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Golubev A., Molchan O.
Machine Learning and Genetic Algorithms

Belarusian National Technical University
Minsk, Belarus

Machine learning algorithms find natural patterns in data that generate insight and predict the unknown for better decisions. Machine learning algorithms use computational methods to *learn* information directly from data without relying on a predetermined equation as a model. The algorithms adaptively improve their performance as the number of samples available for learning increases.

Supervised learning finds patterns (and develops predictive models) using both, input data and output data. All supervised learning techniques area is formed either by classification or by regression. Classification is used for predicting discrete responses and regression is used for predicting continuous responses.

Unsupervised learning finds patterns based only on input data. This technique is useful when you are not quite sure what you are looking for. It is often used for exploratory analysis of raw data. Most unsupervised learning techniques are forms of Cluster Analysis. In Cluster Analysis data items that have some measure of similarity based on characteristic values are grouped [1].

Genetic algorithms (GA) were invented to mimic some of the processes observed in natural evolution. Many people, biologists included, are astonished that life at the level of complexity that we observe could have evolved in the relatively short time suggested by the fossil record. The idea with GA is to use this power of evolution to solve optimization

problems. The father of the original Genetic Algorithm was John Holland who invented it in the early 1970's [2].

Genetic Algorithms have a wide range of applications.

Voice recognition systems such as Siri use machine learning and deep neural networks to imitate human interaction. Siri can identify the trigger phrase *Hey Siri* under almost any condition through the use of probability distributions. By selecting appropriate speech segments from a recorded database, the software can then choose responses that closely resemble real-life conversation.

Google introduced machine learning to Google Maps in 2017, improving the usability of the service. These deep learning algorithms help the app extract street names and house numbers from photos taken by Street View cars and increase the accuracy of search results. With over 80 billion hi-resolution photos collected by Street view cars, analyzing these images by hand would have been extremely time-consuming. Machine learning frees up more time for Google engineers, automatically extracting information from geo-located images and achieving an accuracy rate of 84.2 percent for some of France's most convoluted street signs.

In 2015, Google introduced a smart reply function to Gmail to help users tackle their inbox. The smart reply function is based on two recurrent neural networks: one used to encode incoming mail, the other used to predict possible responses. These networks work in tandem to decipher the meaning behind the incoming message and to automatically suggest three different responses for each.

PayPal uses machine learning algorithms to detect and combat fraud. By implementing deep learning techniques, PayPal can analyze vast quantities of customer data and evaluate risk in a far more efficient manner. Traditionally, fraud detection algorithms have dealt with very linear results: fraud either has or hasn't occurred. But with machine learning

and neural networks, PayPal is able to draw upon financial, machine, and network information to provide a deeper understanding of a customer's activity and motives [3].

The focus will be on making systems that perform specific tasks become our personal assistants. They could help us reduce energy usage by making better use of resources and improve care for the elderly by finding more time for meaningful human contact. Many industries could turn to algorithms to increase productivity. Financial services could become fully automated. Over the next 10 years machine learning technologies will increasingly become an indispensable part of people's lives, transforming the way they work and live.

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