International Scientific Journal of Engineering and Management ISSN: 2583-6129
Volume: 02 Issue: 04 | April – 2023 DOI: 10.55041/ISJEM00268 www.isjem.com
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

Machine Learning

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Abstract

The application of machine learning and deep learning in the field of imaging is rapidly growing. Although the principles of machine and deep learning are unfamiliar to the majority of clinicians, the basics are not so complicated. One of the major issues is that commentaries written by experts are difficult to understand, and are not primarily written for clinicians. The purpose of this article was to describe the different concepts behind machine learning, radiomics, and deep learning to make clinicians more familiar with these techniques.

Introduction

Machine learning (ML) is a type of artificial intelligence (AI) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so. Machine learning algorithms use historical data as input to predict new output values.

These are two types of machine learning:
Supervised learning
Unsupervised learning

Supervised Learning :

Supervised learning is one of the most basic types of machine learning. In this type, the machine learning algorithm is trained on labeled data .Even though the data needs to be labeled a occurately for this method to work, supervised learning is extremely powerful when used in the right circumstances. The algorithm then finds

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relationships between the parameters given, essentially establishing a cause and effe relationship between the variables in the dataset. At the end of the training, the algorithm has an idea of how the data works and the relationship between the input and the output

Unsupervised Learning:

Unsupervised machine learning holds the advantage of being able to work with unlabeled data. This means that human labor is not required to make the datase machine-readable, allowing much larger datasets to be worked on by the program.

Applications of Machine Learning:

Machine learning algorithms are used in circumstances where the solution is required to continue improving post-deployment. The dynamic nature of adaptable machine learning solutions is one of the main selling points for its adoption by companies and organizations across verticals.

Closing Thoughts for Techies

Understanding the basics of machine learning and artificial intelligence is a must for anyone working in the tech domain today. Due to the pervasiveness of AI in today's tech world, working knowledge of this technology is required to stay relevant. With machine learning algorithms, AI was able to develop beyond just performing the tasks it was programmed to do. Before ML entered the mainstream, AI programs wer only used to automate low-level tasks in business and enterprise settings. Machine learning is fundamentally set apart from artificial intelligence, as it has the capability to evolve. Using various programming techniques, machine learning algorithms are able to process large amounts of data and extract useful information. In this way, the can improve upon their previous iterations by learning from the data they are provided.

Radiomics:

Radiomics and radiogenomics are emerging fields that gained interest during the past few years. The word "-omics" is composed of the suffix "ome" meaning "all or complete" and the suffix "ics" meaning "study"; "omics" refers to the science of systematically handling a variety of large amounts of information. Radiomicsis an attempt to convert and extract radiological images into alarge number of numerical data, which can be used for pathologi-cal diagnosis, molecular and genetic information, and prediction of prognosis . Radiogenomics mainly focuses on detecting radiological features associated with a large number of geneticmutations. Although studies have traditionally been conducted to differentiate tumors and predict prognosis based on information such as tumor size, signal, marginal and internal properties, these studies have employed only simple methods in which radiologists measure and visually evaluate computed to moraphy (CT) attenuation and magnetic resonance imaging signal values. On the other hand, radiomics extracts and analyzes all information contained in the

ISSN: 2583-6129
www.isjem.com

images, and is more informative than conventional methods; I it is more likely to provide more accurate diagnosis, prognosis, and prediction of treatment effects. At present, radiomics aims to quantify variations on pixel intensities and include histogram analysis , texture analysis or wavelets.

Over-Fitting:

Over-fitting of machine learning Transferability and reproducibility are major issues in research based on machine learning and deep learning. Conventional methods such as logistic regression have very simple equations and do not provide a complete description of the classification of the training data. Conversely, complex machine learning methods such as deep learning trains the training data to provide complete and correct answers. However, in this situation, one cannot deny the possibility that it is just rote memorization, and unable to solve new problems at all. In fact, simply recording relationships is the most effective way to predict past data, and it is easy to create such a situation by making the neural network more complex for the data. This is called over-fitting; one must design the learning and evaluation methods to prevent this.

Conclusion:

In this review, we have explained recent developments of machine learning, radiomics, texture analysis, deep learning, while focusing on knowledge prerequisites for reading articles about these topics. These techniques have been applied to different field sin which imaging plays a central role. It may be assumed that this article will be of some assistance to general radiologists to have at least a minimum understanding of these technologies.

Reference:

Machine learning is a related application of artificial intelligence, in which a computer is provided programming and large amounts of data to learn its own patterns, rather than the patterns and limits set by a human programmer, and thereby improve from experience. (By Samuel ,1959)

In, 1959 Arthur Samuel defined machine learning as a “field of study that gives computes the ability to learn without being explicity programmed” . (In Thoracic Radiology by V. Courtney Broddus MD)

Additional cardiopulmonary applications for AI include pneumonia detection, detection and quantification of obstructive pulmonary disease, and the CT determination of fractional flow reserve for atherosclerotic coronary disease, among others.

Artificial intelligence methods have been applied to the assessment of ILDs at CT and have shown the ability to predict pulmonary function in patients with IPF

better than visual scoring, potentially identifying nonvisual CT parameters that may predict the severity of functional impairment.

This term, machine learning, is used when an algorithm is improved incrementally by changing parameters so that it is slightly improved every step. ML is defined as an intelligent agent that learns from and act on the environment and improves from experience on a predetermined task with a performance measure. (Das et al., 2015)

Machine learning (ML) is a core branch of AI that aims to give computers the ability to learn without being explicitly programmed. (Samuel, 2000). ML has many subfields and applications, including statistical learning methods, neural networks, instance-based learning, genetic algorithms, data mining, image recognition, natural language processing (NLP), computational learning theory, inductive logic programming, and reinforcement learning. (Mitchell, 1997). ML software can be used to detect patterns in large electronic health record datasets by identifying subsets of data records and attributes that are atypical (e.g., indicate risks) or that reveal factors associated with patient outcomes . (McFowland, Speakman, & Neill, 2013; Neill, 2012)

Artificial neural networks (ANNs) are a type of ML technique that simulates the structure and function of neuronal networks in the brain.

With traditional digital computing, the computational steps are sequential and follow linear modeling techniques. In contrast, modern neural networks use nonlinear statistical data modeling techniques that respond in parallel to the pattern of inputs presented to them.

As with biological neurons, connections are made and strengthened with repeated use. (by Hebbian learning; Hebb, 1949) Modern examples of ANN applications include handwriting recognition, computer vision, and speech recognition. (Haykin & Network, 2004; Jain, Mao, & Mohiuddin, 1996)

