



Survey on healthcare and disease diagnosis via AI

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Abstract. General Background: Modern healthcare relies heavily on accurate disease diagnosis to analyze complex patient data and select effective treatment plans. Specific Background: Advanced computational models, particularly machine learning and deep learning algorithms, are increasingly integrated into clinical settings to interpret medical images, biosignals, and genomic datasets. Knowledge Gap: Existing literature lacks a consolidated overview connecting foundational communication and decision theories directly to the practical deployment, challenges, and legal liabilities of diagnostic algorithms in clinical workflows. Aims: This survey synthesizes foundational machine learning concepts, theoretical models, and practical applications to assess current progress and operational bottlenecks in disease diagnosis. Results: Deep learning architecture demonstrates superior capability in detecting subtle lesions, cardiovascular conditions, and complex malignancies from multi-modal diagnostic data while drastically reducing processing times. Novelty: This review uniquely bridges communication and social exchange frameworks with core diagnostic neural networks to highlight human-algorithmic interaction in clinical environments. Implications: Implementing these decision-support tools mitigates diagnostic errors, streamlines hospital resource allocation, and fosters sustainable precision medicine strategies. **Keywords :** Artificial Intelligence, Machine Learning, Disease Diagnosis, Medical Imaging, Deep Learning

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INTRODUCTION

Artificial intelligence (AI) has associated in fundamental of our life's part with them on today's society. also the AI give itself as a supportive technique in most of domains as a result of created a develop of computer power in methods and techniques (1). AI takes stimulation from component of computer science, mathematics, and statistics (2). One types of AI is machine learning (ML) deal with created algorithms which learn from and produce prophecy on data (3). It was originated the increasing capacity that machines can grip huge inputting information, some machines are even able to detect hidden patterns and composite relevance to make convenient and trustworthy resolution where humans cannot as in figure [1] (4). In theory, the large dataset of any size could be applied by ML with gave a spare experiment to training of the model. The action mode of ML was working via entering the features of computational models which grouping the same observations or in predicting a sure outcome. so, the subclass in ML was deep learning (DL) which algorithms of it via self-learning to train themselves within the sequential of significant characters from input (5).

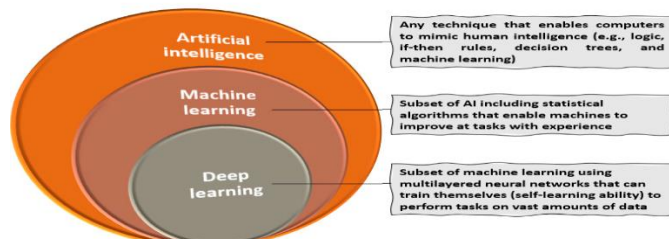
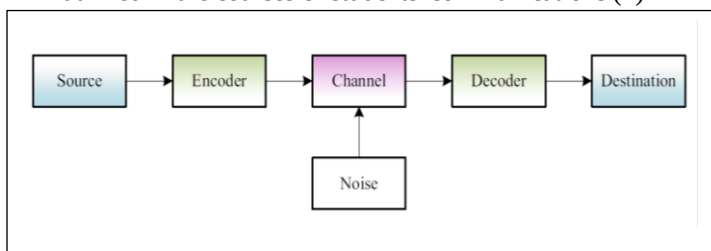


Figure [1]: Correlation between AI, ML, and DL (6).

Theories and model

Communication Theory:

Presented in these theories that communication relationships, when the students pick the better understanding of the theoretical fieldwork of communication as a rich source from these theories with ability to choose assignment's theory or any report very easy due to a "browse" through different theories and all these theories utilized in the courses of students' communications (7).



Topic modeling is the technique of the Natural Language Processing (NLP) which take a popularity in this times and utilize in identification of co-occurrence patterns in the words particular to disclose hidden topics. Graph Neural Topic Model (GNTM) is a topic modeling technique usages Graph Neural Networks (GNNs) to learn document demonstrations successfully (8).

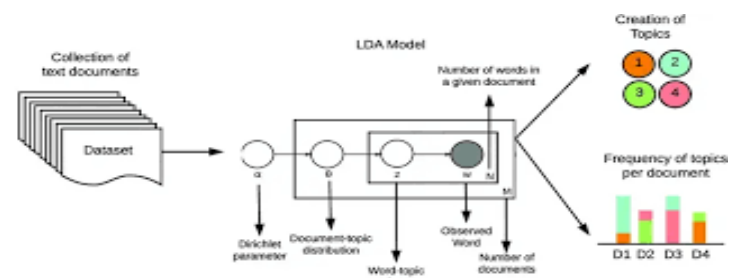


Figure [3]: Topic modeling(8)

- Routine model

This model center of attention in function as on family requires, every day routines, strengths and finally capacities and has a three major features includes intervention the plan, assessment which need, approach consultation and then classroom's run (9)

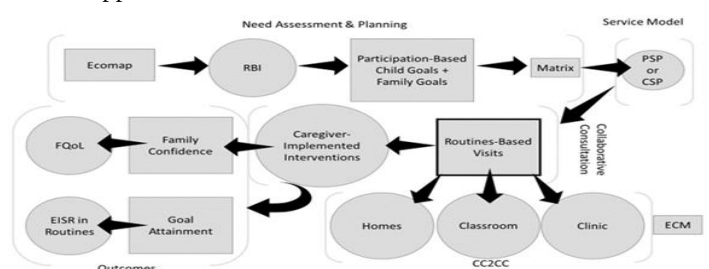


Figure [4]: Routine model (9)

Neural network model

ANN which are established to past event data and related factors, it could to come what occur in the future, also that uses multiplayer training which works systematically based on very strong and objective mathematical knowledge via developed network architectural models which called as Back propagation in the learning process whereas characteristics resembling a biological neural network (JSB). In supervised learning algorithm will be used back propagation as systematic method in ANN and is usually used by perceptions with many layer screens to change the weights in the hidden layers (10).

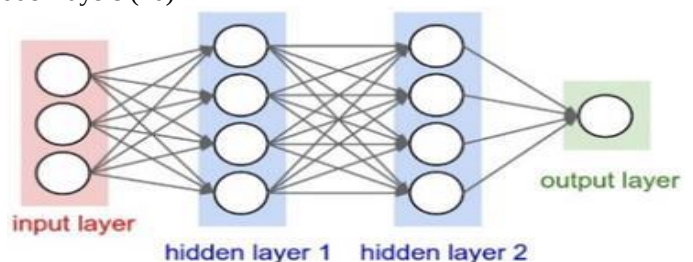


Figure [5]: Neural network model (10)

Persuasion Theory

Theories involve cognitive dissonance theory, rational model, social judgment theory, elaboration likelihood model, theory of reasoned action, narrative paradigm and inoculation theory then these theories attempt to varied the beliefs of peoples, because is still as much an "art" as it is a "science" and the human's nature most complicated with over limited (12).

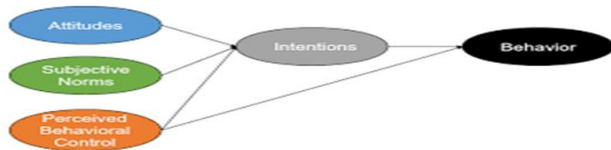


Figure [6]: Persuasion Theory (12)

- Social exchange theory

At 1950s developed the social exchange theory (SET) into a huge collection of research on social affairs performance which useful to understand the relationships of social networks and sociological views. creative of this theory was largely assigned via John Thibaut, George Homans, Peter Blau and Harold Kelley. Personal relationships in societies and bilateral relations. Homans had his own strategy to explaining bond amidst humanity throughout augmentation instrument, whereby the habits of doers are toughening by recompense inhibited by punishments (13).

Two reinforces that enhance motivation and social interaction are rewards and exchange resources. A reward is a consequence of positively meaningful relationships, while a resource is a characteristic that gives a person the ability to enable the reward, motivating people to engage in reciprocity relationships. (13).

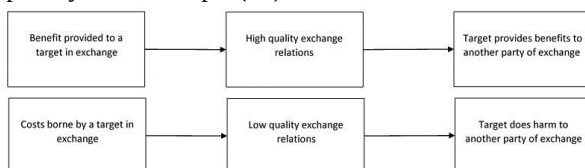


Figure [7]: Social exchange theory(13)

- Frames of mind

Every person has a type of intelligence that differs from another person, and this is the theory of multiple "intelligences." (14).

Gardner announced that the notion of Multiple Intelligences was merely from the programme of a psychologist and not an educator (Gardner, 1983 (15). Schools began revising their educational program based on multiple intelligences. Gardner bespoke that the multiple intelligence theory is beneficial for educational program development, delineation directive, selection of course activities, and related assessment strategies, all these models were illustrated in table (1).

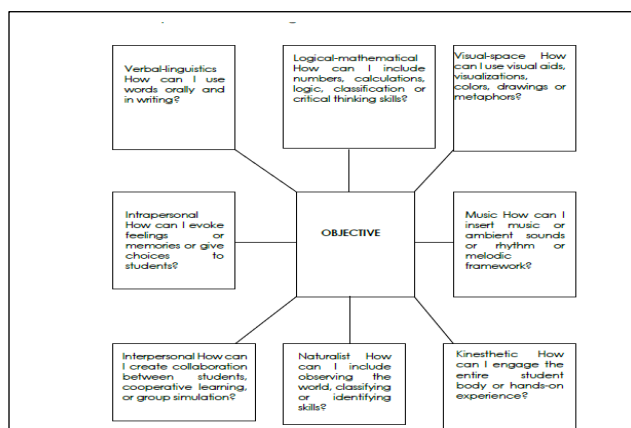


Figure [8]: Frames of Mind(15)

Table (1) : Important AI- related terms and definitions.

Term	illustration	Reference
Machine Learning(ML)	One of the artificial intelligence which uses two types of learning: supervised learning, which predicts data from existing data, and unsupervised learning, which involves discovering general patterns in the data.	(14)
Deep Learning (DL)	A type of (AI) that relies on making electronic devices operate in a way that closely resembles the humanitarian brain.	(15)
Supervise d learning	It's one types of (ML) and is superior to unsupervised learning. This type of learning relies on collecting data and then making predictions.	(16)
Unsuperv ised learning	Which consist of frequent pattern growth algorithm, Apriori algorithm, ECLAT algorithm, clustering using k-means.	(17)
Reinforce ment Learning	One types of (ML) which relies on teaching agents to execute resolution sequentially.	(18)
Model	It a type of (ML) that can make forecast from unseen data.	(19)
Training	It is a means of improving and developing solitary performance, adding	(20)

	new knowledge and dexterity, and increasing their output within their work.	
Features	It is a set of characteristics that distinguishes a particular individual or study from others.	(21)
Decision tree	It include of branch that form a rooted tree, meaning it is a directed tree with a node summon the "root" that has no incoming edges.	(22)
Random Forest	It is considered a type of machine learning and can handle both rating and recession.	(23)
Naïve Bayes(NB)	A categorizing mechanism that assumes self-sufficiency between foreteller (It means that a particular feature is not related to any other feature).	(24)
Logistic Regression	Logistic recession is used to estimate the federation of one or more freelance variable (upshot).	(25)
K-nearest neighbors (KNN)	Thus, the appreciation of the recession function is the mean value of the rebuttal over k approaching neighbors.	(26)
Support vector machine (SVM)	are branch of SLA that have demonstrated remarkable success in a wide range of classification and regression tasks	(27)
Boosting	The key distinction of boosting models is that the base learners are	(28)

	fitted sequentially , boosting is sequential model will overfit as the number of iterations increases	
Artificial Neural Network(ANN)	They are one of the most important AI paradigm and have helped solve many complex problems. They closely resemble the structure of human neurons.	(29)
Deep neural network (DNN)	DNNs were widely usage for (AI) applications, involved computer vision, speech recognition and robotics.	(30)
Convolutional neural network (CNN)	The research community has relied heavily on convolutional neural grids in the pic categorizing process	(31)
Super resolution Convolutional neural network (SRCNN)	Obtaining HR images from LR images.	(32)
Fast super resolution convolutional neural network (FSRCNN)	works similarly to SRCNN, but the pic obtained is volumetric and the grid is 3D.	(33)

Areas of application of artificial intelligence

Artificial intelligence is of great momentousness in solving many problems and has broad applications. as in figure [9] (34).

1.Finance: - artifice detection: To reduce financial losses, AI algorithms are used to conduct financial data analysis and identify artifice.

-Algorithm trading: useful in a market data analysis, make automated trading decisions to optimize investment strategies and identify trends.

-Risk assessment: useful in financial and market data analysis to assessment creditworthiness with risk of investment, and predict the fluctuations of market.

2. Transportation: - To reduce road accidents and improve transportation efficiency, it is preferable to use artificial intelligence in drones and self-driving cars to enhance transmission effectiveness.

-Traffic management: Traffic and vehicle overcrowding can be tracked and assistance provided that to reduce overcrowding and travel time.

-Logistics and supply chain optimization: via usage real time data, predictive the improve routes analysis and (ML), enhance delivery efficiency, and significantly reduce costs. It achieves this by dynamically adjusting delivery plans based on factors like traffic, weather, and delivery constraints, which cuts fuel consumption and improves on-time deliveries.

3.Manufacturing: - AI-powered robotics automate repetitive manufacturing tasks with improved precision and consistency, increasing overall productivity and reducing errors. By taking on demanding jobs, these intelligent robots free up human workers for more complex activities, leading to a more efficient, cost-effective, and safer production environment.

-Quality control: Deficiency finding its consider as visual inspection manner which can recognize automaticall the flaws of the products vai computer vision and DL. capturing to the picture and video to the production line then AI models training for visual data analysis in real time.

-Predictive maintenance: via analyzes sensor data and performance metrics to forecast instrument failures, letting for scheduled maintenance, optimized operations, and reduced downtime. Via detections patterns and anomalies in real-time, AI algorithms predict issues before they occur, leading to more efficient maintenance schedules, extended equipment lifespan, lower costs, and increased operational reliability.

4.Education: -Personalized learning: AI allows for immediate adaptation to solo student needs, discern tuition hiatus and AI confirm that students earn the right level of contribute to when they entail it.

-Intelligent tutoring: AI enhances adaptive learning platforms by creating personalized learning routes which adjust to any student's unique needs, pace, with learning style through data analysis and machine learning. AI enables dynamic difficulty adjustment, real-time feedback, and targeted content delivery, leading to improved engagement.

-Language learning and translation: Real-time machine translation usage AI for looking for arrays in spoken inputs. It also usages DL and neural networks for capturing context and other language variation.

5. Smart Cities:

-Energy management: using ML and neural grids to investigate senior sums of data as of sensors, foresee demand, augment energy dispersal, assimilate renewable energy foundations, and detect potential faults or cyber-attacks. AI enables real-time adjustments to ensure a stable, efficient, and resilient power supply, reducing waste, preventing outages, and improving customer experience through dynamic pricing and demand response programs.

-Waste management: AI enhance waste management by enabling optimized collection routes, leading to reduced fuel

consumption and operational costs. They also improve recycling through automated sorting of waste materials by computer vision and machine learning, which increases the accuracy and rate of recycling while decreasing landfill waste. Furthermore, AI provides predictive analytics to forecast waste generation, allowing for better resource allocation and infrastructure planning.

-Public safety: to detect online peruse cases, survey comportments and patterns, and also identify deviations from normal comportment that may lead to abnormal comportment, using artificial intelligence algorithms.

6. Healthcare: the skills of academics and doctors were improved via MI and AI understand the way of analyzing in biomedical imaging and the generic variations, as in X-ray, CT, MRI (35). where these routes independent on traditional algorithm with no learning also as inSVM, NN, KNN etc. Also the deep learning algorithm like CNN, RNN, LSTM, ELM, GAN and etc. The multi various layers existence in ANN was referred to meaning of the word "deep" after that was then modified within years, but the convolutional filters which the CNN really dependent on their developed that more flexibly adjusted to more available data via two ideas first one maintenances of the spatial locality of the image via any information types and second one learning through abstraction of progressive levels via single layer when utilized a simple patterns, while utilized a multi-layer needed to learn multiple patterns. Employ of AI in analyzing of characters of communication which proposed by some authors as such in used of words, phrases, turn taking, tone and style to make available a return and peer comparison to trainees within constant periods (35). furthermore, the automated methods must be sophisticating which illustrated by other author, whilst the SPs could reflect a physical ailment, in healthcare setting had an effectively communicated between one another occur in actual diagnosis of patients, treatment decision assembly with achievement of optimum patient's consequences (36).

Generally, in nursing programs and modern medical fields also the specialty trainees of these medical oncology with palliative care includes addressing very well the documented gaps of communication skills within the workforce of the healthcare (37). from anther hand the abilities of students to learned in these programs not maintained after entering the clinical practice unless supported via theory and evidence which more effective in communication skills of training but must be reliably and legitimately measured (38). Otherwise. to provide students from their instructors required criticism ally constructive with long term audits as reliably. There are a wide set of activities as teaching, learning, deciding, dealing with feeling or connecting with others which participating vi several people in the exchange (doctors, nurse, patients and caregiver) may have a priority, skillsets or need and unique perspective. Prognosis, end-of-life care, pain, and infertility are just a few examples of emotional found guilty matter that might come up in consultation of medicals. As a result, it can be difficult to build a comprehensive theory and gather experimental directory to support training. (34).



Figure [9]: application of artificial intelligence (40). AI and disease diagnosis:

Medical opinion is the systematic procedure healthcare providers use to identify the cause of a patient's illness, injury, or condition by analyzing symptoms, medicinal history, physical examination findings, and diagnostic tests. It involves gathering data, forming a differential diagnostic, and then using sequential testing to check the most likely diagnosis, which then guides the selection of the appropriate treatment plan (41). Healthcare systems are multifaceted and interesting for all stakeholders, but with the potential to improve patient care and quality of life via AI also with the clinical practice curtailment misdiagnoses to ensure give the specific treatment at the time. (42).

For personalized medicines, divers patient dataset could be analysis and this promises to revolutionize in the precision medicine and health care about a person's genetics, environment, and lifestyle to make precise diagnostic decisions, medical imaging, and electronic health records to More validly prophesy ailment course and prescribe handling of that ameliorate haleness outcomes which identifying the correlations in these complex datasets, the scope of human capability (43, 44). The setting of disease diagnosis, AI systems have demonstrated success in varied applications, from detecting cancers at early stages as in breast cancer to identifying cardiovascular conditions as in arrhythmias before the condition progresses to a more severe stage, potentially preventing heart attacks or strokes and neurological disorders. Early detection is particularly important because it often leads to more effective treatment options in lower healthcare costs with a better quality of patient's life (45).

One of the most prominent benefit of artificial intelligence that's useful to quicken the anatomy in medical's images such as X-ray, MRIs, ultrasounds, CT scan, and DXAs for support the initial detection with disease diagnosis. Otherwise, bio signal (e.g., ECG, EEG, EMG and EHR) (46). After founding that CNN based deep learning models were applied successfully in the lung cancer detection, Alzheimer's disease and diabetic retinopathy via CT, MRI scans and images respectively (47). CNN could be identifying of subtle nodules or lesions in CT images in case of lung cancer identification (48). But, could also essential of detecting tumor size, growth rate and potential metastasis, these characters were serious for therapies preparation with identifying other forms of cancer via biopsy data or the imaging process (49). In histopathology field, AI used to examine tissue samples under microscope furthermore, in genomics fields to genetic mutation detection by genomic

sequences (50).

However, despite the numerous advantages, the incorporation of AI in the healthcare is not without its challenges. These challenges include data privacy concerns, the need for robust validation of AI algorithms, and ensuring that AI systems do not introduce bias or inequity into the diagnosis process. AI has great potential to address issues specific to clinical application (51). AI significantly impacts clinical decision-making by processing vast datasets to provide evidence-based insights, predict patient outcomes. that has disquiet for AI administration in clinical practice is physicians' professional encumbrance in the case of an incorrect decision and assist in diagnosis and treatment planning, thereby enhancing accuracy and efficiency in healthcare (52). Unpracticed doctors may rashly trust AI algorithms' diagnoses, making complications or medical negligence more likely, as both healthcare professionals and AI contractor are embroiled. Incentivize AI professionals to use AI for both diagnosis and confirmation to reduce potential medical malpractice (53, 54). Nonetheless, AI-build medicinal diagnosis is an unbolt scrutiny area, and we strongly encourage investigator to continue their scrutinization to mend the final guess exactness and accelerate the learning process. Medical manpower will prop up healthcare centers, sanatorium, and even the manufacturing sector by provided that smart solutions against diseases and pandemics that instantaneously look to be and wreck the world. (46).

Conclusion

In short, AI clutch immense guarantee to revolutionize clinical care through the innovative use of enormous datum in healthcare, several studies have effectively applied AI especially in the medical diagnostic imaging field to elucidation and remarkably influence healthcare dispatch and diagnosis complex malady such as, cancer, cardiovascular or neurological disorder. on top of that, AI application have a role in reducing human error and personalized healthcare influence historical with patients specified datum to expedite early discernment and create customized medication plans, also useful in functional competence and cost productiveness by diminish superfluous recurrent scan and prospect misdiagnosis. Despite these advancements there are several limitations must be acknowledging as in scarcity of data and require for clinical validation. So, in AI in the years to come with further transform in the medical imaging or the molecular with genomic data to the environmental factors performer for more groundbreaking innovations in this fields.

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Conflict of Interest Statement: The authors declare that there search was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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