International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 2 Feb. 2023, pp: 616-624 www.ijaem.net ISSN: 2395-5252

Literature review Onmultiple Disorder Detection by Gait Analysis Using Machine Learning

Divyachandra R[1], Stephanie Bruno R[2], Surya B[3], Anupriya M[4]

UG Students, B.E Biomedical engineering, SNS College of Technology, Coimbatore, Tamilnadu, India[1]

Date of Submission: 05-02-2023 Date of Acceptance: 20-02-2023

ABSTRACT: Multiple disorders such as nerve disorder, diabetes, stroke, and arthritis are the leading causes of disability in India and throughout the world. As compare to other disorders these types of disorders having high rate of human malfunction, so there is need of promising solution over this kind of diseases. Medical data growth in healthcare communities, accurate analysis of medical data benefit early disorder detection, patient care and community services. So in order to detect these kind of disorders accurate and sensitive gait detection system is proposed to sense the minute activity of data and classify the data using machine learning algorithm to achive the higher accuracy .

KEYWORDS: Gait analysis,Machine leearning prediction,Sensor values.

I. INTRODUCTION

Gait refers to the analyze of movements of body,the way the leg and foot moves ,normally called as locomotion.The measurement of abnormalities in the locomotion is known as gait analysis.

In this project, we are using several sensors for taking out the value of vaious gait analysis and detect multiple disorders.

Diabeteic foot ulcer is a open sore disease , occurs in both adults and kids and affects all ages , with our model by analysing moisture value and spo2 value in the foot , this diabetic foot ulcer can be detected at the early stage with the analyze and comparison of moisture values in machine learning prediction.

Usually kids used to walk improperly in their first walking stage . They place their foot in the floor not with the required pressure and also they place the foot in improper angle. This makes their walk in that improper way . And in the worst case, the kids leg shows to be little bended manner betwwen the knee and ankle.To analyze this we are measuring pfressure value and angle of the foot while they stand , this gives the parent better and early analyze about their child walk or leg issues.

TOE OFF - This is the type of walking when people foot rise from the floor , they doesnt place their toe prperly. This leads to the pain in the middle of foot and ankles. This can also be predicted with the analyze of angular values that taken from all points of the foot and the pressure value taken from all sides of the foot.

It becomes challenging when multiple values are taken and analyze the required disease . It is important to notice the variety of gait value analyzed as the accuracy of development algorithm is dependent on the same.

Currently, there is lot of research is being made on gait analysis. This paper presents literature review of few of the methodologieson gait analysis.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 2 Feb. 2023, pp: 616-624 www.ijaem.net ISSN: 2395-5252

II. FRAMEWORK

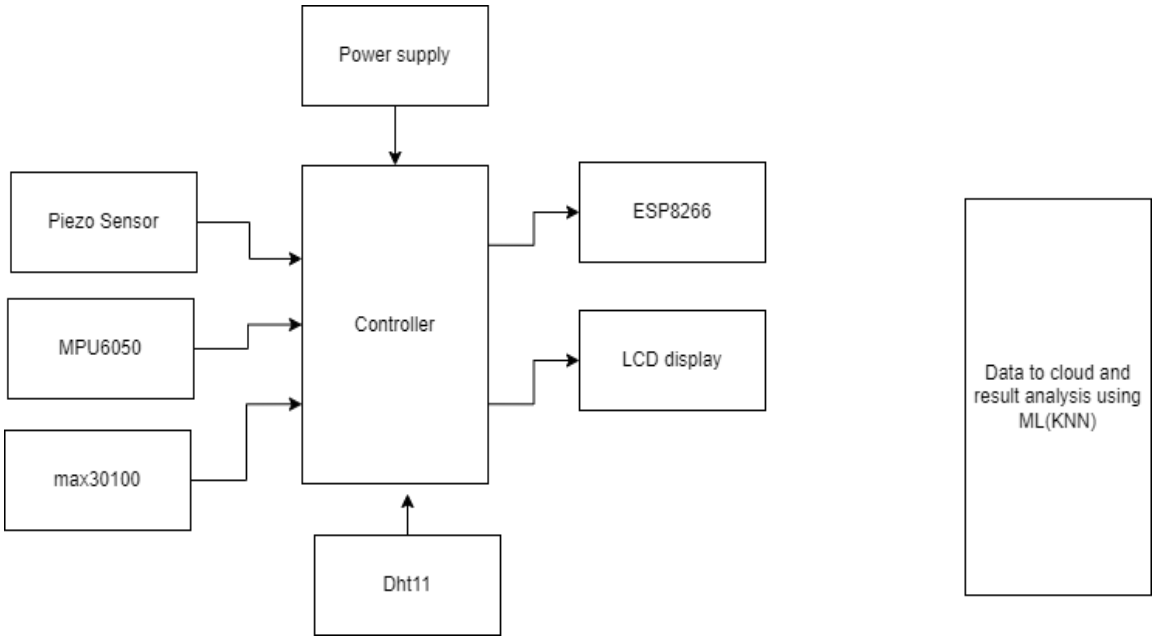

Fig.1.Block diagram

1. Piezo sensor : This sensor is basically used for taking pressure values. It also measures the acceleration , strain values by gathering the required data and converting them to digital values .
2. MPU6050 : This mpu6050 sensor module is a complete 6 axis motion tracking device . It combines 3 axis gyroscopes , 3 axis accelerometer and digital motion processor all in small .
3. Max30100 : Also known as pulse oximeter sensor used for heart rate monitoring . It measures the spo2 and saturation values with the emission of different lights from the 2 led s.
4. Dht11:It is used for measuring the temperature and humidity values . It has wide applications in both weather prediction and also for various analysis .
5. ESP8266 :It is an wifi module , can be used being connected with other microcontrollers .
6. Arduino : It is an microcontroller , for connecting all sensors and programming . The arduino is based on embedded c programming with digital and analog pins for several connections .
7. LCD display : It is used for displaying certain values that are anlyzed and are majorly used for real time output dispaly .
8. Machine learning : Machine learning models are being used for comparing values that are taken to the previously stored values . Here support vector algorithm has been used for better results . The google colab software is being used for the machine learning prediction .

III. LITERATUREREVIEW

1. Punit Gupta,Navaditya Gaur,Rajan Tripathi,Mayank Goyal,Ankit Mundr introduced a method of IoT and Cloud Based Healthcare Solution for Diabetic Foot Ulcer .It plays a vital role in solving real time problems in the field of Healthcare. Abundant problems can be rectified with optimal use of IOT Healthcare. It can be applied to detect Diabetes at early stages, detection of Foot ulcers, anomaly in heart rate and similar scenario. The paper proposed the plan and its working in Healthcare using IOT to detect ulcer in the foot of diabetic patients. The given model examines the medical condition of ulcer cause by diabetic and notify in case of aberration. Node MCU development board plays a vital role in its model development and stores and tracks the medical report of the Patient. It also helps in real time sharing of large chunks of data with great efficiency. Indeed this model slack off maj or time consuming efforts like regular visits to doctor and provide real time update with regards to patient.

2. Mohammed M. Bait-Suwailam,Issam BahadurpresentedamethodforNon-Invasive Microwave CSRR-Based Sensor for Diabetic Foot Ulcers Detection . This paper presents numerical modeling and study of a non-invasive microwave sensor for the detection of diabetic foot ulcers. The developed microwave sensor is based on the subwavelength complementary split-ring resonators (CSRRs) concept, which fits quite well to sense the changes in the electromagnetic properties of the human foot tissues when placed in near-field zone of the foot. To validate the concept, the transmission coefficient between two ports that are attached at sensor's ends is numerically computed for a diabetic foot ulcer and compared against a normal foot. This portable sensor among other non-invasive microwave sensing modalities can provide an early screening tool for diabetic foot care.

3. Siham M Fahmy,Mohamed Hisham Aref,Ibrahim H. Aboughaleb,Mohamed Rabie,Ramy Abdlatydescribedan efficientmethod forChronic ulcers especially diabetic lower extremity ulcers are considered to be a significant problem affecting life quality for both patients as well as the health care system. Any break in the progression of the body\u2019s surface that requires a drawn out time to mend due to the poor blood supply and lacking oxygenation of the injury is similarly seen as a ceaseless injury. The effect of hyperbaric oxygen treatment (HBOT) on the improvement of the mending of the chronic diabetic foot ulcers contrary to traditional methods and medical regimes work which gained poor progression. In our examination the clinical preliminaries have been carried out upon a gathering of (27 patients) during the time of around ten months coming about a critical contrast of wound size and volume closing in conclusive that HBOT sessions for diabetic foot ulcer revealed a high impact in patient treatments. Moreover, improving healing rate with significant reduction of wound surface area and ulcer volume consequently, decreasing patient suffering.

4. Abdelrahman Shata,Nidhal Abdulaziz presented on the theory related to Early Detection of Diabetic Foot Ulcer Using Convolutional Neural Networks .Diabetic Foot Ulcer is a very common problem that faces diabetic patients with almost 15 percent of these patients developing a foot ulcer at least once in their life. Diabetic patients tend to suffer from numbness and loss of sensation in their feet making it hard for them to self-detect the ulcer therefore an early detection method is needed. The approach conducted in this paper uses a 2-dimentional image as an input and using convolutional neural networks to analyze the images. The system will classify the input images into two states, no ulcer or the ulcer is present and in this case the location of the ulcer will be marked on the image. The system achieved an F1- score of 81.3% with an improvement of more than 7% from the F1-score achieved in the Diabetic Foot Ulcer Challenge 2020.

5. Linxin Xing,Liangliang Li,Zheyuan Wang,Hongbing Ma have been defined the work on An Improved UNet Model for Foot Ulcer Image Segmentation in the year 2022 . Extracting accurate morphological features of foot wounds is essential for the correct treatment of foot ulcers (a complication of diabetes). To reduce the workload of healthcare professionals and alleviate the problem that traditional diagnostic methods are heavily influenced by subjective factors, we propose a foot ulcer segmentation method based on an improved UNet model. The proposed method uses the classical network UNet as the backbone, and adds a coarse localization module that makes judgments based on a priori knowledge,and add SVM in the outout node. Tested on the FUSeg dataset, the segmentation result achieved 89.02% on Dice evaluation, and it is higher than compared the state-of-the-art networks .

6. Lefan Wang,Dominic Jones,Graham J Chapman,Heidi J. Siddle,David A Russell,Ali Alazmani,Peter Culmer, presented a framework for A Review of Wearable Sensor Systems to Monitor Plantar Loading in the Assessment of Diabetic Foot Ulcers . Diabetes is highly prevalent throughout the world and imposes a high economic cost on countries at all income levels. Foot ulceration is one devastating consequence of diabetes, which can lead to amputation and mortality. Clinical assessment of diabetic foot ulcer (DFU) is currently subjective and limited, impeding effective diagnosis, treatment and prevention. Studies have shown that pressure and shear stress at the plantar surface of the foot plays an

important role in the development of DFUs. Quantification of these could provide an improved means of assessment of the risk of developing DFUs. However, commercially-available sensing technology can only measure plantar pressures, neglecting shear stresses and thus limiting their clinical utility. Research into new sensor systems which can measure both plantar pressure and shear stresses are thus critical. Our aim in this paper is to provide the reader with an overview of recent advances in plantar pressure and stress sensing and offer insights into future needs in this critical area of healthcare. Firstly, we use current clinical understanding as the basis to define requirements for wearable sensor systems capable of assessing DFU. Secondly, we review the fundamental sensing technologies employed in this field and investigate the capabilities of the resultant wearable systems, including both commercial and research-grade equipment. Finally, we discuss research trends, ongoing challenges and future opportunities for improved sensing technologies to monitor plantar loading in the diabetic foot.

7. Yuto Mibae,Hiroshi Noguchi proposed an Visualization System of 3D Foot Plantar Model with Temperature Information Using RGB-D and Thermography Cameras for Prevention of Foot Ulcer in Diabetic PatientsIn this study, we developed system to visualize 3D foot plantar model with temperature for prevention of diabetic foot ulcer. By visualizing temperature information with 3D foot plantar model, medical staff members can recognize the correspondence between the shape of foot plantar and temperature distribution. The visualized model is effective to identify the signs for diabetic foot ulcers based on foot plantar shape and temperature information for medical staff members such as nurses. The model will also be available for education of the patients who had a risk of diabetic foot ulcers. The system consists of a RGB-D camera and thermography. The system detects foot plantar regions using U-Net from RGB images of both cameras. Then, the system registers two images based on the shape information from the detected foot planter region. Finally, from registered depth and thermographic images, the system creates 3D model with temperature. The system displays foot plantar region whose temperature are higher than the surrounding area, and displays the 3D model using depth information along with temperature information. The experiments demonstrated that our algorithm detected foot plantar region accurately and achieved sufficient performance for registration compared with human annotation. The experiments also showed feasibility of developed system .

8. Madhava S Prabhu,Seema Vermapresenteda method A Deep Learning framework and its Implementation for Diabetic Foot Ulcer Classification in the year of 2021. One of the major global healthcare issue is the Diabetes Mellitus (DM) and it is growing exponentially over the years. The complications that may arise in the diabetic patients is Diabetic Foot Ulcers (DFU) and if not treated on time, it may deteriorate the condition leading to the amputation. The pathogenic factors causing the superficial temperature changes in the foot can be effectively documented using infrared thermograph. The work discussed in this paper aims at proposing a model that can distinguish automatically the healthy skin versus the DFU class from the plantar thermos-grams using the deep learning algorithms. The proposed work is also implemented on a hardware platform using an Embedded Graphics Processing Unit (GPU) called Jetson Nano that runs multiple neural networks simultaneously, The performance of the proposed work is compared and analysed with the existing algorithms such as DenseNet, VGGNet, and MatConvNet architectures. The results showed a significant improvement by achieving maximum accuracy of 97.9%. The deep learning framework to classify healthy and DFU class from plantar thermos-grams is also implemented using an Embedded GPU. The deployment of the proposed architecture using the NVIDIA Jetson Nano tool-kit highlights the appropriateness to embedded systems. This automated system is very useful in various healthcare scenarios to aid the clinicians to support their manual diagnosis of foot screening.

9. Shalok Mohanty,Silky Goel,Rahul Nijhawan, Siddharth Gupta used Identification of Diabetic Foot Ulcer in Images using Machine Learning . It is a known fact that foot ulcers are common complications of patients with uncontrolled diabetes. If the ulcer is not detected early and treated aggressively, it might progress to a fulminating one and the limb might have to be amputated. Such complications can be avoided by early diagnosis and prompt treatment. There are

several classifications of diabetic foot ulcers that would facilitate the treatment. In the current study deep learning frameworks like inception-v3, VGG-16, and VGG-19 were trained on the datasets images containing details of the ulcerated and non-ulcerated feet of the patient. The features that were extracted were provided as the input to the machine learning algorithms for studying the accuracy of the various classifiers. The inception v3 model and the SVM classifier achieve an accuracy of 99.8% as compared to other models.

10. Lei Wang,Yun Sun,Qingguo Li,Tao Liu, Jingang Yi presented a method IMU-Based Gait Normalcy Index Calculation for Clinical Evaluation of Impaired Gait . Inertial measurement units (IMU) have been used for gait analysis in many clinical studies, as a more convenient, low cost and less restricted alternative to the laboratory-based motion capture systems or instrumented walkways. Spatial-temporal gait parameters such as gait cycle duration and stride length calculated from the IMUs were often used in these studies for evaluating the impaired gait. However, the spatial-temporal information provided by IMUs is limited, and sometime suffers incomplete and less effective evaluation. In this study, we develop a novel IMU-based method for clinical gait evaluation. Nine gait variables including three spatial-temporal parameters and six kinematic parameters are extracted from two shank-mounted IMUs for quantifying patient's gait deviations. Based on those parameters, an IMU-based gait normalcy index (INI) is derived to evaluate the overall gait performance. Eight inpatient subjects with gait impairments caused by n-hexane neuropathy and ten healthy subjects were recruited. The proposed gait variables and INI were examined on the inpatients at three to five time instants during the rehabilitation process until being discharged. A comparison with healthy subjects and statistical analysis for the changes of gait variables and INI demonstrated that the proposed new set of gait variables and INI can provide adequate and effective information for quantifying gait abnormalities, and help understanding the progress of gait and effectiveness of therapy during rehabilitation process.

11. Carlos A. BYu-Hung Yeh,Jiun-Lin Yan,Meng-Xun Gu,Yi-Wei Chen,Ta-Sung Lee presented a paper on Frequency-DomainAnalysis for Accurate and Robust Gait Cycle Time Detection with Clinical Data . Gait tasks have become a topic of increasing inter-est in biological engineering research in recent years. One way to obtain the gait cycle time (GCT) is to analyze a subject's gait acceleration signal as recorded by an inertial measurement unit (IMU) [1]. An accurate peak detection of the IMU acceleration has thus become a requirement for GCT analysis. This study proposes a detection procedure for accurately detecting the peaks in a noisy IMU acceleration signal based on a frequency-domain analysis of the acceleration .

12. Prof. Jaychand Upadhyay,Prof. Tad Gonsalves,Rohan Paranjpe,Hiralal Purohit,Rohan Joshi presented on Biometric Identification Using Gait Analysis by Deep Learning . The walking pattern of a human being is termed GAIT. These Gait can be used for biometric identification. The COVID-19 pandemic situation has prompted us to change the ways of doing certain things in a traditional approach one of which includes, traditional biometric authentication systems which are physical contact based. This technology can be used as a method of contactless biometric authentication system in which contact chain forming between the users is prevented. The project that may be supported by supervised learning will acknowledge someone from the Gait features.

13. Xin Chen,Xizhao Luo,Jian Weng,Weiqi Luo,Huiting Li, Qi Tian presents on title Multi-View Gait Image Generation for Cross-View Gait Recognition . Gait recognition aims to recognize persons' identities by walking styles. Gait recognition has unique advantages due to its characteristics of non-contact and long-distance compared with face and fingerprint recognition. Cross-view gait recognition is a challenge task because view variance may produce large impact on gait silhouettes. The development of deep learning has promoted cross-view gait recognition performances to a higher level. However, performances of existing deep learning-based cross-view gait recognition methods are limited by lack of gait samples under different views. In this paper, we take a Multi-view Gait Generative Adversarial Network (MvGGAN)

to generate fake gait samples to extend existing gait datasets, which provides adequate gait samples for deep learning-based cross-view gait recognition methods. The proposed MvGGAN method trains a single generator for all view pairs involved in single or multiple datasets. Moreover, we perform domain alignment based on projected maximum mean discrepancy to reduce the influence of distribution divergence caused by sample generation. The experimental results on CASIA-B and OUMVLP dataset demonstrate that fake gait samples generated by the proposed MvGGAN method can improve performances of existing state-of-the-art cross-view gait recognition methods obviously on both single-dataset and cross-dataset evaluation settings.

14. Nithyakani P,Ferni Ukrit M used Classification Of Gait Pathology Using Enhanced Convolutional Neural Network. Human gait analysis has become a manifold approach to identify gait impairments. Normal human gait has the ability to walk or move without any difficulty. Abnormal human gait maximize the effort to maintain the stability to walk. This abnormality is caused by numerous pathological factors. Gait analysis depend on the expertise to identify the abnormality. Deep learning approach has become more popular and successful approach in image classification, prediction and so on. In order to expedite the challenging gait analysis, deep learning algorithms is utilized in this research work. Enhanced convolutional neural network is proposed and built to identify the gait pathologies with less number of parameters in comparison with pre-trained CNN model. Sagittal view of gait sequence is taken as an input to the proposed model. The layers of the proposed model were optimized to increase the performance. The proposed method is tested over INIT gait dataset, DAI gait dataset and DAI gait dataset 2. The experimental results exhibit that the enhanced convolutional neural network is reliable to classify the gait sequence into pathology in effective manner. The proposed model outperforms 97.4 % accuracy in classifying the gait pathologies of DAI gait 2 dataset when compared with INIT and DAI gait dataset.

15. N. Christy Evangeline,E. Suresh,S. Srinivasan uses Computer-aided appraisement of plantar foot health in Diabetic subjects using Infra-red thermograms . Diabetic foot and lower limb complications are one of serious diabetes related complaints that in most cases lead to infections and amputations. While the Mean Foot Temperature (MFT) of a healthy human being is 30.6 \u00b1 2.6\u00b0C [1], any underlying pathology may cause an unusual variation in the temperature distribution as a result of inflammatory response of the human body. The quantitative and qualitative characterization of the temperature distributions in plantar feet helps in detecting the differences between healthy and at-risk foot. Contrasting the plantar foot into 4 angiosomes, the dissimilarity matrix could be an approach to ascertain the similarity and dissimilarity between the contralateral and ipsilateral angiosomes. Thus making it a suitable measure for quantitative analysis of angiosome temperature patterns which can thereby expedite the detection of `at-risk' regions of plantar foot.

16. Doha Bouallal,Asma Bougrine,Hassan Douzi,Rachid Harba,Raphael Canals,Luis Vilcahuaman,Hugo Arbanil used Segmentation of plantar foot thermal images: application to diabetic foot diagnosis . Abnormal plantar foot temperature changes are an early sign of diabetic foot (DF) ulcer, that can be detected using a thermal camera. This communication is composed of two main contributions. The first one concerns the segmentation of plantar foot thermal images. It consists of using the deep learning method U-Net to segment the thermal images. U-Net is trained by combining the two types of images (thermal and color) given by the thermal camera FLIR ONE Pro. Results show that this multimodal approach performs better than the one using only thermal images, especially for difficult cases. The second part is devoted to a transversal clinical study conducted within the Hospital National Dos de Mayo in Lima, Peru. 122 type II diabetic patients without ulcer were recruited. These individuals were classified into three risk groups of developing a foot ulcer. This classification is based on a medical examination: a low-risk group (R0), a medium-risk group (R1) and finally a high-risk group (R2). The study reveals that the average temperature of the plantar foot is 1\u00b0C higher in R1 than in R0 (p<; 0.1). The R1 group patients are characterized by a rapid recovery of their initial temperature after the cold stress test, compared to R0 and R2 (p<;

0.01). Finally, the mean absolute point-to-point temperature difference between left and right foot is lower in R1 than in R2 (p<; 0.1). These results demonstrate that thermal camera temperature assessment could help in the diagnosis of diabetic foot.

17. KS Suresh,A Sukesh Kumar presented work on Multi Signal Pulse Wave Analysis for the Identification of Vascular Diseases Leading to Diabetic Foot . The peripheral arterial diseases are usually diagnosed by non-invasive investigations, such as hemodynamic assessment of lower level arterial circulation, tissue oxygen perfusion measurements etc. Diabetic foot ulceration is mostly related with peripheral arterial diseases. This work aims to identify the possibilities of diabetic foot by analysing the differential pulse waves of arm and leg. Pulse volume waveforms of ankle and brachium are used for the analysis. Multi signal packet wavelet feature extraction technique is used for identifying the differential features of the right/left limbs. Machine learning classification algorithms are employed for the evaluation purpose. Previous studies have proved the direct relationship between pulse wave velocity and blood pressure. Pulse wave velocity is very much linked with vascular diseases. The Moens Korteweg and Hughes models provides the background for this study, which relates the blood pressure and Pulse Wave Velocity. Samples are collected form the normal diabetic patients and from those who have considerable symptoms of arterial diseases. Multi signal packet wavelet feature extraction techniques are used for identifying the differential features of the right/left limbs. Machine learning classification algorithms are used to identify the accuracy of the method.

18. Gaur,Rajan Tripathi,Mayank Goyal,Ankit Mundra deveoped the IoT and Cloud Based Healthcare Solution for Diabetic Foot Ulcer . Iot plays a vital role in solving real time problems in the field of Healthcare. Abundant problems can be rectified with optimal use of IOT Healthcare. It can be applied to detect Diabetes at early stages, detection of Foot ulcers, anomaly in heart rate and similar scenario. The paper proposed the plan and its working in Healthcare using IOT to detect ulcer in the foot of diabetic patients. The given model examines the medical condition of ulcer cause by diabetic and notify in case of aberration. Node MCU development board plays a vital role in its model development and stores and tracks the medical report of the Patient. It also helps in real time sharing of large chunks of data with great efficiency. Indeed this model slack off maj or time consuming efforts like regular visits to doctor and provide real time update with regards to patient.

19. Siham M Fahmy,Mohamed Hisham Aref,Ibrahim H. Aboughaleb,Mohamed Rabie,Ramy Abdlaty uses Hyperbaric Oxygen Therapy for Healing Diabetic Lower Extremity Ulcers . Chronic ulcers especially diabetic lower extremity ulcers are considered to be a significant problem affecting life quality for both patients as well as the health care system. Any break in the progression of the body\u2019s surface that requires a drawn out time to mend due to the poor blood supply and lacking oxygenation of the injury is similarly seen as a ceaseless injury. The effect of hyperbaric oxygen treatment (HBOT) on the improvement of the mending of the chronic diabetic foot ulcers contrary to traditional methods and medical regimes work which gained poor progression. In our examination the clinical preliminaries have been carried out upon a gathering of (27 patients) during the time of around ten months coming about a critical contrast of wound size and volume closing in conclusive that HBOT sessions for diabetic foot ulcer revealed a high impact in patient treatments. Moreover, improving healing rate with significant reduction of wound surface area and ulcer volume consequently, decreasing patient suffering.

20. Dongran Wang,Ji Ouyang,Peiru Zhou,Junlan Yan,Lin Shu,Xiangmin Xu presents on A Novel Low-Cost Wireless Footwear System for Monitoring Diabetic Foot Patients . Diabetic foot is one of the main complications of diabetes with the characteristics of high incidence and difficulty in treatment. Diabetic patients with peripheral neuropathy may develop foot ulcers, and in severe cases amputations are required and some may even die. Plantar pressure can be used to assess the risk of developing diabetic foot, but the existing plantar pressure monitoring methods are not suitable for long-term monitoring in daily life. This study presents a novel low-cost shoe system for daily monitoring of plantar pressure in diabetics. It includes an insole with

pressure sensor array, which can dynamically monitor the plantar pressure and display the changes of plantar pressure in real time in the mobile phone to provide early warning for patients with high risk of diabetic foot. As for the sensor, copper and carbon black were adopted as the electrode and conductive filler respectively, enabling a mass production with low price. It was soft and bendable, meeting the performance needs of daily plantar pressure monitoring. All devices were encapsulated in shoes, and the data was transmitted wirelessly through Bluetooth, which did not affect the user's walking. After using random forest for feature selection, five classifiers were used to classify the plantar pressure of healthy people, diabetic patients without peripheral neuropathy, and diabetic patients with peripheral neuropathy collected by this system. The experimental results showed that the accuracy of the random forest classifier was the highest, reaching 94.7%, which indicated that the system could be useful for daily plantar pressure monitoring of diabetic patients.

IV. APPLICATIONS

With its best benefits and other pros like Time saving , Easiest way to predict at earlier stage, Applicable for any age, Cost efficient, Accuracy is more the 95 %, Easy way of screening they have good applications in fast moving technology and in industries like Hospitals , Counselling centres , Home for older peoples , Clinics.

V. CONCLUSION

Machine learning techniques are used here for advanced prediction and implementation of these new technologies provide with better accuracy in the gait analysis. The accuracy of the algorithm depends on the values detrmined by the sensors and the merging of those values through n number of iterations in the machine learning .

REFERENCES

[1]. Abdelrahman and Nidhal Abdulaziz, "Early Detection of Diabetic Foot Ulcer Using Convolutional Neural Networks" https://ieeexplore.ieee.org/document/9550812

[2]. Linxin Xing, Liangliang Li, Hongbing Ma, "An Improved UNet Model for Foot Ulcer Image Segmentation" https://ieeexplore.ieee.org/document/9886343

[3]. Punit Gupta, Navadithya Gur and Rajan Tripathi, "IOT and Cloud Based Healthcare Solution for Diabetic Foot Ulcer" https://ieeexplore.ieee.org/document/9315824

[4]. Mohammed M. and Bait Suwailiam, "Non-Invasive Microwave CSRR-Based Sensor for Diabetic Foot Ulcers Detection"https://ieeexplore.ieee.org/document/9429469.

[5]. Siham M Fahmy, Mohamed Hisham Aref, Ibrahim, "Hyperbaric Oxygen Therapy for Healing Diabetic Lower Extremity Ulcer" https://www.hmpgloballearningnetwork.com/site/podsource/product/natrox-oxygen-wound-therapy

[6]. Linxin Xing and Liangliang Li,"An Improved UNet Model for Foot Ulcer Image Segmentation" https://ieeexplore.ieee.org/document/9886343

[7]. Lefan Wang, Dominic Jones and Graham, "A Review of Wearable Sensor Systems to Monitor Plantar Loading in the Assessment of Diabetic Foot Ulcers" https://ieeexplore.ieee.org/document/8944053/

[8]. Yuto Mibae and Hiroshi Noguchi ,"Visualization System of 3D Foot Plantar Model with Temperature Information Using RGB-D and Thermography Cameras for Prevention of Foot Ulcer in Diabetic Patients"https://ieeexplore.ieee.org/document/9708906/

[9]. K. Al-Rubeaan et al., "Diabetic Foot Complications and Their Risk Factors from a Large Retrospective Cohort Study," Plos One, vol. 10, no. 5, May. 2015.

[10]. L. Hurley et al., "A prospective study of risk factors for foot ulceration: The West of Ireland Diabetes Foot Study," QJM: An International Journal of Medicine, vol. 106, no. 12, pp. 1103-1110, 2013.

[11]. M. Turns, "Prevention and management of diabetic foot ulcers," British Journal of Community Nursing, vol. 20, no. Sup3, pp. S30-S37, Mar. 2015.

[12]. C. Tobin et al., "Feet can last a lifetime, A health care provider's guide to preventing diabetes foot problems", National Diabetes Education Program (NDEP). Nov. 2000.

[13]. C. A. Abbott et al., "Innovative intelligent insole system reduces diabetic foot ulcer recurrence at plantar sites: a prospective, randomised, proof-of-concept study," The Lancet Digital Health, vol. 1, no. 6, pp. e308-e318, Oct. 2019.

[14]. H. H. Huang et al., "Portable Bluetooth low energy system for synchronize foot pressure measurement." 2017 IEEE 6th Global Conference on Consumer Electronics (GCCE), pp. 1-2, Oct. 2017.

[15]. A.M. Howell et al., "Kinetic Gait Analysis Using a Low-Cost Insole," IEEE Transactions onBiomedical Engineering, vol. 60,no. 12, pp.3284-3290, 2013.

[16]. Madhava S Prabhu,Seema Verma , "A Deep Learning framework and its Implementation for Diabetic Foot Ulcer Classification" https://ieeexplore.ieee.org/document/9596380

[17]. Xin Chen,Xizhao Luo,Jian Weng,Weiqi Luo,Huiting Li, "Multi-View Gait Image Generation for Cross-View Gait Recognition"https://pubmed.ncbi.nlm.nih.gov/33544673/

[18]. Prof. Jaychand Upadhyay,Prof. Tad Gonsalves,Rohan Paranjpe,Hiralal Purohit,Rohan Joshi., "Biometric Identification Using Gait Analysis by Deep Learning"https://ieeexplore.ieee.org/document/9298276

[19]. Dooslin Mercy Bai, Divya Jenifar, Janaki Eswari Vigna, Sivashankari & Swarnabalaa, "Detection of Foot Ulcer using IoT Technology"http://www.journaleca.com/gallery/jeca-2104.13-f.pdf

[20]. Kerstin Roback, "An overview of temperature monitoring devices for early detection of diabetic foot disorders"https://pubmed.ncbi.nlm.nih.gov/20822392/