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A Survey of Medical Image Analysis Based on Machine Learning Techniques

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ABSTRACT

Machine learning is a result of the availability and accessibility of a massive amount of data collected via sensors and the internet. The concept of machine learning demonstrates and spreads the fact that computers can improve themselves. Deep learning is causing a paradigm shift in medical image analysis. A medical image is a visual representation of the interior of a body, typically used for diagnostic or therapeutic purposes. Researchers and policymakers interested in healthcare outcomes should read this; this research provides an overview of machine learning at a high level. Computer vision is the field of using computer algorithms to understand and analyze visual data, and machine learning is a key tool for developing these algorithms. This review discovered that there are three varieties of machine learning strategies: supervised, unsupervised, and semi-supervised, and they seem to be gaining traction in risk assessment, disease prognosis, and image-based diagnosis, with increasing success. Convolutional neural networks (CNNs), k-means clustering, random forests, transductive learning, and support vector machines are among the most commonly used algorithms. Image analysis using CNN is the most effective method for medical imaging.

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1. INTRODUCTION

ML refers to a field of computer science that creates predictions based on data. It employs algorithms, methods, and processes to discover latent associations within data and to develop descriptive, predictive, or prescriptive tools that capitalize on those associations. Data mining, pattern recognition, artificial intelligence (AI), and deep learning are all frequently used terms in this context (DL) [Patrick Doupe, James Faghmous, and Sanjay Basu, 2019]. ML is a subset of AI that is interested in the design and expansion of algorithms, and it allows today's computers to learn [Mohamed Alloghani, Ahmed Aljaaf,

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Abir Hussain, Thar Baker, Jamila Mustafina, Dhiya Al-Jumeily, and Mohammed Khalaf, 2019] as shown in Fig 1. A large dataset is used to extract general concepts, usually in the form of a response-predicting algorithm. ML is an ever-expanding field. Recent research has focused on computer vision and machine learning.

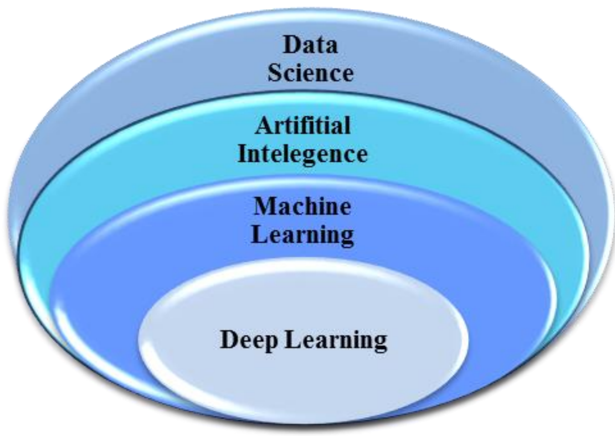

Fig. 1. The relationship between artificial intelligence and machine learning.

Computer vision (CV) is a branch of computer science concerned with the quantification of digital image visual information content [Elizabeth A. Holm, Ryan Cohn, Nan Gao, Andrew R. Kitahara, Thomas P. Matson, Bo Lei, and Srujana Rao Yarasi, 2020]. Image and pattern mappings are used by computer vision to find solutions [Asharul Islam Khan, Salim Al-Habsi, 2020]. A scientific field that extracts information from digital images is known as computer vision. Image information can be used for navigational space measurements, identification, or interactive 3D applications. Computer vision can also be defined by its applications. The growth of algorithms that can recognize the content of an image and use it for other purposes is referred to as "computer vision" [Ranjay Krishna, 2017]. The CV is now used in several alternative apps, such as:

- Handwritten postal codes can be read by optical character recognition (OCR).
- Machine investigation: accelerated inspection of parts for quality assurance
- object recognition
- Automated access for family members via visual authentication
- To improve camera focusing and find pictures more relevantly, face detection can be used.
- Surveillance: keeping an eye out for intruders and analyzing highway traffic
- Medical imaging: capturing images taken before and during surgery. In addition, lengthy studies of people's structural brains as they age are being conducted [Richard Szeliski, 2022].

It is possible that medical image analysis would be the first area in which clients converse with operational AI systems because the data is well-structured and labeled. Examples of digital medical images include X-rays, ultrasound scans, computed tomography scans (CT), positron emission tomography (PET) scans, magnetic resonance imaging (MRI) scans, histology slides, retinal photography, and dermoscopy images [Justin Ker, Lipo Wang, Jai Rao, and Tchoyoson Lim, 2018].

Motivations and contributions

There are several motivations for reviewing machine learning techniques for medical imaging, including:

1- Improving diagnostic accuracy: Machine learning algorithms can be used to analyze medical images and identify patterns that may not be visible to the human eye, which can improve diagnostic accuracy

2- Reducing human error: Machine learning algorithms can be used to automate the diagnostic process and reduce the potential for human error.

3- Improving efficiency: Machine learning algorithms can be used to process medical images quickly and efficiently, which can reduce the time and resources required for diagnosis.

4- Identifying new patterns: Machine learning algorithms can be used to identify patterns in medical images that were previously unknown, which can lead to new discoveries and treatments.

As for the contributions, machine learning techniques have been used in medical imaging to develop algorithms for tasks such as image segmentation, image registration, image enhancement, and image analysis. These techniques have been applied to various modalities including X-ray, CT, MRI, and ultrasound images. Additionally, machine learning has been used to improve the diagnostic performance of radiologists and has been shown to be comparable or even superior to human performance in certain tasks.

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2. MATERIALS AND METHODS

2. 1. TECHNIQUES OF MACHINE LEARNING

Machine learning involves converting a high-dimensional feature vector into quantitative visual information. This data could include a classification, an association with a metadata value, a measurement, the presence of a specific feature, or any other value contained in the feature vector. The life cycle of ML is shown in Figure 2.

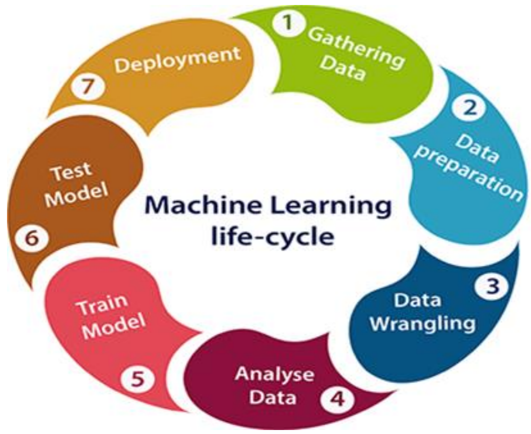

Fig. 2. The Machine Learning life cycle.

There are four kinds of machine learning algorithms: supervised learning models, unsupervised learning, semi-supervised learning, and the reinforcement learning model [Chitra T. Wasnik and Kanchan Mankar, 2019]. Supervised learning, an operation that converts an input into an output using example feedback tuples, is known in this model. The supervised machine learning algorithms are those that require human intervention. In the input dataset, the testing and training datasets are separated. The training dataset contains an output variable that must be projected or classified [Batta Mahesh, 2020]. Using training data, the main objective of supervised learning is to create a component that can patch input images to the labels that relate to them (e.g., cancer). Supervised learning algorithms involve random forests and support vector machines [Daisuke Komura, Shumpei Ishikawa, 2018]. Unsupervised learning There have been no perfect answers, and there is no instructor, in contrast to supervised learning. To find and present interesting data structures, algorithms are left to their own devices. Even a few characteristics are extracted based on the data by unsupervised learning algorithms. When new information becomes available, its classification is based on previously determined characteristics. Its primary applications are clustering and feature reduction [Batta Mahesh, 2020]. Unsupervised learning seeks to surmise a purpose from unmarked images. The goal of unsupervised learning is to infer a function. Anomaly detection, dimensionality reduction, and clustering are among the tasks. Unsupervised learning algorithms include principal component analysis, auto encoders, and k-means. [Daisuke Komura, Shumpei Ishikawa, 2018]. Semi-Supervised Learning It is a technique that combines supervised and unsupervised learning. This technique is only used when unlabeled data is already present and obtaining labeled data becomes uninteresting. Generative models, self-training, adaptive support vector machines, etc. are some of the categories of semi-supervised learning [Chitra T. Wasnik, Kanchan Mankar, 2019]. Reinforcement Learning It is predicated on the notion that if an action is followed by a good result or an improved current situation, the desire to repeat that action grows stronger, i.e., is reinforced. The idea can be extended to permit action choices to be dependent on state information, which then brings in the aspect of feedback. Thus, a reinforcement learning system is the one that enhances its performance by obtaining feedback in the form of a scalar reward, a reinforcement signal that is indicative of the suitability of the response. The learning system is not instructed about what action has to be taken. Instead, it is expected that by experimenting, it will be able to ascertain which actions yield the greatest benefit. The actions can influence not only the immediate benefit but also the subsequent situation and, as a result, the outcome, as well as all successive prizes. The two primary characteristics of reinforcement learning are targeted search and cumulative praise. In other words, it is a technique that makes decisions based on which actions to take such that a positive outcome is obtained. A learner does not know what type of action to take until a particular situation is provided. In addition, the action that a learner takes might influence situations in the future [Chitra T. Wasnik, Kanchan Mankar, 2019]. Fig. 3 lists some of the algorithms of ML.

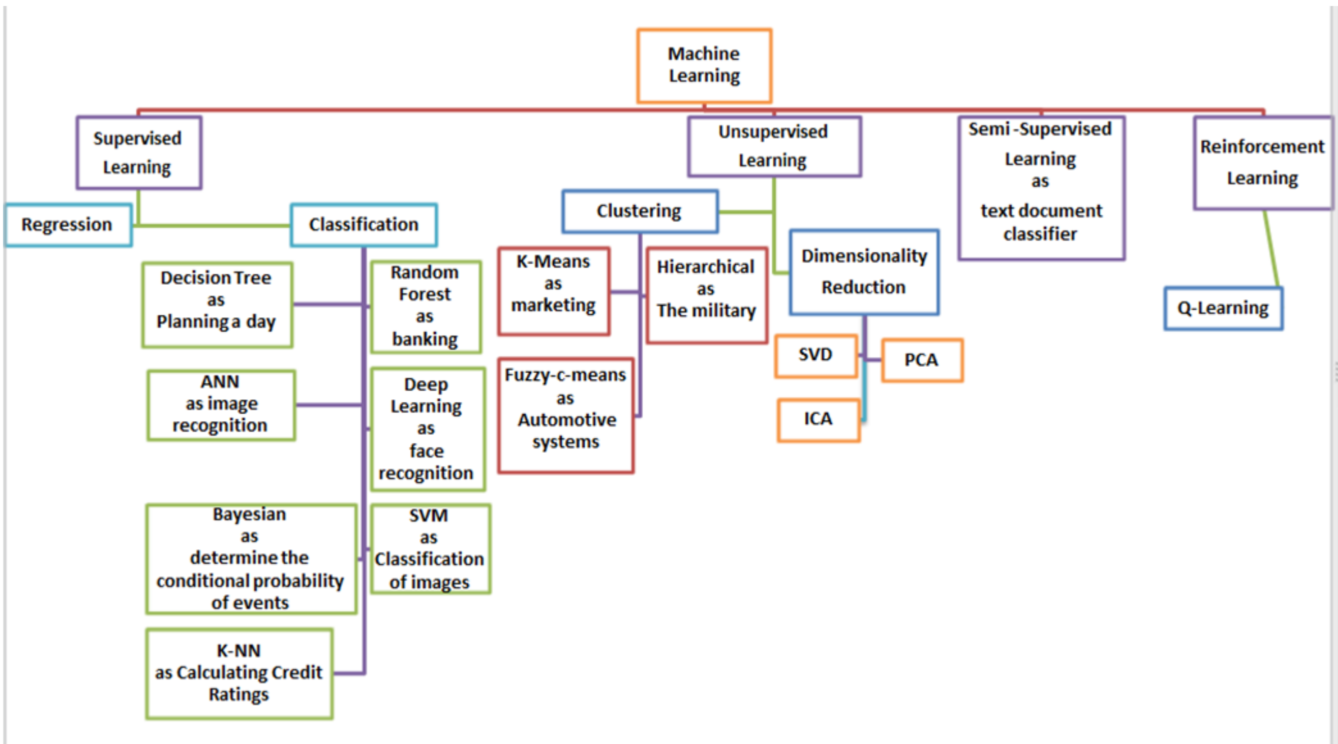

Fig. 3. The Machine Algorithms.

2.2. METHODS

It's safe to say that machine learning and deep learning techniques have been mainstays in the analysis of large quantities of weakly correlated or high-dimensional data for more than a decade. **First** Deep learning is a subset of ANN that is also known as "deep neural networks" (DNN). Recurrent neural networks (RNN), convolutional neural networks (CNN), and artificial neural networks (ANN) DL was developed primarily to address data scalability issues, such as dealing with high-dimensional and large-scale datasets. Rather than a hidden layer sandwiched between the input and output layers as in CNN, ANN and RNN techniques are made up of several convolutional layers of interconnected neurons. "The invisible layers" of processing are defined as the weighted connection concept. Overall, each concealed neuron is composed of present weight and slanted values, which are later modified during the training process until the output results are obtained. Finally, the solution to the given problem is represented by the output layer that contains the weight vector values that were obtained. **Second** support vector machines (SVM), random forests (RF), decision trees (DT) for linear regression, k-nearest neighbors (KNN) for logistic regression (LR), and Naive Bayes are all examples of traditional ML techniques [Saad Shafiq, Atif Mashkoor, Christoph, Mayr-Dorn, and Alexander, 2021]. Many review papers are published for ML; these are listed in Table 1 with information on journals for the last four years.

Table 1 : Machine learning for medical image analysis review articles

NO.	Researcher	Headline
[18]	Susama Bagchi (2020)	A review of machine learning techniques used in computer-aided detection systems for mammogram testing.
[8]	Chitra T. Wasnik (2019)	A Look at Machine Learning Techniques
[19]	Tara A. Retson (2019)	Thoracic and Cardiovascular Imaging Using Machine Learning and Deep Neural Networks
[20]	Bradley J. Erickson (2017)	Medical Imaging Using Machine Learning
[21]	Marleen de Bruijne (2016)	Approaches to machine learning in medical image analysis: from detection to diagnosis

2.3. MEDICAL IMAGE ANALYSIS

For developing new drugs and making clinical decisions, machine learning algorithms could be deeply integrated into all fields of medicine, radically changing how healthcare is delivered. As medical records are increasingly being digitalized, machine learning algorithms have been successful in computer vision tasks at an opportune time. CNN has been used in image analysis detection, according to the researcher. Classification, localization, registration, and segmentation are some of the applications. Localization (drawing a bounding box around a single object in an image) and detection are two different types of machine learning research (creating bounding boxes around multiple objects of various classes). Segmentation is the process of creating outlines and labels all around the perimeters of the target objects (semantic partitioning). Registration is the process of transferring one image (which can be two- or three-dimensional) to another [Justin Ker, Lipo Wang, Jai Rao, and Tchoyoson Lim, 2018].

One of the very first areas where deep learning yielded successful outcomes was image or exam classification, which contributed to medical image processing. Exam classification classifies one or more images (an exam).In most cases, a single diagnostic variable is used as input and an individual test attribute is used as the outcome (e.g., disease present or not). In this context, every diagnostic exam is a sample. Moreover, dataset sizes in computer vision are typically small (for instance, 100s vs. millions of tests). It is not surprising, then, that transfer learning is popular in such applications [Geert Litjens, Thijs Kooi, Babak Ehteshami Bejnordi, Arnaud Arindra Adiyoso Setio, Francesco Ciompi, Mohsen Ghafoorian, Jeroen A.W.M. van der Laak, Bram van Ginneken, Clara I. Sánchez, 2017]. Transfer learning is a technique that uses pre-trained networks (usually on natural images) to try to avoid the (perceived) need for large amounts of data sets required to train deep networks.Transfer learning strategies were identified as (1) a perfectly adequate medical data-trained neural network and (2) a trained network used as a feature extractor.The former strategy has the added benefit of not requiring any deep network training; in this case, the extracted features can be easily integrated into existing image analysis pipelines. Both approaches are well-known and extremely effective. Although only a few writers conduct in-depth research to determine which strategy yields the best outcomes, The two papers that accomplish this [Antony, J., McGuinness, K., Connor, N.E.O., Moran, K.M., 2016] and [Kim, E., Cortre-Real, M., Baloch, Z., 2016] produce contradictory results.

Object classification typically focuses on classifying a minor (already identified) section dividing a medical image into multiple classes (e.g., a module in CT chest classification). To accurately classify many of these tasks, local information about the appearance of lesions must be combined with glB. (2017).obal contextual information about the location of lesions. In most generic deep learning architectures, this combination is not possible. The process of dividing an image into parts to identify meaningful objects or features is known as image segmentation [Erick Moen, Dyan Bannon , Takamasa Kudo, William GraCovert,kus Covert and David Van Valesegmentationgmenorgans of Osubstructures ructures. The segmentation of organ systems and other structural components in medical images enables statistical analysis of clinical features relating to size and shape, such as in brain ancardiac analysisor cardiac. It is also frequently used as the initial step in laptop detection pipelines [Geet Litjens , hijs Kooi , Babak Ehtesham Bejnordi , Arnaud Arindra Adioso Setio , Francesco Ciompi, Mohsen GhJeroen A.W.M.roenA.W.M. van der Laak, Bram van Ginneken, Clara I. Sánchez, 2017]. In the application of deep learning algorithms, lesion segmentation combines substructure segmentation cwithlenges and object deteorgan recognition and organ. Local and global contexts are typically required for accurate se;mentation, as theesult, The networks are multi-stream with different scales or patches with non-uniform samplig, as in [Kamnitsas, K., Ledig, C., Newcombe, V.F., Simpson, J.P., Kane, A.D., Menon, D.K., D., andckert, D., Glocker, B.,2017] and [Ghafoorian, M., Karssemeijer, N., Heskes, T., van Uden, I.W.M., de Leeuw, F.-E., Mar-chiori, E., van Ginneken, B., Platel, B., 2016]. Registration is a popular image analysis task. Medical image alignment (i.e., locative alignment), which involves calculating a transformation of one medical image to another in terms of coordinates, This is frequently achieved in a cyclical framework in which it is assumed that a non-parametric transformation is used and a pre-specified quantitative (e.g., L2-norm: used to calculate the vector coordinate's distance from the vector space's origin) is improved. Although lesion detection and segmentation are more widely used deep learning subjects, deep networks have been discovered by researchers to be useful in achieving the best possible registration performance. In general, two approaches are common in the present literature: First, deep-learning networks are used to compute a similarity metric for image pairs, which is then used to provide the impetus for an incremental optimization strategy. Second, using deep neural networks to predict transformation parameters directly [Geert Litjens, Thijs Kooi, Babak Ehteshami Bejnordi, Arnaud Arindra Adiyoso Setio, Francesco Ciompi, Mohsen Ghafoorian, Jeroen A.W.M. van der Laak, Bram van Ginneken, Clara I. Sánchez, 2017]. The normal anatomy's localization is less likely to pique the interest of a clinician, despite the fact that applications in anatomy education may arise. Localization is also useful in completely automated edge applications, where the radiographic image is examined and determined autonomously without the need to allow for human involvement [Justin Ker, Lipo Wang, Jai Rao, and Tchoyoson Lim, 2018].

2.4. MEDICAL DATASET

Embracing AI and ML is not a one-size-fits-all solution for all problems. Getting your processes under control begins with gathering data and visualizing it in ways that make it easier to understand. To achieve the goal of high-quality production, you'll need to evolve your analytics capabilities so that AI can help you produce products as efficiently and securely as possible. Because Amazon, Google, and Facebook were the first companies to cultivate data sets, they dominated their respective fields. They can increase their comparative advantage because their data sets have grown so large and sophisticated. An AI model's success depends on data that contains relevant features. To properly perform machine learning, a large amount of data is not only necessary but also the right type of data. This is because the system will eventually do what it has learned from the data. Even if a machine is trained on the most appropriate algorithm, if the data is bad, it is more likely to learn the wrong things, draw incorrect conclusions, and not perform as expected. Having high-quality data (and enough of it) can overcome an algorithmic stumbling block in the long run. Data is, therefore, a critical part of success. There are four main sources for a dataset in general: data from real-world usage, survey data, public data sets, and simulated data. Many repositories and sites provide free medical datasets. Table 2 lists some of the links for free datasets.

2.5. TOOLS FOR ML

With the advancement of ML apparatuses, a comprehensive list isn't possible. Python libraries (e.g., PyTorch, Scikit-Learn, and Theano); and TensorFlow from Google are some of the most well-known openly accessible and free and open apparatuses for the creation of machine learning algorithms. There is a wide range of free and open tools available for developing and implementing machine learning. These apparatuses are compatible with the majority of modern programming languages, such as MATLAB, Python, and C++. Furthermore, machines for machine learning tasks and large datasets have been developed, such as the Start and Apache Storm libraries [Susama Bagchi, Kim Gaik Tay, Audrey Huong, and Sanjoy Kumar Debnath, 2020].

3. ML Techniques in Medical Image Analysis

This research provides an overview of several machine learning approaches. ML is now used by everyone, whether consciously or unconsciously. In addition, the study describes the ML operational model, which provides an overview of the ML process. With massive datasets to train and improve a prediction algorithm, machine learning approaches are possibly valuable to researchers in health care looking to enhance healthcare assumptions. When there are many factors to choose from and nonlinear, complex relationships and communication terms cause the outcome of interest, methods of machine learning can assist estimators based on generalizable data. However, machine learning approaches provide significant obstacles for healthcare outcome researchers, which should be considered before embarking on a machine learning project. They can be hard to decipher (for extremely deep learning), difficult to obtain mechanisms of action from (a challenging task for all of the methods mentioned here), and necessitate a significant amount of time and computation resources (especially for ensembles, gradient boosting machines, and deep learning). In the Table 2 summary of lettuce, the review is displayed along with the used ML techniques and descriptions for user data.

Table 2. Available free ML medical datasets.

Dataset Name\ References	Description
Estimation of obesity levels based on eating habits and physical condition [22]	Based on eating habits and physical conditions, this dataset uses data from Mexico, Colombia, and Peru to estimate obesity levels.
Breath Metabolomics [23]	104 breath metabolomics experiments with four subjects were carried out. In a breath of 1652 chemical compounds, average exhalation parameters and metabolite signal intensities were recorded.
Cardiotocography [24]	The diagnostic characteristics of 2126 fetal cardiotocography (CTG) were automatically measured. As a result, the dataset is suitable for 10-class or 3-class experiments. Donation Date :2010-09-07
Dermatology [25]	The family history feature in the dataset created for this domain has the value 1 if any of these diseases have been observed in the family, and 0 otherwise. Donation Date 1998-01-01
Diabetes [26]	A diabetes record system and paper records were used to collect diabetes patient information. Paper records, on the other hand, have fictitious uniform recording times, whereas electronic records have more realistic time stamps. Donation Date :N/A
Heart failure clinical records [27].	During their follow-up period, 299 patients with heart failure had their medical records reviewed, and each patient profile contains 13 clinical features.
Fertility [28]	The WHO 2010 criteria were applied to 100 volunteers' semen samples. Among the factors that influence sperm concentration are sociodemographics, environment, health, and lifestyle.
sEMG for Basic Hand movements [29]	Two databases of surface electromyographic signals are included in the sEMG for Basic Hand movements, which uses Delsys' EMG System to measure the movements of six fingers. Six grasps of daily life were conducted on healthy subjects.
Risk Factor prediction of Chronic Kidney Disease [30]	There is no pre-processing in this dataset; you need to pre-process the data before applying a Machine Learning algorithm.
Shoulder Implant X-Ray Manufacturer Classification [31]	A total of 597 unidentified raw X-ray images were obtained from four manufacturers of embedded shoulder prostheses.
Breast Cancer Coimbra [32]	An observation or measurement of clinical features was achieved on 64 patients with breast cancer and 52 healthy controls.

X-Ray [33]	There were 605 X-ray images in total in the collection. Eight photographs that appeared to be from the same patients were removed, leaving 597 images. Images from the following manufacturers are included in the final set: There were 83 Cofields, 294 Depuys, 71 Torniers, and 149 Zimmers, resulting in a four-class classification problem. Class labels and the manufacturer's name are included in file names.
Drug Review data source [34]	The data source includes patient reviews on specific drugs as well as related conditions, as well as a patient rating of 10 stars that reflects overall patient satisfaction. Crawling online pharmaceutical review sites yielded the data.
Cervical cancer (Risk Factors) [35]	The dataset includes 858 patients' historical medical records, demographic information, and habits, Because of privacy concerns, several patients decided not to answer some of the questions (missing values).
Bone marrow transplant [36]	Pediatric patients with malignant and nonmalignant hematologic disorders are described in the data set. Hematopoietic stem cell transplantation was performed on all unmanipulated patients.

Table 3 lists of reviewed research explaining the topic, method, accuracy, and data.

Table 3. List of reviewed research.

NO/ Year	Topic	Method	Accuracy	dataset
[37] 2021	COVID19 diagnosis framework based on X-ray images of the chest	CNN and PCA	100%	There were only 198 X-ray images affected cases are included in the COVID-19 image data collection. The experimental work was created using images of patients' X-rays from data collection for COVID-19, which Included in the study were 198 X-ray images of virus-infected patients and 210 X-ray images of healthy people from the Chest X-ray Images repository.
[38] 2021	PET/MRI with [68Ga] Ga-PSMA-11	Ga-PSMA-11 PET/MRI [68Ga]	The results of MC cross-validation were 89% and 91%	During follow-up, 50 had OPR data , and 36 of the 52 patients had BCR,.
[39] 2021	Individual Flare Risk In Patients With Rheumatoid Arthritis Who Are Tapering Biological Drugs	Advanced methods	Best accuracy	A total of 135 visits from 41 patients were included in the study.

[40] 2020	Using "DaaS," predict multidrug-resistant urinary tract infections	Catboost SVM NeuralNetworks	71.7 % 63% 68.6%	The database was collected using reports from the Principe di Piemonte Hospital's Clinical Pathology Operative Unit in Senigallia, Marche, Italy.
[41] 2020	An automated method for detecting COVID-19 cases using X-ray images	DarkCovidNet	98.08%	The database contains 127 X-ray images that have been given a diagnosis with COVID-19.
[42] 2020	Fully Automated Head CT Neuroanatomy Segmentation	Deep Learning	A High Level Of Accuracy	Data derived from 62 non-contrast CT scans of normal non-contrasted heads.
[43] 2020	Crohn's disease lesions are detected using video capsule endoscopy.	CNN	varying between 95.4% and 96.7%	From 49 patients, 17,640 CE images were collected, with 10,249 images containing normal mucosa , and 7,391 images containing mucosal ulcers.
[44] 2019	Fundus images can be used to detect age-related macular degeneration	SVM	83.5821%	397 images, 41 of which are of healthy people, 34 of which are of AMD patients, and the rest are of other diseases.
[45] 2019	Identify Antimicrobial Resistance in the ICU	LR kNN DT RF MLP	78.2 % 79.3 % 77.0 % 80.1 % 80.8 %	We propose analyzing data from the UHF ICU's health information systems.
[46] 2019	The Discovery of New Antibacterial	SOM FFN RF GB SVM kNN	73% to 78% 72% to 77% 69% to 80% 68% to 81% 73% to 78% 63% to 76%	Using a proprietary screening campaign, we compiled a representative dataset of over 140,000 molecules with antibacterial activity against Escherichia coli tested in the same assay and under the same conditions.
[47] 2019	Antibiotic sensitivity prediction in critically ill patients	kNN, Gradient And Adaptive Boosting, Decision Tree, Naive Bayes, And Logistic Regression.	87%	On 25526 positive cultures recorded in the MIMIC-III critical care database, a single-centre retrospective cohort analysis was performed.
[48] 2019	Image Classification of Histopathological Breast Cancer	MIL	92.1%	The database contains 7,909 images divided into benign and malignant tumors.
[49] 2018	Age-RelatedMacular Degeneration Detection	CNN with the Blindfold and CNN with Ten-Fold	91.17% and 95.45%	The researchers examined 583 retinal images with early, 402 normal fundus images, intermediate, or advanced AMD, and 125 retinal images with wet AMD.

[50] 2018	Proximal humerus fracture detection and classification	CNN	96%	There were 1,891 normal shoulder images and 4 types of proximal humerus fractures.
[51] 2017	MR Brain Image Classification	Multi-CNN Combination	87.15%	T1-weighted structural MR brain images from the (ADNI) database were used to assess 428 subjects, including 199 Alzheimer's disease patients and 229 healthy controls (NC).
[52] 2016	Tumor classification using digital mammography	CNN-extracted characteristics (with transfer learning)	Both types outperformed either classifier type by a significant margin.	The collection of data included From 219 lesions on full-field digital mammography images, a region of interest was extracted for each lesion.
[53] 2016	A System for Classifying ECG Beats	CNN	92.7%	There are 48 two-channel ambulatory ECG recordings in the database, each spanning 30 minutes

From the reviewed papers, one can note that CNN is the most useful in dealing with the medical image, as shown in Fig 4.

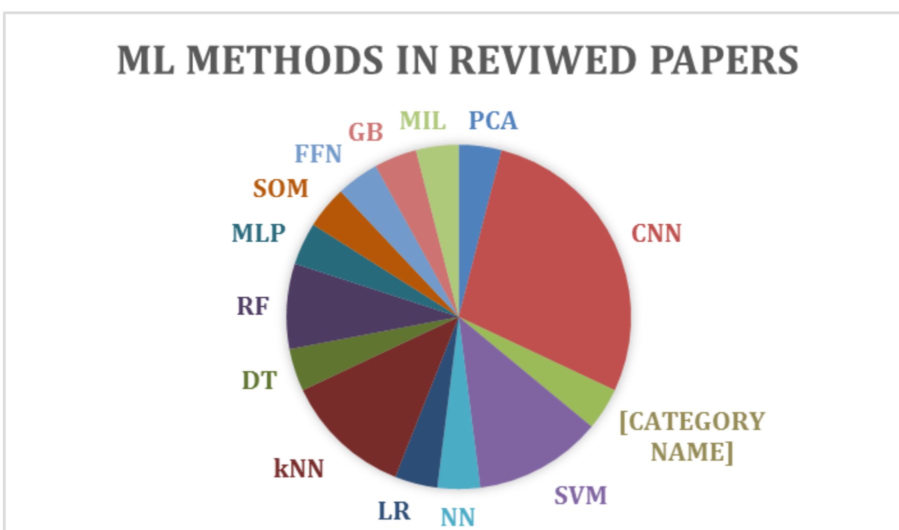

Fig. 4. The ML Methods used in the reviewed paper.

Ever since the invention of this algorithm 50 years ago, machine learning technology has advanced tremendously. Initially, simple models were "brittle" in the sense that any deviations from the examples provided during training would be unacceptable. In today's real-world conditions, machine learning methods exhibit extreme resilience, and forced data dropout during the learning process benefits the systems. As a result of the rapid speed of technological advancement, machine learning systems will take on tasks that were originally believed to be human-only. Because of the vast amount of data available, machine learning approaches may be useful to healthcare researchers attempting to improve healthcare forecast outcomes. There are datasets available for training and modifying a forecasting algorithm. Machine learning approaches These approaches can help generalize information estimation methods. When several confounding variables are chosen and those covariates are correlated, their interactions are complex.

4. CONCLUSIONS

Machine learning algorithms appear to be gaining traction in risk assessment, disease prognosis, and image-based diagnosis, with growing success. There are a lot of scientific possibilities, but to unlock their potential, practical difficulties must be overcome. maximum potential, including how to build excellent models with few resources. Data, how to increase data availability, and how to make the greatest use of data Medical imaging image structure and unique qualities

Many scientific and practical challenges remain to be addressed to realize their full potential, including how to train strong models on small amounts of data, how to improve data access, how to best use the image structure and important properties of medical imaging data in designing the models, how to interpret the findings, and how to apply these results in clinical practice. This paper evaluated carefully selected studies to provide an overview of the state-of-the-art in the field of machine learning for medical applications. The classification demonstrates researchers' primary focus on specific stages. This paper also demonstrated the stages of the relationship with ML tools, techniques, and types. Even though the number of publications in this field is increasing moderately, In the future, we plan to conduct a more in-depth investigation into the relationship between ML algorithms.

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