# Artificial Intelligence Techniques Used In Medical Sciences : A Review

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**Abstract-Artificial intelligence(AI) is more augmented intelligence and that is a fundamental philosophical direction it took where it is complementing people's intelligence with machines that have enough aspects of the intelligent problem solving capabilities that together the person and machine can do better than one or the other. Medical diagnosis is hard for humans it actually takes a lot of time without the help of intelligent machines. AIM( Artificial Intelligence in Medical) systems have been used in health care system mainly for diagnosis tasks. AI is the branch of computer science which deals with the machine intelligence and maximising chances of success and accuracy. Medical is the field where technology is much needed. Our expanding desires of the highest quality of health care and the quick development of ever more detailed medical knowledge leave the doctor without sufficient time to give to each case and attempting to stay aware of the advancements in his field. The main aim of writing this paper is to review the effectiveness of AI techniques in medical sciences and compare them.**

**Keywords-Artificial intelligence, Augmented. Medical diagnosis , Accuracy .**

## I. INTRODUCTION

The definition of AI in medical sciences came in 1984, when AI was just concerned with the AI programs that performed analysis, treatment recommendation and suggestion. Moving further the main question which arises is that how it is checked that whether the computer program has achieved an equivalent intelligence to a human[1]. To solve this problem at the beginning of AI in medical sciences that was checked with the help of turing test which in case declared the given program as intelligent if the results were positive in more than 50% of cases. The next was that what are the fields in which AI in medical sciences was first used and the journey of AI in medical sciences field that evaluated to a great level now with the possibilities of future. The starting of AI in medical sciences came from the tasks like result generating devices, assistance in diagnosis of a disease,

information retrieval, image recognition and interpretation, expert laboratory information system and machine learning [2]. In recent decades AI has emerged medicine, human biology and health care systems. Major researches have been made in the field of intelligent devices and instruments that aid in the medical field. The new stream of engineering has become which is known as medical knowledge engineering [3].The main concept on which AI is working is power of decision making and detecting through the algorithms and huge available data[4].. Modern technologies as combining deep learning with AI so that doctors can do classification, detection, segmentation and other various medical predictions[5]. This study and the achieved results represents that how much AI has evolved in medical sciences and its origin and the future of AI in medical sciences. In this research there is vision idea of new AI devices. The paper is organised as per Section 2 which represents methodology, Section 3 which represent literature review of papers and Section 4 focuses on the result and the new possibility in the AI field. At last there is conclusion in section 5.

## II. RESEARCH METHODOLOGY

Literature Review is conducted so to achieve the objective of writing the research paper. "Literature review means a process of identifying, analysing and then understanding the available research in order to achieve the objective."

### A. Main objective

The main objective of this research paper is to find out the most efficient techniques that are used in the field of AI in medical sciences. After reviewing the papers the result can be concluded that what is the percentage of the different AI techniques and their efficiency.

### B. Search strategy for primary studies

Researches that are carried out are from IEEE Explore and Cornell university library. The study was restricted to only the material that was available online. At the beginning the material was collected from the internet in form of research papers by searching the topics related to the

Artificial Intelligence in medical sciences. After having the research paper an extensive study was done.

C.    Inclusion and Exclusion criteria

Only the research papers which were related to the topic were included and rest of them was excluded. In literature review 18 papers were selected that contains the research related to the topic over last decade.

### III.    LITERATURE REVIEW

In this paper author gave a quick review of prediction models from 2004 to 2014 that provided medical diagnosis using the data mining tools. Author has given a comparison that shows the accuracy level of models that were given by different researchers[6]. In this paper author compared the outputs of the SVM model to ANN models. This paper gives a medical choice backing framework for coronary illness characterization in a sane, purpose , precise and fast manner because a precise conclusion at an early stage taken care by right medical assistance can result in avoiding the increase in death rate[7]. In this paper author focuses on AI and its uses in biomedical image processing and how a medical image is processed using several different models. Each model is given with the example figure [8].In this paper author purposes a framework that is TDTD(thyroid disease types diagnostics). Due to existence of non-polable nodule in the thyroid its hard to detect the structural changes such as "euthyroid" is normal thyroid hormonal function state but this later on can be involved in the initial stages of goiter, multiple nodule goitre and cancer. In this paper author purpose and gives performance analysis about TDTD [9]. In this paper author encourages the emerging use of AI in medical sciences as technical support for decision making. In this paper author talks about that positive feature come out as result if two strong qualities in the same system are combined that are accuracy of mathematics and the power of current technologies. In this paper author gave two techniques of medical decision making along with the examples, algorithms, advantages and disadvantages in both the cases[10]. In this paper author did a initial study on M2M technology to help cardiovascular patients in their healthcare and health cure system[11]. In this paper author purpose the development of mobile application system so that hydrocephalus , a condition causing serve headache can be assisted by doctors with the use of AI. In this paper author aimed to highlight the importance of AI in medical science. Author analysed the web application that is currently being used to collect the information of the patients suffering from hydrocephalus. In this paper author describes that paper only focuses on specific headache type that is hydrocephalus[12]. In this paper author presents the design and development of a personal health records(PHR) system to assist the doctors in analysing and monitoring of behaviours of patients with autism spectrum disorders. In this paper author focused on the aim to provide a system that provides relation between the gestures by the patients and the trend in clinical data[13]. In this paper author proposed a disease diagnosis algorithm based on ACO and IG. This method contains two stage. In this paper author took 3 data sets and checks the accuracy using the purposed method SVM and AI. Then the author combined two of different methods and the accuracy was higher in every case where AI was combined with them. In this paper author gave a hybrid algorithm for disease diagnosis that works better[14]. In this paper author talks about artificial immune network as one of the most intelligent systems that are inspired by working of immune system .in this paper author purposes using two clustering techniques combining it with aiNet algorithm for medical purpose[15]. In this paper author focuses on the idea of probabilistic aspect chosen in the decision making of diagnosis process. In this paper author focuses on the Bayesian network are efficient and reliable in AI problem and helps in decision applications[16]. In this paper author modified the pneumatic muscle using analytical modelling , numerical modelling and artificial intelligence based modelling[17]. In this paper author purposes an intelligent system based on multilayer ANN , multitier solution analysis and thresholding[18]. In this paper author performed real time virtual heart development to provide closed loop validation. In order to provide this author developed EGM model which can capture local cardiac activities , stimuli after potentials and far field signals[19]. In this paper authors evaluated 12 classification technique on chronic kidney disease data. In this paper author used predictive accuracy, precision sensitivity and specificity as metrics for performance evaluation[20]. In this paper author proposed doctor AI system that is RNN based model which can predict future disease of the patients by learning patient representation from large amount of patients records[21]. In this paper author describes an approach toward the medical diagnosis based on SP theory[22]. In this paper author developed a sensible classifier composed with MACA and reinforced with AIS method that uses fuzzy logic for anticipating the slicing sites, protein and promoter regions[23]. The detailed study is shown in the table 1.

| 0bjective | Method/ techniques used | Datasets used | Pros and cons | Analysis | Ref |
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| Prediction of heart disease at early stage using data mining models and AI techniques | Data mining techniques like naïve bayes, decision tree, genetic algorithm, clustering algorithm like KNN, regression tree techniques, association rule | Medical records of people having heart disease with chest pain, cholesterol and risk factors like blood sugar | The overall accuracy obtained with all the models was 90%<br><br>All the techniques available have not used big data analysis and deep learning using AI due to which accuracy was not achieved | Doctors can help the patients by forecast of the heart disease before occurring. The large data from the medical diagnosis is analysed by data mining to take out the patterns which are hidden with their unknown relationships and deep learning to help the doctors to have better understanding to prevent the risks. If the data mining techniques was combined with the big data analytics in the prediction of heart disease before it happens the prediction models will have best accuracy. | [6] |
| Classifying and predicting heart disease risk using techniques of support vector machine and artificial neural network | Support vector machine, artificial neural network, data mining, kernel functions, back propagation | Cleveland heart database , statlog database collected from USI repository | By keeping away the repetitive searches with a proper end goal to locate the best points to use in prediction.<br><br>Accuracy in predicting the heart disease is higher in SVM model | The accuracy of results of SVM is 92.1%, ANN is 91.0% & DT is 89.6%. SVM utilises both linear and non-linear kernel functions. It classifies the data by searching the hyperlane, the point which separates the data points of first class from the second class. If the margin is coming out is large model is better. ANN is an intelligent model that is replica of the organisation and elements of organic neural systems. These are non -linear measurable information representing device where in the middle of inputs complex connections are there and their results are demonstrated as new examples. | [7] |
| Uses of AI in biomedical image processing segmentation of medical images, its application advantages and disadvantages | Grey scale and colour image analysis , textural analysis , data mining techniques , artificial neural network classification, fuzzy logic | Input images of various body parts | It provides quick diagnose and possible solution to various health problem.<br><br>Only limited work can be done which is programmed | There are five phases in the process of image analysis which include pre-processing of image which includes noise removal , image enhancement , edge detection etc. segmentation phase image mining is carried out using AI methods , extraction and selection features ,recognition and at last post processing which all together gives an outcome of tumour , lesion , cancer or some other kind of abnormality. These are two current available methods fuzzy logic and ANN which works on. | [8] |
| Machine learning and AI base techniques TDTD: Thyroid Disease Type Diagnostics | MDC( medical data cleaning) | Real word data sets of thyroid disease received from SMBBMU( Shaheed Muhtarma | The TDTD approach gives a accuracy result of 95.6% with 10K fold cross validation .<br><br>There are other approaches | The given methodology have three main phases in the first phase it fills the missing value and eradicate the incomplete observation with the technique of MDC by building classifier based upon the Bayesian isotonic regression algorithm. In second phase the classification models to decade about the | [9] |

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| to solve the complex problem of thyroid disease | | Benazir Bhutto medical university) Pakistan and UCI machine learning | which have 99.9% accuracy levels such as AIS-based machine learning techniques SVM, RBF, PNN | occurrences of thyroid disease are made at the functional and structural level using multi and binary SVM algorithms and at last result visualisation and performance evaluation is done using confusion matrix method. TDTD provides the assistance to the physicians during the diagnostic procedure in a very structured and transparent manner. | |
| Benefits of using AI in medical predictions | Knowledge based solution , probabilistic reasoning | Blood samples of patients | Knowledge based solution- It is easy in implementing  The graph will become too complex if task have many data with complex connections.  Probabilistic reasoning- Can be used for complex problems in which above fails | There are main advantages of medical decision making system that are it can work stress and fatigue free at a high speed, it is very efficient , it can be started again and again and it has a large memory data to make complex connections between them. The knowledge base solution mechanism represents the things a machine should know in order to generate solution. It uses logical operators to make connections and create a decisional system with outcome. In probabilistic reasoning the probability is an outcome of processing the previous data of disease. | [10] |
| Initial study on designing machine to machine system in health cure modeling for cardiovascular disease patients | M2M technology, sensors, case based reasoning | Hypothetical example of patient , server and doctor | Patient can have expert advice sitting at home.  Due to some technical error the treatment may postpone | The purposed system has 5 steps first one is health monitor of the patient that are health monitor, reporting to analysis system medication, recommendation, doctor approval and medication or cure. The patient who stays at home have their medical recommendation for medicines using the AI technique called case based reasoning. The four steps involved in CBR are retrieve, reuse, revise and retain a problem. This purposed system helps the patient which can not physically go to the doctor due to lack of resources | [11] |
| Medical survey about are AI systems able to diagnose the underlying causes of specific headache. | Neuro diary web application | Neuro diary web application | The web application have been improved in many aspects.  The web application only focuses on one kind headache | The survey study have been divided into two phases. In the first phase the neuro diary web application have been modified to the extends like interface screens, more visualisation, extending the online assistance, output user interface .In the second phase the application is made more accessible by introducing in the mobile so that clinicians can diagnose the cause easily by the data submitted by the patients. | [12] |
| Personal health records system for | Hidden markov models , template | Clinical data from department of child | The accuracy obtained was 92%  The results were | PHR consist of sensor networks and events generator which are over the patient's body, gesture recognition system which produces a set of | [13] |

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| patients with autism spectrum disorders | matching techniques , wearable sensors and machine learning algorithms , situation calculus. | psychiatry at the Children's Hospital Santobono Pousilipon in Naples | not shown | medical report enhanced by the incoming gestures. Then these medical report are saved in database and will be compared with the previous reports known as data collection interface and data analysis,. | |
| Algorithm for disease diagnosis | Ant colony optimization, information gain , SVM, AI | Datasets of Wisconsin breast cancer, pima Indians diabetes, hepatitis | Alone ACO gives 93.88%, 73.32% and 81.76 in three cases

It is much lower than AI | AI algorithm is combined with ACO and IG which increases its performance | [14] |
| Immune based clustering for medical diagnostic systems | Artificial immune system algorithm , clustering techniques | Iris data set containing 150 samples and group 5 of wisconsin breast cancer database | DBSCAN and K-means have good clustring capabilities under aiNET algorithms

K-means have higher accuracy | The aiNET algorithm has two stages : in the first stage it gives a group of memory cells that shows compressed data representation of datasets. In second stage it detects clusters using minimum spanning tree. | [15] |
| MRI cases containing cerebral tumors retrieval using Bayesian network | Bayesian network model | Medical cases from Sahloul hospital | Results were obtained 68%

Tumors detection is hard when there is close similarity between tumors description | With the use of similarity algorithm Bayesian network model have been tested. Algorithm tests the role of probability reasoning in a Bayesian network inference. Bayesian networks calculate the probability of each hypothesis from the given data and makes prediction. | [16] |
| Dynamic modelling of pneumatic muscle | Artificial neural network , fuzzy inference system , gradient descent method, genetic algorithm , modified genetic algorithm | Single pneumatic muscle and exhaustive data | After dynamic modelling PMA provide better prediction accuracy.

Still modifications need to be done | The modified PMA can now easily tolerate the varying while changing the length and pressure. From ANN fuzzy model was found to be more accurate. | [17] |
| An artificial intelligent system for PET tumour detection | Artificial neural network | Phantom and real positron emission tomography images | Good performance for ANN in detecting tumour

Still more accuracy can be achieved | Evaluation for the system output was carried out objectively and subjectively. | [18] |
| Intra-cardiac electrogram model to bridge virtual hearts and | Intra-cardiac electrogram model (IEGM) | Virtual heart and EGM device | The model is able to reproduce clinically observed sensing problem, extending the | The model is based on hybrid automation which do formal analysis and real time implementations . HA has oversensing and undersensing modes. The sensing controller in IEGM can distinguish unipolar or | [19] |

| | | | capabilities. The morphology still can be improved by refining the heart model for implantable cardioverter defibrillator validation | bipolar electrogram (EGM) sensing configurations. EGM can capture real time signals by refining the heart model | |
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| Chronic kidney disease diagnosis | Decision tree, support vector machine, discriminant analysis , K-nearest neighbours , ANN | Chronic kidney disease dataset from UCI data repository | Decision tree diagnosis proved to be best. The sensitivity of decision tree was lower then other classifiers | Decision tree analysis performed best with 98.6% accuracy, 0.9720 sensitivity, precision of 1 and specifity of 1. The most commonly used decision tree algorithm are ID3 , CART and C4.5. | [20] |
| Predicting clinical events via recurrent neural networks using Doctor AI model | Recurrent neural networks | Stamped EHR data from 20k patients over 8 years | This model achieved 79.8% efficiency. Sometimes due to incorrect predictions the patient health can degarde | RNN are initialized using skip gram embedding so its speed and accuracy both are increased. RNN have capability of transfer learning between different institutions. Small set of data can take the pattern of information from a large number of data. | [21] |
| Medical diagnosis as pattern recognition | SP theory of computing and cognition | Sample DNA sequences | It is proved to be simple and intuitive. This SP model does not have industrial strength. | sp model has a capacity to adapt to mistakes and instabilities in diagnostic data; the simplicity of storing measurable data as frequencies of event of ailments; a strategy for assessing elective indicative speculations that yields genuine probabilities, nd a system that ought to encourage unsupervised learning of medicinal information and the incorporation of restorative finding with other AI applications. | [22] |
| Building a classifier based on Multiple Attractor Cellular Automata | fuzzy logic with version Z, an artificial immune system technique (AIS), Clonal algorithm | 1, 97,000 data sets taken from Fickett & Toung , EPDnew, and other sequences from a renowned medical university | The accuracy AISMACA-Z classifier is 90.6% in average Still more accuracy can be achieved | proposed classifier can deal with vast informational indexes and groupings of different lengths. This classifier surely gives instinct towards utilization of MACA to a many issues in bioinformatics. | [23] |

Table 1: Data extracted from various research papers and their comparison.

## IV. RESULT

After going through many research papers the techniques which are used most in AI is shown in the graph below. The other techniques in figure 1 includes medical data cleaning , template matching techniques ,case based reasoning etc.
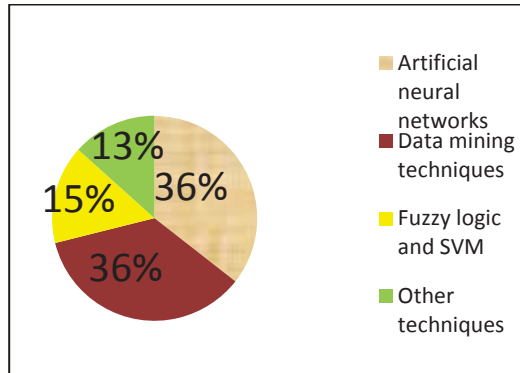


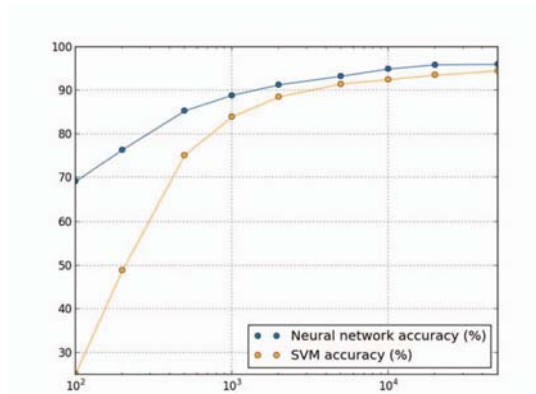Fig.1. Graph related to techniques used in medical science



Fig.2. Comparison of accuracy between neural network and SVM

The comparison of the accuracy level on the basis of the research paper reviewed is done in figure 2 and neural networks was used mostly due to the efficient results. Many data mining techniques were used in different research papers so collective comparison of their intensity of use is shown in figure 3. Decision tree (DT) was found to be used most and after that Support vector machine (SVM). So these two can be said as the most recently used data mining techniques with desired outputs .
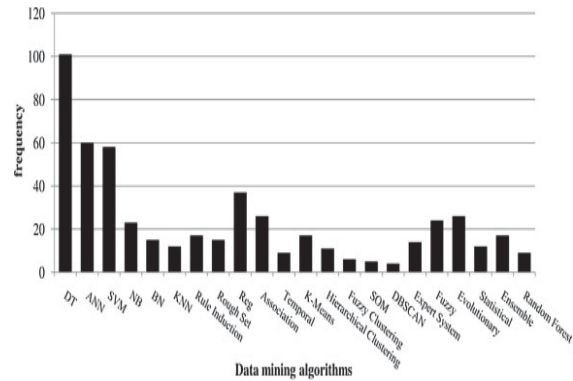


Fig.3. Comparison of mining algorithm used in medical sciences

## V. CONCLUSION

The purpose of conducting this study was to focus on the use of AI techniques in the field of medical sciences. Artificial neural network and data mining techniques are found to be most commonly used AI techniques with highest percentage of use because the efficiency rate is very high with these techniques. Fuzzy logic and the support vector machine (SVM) was the second most commonly used techniques. Deep learning and pattern recognition was the field that have been given more attention in the last decade as they helped in prediction of the disease before occurring. The work on hybrid algorithm was seen most to increase the efficiency of techniques. Still there are many areas that can be included in the research as they are untouched and have many possibilities to make use of AI in medical sciences better.

## VI. REFERENCES

[1] Hunt, D. L., Haynes, R. B., Hanna, S. E., & Smith, K. (1998). Effects of computer-based clinical decision support systems on physician performance and patient outcomes: a systematic review. *Jama*, *280*(15), 1339-1346.

[2] Kumar, D., Sharma, A., & Grover, T. ARTIFICIAL INTELLIGENCE A STUDENT VIEW POINT.

[3]www.science.direct.com/science/journel/09333657?sdc=1

[4] www.mdc.com/2017/05/11

[5]https://www.nvindia.com/en_us/deeplearningai/industries/healthcare

[6] Banu, N. S., & Swamy, S. (2016, December). Prediction of heart disease at early stage using data mining and big data analytics: A survey. In *Electrical, Electronics, Communication, Computer and Optimization Techniques (ICEECCOT), 016 International Conference on* (pp. 256-261). IEEE.

[7] Radhimeenakshi, S. (2016, March). Classification and prediction of heart disease risk using data mining techniques of Support Vector Machine and Artificial Neural Network. In *Computing for Sustainable Global Development (INDIACom), 2016 3rd International Conference on* (pp. 3107-3111). IEEE.

[8] Shukla, S., Lakhmani, A., & Agarwal, A. K. (2016, April). Approaches of artificial intelligence in biomedical image processing: A leading tool between computer vision & biological vision. In *Advances in Computing, Communication, & Automation (ICACCA)(Spring), International Conference on*(pp. 1-6). IEEE.

[9] Ahmed, J., & Soomrani, M. A. R. (2016, January). TDTD: Thyroid disease type diagnostics. In *Intelligent Systems Engineering (ICISE), 2016 International Conference on* (pp. 44-50). IEEE.

[10] Albu, A., & Stanciu, L. (2015, November). Benefits of using artificial intelligence in medical predictions. In *E-Health and Bioengineering Conference (EHB), 2015* (pp. 1-4). IEEE.

[11] Enriko, I. K. A., Wibisono, G., & Gunawan, D. (2015, May). Designing machine-to-machine (M2M) system in health-cure modeling for cardiovascular disease patients: Initial study. In *Information and Communication Technology (ICoICT), 2015 3rd International Conference on* (pp. 528-532). IEEE.

[12] Farrugia, A., Al-Jumeily, D., Al-Jumaily, M., Hussain, A., & Lamb, D. (2013, December). Medical Diagnosis: Are Artificial Intelligence Systems Able to Diagnose the Underlying Causes of Specific Headaches?. In *Developments in eSystems Engineering (DeSE), 2013 Sixth International Conference on*(pp. 376-382). IEEE.

[13] Vajda, S., You, D., Antani, S. K., & Thoma, G. R. 2014 IEEE Symposium on Computational Intelligence in Healthcare and e-health (CICARE).

[14] He, F., Yang, H. M., & Fan, L. G. (2012, December). A novel algorithm for disease diagnosis. In *Computer Science and Network Technology (ICCSNT), 2012 2nd International Conference on* (pp. 29-32). IEEE.

[15] Abu-Zeid, N., Kashif, R., & Badawy, O. M. (2012, November). Immune based clustering for medical diagnostic systems. In *Advanced Computer Science Applications and Technologies (ACSAT), 2012 International Conference on* (pp. 372-375). IEEE.

[16] Yazid, H., Kalti, K., Elouni, F., Essoukri, N. B. A., & Tlili, K. (2010, December). MRI cases containing cerebral tumors retrieval using Bayesian networks. In *Signal Processing and Information Technology (ISSPIT), 2010 IEEE International Symposium on* (pp. 7-12). IEEE.

[17] Jamwal, P. K., Hussain, S., & Xie, S. Q. (2009, December). Dynamic modeling of pneumatic muscles using modified fuzzy inference mechanism. In *Robotics and Biomimetics (ROBIO), 2009 IEEE International Conference on* (pp. 1451-1456). IEEE.

[18] Sharif, M. S., & Amira, A. (2009, November). An intelligent system for pet tumour detection and quantification. In *Image Processing (ICIP), 2009 16th IEEE International Conference on* (pp. 2625-2628). IEEE.

[19] Ai, W., Patel, N., Roop, P., Malik, A., Allen, N., & Trew, M. L. (2017). An intracardiac electrogram model to bridge virtual hearts and implantable cardiac devices. *arXiv preprint arXiv:1703.01107*.

[20] Sharma, S., Sharma, V., & Sharma, A. (2016). Performance Based Evaluation of Various Machine Learning Classification Techniques for Chronic Kidney Disease Diagnosis. *arXiv preprint arXiv:1606.09581*.

[21] Choi, E., Bahadori, M. T., Schuetz, A., Stewart, W. F., & Sun, J. (2016, December). Doctor ai: Predicting clinical events via recurrent neural networks. In *Machine Learning for Healthcare Conference* (pp. 301-318).

[22] Wolff, J. G. (2006). Medical diagnosis as pattern recognition in a framework of information compression by multiple alignment, unification and search. *Decision Support Systems*, *42*(2), 608-625.

[23] Sree, P. K., & Babu, I. R. (2014). AIS-MACA-Z: MACA based Clonal Classifier for Splicing Site, Protein Coding and Promoter Region Identification in Eukaryotes. *arXiv preprint arXiv:1404.1144*.