What is machine learning? [closed]

Asked 14 years, 8 months ago Modified 7 years, 1 month ago

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101

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- What is **machine learning** ?
- What does machine learning **code** do ?
- When we say that the machine learns, does it modify the code of **itself** or it modifies history (database) which will contain the experience of code for given set of inputs?

machine-learning definition

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edited Oct 27, 2017 at 7:17

quintumnia

172 ● 1 ● 2 ● 15

asked Apr 12, 2010 at 6:55

Kushal Waikar

2,994 ● 5 ● 27 ● 31

github.com/niektuytel/Machine_Learning/tree/main
– niek tuytel Jul 5, 2021 at 22:41

9 Answers

Sorted by: Highest score (default)

157

> What is a machine learning ?

Essentially, it is a method of teaching computers to make and improve predictions or behaviors based on some data. What is this "data"? Well, that depends entirely on the problem. It could be readings from a robot's sensors as it learns to walk, or the correct output of a program for certain input.

Another way to think about machine learning is that it is "pattern recognition" - the act of teaching a program to react to or recognize patterns.

> What does machine learning code do ?

Depends on the *type* of machine learning you're talking about. Machine learning is a *huge* field, with hundreds of different algorithms for solving myriad different problems -

see Wikipedia for more information; specifically, look under Algorithm Types.

> When we say machine learns, does it modify the code of itself or it modifies history (Data Base) which will contain the experience of code for given set of inputs ?

Once again, *it depends*.

One example of code actually being modified is Genetic Programming, where you essentially evolve a program to complete a task (of course, the program doesn't modify itself - but it does modify another computer program).

Neural networks, on the other hand, modify their parameters automatically in response to prepared stimuli and expected response. This allows them to produce many behaviors (theoretically, they can produce *any* behavior because they can approximate any function to an arbitrary precision, given enough time).

I should note that your use of the term "database" implies that machine learning algorithms work by "remembering" information, events, or experiences. This is not necessarily (or even often!) the case.

Neural networks, which I already mentioned, only keep the current "state" of the approximation, which is updated as learning occurs. Rather than remembering what

happened and how to react to it, neural networks build a sort of "model" of their "world." The model tells them how to react to certain inputs, even if the inputs are something that it has never seen before.

This last ability - the ability to react to inputs that have never been seen before - is one of the core tenets of many machine learning algorithms. Imagine trying to teach a computer driver to navigate highways in traffic. Using your "database" metaphor, you would have to teach the computer exactly what to do in *millions* of possible situations. An effective machine learning algorithm would (hopefully!) be able to learn similarities between different states and react to them similarly.

The similarities between states can be anything - even things we might think of as "mundane" can really trip up a computer! For example, let's say that the computer driver learned that when a car in front of it slowed down, it had to slow down to. For a human, replacing the car with a motorcycle doesn't change anything - we recognize that the motorcycle is also a vehicle. For a machine learning algorithm, this can actually be surprisingly difficult! A database would have to store information separately about the case where a car is in front and where a motorcycle is in front. A machine learning algorithm, on the other hand, would "learn" from the car example and be able to generalize to the motorcycle example automatically.

 edited Apr 13, 2010 at 11:48

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answered Apr 12, 2010 at 7:19

Daniel G

69.6k ● 7 ● 46 ● 42

3 Your explanations are really very worth and appreciable. Can you please elaborate "Computer" driver's example in deep (with respect to your statement-"learn similarities between different states") ? – Kushal Waikar Apr 13, 2010 at 9:58

1 Why 'KNN' or 'K means' comes under Machine Learning. Can you explain please. Thank you – Sunku Vamsi Tharun Kumar Nov 14, 2019 at 11:10

25

Machine learning is a field of computer science, probability theory, and optimization theory which allows complex tasks to be solved for which a logical/procedural approach would not be possible or feasible.

There are several different categories of machine learning, including (but not limited to):

- Supervised learning
- Reinforcement learning

Supervised Learning

In supervised learning, you have some really complex function (mapping) from inputs to outputs, you have lots of examples of input/output pairs, but you don't know what that complicated function is. A supervised learning algorithm makes it possible, given a large data set of

input/output pairs, to predict the output value for some new input value that you may not have seen before. The basic method is that you break the data set down into a training set and a test set. You have some model with an associated error function which you try to minimize over the training set, and then you make sure that your solution works on the test set. Once you have repeated this with different machine learning algorithms and/or parameters until the model performs reasonably well on the test set, then you can attempt to use the result on new inputs. Note that in this case, the program does not change, only the model (data) is changed. Although one could, theoretically, output a different program, but that is not done in practice, as far as I am aware. An example of supervised learning would be the digit recognition system used by the post office, where it maps the pixels to labels in the set 0...9, using a large set of pictures of digits that were labeled by hand as being in 0...9.

Reinforcement Learning

In reinforcement learning, the program is responsible for making decisions, and it periodically receives some sort of award/utility for its actions. However, unlike in the supervised learning case, the results are not immediate; the algorithm could prescribe a large sequence of actions and only receive feedback at the very end. In reinforcement learning, the goal is to build up a good model such that the algorithm will generate the sequence of decisions that lead to the highest long term utility/reward. A good example of reinforcement learning is teaching a robot how to navigate by giving a negative

penalty whenever its bump sensor detects that it has bumped into an object. If coded correctly, it is possible for the robot to eventually correlate its range finder sensor data with its bumper sensor data and the directions that sends to the wheels, and ultimately choose a form of navigation that results in it not bumping into objects.

More Info

If you are interested in learning more, I strongly recommend that you read Pattern Recognition and Machine Learning by Christopher M. Bishop or take a machine learning course. You may also be interested in reading, for free, the lecture notes from CIS 520: Machine Learning at Penn.

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edited Apr 12, 2010 at 8:04

answered Apr 12, 2010 at 7:58

Michael Aaron Safyan

95.4k ● 16 ● 139 ● 200

2 You mentioned "...logical/procedural approach would not be possible or feasible." Could you please elaborate this with examples? Thank you. – LionHeart Jun 9, 2011 at 14:29

@LionHeart, a good example is character recognition. You could try coding up an algorithm that can recognize various curves, lines, and other features of the various characters, but when it comes down to it, that is a very difficult task, and ML solves it quite simply. – Michael Aaron Safyan Jun 12, 2011 at 8:52

12

- **Machine learning** is a scientific discipline that is concerned with the design and development of algorithms that allow computers to evolve behaviors based on empirical data, such as from sensor data or databases. Read more on Wikipedia
- Machine learning **code** records "facts" or approximations in some sort of storage, and with the algorithms calculates different probabilities.
- The code **itself** will not be modified when a machine learns, only the database of what "it knows".

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edited Apr 12, 2010 at 7:07

answered Apr 12, 2010 at 7:01

Espo

41.9k ● 21 ● 136 ● 161

Machine learning does not require a database. It also does not always record "facts". Some things are conjectures. Some things are approximations. Not everything a machine learns can be considered a fact. – Kevin Crowell Apr 12, 2010 at 7:10

2 You are still limiting your answer to a specific region of machine learning. Facts or approximations are not always recorded. Things can be experienced, reacted to, and forgotten. "Storage" is not a staple of machine learning. It can be used, but is not a necessity. – Kevin Crowell Apr 12, 2010 at 7:15

4 if machine learning program stored the data it learned, then there would be no point of having the program... we would just query the data itself. Most ML programs only create a model of the data since a data set can be quite large (several GB) and we want the program to have predictive power over unseen data sets. There is almost no reason for an ML program to store data. – Kiril Apr 12, 2010 at 7:44

12

Machine learning is a methodology to create a model based on sample data and use the model to make a prediction or strategy. It belongs to artificial intelligence.

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edited Apr 12, 2010 at 7:37

Fabian Steeg

45.6k ● 7 ● 87 ● 113

answered Apr 12, 2010 at 7:03

zs2020

54.4k ● 30 ● 156 ● 222

11

Machine learning is simply a generic term to define a variety of learning algorithms that produce a quasi learning from examples (unlabeled/labeled). The actual accuracy/error is entirely determined by the quality of training/test data you provide to your learning algorithm. This can be measured using a convergence rate. The reason you provide examples is because you want the learning algorithm of your choice to be able to informatively by guidance make generalization. The algorithms can be classed into two main areas supervised learning(classification) and unsupervised

learning(clustering) techniques. It is extremely important that you make an informed decision on how you plan on separating your training and test data sets as well as the quality that you provide to your learning algorithm. When you providing data sets you want to also be aware of things like over fitting and maintaining a sense of healthy bias in your examples. The algorithm then basically learns wrote to wrote on the basis of generalization it achieves from the data you have provided to it both for training and then for testing in process you try to get your learning algorithm to produce new examples on basis of your targeted training. In clustering there is very little informative guidance the algorithm basically tries to produce through measures of patterns between data to build related sets of clusters e.g kmeans/knearest neighbor.

some good books: Introduction to ML (Nilsson/Stanford), Gaussian Process for ML, Introduction to ML (Alpaydin), Information Theory Inference and Learning Algorithms (very useful book), Machine Learning (Mitchell), Pattern Recognition and Machine Learning (standard ML course book at Edinburgh and various Unis but relatively a heavy reading with math), Data Mining and Practical Machine Learning with Weka (work through the theory using weka and practice in Java)

Reinforcement Learning there is a free book online you can read: http://www.cs.ualberta.ca/~sutton/book/ebook/the-book.html

IR, IE, Recommenders, and Text/Data/Web Mining in general use alot of Machine Learning principles. You can even apply Metaheuristic/Global Optimization Techniques here to further automate your learning processes. e.g apply an evolutionary technique like GA (genetic algorithm) to optimize your neural network based approach (which may use some learning algorithm). You can approach it purely in form of a probablistic machine learning approach for example bayesian learning. Most of these algorithms all have a very heavy use of statistics. Concepts of convergence and generalization are important to many of these learning algorithms.

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answered May 30, 2011 at 8:34

meme

121 ● 1 ● 2

9

Machine learning is the study in computing science of making algorithms that are able to classify information they haven't seen before, by learning patterns from training on similar information. There are all sorts of kinds of "learners" in this sense. Neural networks, Bayesian networks, decision trees, k-clustering algorithms, hidden markov models and support vector machines are examples.

Based on the learner, they each learn in different ways. Some learners produce human-understandable frameworks (e.g. decision trees), and some are generally inscrutable (e.g. neural networks).

Learners are all essentially data-driven, meaning they save their state as data to be reused later. They aren't self-modifying as such, at least in general.

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answered Apr 12, 2010 at 7:17

Shaggy Frog

27.6k ● 16 ● 92 ● 129

8

I think one of the coolest definitions of machine learning that I've read is from this book by Tom Mitchell. Easy to remember and intuitive.

> A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E

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answered Sep 11, 2011 at 7:26

vikram360

161 ● 1 ● 3

22 I've always hated how this definition is repeated, even taught, despite its unnecessary use of symbols. Simpler, better: A computer program is said to learn from experience with respect to some class of tasks if its performance in these tasks, with respect to some performance measure, improves with experience. Now let's simplify some more. `A computer program is said to learn in the context of performing a task if its performance with`

`respect to some measure improves with experience.` – Ninjakannon Oct 25, 2013 at 10:21

1 I have been doing Machine Learning for about a year now and even today I have to read it a few times to understand what it exactly means. I wonder am I bad or is it the definition. – Maxim Dsouza Sep 5, 2018 at 9:34

7

- Shamelessly ripped from Wikipedia: Machine learning is a scientific discipline that is concerned with the design and development of algorithms that allow computers to evolve behaviors based on empirical data, such as from sensor data or databases.
- Quite simply, machine learning code accomplishes a machine learning task. That can be a number of things from interpreting sensor data to a genetic algorithm.
- I would say it depends. No, modifying code is not normal, but is not outside the realm of possibility. I would also not say that machine learning always modifies a history. Sometimes we have no history to build off of. Sometime we simply want to react to the environment, but not actually learn from our past experiences.

Basically, machine learning is a very wide-open discipline that contains many methods and algorithms that make it impossible for there to be 1 answer to your 3rd question.

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answered Apr 12, 2010 at 7:08

Kevin Crowell

10.2k ● 4 ● 36 ● 51

6

Machine learning is a term that is taken from the real world of a person, and applied on something that can't actually learn - a machine.

To add to the other answers - machine learning will not (usually) change the code, but it might change it's execution path and decision based on previous data or new gathered data and hence the "learning" effect.

there are many ways to "teach" a machine - you give weights to many parameter of an algorithm, and then have the machine solve it for many cases, each time you give her a feedback about the answer and the machine adjusts the weights according to how close the machine answer was to your answer or according to the score you gave it's answer, or according to some results test algorithm.

This is one way of learning and there are many more...

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edited Apr 12, 2010 at 7:17

answered Apr 12, 2010 at 7:10

Dani

15.1k ● 12 ● 66 ● 111