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Research paper

The Future of Health care: Machine Learning

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Abstract

Machine learning (ML) is a rising field. Machine learning is to find patterns automatically and reason about data.ML enables personalized care called precision medicine. Machine learning methods have made advances in healthcare domain. This paper discuss about application of machine learning in health care. Machine learning will change health care within a few years. In future ML and AI will transform health care, but quality ML and AI decision support systems (DSS) Should Require to address the problems faced by patients and physicians in effective diagnosis.

Keywords: *Machine Learning; health care; artificial intelligence; decision support system.*

1. Introduction

Machine learning is widely regarded as one of the disruptive technologies of the moment. Machine learning is the development of algorithms which can learn from data. Progress in machine learning is driven by availability of huge data and low cost computation. Machine learning focuses on developing algorithms based on the machine's past experiences. In simple terms machine learning is defined as the extraction of knowledge from data. The goal of machine learning is to identify patterns in data and then to perform useful inference using those patterns that have been learned [1] Figure 1 shows the difference between traditional programming and machine learning.

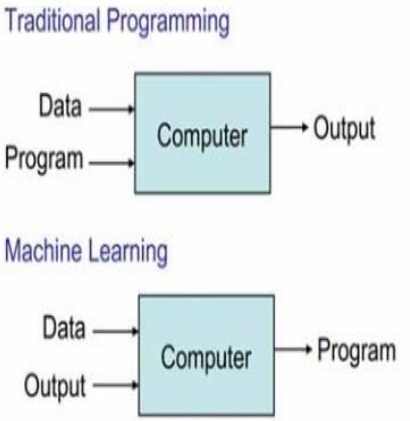


Fig 1: Comparison of Traditional and Machine Learning [2]

The purpose of machine learning is to produce more positive outcomes with increasingly precise predictions. Machine learning techniques heavily relies on computing power. Building algorithms capable of doing this, uses the binary yes and no logic of the computers is the foundation of machine learning. Machine learning is classified into two types 1) Supervised and 2) Unsupervised

Figure 2 shows the machine learning types. In supervised learning labels for the training data is provided and /or select features to feed the algorithm to learn, whereas in unsupervised learning algorithm is applied on raw data and learns fully automatic.

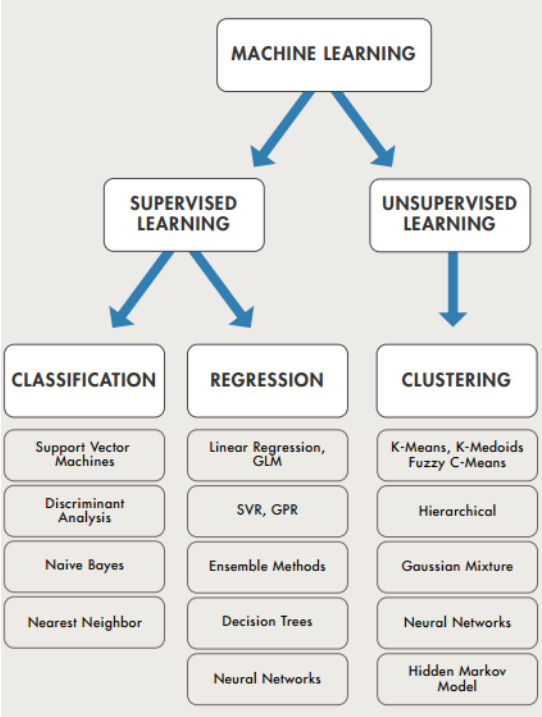


Fig 2: Machine learning classification [3]

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Machine learning Vs statistics

Statistical techniques have been used to extract implicit information from data, but statistical analysis requires mathematical background. Statistical analysis is time consuming as the analyzer needs to formulate and test each hypothesis, whereas machine learning automates the generation and testing of hypothesis. Statistical techniques rely on heavy computation on small data sets. Table 1 shows the comparison of statistical analysis and machine learning.

Table 1: statistical Vs machine learning comparison

Sl no	Statistical Techniques	Machine Learning
1	Analyze and summarize data	Learning from data
2	Requires independent features	Redundancy in features is allowed
3	Promotes data reduction	Does not provide data reduction
4	Focused on traditional data analysis	Used to solve complex problems

Health care is one of the most complex, challenging and expensive industry. Machine learning is widely used in health care .Despite of progress made in ICT still there is a need for innovation in health care informatics. Medical data consists of X ray results, DNA sequences, blood samples, vaccination, vital signs etc. Machine learning is able to efficiently obtain, analyze and draw conclusions. Machine learning in health care is a challenging issue due to 1) Large volume and variety of data example includes ECG to text data 2) challenges related to missing data, task heterogeneity and temporal consistency.

2. Application of Machine learning in Medicine

Machine learning, yields better results in health care domain. As per McKinsey report machine learning and big data in pharmacy and medicine could generate revenue up to $100B annually .This is due to the faster decision-making, improved efficiency clinical trials, optimized innovation.

There are various applications of machine learning in pharmacy. They are broadly classified into [4]

1) Disease Identification/Diagnosis
2) Personalized Treatment/Behavioral Modification
3) Drug Discovery/Manufacturing
4) Clinical Trial Research
5) Radiology and Radiotherapy
6) Smart Electronic Health Records
7) Epidemic Outbreak Prediction

Web search giant Google is developing "Google's Deep Mind Health", technology to address macular degeneration in aging eyes.

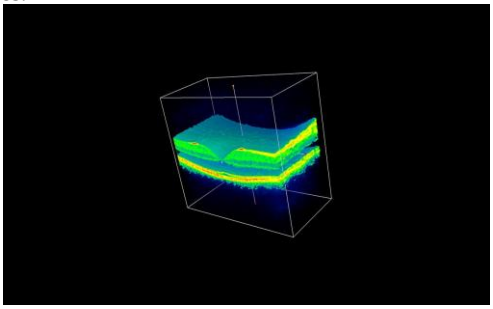


Fig 3: Google Deep Mind Health – An OCT scan of one of the Deep Mind Health team's eyes[5]

Google is working with University College London Hospital (UCLH) to develop ML algorithms capable of detecting cancerous tissues and healthy tissues help improve radiation treatments.

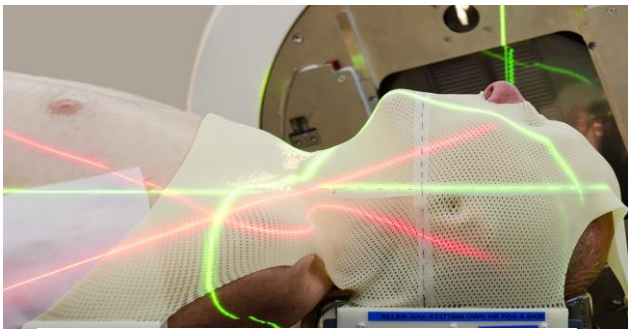


Fig 4: Google Deep Mind Health – radiotherapy planning [6]

Machine learning and Artificial technologies are widely used to monitor and predict epidemic outbreaks based on data collected from social media updates, from the web, and the data collected from the satellites.[7]

ProMED-mail is used for monitoring emerging diseases and providing outbreak reports in real-time. Screen shot of ProMED is shown in figure.



Fig 5: Going International [8]

3. Start-ups in Machine learning Domain

The number of startups entering the healthcare using machine learning and AI has increased in recent years. As per Frost & Sullivan report, by 2025, AI systems could be involved in everything from population health management, to digital avatars capable of answering specific patient queries [9]

Few Artificial and machine learning based startups in India are[10]

1) SigTuple
2) Aindra
3) Niramai Health Analytix
4) Advenio Technosys
5)Ten3T
6) QorQL

7) Touchkin
8) Predible Health
9) Healthmir
10) Orbuculum



Fig 6: Health care startups using AI [11]

Various Health Care Startups Using Machine Learning and Artificial Intelligence.

1. For patient data and risk analysis

Sl No	Name Of The Startup
1	Roam
2	Apixio
3	Ensodata
4	Medalogi
5	Pulse Data
6	Cloudmedx
7	Medaware
8	Zephyr Health
9	Health Fidility
10	Lytics
11	Medal
12	Flash Back Technologies

2. Lifestyle management and monitoring

Sl No	Name Of The Startup
1	Aicure
2	Lucina
3	Wellhok
4	Intendu
5	Peerwell
6	Ovla Health

3. Nutrition

Sl No	Name Of The Startup
1	Nuritas

4. Emergency Room And Surgery

Sl No	Name Of The Startup
1	Gauss Surgical
2	Medasense

5. Inpatient care hospital management

Sl No	Name Of The Startup
1	Qualaris
2	Analytics Md
3	Jvion

6. Medical imaging and diagnosis

Sl No	Name Of The Startup
1	Baylabs
2	Zebra
3	Deep Genomics
4	Pathway Genomics
5	Curemetrix
6	Enlitic
7	Arterys

7. Mental Health

Sl No	Name Of The Startup
1	Tao
2	Ginger Io

8. Drug discovery

Sl No	Name Of The Startup
1	Globavir
2	Numedii
3	Numerate
4	Benevolent Ai

9. Virtual Assistants

Sl No	Name Of The Startup
1	Buoy
2	Babylon
3	Yourmd
4	Sophie Bot
5	Medwhat

10. Wearables

Sl No	Name Of The Startup
1	Touch Kin
2	Physiq
3	Atlas
4	Biobeats
5	Sentrian
6	Crycadia

4. Conclusion

Machine learning can be applied to health care data to develop robust risk models. Healthcare industry is already overburdened with the exploding population and lack of trained doctors. The ratio of doctor to patients in India is 1:1700 which is far higher than the recommended ratio of 1 in every 1000 patients by WHO. Major companies like Enlitic, MedAware, and Google, have launched massive projects focused on improving machine learning and artificial intelligence systems for healthcare system. The spontaneous increase of efficient healthcare providers is not possible. Use of machine learning and artificial intelligence technologies can enhance the productivity and precision of existing ones. Use of these technologies will help in serving more patients in a less time and also improve healthcare outcomes and reduce the healthcare expense.

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