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# Deep Learning: A Review methods for Predicting Using health data to Diagnose a patient

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***Abstract*: *Heaviness has been related to stroke, depression, and cancer are some of the most serious dangers to human existence. Heart disease, stroke, obesity, and type II diabetes are all disorders that have an impact on our way of life. Using data mining and machine learning approaches to forecast disease based on patient treatment history and health data has been a battle for decades. Many studies have used data mining approaches to forecast specific diseases using pathology data or medical profiles. These methods attempted to predict disease recurrence. Based on historical data from a multi-label classification problem, the review will focus on chronic disease prediction using various techniques such as convolutional neural networks (CNN), heterogeneous convolutional neural networks (HCN), and recurrent neural networks (RNNs). The study examines the current state of the art approaches for action recognition and prediction, as well as the future possibilities of the research.***

**Keywords:** Deep Learning, convolutional neural networks (CNN),, Region-based Convolutional Neural Networks (R-CNN), Risk Prediction, and Electronic Health Records are some of the keywords employed in this work.

## 1. Introduction

The review will focus on chronic illness prediction utilizing various techniques such as convolutional neural networks (CNN), heterogeneous convolutional neural networks (HCN), and recurrent neural networks based on historical data accessible in a multi-label classification issue (RNNs). The study looks at the current state of the art in action recognition and prediction, as well as the research's potential future applications. Deep learning's recent success in a wide range of ML applications have had an impact on the creation of models that can learn complicated, hierarchical representations of raw data with minimal preprocessing and produce more accurate out comes. Several papers on various data mining techniques for diagnosing heart disease have been published, including Decision trees include Naive Bayes, neural networks, kernel density, automatically formed groups, the bagging approach, and the support vector machine, all of which show varying degrees of accuracies in disease prediction.

EHRs (Electronic Health Records) are standardised compilations of patient health data across time, such as diagnoses, prescriptions, lab tests, therapies, and other data that characterise patient health, that are the result of one or more interactions with a variety of healthcare providers or organisations EHR data offers a unique chance to characterise sickness patterns and disease risk because to its heterogeneity, high dimensionality, sparsity, irregularity, and bias. [11]. In order to address these concerns, previous research has developed a number of ways for extracting and expressing features from Electronic health record Information.

DL refers to large-scale multi-layer back-propagation neural networks that are transforming sectors such as computer vision, speech recognition, and natural language processing [2]. The two emerging types of neural networks for deep learning models are unsupervised learning (deep Boltzmann machines and their derivatives) and supervised learning (convolutional neural network (CNN), multilayer perception (MLP), and recurrent neural network (RNN)). CNNs have received a great deal of attention for modelling signal channel interactions in applications such as image recognition and captioning.



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In order to explore symbolic information, Convolutional Neural Networks (CNNs) were proposed. The convolution administrator, which is a simple way to conduct sophisticated operations on the convolution channel, inspired the name of these systems. Rather of using established components, CNN modifies privately coupled neurons that communicate with information relevant regions. Because these channels are connected to the full image multiple times, the resulting network looks like a series of covering responsive fields. The primary advantage of a CNN is that during back-propagation, the system just needs to change a few parameters that are similar to a single example of the channel, significantly reducing the associations compared to a traditional NN design [10].

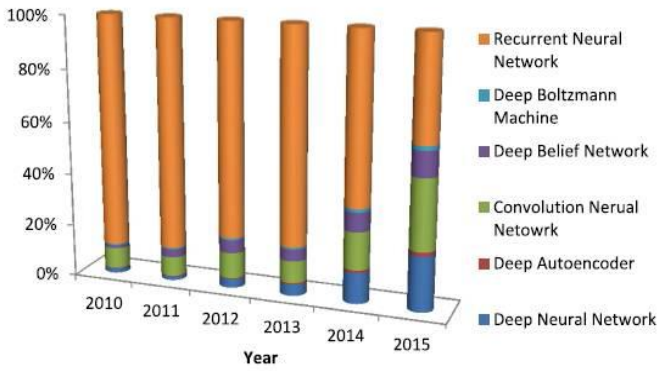


**Figure 1:** Deep learning algorithms utilised in healthcare as a percentage of total[7].

## 2. Related Work

A number of recognised approaches for feature representation of EHR data, as well as a number of deep learning algorithms for studying these novel representations, are available. In this section, we'll look at some related works.

Medical professionals frequently utilise images and texts to represent data, such as MRIs, medical notes, and ECGs. Several researchers have concentrated on extracting characteristics from medical data using a variety of methods to solve problems such as classification, regression, and retrieval. In recent years, there has been a surge in interest in data analytics due to patient Electronic Health Records (EHR). EHRs include a wealth of precise clinical data and provide a number of benefits for clinical research, including cost effectiveness, big data scalability, and the ability to examine data over time.

Several research initiatives have used patient EHRs for data analytics, including the [1] technique, which was capable of extracting details about the connections between heterogeneous graph features. HCNN outperforms traditional convolutional neural networks in predicting the risk of comorbid conditions in a comparison study using patient EHR data. [2] Raw EHRs are input into a CNN model that collects consecutive sequential information to generate a vector representation based on supervised classification approach and triplet loss based distance metric learning method to determine the similarity of patient pairings. MOHD USAMA et al [3] proposed a model based on RCNN for illness risk assessment that uses structured and unstructured data to extract fine-grain aspects of chronic infarction disease and make existing models more accurate [4] show how deep learning has aided the development of more data-driven healthcare arrangements by allowing for programmed age of highlights, which reduces the amount of human intervention in the process. Deep learning has provided a good resurrection of NNs and connectionism, according to Daniele Rav' et al [7], thanks to the actual integration of the newest breakthroughs in parallel processing enabled by coprocessors as computational resources.

Using brain MRI data analysis, Jyoti Islam et al [9] presented a deep convolutional neural network for Alzheimer's disease diagnosis. While most existing approaches use binary classification, their model can distinguish between



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distinct phases of Alzheimer's disease and performs better for early-stage diagnosis. [12] For a specific scenario of chronic disease predictive modelling, proposed a deep learning framework for evaluating patient EHRs, consisting of four layers: input layer, one-side convolution layer, max-pooling layer, and softmax prediction layer.

## 3. Deep Learning Approaches

Deep Learning is a recent update on Artificial Neural Networks that takes advantage of available low-cost computation.

Many methods are concerned with very big datasets of tagged analogue data, such as image, text, audio, and video, and they are concerned with developing far larger and more complicated neural networks.

The most widely used deep learning algorithms are as follows:

**3.1 Convolutional Neural Network (CNN):** CNN is one of the most common types of image identification and classification algorithms. CNNs are widely employed in domains such as object detection, face recognition, and so on. To train and test an image, deep learning CNN models are employed. The input image is passed through a succession of convolution layers with filters called Kernels, Pooling, fully connected layers (FC), and the Soft max function is applied to identify an object with probabilistic values between 0 and 1. The flow of CNN processing an input image and classifying objects based on values is depicted in the diagram below.

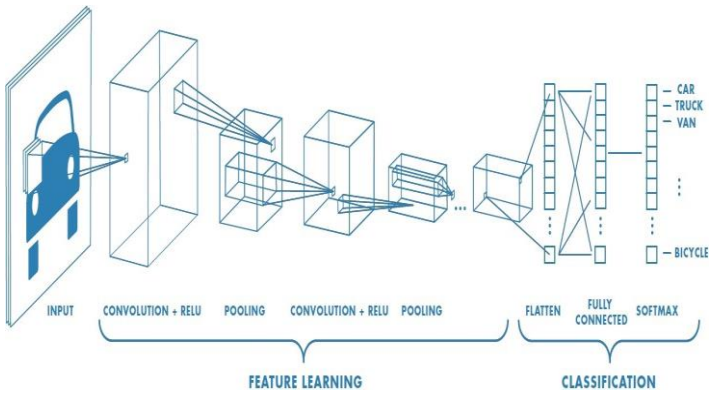


**Figure 2:** Many convolutional layers in a neural network

**3.2 Recurrent Neural Networks are a type of neural network that (RNNs)**

Recurrent neural networks are a type of deep learning algorithm that learns in a sequential manner. In a neural network, we always assume that each input and output layer is independent of all other levels. The name recurrent neural networks comes from the fact that they perform mathematical operations in a sequential order.



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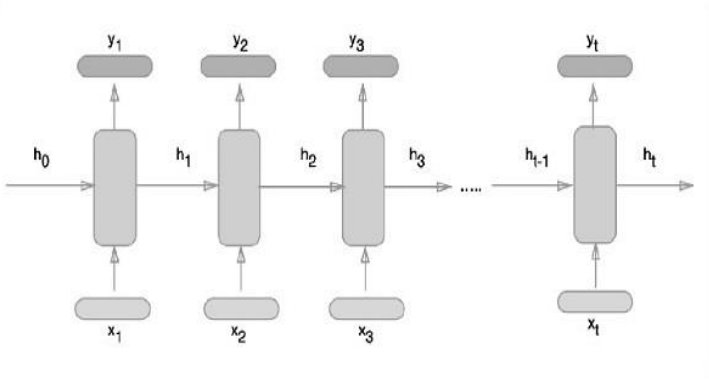


**Figure 3:** Recurrent Neural Networks (RNNs) are a type of neural network

### 3.3 Long-Term Short-Term Memory Networks (LSTMNs) are a type of memory (LSTMs)

A recurrent neural network is a type of long short term memory. The output of the previous step is used as input in the current step in RNN. It addressed the issue of RNN long-term dependency, in which the RNN is unable to predict words stored in long-term memory but can make more accurate predictions based on current data. On the basis of time series data, it is utilised for processing, predicting, and classifying.

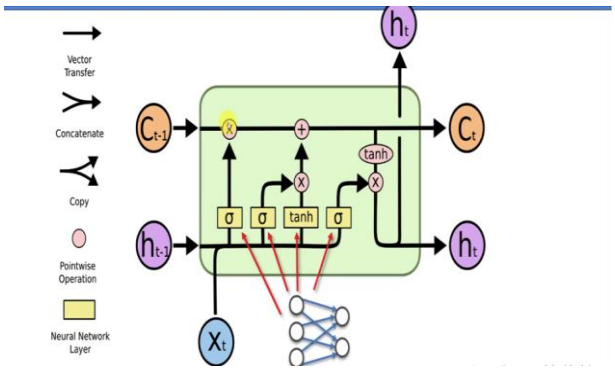


**Figure 4:** Long-Term Short-Term Memory Networks (LSTMNs) are a type of memory

**Figure 4:** Long-Term Short-Term Memory Networks (LSTMNs) are a type of memory

### 3.4 DBMs (Deep Boltzmann Machines) and DBNs (Deep Belief Networks) are two types of deep belief networks (DBN)

The major training techniques for DNNs (Deep neural networks) are a type of neural network that uses stochastic gradient descent and back propagation.. DNNs are trained using two major strategies. The first method uses a filtering mechanism, whereas the second employs unsupervised pre-training. Convolutional Neural Networks (CNNs) use the first filtering technique to filter inputs locally. Filtering is done by using weight matrices to convolve the input. In the second way, data processing begins with an unsupervised learning strategy. Unlabeled information could be implmented at this point. The Deep Neural Network is then fine-tuned using indentified data and a



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supervised approach. This semi-supervised technique is used in Deep Belief Networks (DBN) and Deep Belief Models (DBMs).

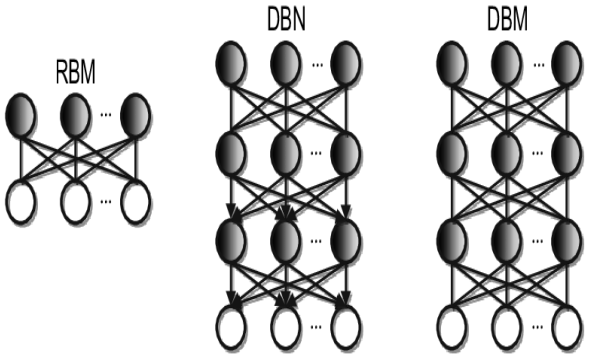
## 4. Deep learning in healthcare

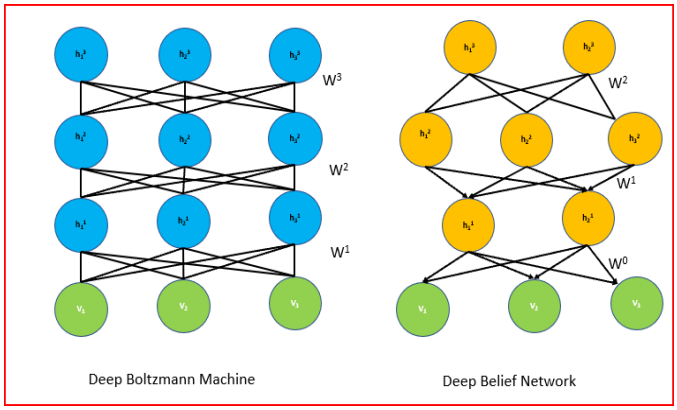
Medical practitioners and researchers are using deep learning to uncover Data's untapped potential & better provide assistance to the healthcare business business. Deep learning in healthcare enables clinicians to precisely analyse any ailment and effectively treat it, resulting in improved medical judgments.

### 4.1 Pharmaceutical research and development

Deep learning in healthcare aids in the discovery and development of new treatments. The latest development looks at the patient's medical history and suggests the best course of action.

### 4.2 Medicine's use of imaging



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Heart disease, cancer, and brain tumours are diagnosed using medical imaging procedures such as MRI scans, CT scans, and ECG. As a result, deep learning assists doctors in better 10nalyzing diseases and providing the best treatment to patients..

**4.3 Insurance fraud**

Medical insurance fraud claims are analysed using deep learning. It can predict fraud claims that are likely to occur in the future using predictive analytics. Deep learning also aids the insurance business in sending discounts and offers to its target patients.

**4.4 Dementia, such as Alzheimer's disease, is a kind of dementia.**

Alzheimer's disease is one of the major difficulties facing the medical sector. Alzheimer's disease is detected early using a deep learning algorithm.

**4.5 An Organism's complete set of DNA**

A DL technology is used to comprehend a genome and assist patients in gaining an understanding of diseases that may impact them. In genetics and the insurance sector, deep learning has a bright future. Cell scope employs deep learning techniques to enable parents to monitor their children's health in real time via a smart device, reducing the need for frequent doctor visits. Deep learning in healthcare can give amazing applications for doctors and patients, allowing to assist doctors in making more informed medical decisions.

## 5. In the healthcare segment, there are a variety of deep learning approaches that can be used.

1. Full-resolution mammography pictures may be used to accurately forecast the likelihood of a woman acquiring breast cancer using deep learning.
2. On stroke diagnosis, all radiologists can achieve expert-level performance. with the deep learning technology in their hands.
3. Through adaptive testing, ML can improve the response rate to surveys and the data's relevancy.:
4. DL sifts through vast volumes of free-text responses or information hidden in verbose clinical notes to deliver more accurate and relevant data, enhancing the utility of patient-reported data.
5. CNNs are ideal for image analysis, such as MRI and x-ray imaging.
6. Convolutional Neural Networks are designed specifically for image processing, allowing networks to run more quickly and handle larger photos.
7. Although DL outperforms traditional ML approaches for analysing unstructured text, several significant obstacles, such as the quality of EHR data, are preventing these tools from reaching their full potential.
8. CNNs are being used by researchers to develop ways for detecting tuberculosis, heart illness, Alzheimer's disease, and other diseases, as well as skin cancer diagnoses.

**5.1 In the healthcare industry, there is a comparison of deep learning techniques.**



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| SN | Title of paper | Author and date | Dataset | DLUsed | Application |
|---|---|---|---|---|---|
| 1. | Deep Patient Similarity Learning for Personalized Healthcare [2] | Qiuling Suo , Fenglong Ma, Ye Yuan , Mengdi Huai, Weida Zhong, Jing Gao,Aidong Zhang | Electric health records (EHR) | CNN | Obesity, Diabetes, chronic Obstructive pulmonary disease (COPD). |
| 2 | Deep Feature Learning for Disease Risk Assessment Based on Convolutional Neural Network With Intra-Layer Recurrent Connection by Using Big Data[3] | MOHD USAMA, BELAL AHMAD, JIAFU WAN, M. SHAMIM HOSSAIN, MOHAMMED | real-life medical big data obtained from a hospital in central China from 2013 to 2014 | RCNN | risk assessment of cerebral infarction disease. |
| 3 | Deep Convolutional Neural Networks for Chest Diseases Detection[6] | Rahib H. Abiyev and Mohammad Khaleel Sallam Ma'aitah, Journal of healthcare Engineering, | National Institutes of Health Clinical Center | BPNN, CNN, CpNN | Diagnosis of chest diseases. |
| 4 | Detection of Alzheimer's Disease from MRI using Convolutional Neural Network with Tensorflow[8] | G. J. Awate, S. L. Bangare, Dr. G. Pradeepini, Dr. S. T. Patil | Open Access Series of Imaging Studies dataset. | CNN | Alzheimer prediction |
| 5 | Brain MRI analysis for Alzheimer's disease diagnosis using an ensemble system of deep convolutional neural networks[9] | Jyoti Islam, Yanqing Zhang, Springer, | Open Access Series of Imaging Studies dataset. (OASIS) | CNN | Detection Alzheimer's disease |
| 6 | Deep Learning for Health Informatics[7] | Daniele Rav`ı, Charence Wong, Fani Deligianni, Melissa Berthelot, Javier Lo,and Guang-Zhong | EHR | CNN | health informatics, providing a critical analysis for various chronic disease. |
| 7 | A Convolutional Neural Network Model for Online Medical Guidance [5] | Cuili Yao, Yue Qu, Bo Jin,Li Guo, Chao Li, Wenjuan Cui, and Lin Feng | Real Life medical data | NamedEntity Recognition , CNN | automated medical consultation |
| 8 | Classification using Convolutional Neural Network for Heart and Diabetics Datasets, [13] | Tharani.S, Dr. C. Yamini, (2016) | Dataset | CNN | Heart disease |
| 9 | Heterogeneous Convolutional Neural Networks for Comorbid Risk Prediction with Electronic Health Records[1] | Jinghe Zhang, Jiaqi Gong, Laura Barnes | EHR | HCNN | Study type 2 diabetes and chronic kidney disease leading congestive heart failure. |
| 10 | Predicting Disease By Using Data Mining Based on Healthcare Information System[14]. | Feixiang Huang, Shengyong Wang, and Chien-Chung Chan , IEEE, 2012. | real world Healthcare Information System database | DT, Naive Bayes and Neural Network | Prediction of hypertension along with other disease like diabetes, and heart diseases. |

## 6. Conclusion

Deep learning has risen to the forefront of machine learning and pattern identification in recent years. DL has the ability to transform the way humans learn transform healthcare in the future. Artificial Intelligence (AI) has grown in popularity and is now routinely employed in cancer detection and treatment. Medical imaging and diagnosis can be more exact thanks to deep learning for computer vision. In this research, we show how deep learning has aided the production of more data-driven health informatics solutions by allowing for the autonomous generation of features that reduce the need for human intervention.

The neural network is trained using the Convolutions technique to conduct medical data classification. The experiment is carried out with a heart disease dataset, and Modes for single and multilayer neural networks are used. Algorithms for deep learning used in healthcare contexts have the ability to consistently produce high-quality findings.

## REFERENCES

[1] Yao AC. Protocols for secure computations. In: 23rd Annual Symposium on Foundations of Computer Science (SFCS 1982), Los Angeles, CA, USA, 1982, 160–4.

[2] Dwork C. Differential privacy. In: Encyclopedia of Cryptography and Security, Springer, Berlin, Germany, 2011, 338–40.

[3] Leoni D. Non-interactive differential privacy: a survey. In Proceedings of the First International Workshop on Open Data, 2012

[4] McSherry F, Talwar K. Mechanism design via differential privacy. In: 48th Annual IEEE Symposium on Foundations of Computer Science, 2007

[5] Lyons J, Dehzangi A, Heffernan R, et al.Predicting backbone Cα angles and dihedrals from protein sequences by stacked sparse auto-encoder deep neural network. J Comput Chem 2014



Publisher: Noida Institute of Engineering & Technology,
19, Knowledge Park-II, Institutional Area, Greater Noida (UP), India.

[6] Liang Z, Zhang G, Huang JX, et al. Deep learning for healthcare decision making with EMRs. In IEEE International Conference on Bioinformatics and Biomedicine, 2014

[7] D. Wulsin, J. Gupta, R. Mani, J. Blanco, B. Litt Modeling electroencephalography waveforms with semi-supervised deep belief nets: fast classification and anomaly measurement J. Neural Eng., 8 (2011)

[8] S. Hochreiter, J. SchmidhuberLong short-term memory Neural Comput., 9 (1997

[9] J. Chung, C. Gulcehre, K. Cho, Y. Bengio, Empirical evaluation of gated recurrent neural networks on sequence modelling, arXiv preprint arXiv:14123555, 2014

[10] J. Cong, B. Xiao, Minimizing computation in convolutional neural networks, International conference on artificial neural networks, Springer, 2014.

[11] M.D. Zeiler, R. Fergus, Visualizing and understanding convolutional networks, European conference on computer vision, Springer, 2014

[12] M. Längkvist, L. Karlsson, A. Loutfi A review of unsupervised feature learning and deep learning for time-series modeling Pattern Recogn. Lett., 42 (2014)

[13] J. Bian, B. Gao, T.-Y. Liu, Knowledge-powered deep learning for word embedding, Joint European Conference on Machine Learning and Knowledge Discovery in Databases, Springer, 2014

[14] A. Graves, A.-r. Mohamed, G. Hinton, Speech recognition with deep recurrent neural networks. Acoustics, speech and signal processing (icassp), 2013 ieee international conference on: IEEE; 2013..

[15] A. Krizhevsky, I. Sutskever, G.E. Hinton, Imagenet classification with deep convolutional neural networks. Advances in neural information processing systems, 2012.

[16] O. Abdel-Hamid, A.-r. Mohamed, H. Jiang, L. Deng, G. Penn, D. Yu Convolutional neural networks for speech recognition IEEE/ACM Trans. Audio Speech Lang. Process., 22 (2014),



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