This is Regularization methods but you also can use it as shinkage dimension.

jalg August 15, 2016 at 11:37 pm #

REPLY

Do any of the algorithms have a feedback loop?

Bryan August 19, 2016 at 9:20 am #

REPLY

Jason- would like to discuss in detail the ability to project outcomes of sporting events using your algorithms. Have you ever researched?

Please email

utdad1@gmail.com

Jason Brownlee August 20, 2016 at 6:01 am #

REPLY

I have only done a little work in that area Bryan.

You can contact me directly here:
http://machinelearningmastery.com/contact

Howard Schneider September 11, 2016 at 7:00 am #

REPLY

Thanks for this wonderful tour of the machine learning algoritem zoo — more fun than the real one.

Jason Brownlee September 12, 2016 at 8:29 am #

REPLY

I'm glad you found it useful Howard.

srinivas n September 15, 2016 at 7:28 am #

REPLY

This is useful, but it could be made more useful for someone new to the field, specifcally in the section where algorithms are grouped by similarity, by clarifying exactly what is being learned. Eg Regression algorithms learn the curve that best fits the data points, Bayesian learning algorithms learn the parameters and structure of a Bayesian network, Decision Tree algorithms learn the structure of the decision tree, etc.

Additionally some kind of task based classification would be helpful. Eg if you're trying to classify then the following kinds of ML algorithms are best, if you're trying to do inference then rule learning and bayesian network learning are good, if you're curve fitting then regression is good, etc.

srinivas n September 15, 2016 at 7:31 am #

REPLY

Just to clarify that first point I made: eg when you write Naive Bayes, its not the Naive Bayes method itself that's being learned, nor whether a given fruit is an apple or pear, but the structure and parameters of that network that apply Bayes method and can then be used to classify a given fruit

Jason Brownlee September 15, 2016 at 8:23 am #

REPLY

Great suggestion, thanks Srinivas.

Anuj Jain September 21, 2016 at 10:04 pm #

REPLY

Hi Jason,

This article depicted almost all algorithms theoretically best at least for me (as a beginner) But i am new to ML so i am not able to relate algorithms use cases in a real life problems/scenarios. Can u please suggest me some links where i could be able to relate each algorithms with a different real time/real life business problem?

Thanks in advance! 🙂

Jason Brownlee September 22, 2016 at 8:11 am #

REPLY

Hi Anuj, it is generally helpful think of predictive modeling problems in terms of classification (predict a class or category) and regression (predict a number).

You can then divide algorithms into classification and regression types.

This page has a nice list of modern and popular machine learning problems:
http://machinelearningmastery.com/tour-of-real-world-machine-learning-problems/

Yadav Avdhesh October 24, 2016 at 10:23 pm #

REPLY

Hi Jason.
I am beginner of Machine learning. Can you suggest that how to start learning and what are the basic things to need for this.

Best Regards,
Avdhesh

Jason Brownlee October 25, 2016 at 8:24 am #

REPLY

Great question Avdhesh,

I teach a top-down approach to machine learning, you can learn all about it here:
http://machinelearningmastery.com/start-here/#getstarted

Steffen November 19, 2016 at 2:24 am #

REPLY

Jason, this is an excellent list, thank you.

I am totally new to the topic – so it is a good starting point. In other 'domains' of methods, patterns or algorithm types I am more familiar with one could typically define generic weaknesses/pains, strengths/gains and things to look at with care (e.g. how to set parameters). I wonder what those would be for each of the algorithm groups you specified.

I have seen that you described use cases, e.g. one could use Bayesian Algorithms and Decision Tree Algorithms for classification. But when would I e.g. prefer the one over the other for classification? …just an example…

Jason Brownlee November 19, 2016 at 8:49 am #

REPLY

It's a great question Steffen, and very hard to answer.

The best practical approach to find the best/good algorithms for a given problem is trial and error. Heuristics provide a good guide, but sometimes/often you can get best results by breaking some rules or modeling assumptions.

I recommend empirical trial and error (or a bake-off of methods) on a given problem as the best approach.

Dr. Khalid Raza November 20, 2016 at 6:04 pm #

REPLY

Dear Dr. Jason,

Very nice post. thanks

Jason Brownlee November 22, 2016 at 6:47 am #

REPLY

I'm glad you found it useful Khalid.

Tammi November 29, 2016 at 11:32 pm #

REPLY

Hi Jason,

Thank you so much for your article.

How would you suggest NLP can be utilised to measure research performance?

Jason Brownlee November 30, 2016 at 7:56 am #

REPLY

Sorry, I'm not an expert in NLP Tammi.

sbollav December 10, 2016 at 4:01 am #

REPLY

Hi Jason,

Wonderful post ! Really helped me a lot in understanding different algorithms.

My question is i have seen lot of algorithms apart from the above list.

Can you please post the algorithms, how they work with list of examples.

Example: Cart algorithm (Decision Trees) – How they split, entropy, info gain, gini index and impurity.

I hope you got my question. Likewise for all algorithms.

Jason Brownlee December 10, 2016 at 8:08 am #

REPLY

Sure, I explain how algorithms work in this book:
https://machinelearningmastery.com/master-machine-learning-algorithms/

If you're more of a coder, I explain how they work with Python code in this book:
https://machinelearningmastery.com/machine-learning-algorithms-from-scratch/

I hope that helps.

Iman December 11, 2016 at 7:32 pm #

REPLY

Your page, no your website is gold. I have very poor knowledge in Machine learning, and you helped me in few paragraphs to learn more when to use which algorithm. I am yet to go through your book, but I decided a thank you is a must. Thanks a lot.

Jason Brownlee December 12, 2016 at 6:47 am #

REPLY

Thanks Iman.

sbollav December 15, 2016 at 9:57 pm #

REPLY

Hi Jason,

Thank you for kind reply.

Master Machine Learning Algorithms – With this book, Is it possible to understand how the algorithm works and how to build the predictive models for different kinds training sets.

And by seeing the problem or train data, can we say that the machine learning (tree based, knn, Naive base or optimisation) and the algorithms (cart, c4.5) are best suitable.

I can purchase that above book that you have mentioned –

But I am more concerned with how the algorithm works (more illustration) and apply in machine learning. Present i am using R.

Jason Brownlee December 16, 2016 at 5:43 am #

REPLY

Hi sbollav, after reading Master Machaine Learning Algorithms you will know how 10 top algorithms work.

For working through predictive modeling problems in R, I would suggest the book: Machine Learning Mastery With R:
http://machinelearningmastery.com/machine-learning-with-r/

It does not teach how algorithms work, instead, after reading it you will be able to confidently work through your own machine learning problems and get usable results with R.

I hope that helps.

Jemmy January 16, 2017 at 10:41 am #

REPLY

Thanks ever so much for your great post

Do you have any idea about PQSQ algorithms? Could you dive in?

Jason Brownlee January 16, 2017 at 11:02 am #

REPLY

Sorry, I have not heard of this type of algorithm.

Cara February 7, 2017 at 1:17 am #

REPLY

Hey Jason.
So I'm writing my thesis on MLAs in Motion Analysis (focussing on instrumented insoles) and I was wondering which type of MLA would be the most useful and if your ebook has the information I need (like what kind of data needs what kind of MLA) or if I should keep scouring PubMed for answers. Mostly I found C4.5, CART, Naïve Bayes, Multi-Layer Perceptrons, and Support Vector Machines (especially SVM, it seems like the most popular in rehab technologies), but I want to be thorough. After all my degree depends on it 😛
Your summary on this page was already very helpful, so thank you for that!

Jason Brownlee February 7, 2017 at 10:20 am #

REPLY

Hi Cara, I do not cover the problem of motion analysis directly.

I would advise evaluating a suite of algorithms on the problem and see what works best. Use what others have tried in the literature as a heuristic or suggestions of things to try.

Vicky February 10, 2017 at 11:28 pm #

REPLY

Hi Jason ,

This is really a superb classification of algorithms.

Can you please help me with below.

I have few rules and I classified my target variable as 0 or 1 by these rules.

Now I want Machine to learn these rules and predict my target variable .

Can you please suggest me which algorithm is good to do so.

Jason Brownlee February 11, 2017 at 5:02 am #

REPLY

Why not just use your rules directly Vicky? Why is another algorithm required?

Vicky February 12, 2017 at 2:52 am #

REPLY

Hi Jason ,

These rules are not straight forward and requires SME judgement.

I wanted to know if there is any possibility to teach machine these rules.

Jason Brownlee February 12, 2017 at 5:36 am #

REPLY

Hi Vicky,

Yes, there will be a number of ways. Generally, machine learning is intended to learn the mapping/rules automatically from examples of the data input and output.

Perhaps try this approach, try a few different methods. You may even come up with an objectively better mapping.

Dina February 21, 2017 at 6:38 am #

REPLY

Hi Jason

First thank you for your explanation..

I'm new in Machine learning and i have a question,, all the algorithm can i use it in the supervised learning ?? and how to know what is the best model can i use it for the classification image?

Thank you

Jason Brownlee February 21, 2017 at 9:39 am #

REPLY

Great question Dina,

We cannot know which algorithm will be best for a given problem. We must design experiments to discover it.

See this post on the topic:
http://machinelearningmastery.com/a-data-driven-approach-to-machine-learning/

Abhisek February 22, 2017 at 12:59 am #

REPLY

Let's take a look at four different learning styles in machine learning algorithms:

Where is the fourth one ?

Jason Brownlee February 22, 2017 at 10:04 am #

REPLY

Thanks, fixed.

Olatunde Tijani March 14, 2017 at 2:41 pm #

REPLY

Jason, am happy to find your site where machine learning and its algorithm are discussed. Its comforting. Am working on Natural Language Processing and intend to add a machine learning algorithm to it but alas you listed NLP under other type of machine learning algorithm. That's startling! Because my aim was to locate the best algorithm to use.

Jason Brownlee March 15, 2017 at 8:08 am #

REPLY

Thanks, it's great to have you here.

I hope to cover NLP in detail later this year.

Nipuna March 24, 2017 at 1:55 am #

REPLY

Jason, how to use machine learning, NLP or both to predict user next sentence based on previously entered text

Jason Brownlee March 24, 2017 at 7:56 am #

REPLY

I don't have many NLP examples yet, soon hopefully.

This might help as a start:
http://machinelearningmastery.com/predict-sentiment-movie-reviews-using-deep-learning/

PatsWagh96 March 24, 2017 at 12:57 pm #

REPLY

Sir need a formal introduction for "Grouping of algorithms by similarity in form or function". Everywhere on internet it comes under the supervised learning style classified a

scluster classification so is it a part of learning style??

Michael May 15, 2017 at 1:51 pm #

REPLY

I guess you missed forecasting algorithms like ARIMA, TBATS, Prophet and so on.

Jason Brownlee May 16, 2017 at 8:34 am #

REPLY

I cover time series in detail here:
http://machinelearningmastery.com/start-here/#timeseries

Deepak May 17, 2017 at 11:03 am #

REPLY

Hi Jason ..You had created a great site.

Keep sharing the good stuff.

God Bless you.

Jason Brownlee May 18, 2017 at 8:26 am #

REPLY

Thanks Deepak!

Azarm Nowzad May 18, 2017 at 12:00 am #

REPLY

Hi Jason,

thanks for sharing this great stuff. I need to choose an ML algorithm on a non-rigid object detection in an image data base (smoke, cloud,…). Do you have any suggestion on the proper algorithm or a way to find it out. I come to the point to use CNN. Still not sure why should it be ?
tnx a lot

Jason Brownlee May 18, 2017 at 8:38 am #

REPLY

Yes, I would recommend a CNN.

Fakhre Alam May 29, 2017 at 8:12 am #

REPLY

How do we decide which machine learning algorithm to use for a specified problem?

Jason Brownlee June 2, 2017 at 12:18 pm #

REPLY

A great question, see this post:
http://machinelearningmastery.com/a-data-driven-approach-to-machine-learning/

Kumar May 31, 2017 at 4:03 pm #

REPLY

Hi Jason, its amazing material. Do you have any suggestion for online clustering techniques ?

Jason Brownlee June 2, 2017 at 12:44 pm #

REPLY

Thanks Kumar, sorry I don't have material on clustering.

Girish Korekar June 14, 2017 at 2:55 am #

REPLY

I would like know about the How an 'algorithms' works on "Machines"?
Here, please consider "Machines" as a "Humans" or "biological VIRUS" or "any living cells".

I would say biological individuals have a logical series of an algorithm, which is regulates their commands and response. These algorithms we may call as a 'Genetic Material' as 'DNA or RNA'; but I would like to see them as an "ALGORITHMS" which is regulates there all activities like responses and commands. Because, particular DNA or RNA sequences have special type of code, which can be used by different performers, here performers are Enzymes.

My query is that, can we able to form algorithms like DNA or RNA which can be able to run a Machine?
It can be possible to form a Human made Biological VIRUS that can be cure our infected cells within a Human Body?

Jason Brownlee June 14, 2017 at 8:49 am #

REPLY

Sure, take a look at biologically inspired computational methods.

I have a whole book on the topic:
http://cleveralgorithms.com/nature-inspired/index.html

Pavan GS July 14, 2017 at 1:27 am #

REPLY

Great article Jason…and a engaging comments section which is rarely the case. Appreciate the effort and many thanks to all the others. The comments are as informative as the article itself

Jason Brownlee July 14, 2017 at 8:30 am #

REPLY

Thanks Pavan.

Pavan GS July 14, 2017 at 1:33 am #

REPLY

#edit#
“a engaging comments section which is rarely the case on so many other sites”

Jason Brownlee July 14, 2017 at 8:31 am #

REPLY

I work hard to respond to every comment I see. It’s getting harder and harder with 100s per day now.

Ahmed July 17, 2017 at 4:38 am #

REPLY

Hi Dr. Jason;
I have problem with Fast Orthogonal Search (FOS) for dimensionality reduction. So do you have any suggestion to build it on MATLAB.
thanks

Jason Brownlee July 17, 2017 at 8:47 am #

REPLY

I do not, sorry.

diviya July 24, 2017 at 6:37 pm #

REPLY

I have a doubt can we combine nature inspired algorithm with machine learning to improve accuracy level of our data

Jason Brownlee July 25, 2017 at 9:38 am #

REPLY

Perhaps. For example, genetic algorithms can help turning hyperparameters or choosing features.

I have a book on nature inspired algorithms I wrote right after completing my Ph.D., it’s free online here:
http://cleveralgorithms.com/nature-inspired/index.html

Joshua Reeve July 31, 2017 at 4:17 am #

REPLY

Hello Jason, could you label all the algorithms on this page as supervised, unsupervised, or semi-supervised? It’s easy enough to understand what these three different types are, but which ones are which? Thanks.

Jason Brownlee July 31, 2017 at 8:19 am #

REPLY

Most of applied machine learning (e.g. predictive modeling) is concerned with supervised learning algorithms.

The majority of algorithms listed on this page are supervised.

David Nettleton August 1, 2017 at 2:33 am #

REPLY

Hi Jason, thanks for your great article! I would propose an alternative classification of ml algorithms into two groups: (i) those which always produce the same model when trained from the same dataset with the récords presented in the same order and (ii) those which produce a different model each time. But I would be interested on your thoughts about this.
Best regards, David

Jason Brownlee August 1, 2017 at 8:03 am #

REPLY

Nice David. Really this is the axis of “model variance”.

Think of it as a continuum though, not binary. Many (most!) ML algorithms suffer variance of some degree.

REPLY

David Nettleton August 4, 2017 at 7:25 pm #

Thanks for your reply, Jason. Yes, the continuos scale would be better. Some years ago I worked with simulated annealing/gradient descent, genetic algs. and neural networks (which performed random jumps to escape local minimums). However, on the other hand, the information gain calculation inside a rule induction algorithm such as M5Rules always follows the same path (?) Could be the basis for an article ;-

REPLY

Jason Brownlee August 5, 2017 at 5:45 am #

Thanks for the suggestion David.

REPLY

Mirna Magdy August 9, 2017 at 3:14 am #

Great job , but you didn’t include References for your topic!!!

REPLY

Jason Brownlee August 9, 2017 at 6:43 am #

Thanks Mirna, what references do you want to see?

REPLY

Jeven Dale M. Marfil August 10, 2017 at 10:31 am #

Is it possible to produce a function from the unsupervised machine learning?

REPLY

Jason Brownlee August 10, 2017 at 4:39 pm #

Sure, what do you mean exactly?

REPLY

Jeven Dale M. Marfil August 10, 2017 at 6:13 pm #

Thank you for the reply sir. Say I collected a large amount of data e.g. temperature for a period of time. I was wondering how to apply machine learning in interpreting the data. That is why my idea was to produce a function out from the graph, is this still relevant to machine learning?

REPLY

Jason Brownlee August 11, 2017 at 6:38 am #

It sounds like you are describing a regression equation, like a line of best fit.

If a line of best fit is good enough for you, then I would recommend using it.

You can use a suite of machine learning algorithms to make predictions, this process will give you an idea of what is involved:
http://machinelearningmastery.com/start-here/#process

REPLY

Massimo August 29, 2017 at 9:42 pm #

Hi Jason
I have created several supervised models with some regression and classification estimators. I want to know how to create a data driven application using these models? Could you explain what does it mean?

REPLY

Jason Brownlee August 30, 2017 at 6:16 am #

You would need to treat it like any other software project and start by defining the goals/requirements of the project.

REPLY

Rizwan Mian, PhD September 2, 2017 at 7:13 am #

Thanks Jason. Another superb job. 🙂

For sometime now, I have been looking for an authoritative paper on taxonomy, survey and classification of ML algorithms with examples. This article is absoulutely a step in that direction — can be massaged into a taxonomy/survey paper?

Nonetheless as other readers noticed, it is missing some topics: preprocessing including anomaly detection and feature selection, NLP, genetic algorithms, recommender systems etc.

Wonder if you know of any academic work on the topic. I did not find any in ACM CSUR.

Waiting anxiously! 🙂

REPLY

Jason Brownlee September 3, 2017 at 5:37 am #

Thanks for the suggestion.

I will update the post soon and add more algorithms. I don't have plans on turning it into a survey sorry.

REPLY

ammar September 6, 2017 at 10:18 pm #

Hi Jason
i am work on classification project and i have uncertain rules in the final classifier.
which algorithm you thing it will be more efficient in this case ?

REPLY

Jason Brownlee September 7, 2017 at 12:54 pm #

Try a suite of algorithms and see what works best on your problem?

REPLY

shalini September 17, 2017 at 12:24 pm #

What algorithms can one use to retrain a Model every day using new data that has user feedback as to whether the model classified the Response into correct Label, and if not the correct label is provided by the user. I want to retrain the model using this feedback and going forward give more weight to the signatures with correct labels.

REPLY

Jason Brownlee September 18, 2017 at 5:43 am #

Many algorithms are updatable. I would recommend testing a suite of algorithms and see what works on your problem, then pick one that is updatable.

REPLY

prasad October 13, 2017 at 4:43 pm #

Hi Jason, I'm a front end developer, but now i would like to learn machine learning. Could you guide me to learn it in best way?

REPLY

Jason Brownlee October 14, 2017 at 5:39 am #

My best advice is here:
https://machinelearningmastery.com/start-here/#getstarted

I would recommend that you start with Weka:
https://machinelearningmastery.com/start-here/#weka

REPLY

MBarnett October 19, 2017 at 1:24 pm #

Hmmm.. the download map link is broken….

REPLY

MBarnett October 19, 2017 at 1:25 pm #

Sorry… spoke too soon.. link of the website went to an error, but just got the download email. Thank you !

REPLY

Jason Brownlee October 19, 2017 at 3:59 pm #

Sorry about that, the download works, but the redirect to my thank-you page is broken. I'm working on it.

REPLY

viswanath yakkala November 13, 2017 at 8:37 pm #

Support Vector Machines, a supervised ML Algorithm is not there explicitly in the ML Algorithm mindmap.
Am i overlooked?

REPLY

Jason Brownlee November 14, 2017 at 10:08 am #

Correct. You could add it if you wish.

ravi November 17, 2017 at 5:29 pm #

REPLY

Which Optimisation Algorithm is best? Genetic Algorithm (or) ABC Algorithm (or) Support Vector Machine (or) Paricle swam Optimisation (or) Ant Colony Optimisation.And explain it

Jason Brownlee November 18, 2017 at 10:13 am #

REPLY

There is no best algorithm. Try a suite and see what works best for your specific sample of data and requirements.

Shima December 1, 2017 at 3:07 am #

REPLY

Hi Jason, very useful classification. Thank you. I wanted to know that HMM and FST are being considered as machine learning algorithms or not?

Jason Brownlee December 1, 2017 at 7:41 am #

REPLY

Yes, sure.

Gaurav Jain December 12, 2017 at 7:11 pm #

REPLY

Thanks for such an awesome blog entry!

Jason Brownlee December 13, 2017 at 5:30 am #

REPLY

You're welcome, I'm glad it helped!

Alex December 27, 2017 at 10:03 pm #

REPLY

Awesome work and page Jason! Really a fantastic job you have made. Many many thanks for your effort.

Jason Brownlee December 28, 2017 at 5:22 am #

REPLY

Thanks Alex!

kawther March 6, 2018 at 10:26 pm #

REPLY

Many thanks for this tour,
I am working on anomaly detection in networks, which kind of algorithms you may suggest,
Thank you

Jason Brownlee March 7, 2018 at 6:13 am #

REPLY

Try many algorithms and see what works best for your specific data.

Divyansh Upman April 13, 2018 at 7:43 pm #

REPLY

Hi Jason

May I please know if there are any pre-requisites for ML in python

Jason Brownlee April 14, 2018 at 6:33 am #

REPLY

Not really other than learning some python.

You can get started with ml in python here:
https://machinelearningmastery.com/start-here/#python

Blair July 4, 2018 at 7:14 pm #

REPLY

Hi Jason,

I am a beginner in programming and I am planning to use Machine Learning algorithm to calibrate sensor data against reference data (in Python). What are some algorithms that you would suggest?

Thanks!

Jason Brownlee July 5, 2018 at 7:39 am #

REPLY

Try a suite of methods to see what works for your specific prediction problem.

Also see this:
https://machinelearningmastery.com/faq/single-faq/what-algorithm-config-should-i-use

Raj July 13, 2018 at 10:10 pm #

REPLY

Thanks Jason for sharing very nice article.

Suppose consider a scenario where a patient took drug (X) and develop five possible side effect (X-a, X-b, X-c, X-d,X-e).

I need to find out the signal i.e. causal relationship between drug and its side effect based on few parameters (like seriousness, suspected etc..).
If the parameter is present, I give score as 1, if not present- score as 0 and -1 for not applicable.

Which algorithm should I use to find the best drug-event relation based on score or any alternative approach do u prefer.

Jason Brownlee July 14, 2018 at 6:18 am #

REPLY

This process will help you to work through your problem systematically:
https://machinelearningmastery.com/start-here/#process

Raj July 14, 2018 at 12:30 pm #

REPLY

Hi Jason,

I am currently learing Machine Learning and the link that you shown, is 50% done.

I am bit confused which algorithm is suitable to find best event based on few paramaters.

Is it something Hierarchical clustering or decision tree or any other algorithm which u recommend.

Jason Brownlee July 15, 2018 at 6:04 am #

REPLY

This is a common question that I answer here:
https://machinelearningmastery.com/faq/single-faq/what-algorithm-config-should-i-use

Olanrewaju Sanni September 5, 2018 at 9:07 pm #

REPLY

Hi Jason,

Is it possible to incorporate machine learning into the heuristic or semi-heuristic algorithms in job scheduling to improve optimisation? If yes, can you recommend some materials on this to me?

Jason Brownlee September 6, 2018 at 5:34 am #

REPLY

Perhaps. I don't have examples, sorry.

Leave a Reply

Name (required)

Email (will not be published) (required)

Website

SUBMIT COMMENT