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## Book Review:

### **The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World.**

Pedro Domingos.

Basic Books. 2015. ISBN 978-0465065707.

Nowadays, “machine learning” is present in several aspects of the current world, internet advisors, advertisements and “smart” devices that seem to know what we need in a given moment. These are some examples of the problems solved by machine learning.

This book presents the past, the present and the future of the different types of machine learning algorithms. At the beginning of the book, the author takes us to the first years of the computing science, where a programmer had to do absolutely everything by himself to make an algorithm do a certain task. As time passes, there appeared the first algorithms that were capable of programming themselves learning from the available data.

The author presents what he himself calls the five “tribes” of machine learning, the essence that defends each one and the kind of problems that are able to solve without problems. With a great amount of simple examples, the author depicts which advantages and disadvantages of the “master” algorithms of each “tribes” are, saying that the problem that a tribe solves perfectly well, another one cannot do it, and the other way about. The author suggests to get the best out of each “tribe” and make a unique learning algorithm able to learn without caring about the problem: the master algorithm.

Chapter 1, “The machine learning revolution”, tells the story of the algorithms, the difficulty and complexity of each problem. It presents, in an introductory way, what a learner algorithm is and how advantageous is the fact that a computer is faster than a human. Any computer is able to see a great amount of data much faster than any human being, therefore any computer is, theoretically, able to learn much faster than human race.

Chapter 2, “The master algorithm”, shows the most known learning algorithms in machine learning literature. The concept that any knowledge in humanity (in the past, present a future times) can be taken from the data through an algorithm is presented. It describes the analogies of each type of algorithm with the tasks that the human brain performs, assuming that, if the brain is able to solve any problem, then it means that there exists one unique algorithm that could solve everything; the main goal is to find it.

Chapters 3 to 7, each of them, deal with the five “tribes” of machine learning. Each of these five chapters describes the story of each “paradigm” of machine learning, from its start to the present time. It also describes what each tribe defends and which are the advantages and disadvantages of the algorithms of each “tribe”; it is always depicted with several examples easy to understand. Chapter 3, “Hume’s problem of induction”, shows the “tribe” of the “symbolist”: the inductive reasoning versus the deductive reasoning. This tribe lays out the idea that knowledge can be expressed by rules. Chapter 4, “How does your brain learn?”, depicts the similarities between the brain and the computer working process, introducing “connectionist” tribe and their weapons: neuronal networks. Perceptron and Backpropagation algorithms are detailed. Chapter 5, “Evolution: Nature’s learning algorithm”, the “evolutionary” tribe is presented along with Darwin’s genetic theory of natural selection, and the introduction of the genetic and evolutionary algorithms. Chapter 6, “In the church of the reverend Bayes”, the “bayesians” tribe is shown; and it is also stated that any knowledge or inference can be modelled in probabilistic terms. It shows Bayes theory, Markov’s hidden models and the bayesians’ networks. Chapter 7, “You are what you resemble” depicts the “analogizers” tribes and the idea that knowledge can be taken from the similarities that the studied examples present. The Nearest neighborhood and Support Vector algorithms are studied in this chapter.

Chapter 8, “Learning without a teacher”, presents the difficulties that exist nowadays if a “baby robot” had to be taught as any human being is since they are born. It is shown, through daily life examples of a person-and the decisions he/she makes- which is the “type” of algorithm that the brain uses to perform such actions and the analogies to the algorithms presented in the previous chapters. The brain has a little bit of each “tribe”, therefore the brain is the master algorithm. It has just to be found.

In Chapter 9, “The pieces of the puzzle fall into place”, the author makes an introduction to what get the master algorithm means: a unique learning algorithm able to learn, isolating itself from the application where it is performed. It presents the concepts of metalearning and deep learning. It shows some works and researches of his own: Markov logic networks, where a unique algorithm collects the concepts of logic and probabilities, two of the five “tribes”.

Chapter 10, “This is the world on machine learning”, illustrates how the future would be, its advantages and if the master algorithm exists. Nowadays, there are plenty of digital information about each person around the world and how the master algorithm would take advantage of such information to learn about each of us and help us in our daily life.

The author does not tell us how the master algorithm will be discovered, but what he does tell us is that the machine learning scientific community is heading that way, and that every researcher in this area should start contributing with the master algorithm construction.

The book is written in a pleasant way, it is very easy to read, without technical terms or formula in an excessive way. Each concept that the author wants to show is always supported by several daily life examples. This book is either for those who are machine learning experts (and, therefore, members of some tribes) or for those interested in the machine learning world, its scope, its current advantages and disadvantages. It also guides the reader to look ahead for future research in this field.

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