NATURAL BRAIN-INSPIRED FOR HEALTH MONITORING SYSTEM USING ARTIFICIAL INTELLIGENCE

[1]Fariha Quadry,[2]Dr. G.Kalaimani
[1]PG Scholar, M.Tech, Dept of CSE, Shadan Women's College of Engineering and Technology, Hyderabad, TS.
fariha.quadry@gmail.com
[2]Professor, Dept of CSE, Shadan Women's College of Engineering and Technology, Hyderabad, TS.
kalaimaniphd@gmail.com

ABSTRACT

In recent years, there has been a growing interest in smart e-Health systems to improve people's quality-of-life by enhancing healthcare accessibility and reducing healthcare costs. Continuous monitoring of health through the smart e-Health system may enable automatic diagnosis of diseases like Arrhythmia at its early onset that otherwise may become fatal if not detected on time. In this work, we developed a cognitive dynamic system (CDS)-based framework for the smart e-Health system to realize an automatic screening process in the presence of a defective or abnormal dataset. A defective dataset may have poor labeling and/or lack enough training patterns. To mitigate the adverse effect of such a defective dataset, we developed a decision-making system that is inspired by the decision-making processes in humans in case of conflict-of opinions (CoO). We present a proof-of-concept implementation of this framework to automatically identify people having Arrhythmia from single lead Electrocardiogram (ECG) traces. It is shown that the proposed CDS performs well with the diagnosis errors of 13.2%, 9.9%, 6.6%, and 4.6%, being in good agreement with the desired diagnosis errors of 25%, 10%, 5.9%, and 2.5%, respectively. The proposed CDS algorithm can be incorporated in the autonomic computing layer of a smart-e-Health-home platform to achieve a pre-defined degree of screening accuracy in the presence of a defective dataset.

I. INTRODUCTION

Presently, the autonomic dynamic frameworks (ADMS) for savvy intuitive digital actual frameworks (CPS) are drawing in much consideration from specialists and innovation suppliers. The CDS is motivated by the neuroscience model of the human cerebrum introduced in and it is based on the standards of discernment, i.e., discernment activity cycle (PAC), memory, consideration, knowledge, and language. Discs has found applications in the brilliant home savvy e-Health home [and long-haul fiber-optic connection It is proposed as an option in contrast to commonplace man-made consciousness (AI) strategies for the majority AI applications. In this paper, we present a mental powerful framework (CDS) for the screening system in shrewd e Health frameworks in view of the discernment and various activity cycles (PMAC) and the dynamic cycles in people if there should arise an occurrence of a contention of assessment (CoO). The algorithmic show of a CDS detailed in depended on straight and Gaussian conditions (LGEs). Nonetheless, wellbeing related physiological information, which are estimated to evaluate medical issue are by and large not typically appropriated, for example they are non-Gaussian. Besides, most highlights extricated from the deliberate physiological signs change in a non-direct way with the human medical issue. Accordingly, human wellbeing and brilliant e-Health frameworks can be considered as non-Gaussian and non-straight wellbeing conditions (NGNLHEs) as detailed on account of bosom malignant growth displaying in. In a NGNLHE medical services framework, the results are not straightly reliant upon the data sources. Besides, the results of such a framework don't follow Gaussian circulations. In a CDS was proposed for savvy fiber optic correspondence frameworks to show its high accuracy critical thinking skill in complex shrewd frameworks. It ought to be noticed that we utilize the term mental independent direction (CDM) to characterize dynamic utilizing CDS. The CDS was introduced in [as an upgraded AI that took advantage of the greatest likelihood (MAP) approach for the CDM. The CDS in this manner executed brought about an elite execution CDM, which anyway utilized a dependable dataset to prepare the model. When the datasets are not dependable because of poor naming and additionally deficient preparation designs damaged or unusual, the PAC-based CDS can't perform all around ok to fulfill prerequisites to give solid outcomes to predefined medical services strategy. This can be made sense of with a similarity to the dynamic course of the human mind when it makes a judgment in view of some uncertain data, hence risking pursuing an off-base choice. In this paper, we propose a CDS calculation to understand a dependable screening technique in a shrewd e-Health framework from a flawed dataset. Here, we took advantage of the idea of CoO to understand the CDM for the NGNLHE framework. We additionally summed up the idea of PAC in the PAC-based CDS to discernment multi activities cycles (PMAC) to carry out the CoO.

EXISTING SYSTEM

In Existing System, The period of "Huge Data", the utilization of AI is turning out to be more far and wide and the exhibitions accomplished by this approach are turning out to be increasingly fabulous. Medication isn't resistant to this pattern and numerous utilizations of these AI advances are utilized in this field, including determination forecast. AI strategies were additionally used to produce reports from clinical pictures. In ML-based methods, a summed-up expectation model is created from an underlying arrangement of information that hence considers extricating designs from the deliberate information.

LITERATURE SURVEY

Professional chat application based on natural language processing.

There has been an emerging trend of a vast number of chat applications which are present in the recent years to help people to connect with each other across different mediums, like Hike, WhatsApp, Telegram, etc. The proposed network-based android chat application used for chatting purpose with remote clients or users connected to the internet, and it will not let the user send inappropriate messages. This paper proposes the mechanism of creating professional chat application that will not permit the user to send inappropriate or improper messages to the participants by incorporating base level implementation of natural language processing (NLP). Before sending the messages to the user, the typed message evaluated to find any inappropriate terms in the message that may include vulgar words, etc., using natural language processing. The user can build an own dictionary which contains vulgar or irrelevant terms. After pre-processing steps of removal of punctuations, numbers, conversion of text to lower case and NLP concepts of removing stop words, stemming, tokenization, named entity recognition and parts of speech tagging, it gives keywords from the user typed message. These derived keywords compared with the terms in the dictionary to analyze the sentiment of the message. If the context of the message is negative, then the user not permitted to send the message

Real world smart chatbot for customer care using software as service (SaaS) architecture.

It's being very important to listen to social media streams whether it's Twitter, Facebook, Messenger, LinkedIn, email or even company own application. As many customers may be using this streams to reach out to company because they need help. The company have setup social marketing team to monitor this stream. But due to huge volumes of users it's very difficult to analyses each and every social message and take a relevant action to solve users' grievances, which lead to many unsatisfied customers or may even lose a customer. This papers proposes a system architecture which will try to overcome the above shortcoming by analyzing messages of each ejabberd users to check whether it's actionable or not. If it's actionable then an automated Chatbot will initiates conversation with that user and help the user to resolve the issue by providing a human way interactions using LUIS and cognitive services. To provide a highly robust, scalable and extensible architecture, this system is implemented on AWS public cloud.

An Overview of Artificial Intelligence Based Chatbots and An Example Chatbot Application.

Chatbot can be described as software that can chat with people using artificial intelligence. These software are used to perform tasks such as quickly responding to users, informing them, helping to purchase products and providing better service to customers. In this paper, we present the general working principle and the basic concepts of artificial intelligence based chatbots and related concepts as well as their applications in various sectors such as telecommunication, banking, health, customer call centers and e-commerce. Additionally, the results of an example chatbot for donation service developed for telecommunication service provider are presented using the proposed architecture.

Intelligent travel chatbot for predictive recommendation in echo platform

Chatbot is a computer application that interacts with users using natural language in a similar way to imitate a human travel agent. A successful implementation of a chatbot system can analyze user preferences and predict collective intelligence. In most cases, it can provide better user-centric recommendations. Hence, the chatbot is becoming an integral part of the future consumer services. This paper is an implementation of an intelligent chatbot system in travel domain on Echo platform which would gather user preferences and model collective user knowledge base and recommend using the Restricted Boltzmann Machine (RBM) with Collaborative Filtering. With this chatbot based on DNN, we can improve human to machine interaction in the travel domain

Chatbot Using a Knowledge in Database Human-to-Machine Conversation Modeling

A chatterbot or chatbot aims to make a conversation between both human and machine. The machine has been embedded knowledge to identify the sentences and making a decision itself as response to answer a question. The response principle is matching the input sentence from user. From input sentence, it will be scored to get the similarity of sentences, the higher score obtained the more similar of reference sentences. The sentence similarity calculation in this paper using bigram which divides input sentence as two letters of input sentence. The knowledge of chatbot is stored in the database. The chatbot consists of core and interface that is accessing that core in relational database management systems (RDBMS). The database has been employed as knowledge storage and interpreter has been employed as stored programs of function and procedure sets for pattern-matching requirement. The interface is standalone which has been built using programing language of Pascal and Java.

II. METHODOLOGY

In proposed system, Machine Learning (ML) services now used in a number of mission-critical human-facing domains, ensuring the integrity and trustworthiness of ML models becomes all important. In this work, we consider the paradigm where cloud service providers collect big data from resource-constrained devices for building ML-based prediction models that are then sent back to be run locally on the intermittently-connected resource-constrained devices. Our proposed heuristic strives to minimize the communications overhead between the cloud and the resource-constrained devices. Selected ML models are sent to resource-constrained devices to be used.

- Machine Learning Approaches
- Reinforcement Learning
- CDS Implementation Using ML Approaches

Machine Learning Approaches

Machine learning enables some degree of intelligence in machines by extracting and using the information about patterns in datasets, examples, and experiences. There are several, machine learning approaches such as supervised learning, reinforcement learning, semi-supervised learning, unsupervised learning, and transfer learning. However, we will focus on two approaches that are more relevant to this work i.e. supervised learning and reinforcement learning.

Reinforcement Learning

Reinforcement learning (RL) resolves a decision-making problem by learning and evolving through a trial-and-error approach, realized by the interaction between computing agent and a dynamic environment. While searching in the state-action space, the computing agent attempts to reach the highest reward (or lowest penalty) based on the feedback received from the dynamic environment. For example, in healthcare applications, the RL algorithm tries to improve the model parameters by iteratively simulating the states e.g. a user health’s condition. Then, after applying the action (e.g. activating or deactivating sensors, amount of medication delivery, or modeling accuracy), the computing agent obtains the feedback reward from the environment (healthy or unhealthy - decision made by the MDs in the clinic). The RL algorithm finally converges to a model that may generate optimal decisions. Unlike the SL algorithm, RL algorithms typically do not require a prior database andcan automatically find the most appropriate actions by optimizing the feedback reward/penalty received from the dynamic environment.

- **CDS Implementation Using Approaches**

In the earlier implementations of CDS, the PAC was realized by combining conventional ML approaches, such as RL, and SL. Here, we focus on how a PAC-based CDS and the proposed CDS in this paper can overcome weaknesses of SL and RL.

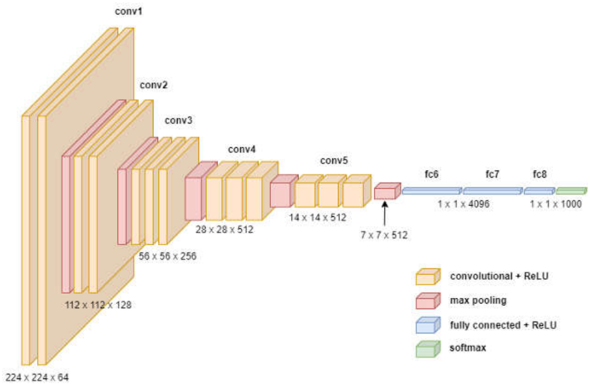
1. Typical PAC-Based CDS

A PAC-based CDS can be implemented by combining both SL and RL techniques of conventional machine learning. Shows the block diagram of a PAC-based CDS for the healthcare environment. The Preceptor of the CDS can extract a model using the SL algorithm. The Preceptor then generates an internal reward and predicts the outcome of the dynamic environment (human health in this case) using the extracted model. The Executive receives the internal reward from the Preceptor through the feedback channel. The Executive is built upon an RL-based ML approach that based on the internal reward in the current PAC finds an action, which can optimize the internal reward for the next PAC. The internal reward gives the CDS self-awareness, self-consciousness, and independence from the dynamic environment In short, the RL-based Executive of a PAC-based Cestuses the internal reward produced by the model extracted in the SL-based Preceptor to apply a cognitive action on the dynamic environment. Therefore, a PAC-based CDS can be considered as an enhanced AI. In typical RL, the agent applies the actions on a trial and error basis to receive feedback from the environment, whereas the CDS has a ‘‘conscience’’ about the actions. Therefore, the CDS is a more appropriate choice in intelligent machine applications, especially to ensure safety and security in healthcare applications.

2. Proposed PMAC-Based CDS

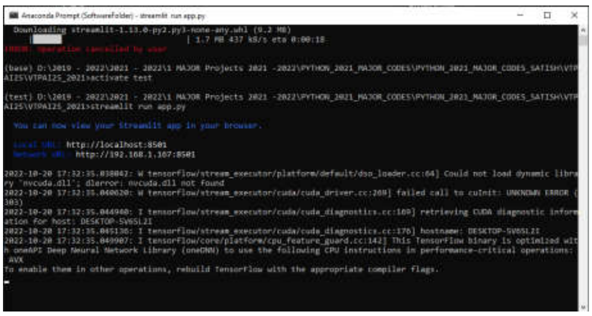
In a typical PAC, the CDS applies an action on the environment and then uses the calculated reward (internal/external) to gain experience. The RL in the Executive then optimizes the reward in the following PAC by finding the most appropriate action. As mentioned before, the Preceptor of a PAC-based CDS uses SL to extract a model of the environment that requires a well-labeled dataset with enough number of training patterns to enhance the reliability of the model. For example, in the case of orthogonal frequency division multiplexing (OFDM) long-haul fiber optic communication systems when the CDS operates in the bit error rate (BER) improvement mode, the internal rewards and model converges after N = 512 frames. Unlike fiber-optic communications, where training data with accurate labeling are available at a much faster rate, the number of training patterns in the available datasets for healthcare applications is generally limited. In addition, the labeling of the healthcare dataset can be erroneous owing to its dependence on human skills. Moreover, a dataset can be inherently defective or manipulated by hidden cyber-attack. These shortcomings in the available data may result in an over fitted model, potentially causing the test accuracy of the model to drop significantly compared to the training accuracy. In such a case, one can infer that the used dataset for model extraction is badly labeled and/or lacks enough training patterns required to extracting a reliable, accurate and converged model.

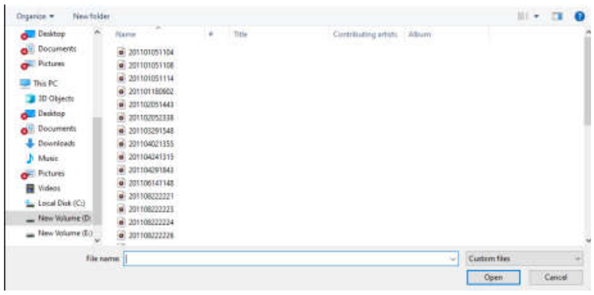
1. SYSTEM ARCHITECTURE

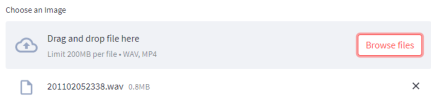


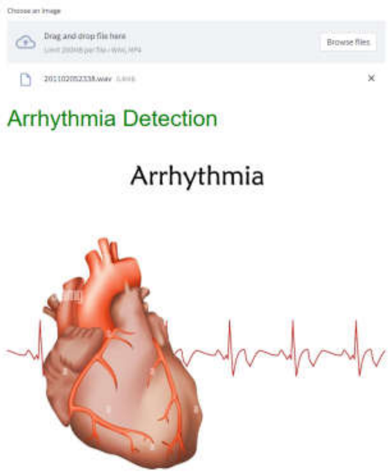
2. RESULTS

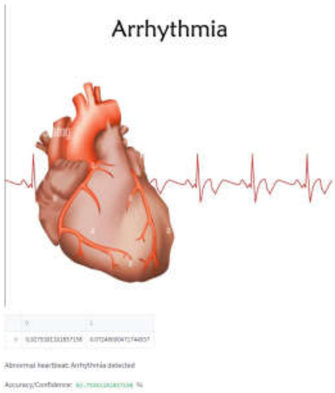
Although we only use LSTM for developing the models in this paper, other types of models (e.g., CNN, deep neural networks, and SVM) can also be explored. It would be interesting to perform a comparative study of these models and also consider their robustness to adversarial attacks compared to our proposed fixing heuristic. Additionally, potential applications of our proposed heuristic can be explored in the speech, video, and medical domains, and in recommendation systems.

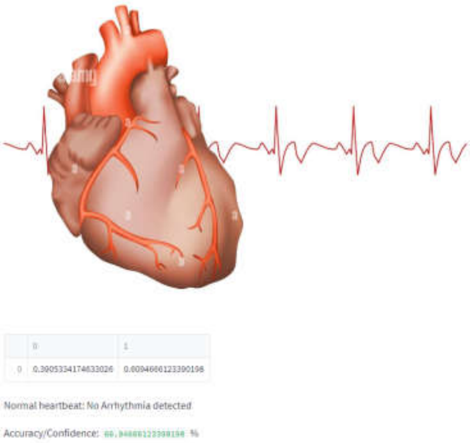












APPLICATION

- Retail and e-commerce.
- Travel and hospitality.
- Banking, finance, and fintech.
- Healthcare.
- Media and entertainment.
- Education.

3. CONCLUSION

In recent years, there has been a growing interest in developing smart interactive cyber-physical systems (CPS) such as smart home and e-Health. An autonomic decision-making system (ADMS) is of paramount importance for the autonomic computing layer of such systems. The ADMS for a smart e-Health Home may include functionalities such as real-time dynamic training or decision-making, screening process, treatment, healing tracking as well as recommendations for healthy living. In this paper, we proposed PMAC-based cognitive dynamic system (CDS) for anadems to enable automatic screening of human health within acceptable level of false alarm rates. We also proposedCoO-inspired decision-making algorithm that allows the proposed CDS to make a decision at a pre-defined level of confidence even when the training dataset itself is poorly labeled or unbalanced. The system architecture and algorithms are developed to realize a health screening (i.e., healthy or unhealthy) application with an acceptable level of the false alarm policy. To illustrate the application of the proposed system, a proof of-concept case study is performed on a defective dataset office traces. The performance of the proposed CDS shows good agreement with the desired performance metrics. Forte desired diagnosis errors equal or less than 25%, 10%, 5.9%, and 2.5%, the CDS achieved diagnosis errors of 13.2%, 9.9%, 6.6%, and 4.6%, respectively. These diagnosis errors are achieved with acceptable false alarm rates of 20.1%, 25%, 28.4%, and 54.7%, respectively. Therefore, we could simulate the flexibility and reliability of the proposed CDS for screening purposes even with a training dataset that is defective or tempered through a cyber-attack that may disrupt the labeling or remove some training patterns from the dataset. In summary, a CDS for health screening applications proposed and implemented. This CDS incorporates decision-making trees, non-monotonic reasoning, a decision making approach inspired from humans in the case of conflict-of-opinions, prediction using the extracted model, and the characteristics of non-Gaussian and non-linear health features. The CDS checks only one feature in each perception-multiple-action cycle, making the proposed algorithm simple and fast. Finally, this work is the second step for designing the ADMS for screening applications in a smart-Health system that can be extended for different healthcare policies such as diagnosing the disease class, prevention and early detection.

4. FUTURE ENHANCEMENT

In our future work, a CDS for health screening applications proposed and implemented. This CDS incorporates decision-making trees, non-monotonic reasoning, a decision-making approach inspired from humans in the case of conflict-of-opinions, prediction using the extracted model, and the characteristics of non-Gaussian and non-linear health features. The CDS checks only one feature in each perception-multiple-action cycle, making the proposed algorithm simple and fast. Finally, this work is the second step for designing the ADMS for screening applications in a smarte-Health system that can be extended for different healthcare policies such as diagnosing the disease class, prevention and early detection.

REFERENCES

[1] An Architectural Blueprint for Autonomic Computing. (Jun. 2005) IBM Autonomic Computing White Paper. Accessed: May 1, 2021. [Online]. Available: https://www-03.ibm.com/

autonomic/pdfs/AC%2Blueprint%20White%20Paper%20V7.pdf
[2] J. O. Kephart and D. M. Chess, ''The vision of autonomic computing,'' Computer, vol. 36, no. 1, pp. 41–50, Jan. 2003.
[3] M. J. Deen, ''Information and communications technologies for elderly ubiquitous healthcare in a smart home,'' Pers. Ubiquitous Comput., vol. 19, nos. 3–4, pp. 573–599, Jul. 2015.
[4] S. Majumder, T. Mondal, and M. J. Deen, ''Wearable sensors for remote health monitoring,'' Sensors, vol. 17, no. 1, pp. 130–175, 2017.
[5] H. Wang, N. Agoulmine, M. J. Deen, and J. Zhao, ''A utility maximization approach for information-communication tradeoff in wireless body area networks,'' Pers. Ubiquitous Comput., vol. 18, no. 8, pp. 1963–1976, Dec. 2014.
[6] H. Wang, ''Information-based energy efficient sensor selection in wireless body area networks,'' in Proc. IEEE Int. Conf. Commun.-Symp. Sel. Areas Commun. E-Health Track, Kyoto, Japan, Jun. 2011, pp. 1–6,
[7] S. Majumder, E. Aghayi, M. Noferesti, H. Memarzadeh-Tehran, T. Mondal, Z. Pang, and M. J. Deen, ''Smart homes for elderly healthcareRecent advances and research challenges,'' Sensors, vol. 17, no. 11, pp. 2496–2528, 2017.
[8] J. M. Fuster, Cortex and Mind: Unifying Cognition. London, U.K.: Oxford Univ. Press, 2003.
[9] S. Feng, P. Setoodeh, and S. Haykin, ''Smart home: Cognitive interactive people-centric Internet of Things,'' IEEE Commun. Mag., vol. 55, no. 2, pp. 34–39, Feb. 2017.
[10] M. Naghshvarianjahromi, S. Kumar, and M. J. Deen, ''Brain-inspired intelligence for real-time health situation understanding in smart e-Health home applications,'' IEEE Access, vol. 7, pp. 180106–180126, 2019.
[11] M. Naghshvarianjahromi, S. Kumar, and M. J. Deen, ''Brain inspired dynamic system for the quality-of-service control over the long-haul nonlinear fiber-optic link,'' Sensors, vol. 19, no. 9, pp. 2175–2195, 2019.
[12] M. Naghshvarianjahromi, S. Kumar, and M. J. Deen, ''Brain inspired dynamic system for the quality-of-service control over the long-haul nonlinear fiber-optic link,'' in Proc. 16th Canadian Workshop Inf. Theory (CWIT), Hamilton, NY, Canada, Jun. 2019, pp. 1–5.
[13] M. Naghshvarianjahromi, S. Kumar, and M. J. Deen, ''Smart longhaul fiber optic communication systems using brain like intelligence,'' Proc. 16th Can. Workshop Inf. Theory (CWIT), Hamilton, ON, Canada, Jun. 2019, pp. 1–6.
[14] M. Naghshvarianjahromi, S. Kumar, and M. J. Deen, ''Brain-inspired cognitive decision making for nonlinear and non-Gaussian environments,'' IEEE Access, vol. 7, pp. 180910–180922, 2019.
[15] M. Naghshvarianjahromi, S. Kumar, and M. J. Deen, ''Natural brain inspired intelligence for non-Gaussian and nonlinear environments with finite memory,'' Appl. Sci., vol. 10, no. 3, pp. 1150–1177, 2020.
[16] S. Haykin, Cognitive Dynamic Systems: Perception-Action Cycle, Radar, and Radio. Cambridge, U.K.: Cambridge Univ. Press, 2012.
[17] N. F. Marko and R. J. Weil, ''Non-Gaussian distributions affect identification of expression patterns, functional annotation, and prospectiveclassification in human cancer genomes,'' PLoS ONE, vol. 7, no. 10,Oct. 2012, Art. no. e46935.
[18] R. Bono, M. J. Blanca, J. Arnau, and J. Gómez-Benito, ''Non-normaldistributions commonly used in health, education, and social sciences:A systematic review,'' Frontiers Psychol., vol. 8, pp. 1–13, Sep. 2017.
[19] B. J. Drew, P. Harris, J. K. Zègre-Hemsey, T. Mammone, D. Schindler,R. Salas-Boni, Y. Bai, A. Tinoco, Q. Ding, and X. Hu, ''Insights into theproblem of alarm fatigue with physiologic monitor devices: A comprehensive observational study of consecutive intensive care unit patients,'' PLoSONE, vol. 9, no. 10, Oct. 2014, Art. no. e110274.
[20] J. Henry, ''Adoption of electronic health record systems among us nonfederal acute care hospitals: 2008-2015,'' ONC Data Brief, no. 35, pp. 1–9, Oct. 2016.
[21] M. Ghassemi, T. Naumann, F. Doshi-Velez, N. Brimmer, R. Joshi,A. Rumshisky, and P. Szolovits, ''Unfolding physiological state: Mortalitymodeling in intensive care units,'' in Proc. KDD, 2014, pp. 75–84.
[22] V. Gulshan, ''Development and validation of a deep learning algorithm fordetection of diabetic retinopathy in retinal fundus photographs,'' J. Amer.Med. Assoc., vol. 316, no. 22, pp. 2402–2410, 2016.
[23] A. Esteva, B. Kuprel, R. A. Novoa, J. Ko, S. M. Swetter, H. M. Blau,and S. Thrun, ''Dermatologist-level classification of skin cancer with deepneural networks,'' Nature, vol. 542, no. 7639, pp. 115–118, Feb. 2017.
[24] Y.-A. Chung and W.-H. Weng, ''Learning deep representations of medicalimages using siamese CNNs with application to content-based imageretrieval,'' in Proc. Workshop Mach. Learn. Health (ML4H), 2017, pp. 1–5.
[25] K. Nagpal, D. Foote, Y. Liu, P.-H.-C. Chen, E. Wulczyn, F. Tan, N. Olson,J. L. Smith, A. Mohtashamian, J. H. Wren, G. S. Corrado, R. MacDonald,L. H. Peng, M. B. Amin, A. J. Evans, A. R. Sangoi, C. H. Mermel,J. D. Hipp, and M. C. Stumpe, ''Development and validation of a deeplearning

algorithm for improving gleason scoring of prostate cancer,'' NPJDigit. Med., vol. 2, no. 1, pp. 1–11, Dec. 2019.
[26] A. Raghu, ''Continuous state-space models for optimal sepsis treatment-adeep reinforcement learning approach,'' in Proc. Mach. Learn. Healthcare (MLHC), 2017, pp. 1–17.
[27] W.-H. Weng, ''Representation and reinforcement learning for personalizedglycemic control in septic patients,'' in Proc. NIPS, 2017, pp. 1–8.
[28] M. Komorowski, L. A. Celi, O. Badawi, A. C. Gordon, and A. A. Faisal, "The artificial intelligence clinician learns optimal treatment strategies forsepsis in intensive care,'' Nature Med., vol. 24, no. 11, pp. 1716–1720,Nov. 2018.

AUTHOR PROFILE's

Ms. FARIHA QUADRY, completed her B.Tech(CSE) from Shadan Women's College Of EngineeringAnd Technology,Khairtabad, Hyderabad, TS, India. Presently, she is pursuing her Masters inComputer Science & Engineering from Shadan Women's College of Engineering &Technology,Khairtabad, Hyderabad, TS, India.

Dr.G.KALAIMANI received the Ph.d degree in Information and Communication Engineering fromAnna University, Chennai. She has 16 years of teaching experience. Her areas of interest includecomputer networks, database management systems, advanced algorithm, data structure, cloudcomputing. At present she is working as a professor in Department of Computer Science andEngineering at Shadan Women's College of Engineering and Technology, Hyderabad. She haspublished 14 papers in International Journal, 2 papers in International Conferences.