IJCSE International Journal of Computer Sciences and Engineering Open Access
Survey Paper Vol. 8, Issue.10, October 2020 E-ISSN: 2347-2693

A Survey on the Machine Learning For E-Learning System and Dyslexia

V. Kala[1*], S. Vimala[2]

[1]Department of Computer Science, K. P. National College of arts and science, Batlagundu, Tamilnadu, India
[2]Department of Computer Science, Mother Teresa Women's University, Kodaikanal, Tamilnadu, India

**Corresponding Author: kalamurali.p@gmail.com*

DOI: https://doi.org/10.26438/ijcse/v8i10.121126 | Available online at: www.ijcseonline.org

Received: 10/Oct/2020, Accepted: 20/Oct/2020, Published: 31/Oct/2020

Abstract— Learning disabilities like dysgraphia, dyslexia, dyspraxia, etc. interfere with academic achievements yet have likewise long terms consequences beyond academic time. It is widely admitted that between 5% to 10% of the total population is subject to this kind of disability. For assessing such disabilities in early childhood, children have to solve a battery of tests. Human experts score these tests and decide whether the children require specific education strategies based on their marks. The assessment can be lengthy, exorbitant, and emotionally difficult. Dyslexia is a learning disorder characterized by a lack of reading and/or composing skills, trouble in fast word naming and likewise poor in spelling. Dyslexic people have great trouble to read and interpret words or letters. Research work is carried out to order dyslexic from non-dyslexics by different approaches, for example, machine learning, image processing, understanding the cerebrum behaviour through brain science, contemplating the differences in life systems of mind. In recent years, e-learning systems have played an increasingly significant role in higher education and, specifically, in enhancing learning experiences for people who have learning difficulties. However, huge numbers of the people involved in the development and implementation of e-learning instruments overlook the needs of dyslexic students. In this paper, a detailed literature survey is carried on the machine techniques for the prediction of dyslexia students and e-learning for learning and cognitive disabilities.

Keywords— Machine Learning, dysgraphia, e-learning, brain science, cognitive;

I. INTRODUCTION

In recent years, an increasing spotlight has been placed on the role technology can play in enhancing teaching and learning experiences. E-learning has become a fundamental apparatus for progressing student's knowledge, understanding, and skills, and the web, specifically, has become a typical educational device in the homeroom setting [1]. Although the technologies that are currently available have positively affected teacher's abilities to deliver the educational program, students who have disabilities are often overlooked in the development and arrangement of these apparatuses and, all things considered, they don't benefit from the same learning experiences as those without disabilities. This is especially the case with students who have dyslexia. As per Beacham and Alty,1 the e-learning materials that are ordinarily employed were developed with the needs and capabilities of non-dyslexic learners at the top of the priority list. They guarantee that this results in a 'powerlessness to provide accessibility and convenience for all learners [2]. They include that e-learning materials in their current structure go about as a hindrance to dyslexic student's learning as opposed to a guide, because the resources don't take into consideration the individual learning approaches that these students exhibit and, therefore, present students with dyslexia with further challenges and disadvantages.

II. BACKGROUND STUDY OF LEARNING DISABILITY

"Learning Disabilities" (or learning disorders) [3] is an "umbrella" term describing several specific disorders, for example, dyslexia, dyspraxia, dysgraphia, etc. A detailed view can be found in the book Diagnostic and Statistical Manual of Mental Disorders [4] (otherwise called DSM-5) from the American Psychiatric Association. Diverse studies suggest that learning disabilities are characterized by subtle and spatially distributed varieties in mind life systems. All things considered, they ought not be confused with learning problems which could be the result of visual, hearing, or motor handicaps, or even social issues.

Explaining the neurological underpinning of a learning inability has been a serious objective of research over the previous twenty years. Despite much progress has been made across diverse research fields, learning disabilities causes are as yet not well understood. These learning disorders can be investigated from a great deal of other viewpoints also, for example,

- Their prevalence based on the family and the order.

- The effect of alternative operational definitions of "learning disabilities".

Nevertheless, we can agree with who thinks that: it is possible to identify dyslexia with a high reliability, even though the exact nature of dyslexia is as yet unknown. We consider unknown. We consider this is likewise substantial with other learning disorders. Despite a lack of understanding of the causes, the side effects are generally clear and described comprehensively in the DSM–5 under the terms of Developmental Coordination Disorders. To make it short:

- Dyslexia is a learning disorder which impacts the person's capacity to read
- Motor dysgraphia is a learning disorder which impacts the individual capacity to write.

Motor dysgraphia may likewise be a marker of Developmental Coordination Disorder (DCD, for example, dyspraxia [5]. These disorders remain over the age however can be mitigated with appropriate instructional courses. It's anything but a matter of Yes or No and the manifestations range from mellow to severe. It is widely admitted that more or less 10% of the total populace has (to some extend) a learning disorder. One can refer for instance from Duke University or again to DSM-5. It is well known that any blend of the disorders described in DSM-5 often leads to academic failure. Nevertheless, provided with an appropriate education strategy, a child with learning difficulties will acquire the same skills as a standard child. Very often, these children can likewise get government supports in diverse manners (specific teaching lessons, extra educational cost, extra time for exams, specific staff helping during the homeroom, etc.). To get such a support, the criteria is to provide a certificate originating from an accredited specialist, who is in charge of assessing the child. The assessment might be lengthy, exorbitant and emotionally agonizing. Moreover, the limited number of accredited pathologists may make this process time expending. This circumstance prevents many individuals, often among the most targeted populace, to carry on an assessment. This searches quick, effective and widely available assessments (or pre-assessments) of essential interest. Our methodology is ordinarily a candidate answer for this issue.

III. BACKGROUND STUDY OF MACHINE LEARNING

Machine Learning is a method that is utilized to take in and recognize new patterns of information from existing huge information. It permits researchers and information experts to feasibly recognize the strategies and plans to be conceived. To develop strategies to perform clustering, regression and classification utilizing relevant information hidden in huge information repositories Machine learning calculations are comprehensively classified as directed and unsupervised learning. Supervised learning is the machine learning action that infers a capacity from information whose class labels are already known with preparing examples. Unsupervised learning is a task that infers a capacity from information whose class labels are unknown [6]. Machine learning is a rising trend in healthcare that helps medicinal specialists for better investigation, expectation and treatment of people. There exist many machine learning models, every one of which performs prediction in different styles. Selecting a fitting machine learning calculation is a one of major and complex task.

Machine learning is a type of computerized reasoning that learns and identifies new patterns from an enormous measure of information. It permits information scientists and examiners to effectively identify the possible opportunities, and design strategies/techniques to improve customer fulfilment, utilizing relevant information hidden in enormous informational collections. Machine learning is an emerging trend in the health space that helps medical experts for better analysis, prevention, and treatment of people. There exist many machine learning models, each of which formulates prediction in different designs. Picking an appropriate machine learning calculation is a key role because there are numerous to choose from. Machine learning calculations are classified as supervised and unsupervised learning. Supervised learning will be learning from already trained information whose class category is already known. Unsupervised learning categorizes the given information whose class category is unknown by learning the similarities in the given information. Most predominantly used machine learning methods are support vector machine (SVM), Neural Networks, Decision Tree, Bayesian Classifier, k-means clustering, and Logistic Regression. Support vector machine is a classifier utilizing kernel for pattern analysis, ranking crude information, clustering, and classification of information. It creates a model that can arrange a given new dataset to some class utilizing a set of preparing examples. It is a nonparametric supervised learning method suitable for information which has numerous features [7]. Neural networks mirror the functionality of the mind which understands information and comes up with different predictions based on the information. Counterfeit Neural Networks has three layers, for example, input, hidden, and yield layer. The info layer has the crude features, hidden layer has the profoundly connected neurons, and the yield layer has the prediction [8]. The neurons are fine-tuned until we get a fine prediction. It discovers it use in speech and object recognition, natural language processing, and image segmentation. Decision trees is a type of supervised learning which use directed charts to model decision-making by predictive modeling approach. This methodology is to learn the decision tree from a given information. Random Forest is an ensemble of thousands of decision trees widely used in numerous applications. K-means clustering is an unsupervised learning approach that finds unmistakable gatherings in a given information based on their similarities. It works on information whose class labels are not known. In the name, K refers to the number of unmistakable gatherings created. If discovers it use in

different business applications. Logistic regression is from measurements. This machine learning calculation is simple and works best when there is a chance of just two yields and they are exceptionally dependent on explanatory variables. It estimates the probable outcome when given a set of observed variables.

IV. LITERATURE REVIEW

Malav, Anuraj, and Neelu J. Ahuja [9] reviewed a different interventions of machine learning in selected types of teaching learning systems, presented as a descriptive analysis, recommendations emergent from this analysis have been presented. Further the chance of relevance of these systems for supporting learning of individual with disabilities, has been explored and evidentially advocated machine learning calculations hold tremendous potential in terms of enriching the systems, encouraging the learning of people with special needs by giving versatility and adoptive learning experiences learning effectiveness, and this idea has been further extended to a recommendation for people with an incapacity, essentially with the deemed design alternatives.

Khan, Rehman Ullah, Julia Lee Ai Cheng, and Oon Yin Bee [10] proposed such a machine learning based diagnostic and classification system. The system has three components: the diagnostic module is a pre-screening application that can be used by experts, trained users and parents for detecting the side effects of dyslexia. The second module is classification, which classifies the kids into two gatherings, non-dyslexics and dubious for dyslexia. A third module is an analysis instrument for researchers.

El Hammoumi, Oussama, et al [11] this paper centers on outward appearance recognition utilizing convolutional neural networks and its application in e-learning systems, by presenting a new system composed of three principle steps: pre-processing, features extraction and classification.

Chitra, K., and R. Umamaheswari [12] provided a semantically enhanced module-based e-learning for computer science program on a learner centric perspective. The learners are categorized based on their proficiency for giving personalized learning environment to users. Learning disorders on the foundation of e-learning despite everything require loads of research. Therefore, this paper likewise provided a personalized assessment theoretical model for alphabet learning with learning objects for children's who face dyslexia.

Rajapakse, Sampath, et al [13] described results of an evaluation of a prototype mobile application which helps the dyslexic users to deal with their reading difficulties in real life successfully, while they are receiving proper treatments. This prototype can identify the texts around them and read it noisily with the goal that user can understand and will be allowed to customize the chunking, looking over and featuring of words as per their inability levels. By integrating word reference support with the phonic and morphological structure of the word, the user will be able to comprehend troublesome and complex words easily. What's more, the investigation likewise explored the use of a machine learning way to deal with improve the effectiveness of the learning dyslexic complex words.

Hamid, Siti Suhaila Abdul, et al [14] focused on giving the support to help students with dyslexia deal with their trouble through adaptively sense their behavior for engagement perspective. Consequently, we apply machine learning approach that utilizes Bag of Features (BOF) image classification to predict student engagement towards the learning content. The engagement prediction was relatively utilizing frontal face of the 30 students. The writers used Speeded-Up Robust Feature (SURF) key point descriptor and clustered utilizing k-Means method for the codebook in this BOF model. Then, the creators classified the model utilizing 3 types of classifier which are Support Vector Machine (SVM), Naïve Bayes and K-Nearest Neighbours (k-NN) to locate the best classification result.

Rello, Luz, et al [15] seeked to change this through early detection utilizing machine learning models that predict dyslexia by observing how people interact with an etymological computer-based game. The creators designed items of the game taking into account (I) the empirical etymological analysis of the errors that people with dyslexia make, and (ii) specific cognitive skills related to dyslexia: Language Skills, Working Memory, Executive Functions, and Perceptual Processes.

Chu, Hui-Chuan, et al [16] proposed an outward appearance based emotion recognition method with change detection. An emotion elicitation experiment was performed to collect facial-based landmark signals to manufacture classifiers of emotion recognition. The proposed method used sliding window technique and support vector machine (SVM) to construct classifiers to recognize emotions. To determine hearty features for emotion recognition, Information Gain (IG) and Chi-square were used for feature evaluations. The effectiveness of classifiers with different parameters of sliding windows was likewise examined.

Cinquin, Pierre-Antoine, Pascal Guitton, and Hélène Sauzéon [17] The systematic literature review was performed through a four-step process including an exhaustive search of scientific literature databases, the selection of studies through exclusion and consideration criteria, and literature analysis and synthesis.

Cinquin, Pierre-Antoine, Pascal Guitton, and Hélène Sauzéon [18] The research network has worked on recognizing dyslexic from non-dyslexic people by utilizing different machine learning approaches, image processing techniques, design assessment, and assistive apparatuses to

support dyslexia. This survey paper looks at different dimensions of research toward dyslexia.

Elhammoumi, Oussama, et al [19] The point of this paper is to propose a programmed learning style detection that works by the method of children interaction with the system. In this examination, an Artificial Neural Network is used to predict the learning style of children with LDs.

Atkar, Geeta Bhimrao, and J. Priyadarshini [20] makes the process programmed and the system goes about as a personal trainer to the dyslexic children. By doing this model, the children can learn more interactively and will remember the words as the system can show different pictures for the same word. The use of machine learning techniques makes this system more accurate and the system will be trained for speech recognition and phonetics of each alphabet and words in Hindi.

Jothi Prabha, An., and R. Bhargavi [21] a prediction model has been proposed that uses statistical methods to differentiate dyslexics from non-dyslexics utilizing their eye movement. The eye movements are tracked with an eye tracker. Eye movement has numerous features like obsessions, saccades, transients, and mutilations. From the crude information of eye tracker, elevated level features are extracted utilizing Principal Component Analysis. This paper proposed a Particle Swarm Optimization (PSO)-based Hybrid Kernel SVM-PSO for the prediction of dyslexia in people.

Chakraborty, Ms Vani [22] surveyed the papers to understand the work done on the Learning disabilities with Machine Learning. Learning handicap isn't a condition that can be cured. In any case, with the correct identification and help, such children can benefit from outside assistance to identify their potential and they can proceed to make an appropriate career choice for the future. Machine learning is used in wide variety of fields these days to predict the future outcomes. One of the most useful area of machine learning application would be predicting learning handicap in children, identifying the genuine inability and how early it very well may be identified.

Dcruz, Francis, Vijitashw Tiwari, and Mayur Soni [23] aimed of personalized learning is to help students with disabilities. The system includes 4 sections: (I) To predict the learning level of the user. (ii) Generating multimodal learning materials utilizing web mining. (iii) User preferences are associated with the result. (iv) Personalized contents for users delineated with an intelligent interface.

Hamid, Siti Suhaila Abdul, et al. [24] proposed an alternative method to predict student engagement through frontal face detection. The writers applied machine learning approach that utilizes Speed-Up Robust Features (SURF) descriptor to detect key interest purpose of the images and cluster utilizing different codebook sizes. For classification model, we used Support Vector Machine (SVM) with two different kernels and Naïve Bayes.

Rezvani, Z., et al [25] aimed at designing a neurobiologically based classifier to differentiate two gatherings of children, one gathering with and the other gathering without dyslexia in a powerful manner. The writers used EEG resting-state information of 29 dyslexics and 15 run of the mill readers in grade 3, and calculated weighted connectivity matrices for multiple frequency bands utilizing the phase lag index (PLI). From the connectivity matrices, we derived weighted connectivity charts. Several nearby network measures were computed from those diagrams, and 37 False Discovery Rate (FDR) corrected features were selected as contribution to a Support Vector Machine (SVM) and a typical K Nearest Neighbours (KNN) classifier.

Kaisar, Shahriar [26] surveyed analyses recent commitments in detecting dyslexia utilizing machine learning techniques and identify potential opportunities for future research. Researchers have proposed a wide range of techniques to detect developmental dyslexia, which includes game-based techniques, reading and composing tests, facial image capture and analysis, eye tracking, Magnetic reasoning imaging (MRI) and Electroencephalography (EEG) examines.

Chakraborty, Ms Vani, and Meentachi Sundaram [27] studied demonstrated that the earlier dyslexia is recognized and backing is given in education and preparing, the more its negative effects can be alleviated. Subsequently, developing a strong and target screening technique to analyze dyslexia at an early age would be of most extreme significance.

Knoop-van Campen, Carolien AN, Eliane Segers, and Ludo Verhoeven [28] studied both learning process and learning outcomes in students with and without dyslexia can shed light on this issue and helps to see if there are imperatives to the redundancy effect as proposed in the Cognitive Theory of Multimedia Learning. To conclude, adding sound seems to harm the nature of knowledge and leads to less efficient learning over the two gatherings.

Trivedi, Mr Viraj, et al [29] discussed what learning inability means and some of its types and the technique used to determine the severity of the learning incapacity and to extract patterns and evaluate them to overcome the challenges faced by them in their life.

Low, Spencer [30] used resting state functional MRI (rsfMRI) information coupled with multivariate pattern analysis (MVPA) to develop models that predict RD finding in a large populace of children. rsfMRI uses blood oxygen level dependent (BOLD) signs to provide information about functional enactment and connectivity between both nearby and nonlocal mind regions. Through MVPA, specifically support vector machines (SVMs) and

random forest classifiers, patterns of temporal connectivity that differentiate between RD and non-RD children were identified and the precision of the model was calculated.

Usman, Opeyemi Lateef, and Ravie Chandren Muniyandi [31] proposed a methodology for a secure dyslexia biomarkers classification utilizing a deep learning model and the concept of residue number system (RNS). A special modulus set of RNS was used to develop a pixel-bitstream encoder that encrypts the 7-piece twofold value of each pixel present in the preparation and testing mind magnetic resonance imaging (MRI) dataset (neuroimaging dataset) before classification utilizing cascaded deep convolutional neural network (CNN).

Fellman, Daniel, et al [32] The point of the present examination was to examine how singular differences in online activities is related to visuospatial-and verbal WM performance. One aspect vital for all kind of learning that is relatively unstudied about e-learning is working memory (WM), conceptualized as the capacity to keep up and manipulate approaching information before it decays.

Martinez-Murcia, Francisco J., et al [33] The purpose of this work is to check whether these differences exist and how they are related to children's performance in different language and cognitive tasks generally used to detect dyslexia. To this purpose, temporal and spectral inter-channel EEG connectivity was estimated, and a denoising auto encoder (DAE) was trained to learn a low-dimensional representation of the connectivity matrices.

Razzaque, Anjum, and Allam Hamdan [34] discussed literature to investigate what character students' Learning Style (LS) and the Internet of Things (IoT) has on learner expectations, through the outcomes that are learning (LOs) of the students.

Vinutha K.N and K.S.Sampada [35] proposed a Automation Testing for the recommender system, with Feature Vector Algorithm .It performs a automation on each modules of the Feature Vector algorithm and also checks the Cross-Browser compatibility across the browser and also collects the online reviews from by using Web Crawling Technique.

V. CONCULSION

Dyslexia disease indications and characteristics can shift based on the different languages so language-based classification needs to be considered. Several soft figuring methods used have fewer precision levels which can be improved. Numerous cases while utilizing image datasets of the cerebrum for prediction of dyslexia, not all pieces of the mind are analyzed. They analyzed just a specific piece of the mind for dyslexia prediction which isn't efficient, because dyslexia may evolve through a different piece of the cerebrum. Numerous assistive instruments can be designed for helping dyslexics to improve their reading and composing skills. Early and better prediction of dyslexia is likewise a challenging issue. In this work, the different research work on the use of machine learning techniques, image processing, and assistive apparatuses used for the prediction/assistance of dyslexia has been discussed. The greater part of the machine learning calculations used for the prediction of dyslexia focuses just on the few characteristics or side effects of dyslexia. Dyslexia characteristics may fluctuate depending on the language, hence language-based classification needs to be done for better prediction.

REFERENCES

[1] Asteriadis, Stylianos, et al. "Estimation of behavioral user state based on eye gaze and head pose—application in an e-learning environment."*Multimedia Tools and Applications* **41.3, 469-493, 2009.**

[2] Srivastava, Bhavana, and Md Tanwir Uddin Haider. "Personalized assessment model for alphabets learning with learning objects in e-learning environment for dyslexia." *Journal of King Saud University-Computer and Information Sciences*, **2017**.

[3] David, Julie M., and Kannan Balakrishnan. "Machine learning approach for prediction of learning disabilities in school-age children." *International Journal of Computer Applications* **9.11, 7-12, 2010.**

[4] Kroese, Biza Senfert. "Cognitive-behavioural therapy for people with learning disabilities." *Behavioural and Cognitive Psychotherapy* **26.4, 315-322, 1998.**

[5] Polatajko, Helene J., and Noemi Cantin. "Developmental coordination disorder (dyspraxia): an overview of the state of the art." *Seminars in pediatric neurology*. Vol. 12. No. 4. WB Saunders, **2005**.

[6] Cui, Zaixu, et al. "Disrupted white matter connectivity underlying developmental dyslexia: a machine learning approach." *Human brain mapping* **37.4, 1443-1458, 2016.**

[7] Baştanlar, Yalin, and Mustafa Özuysal. "Introduction to machine learning." *miRNomics: MicroRNA Biology and Computational Analysis*. Humana Press, Totowa, NJ, **105-128, 2014.**

[8] Smola, Alex, and S. V. N. Vishwanathan. "Introduction to machine learning." *Cambridge University, UK* 32.34 (2008): **2008**.

[9] Malav, Anuraj, and Neelu J. Ahuja. "Machine Learning Techniques for Effective Facilitation of Teaching and Learning: A Narrative Review." *i-Manager's Journal on Computer Science* **6.2, 42, 2018.**

[10] Khan, Rehman Ullah, Julia Lee Ai Cheng, and Oon Yin Bee. "Machine learning and Dyslexia: Diagnostic and classification system (DCS) for kids with learning disabilities." *International Journal of Engineering & Technology* **7.3.18, 97-100, 2018.**

[11] El Hammoumi, Oussama, et al. "Emotion Recognition in E-learning Systems." *2018 6th International Conference on Multimedia Computing and Systems (ICMCS)*. IEEE, **2018**.

[12] Chitra, K., and R. Umamaheswari. "Semantically Enchanced Personalised Adaptive E- Learning for General and Dyslexia Learners: An Ontology Based Approach." *International Journal of Advanced Networking and Applications* **10.1, 3717-3723, 2018.**

[13] Rajapakse, Sampath, et al. "ALEXZA: A Mobile Application For Dyslexics Utilizing Artificial Intelligence And Machine Learning Concepts."*2018 3rd International Conference on Information Technology Research (ICITR)*. IEEE, **2018**.

[14] Hamid, Siti Suhaila Abdul, et al. "Dyslexia adaptive learning model: student engagement prediction using machine learning

approach." *International Conference on Soft Computing and Data Mining*. Springer, Cham, **2018**.
[15] Rello, Luz, et al. "Screening dyslexia for English using HCI measures and machine learning." *Proceedings of the 2018 international conference on digital health*. **2018**.
[16] Chu, Hui-Chuan, et al. "Facial emotion recognition with transition detection for students with high-functioning autism in adaptive e-learning." *Soft Computing* **22.9 : 2973-2999, 2018**
[17] Cinquin, Pierre-Antoine, Pascal Guitton, and Hélène Sauzéon. "Online e-learning and cognitive disabilities: A systematic review." *Computers & Education* **130: 152-167, 2019.**
[18] Elhammoumi, Oussama, et al. "The Use of NN to Detect Learning Styles of Children with Learning Disabilities in E-Learning System."*International Conference on Advanced Intelligent Systems for Sustainable Development*. Springer, Cham, **2019**.
[19] Atkar, Geeta Bhimrao, and J. Priyadarshini. "Enhancing Readability of Dyslexic Children by Machine Learning Techniques—A Survey." *Proceedings of the Third International Conference on Microelectronics, Computing and Communication Systems*. Springer, Singapore, **2019**.
[20] Jothi Prabha, A. and R. Bhargavi. "Prediction of dyslexia from eye movements using machine learning."*IETE Journal of Research* (): **1-10, 2019**
[21] Chakraborty, Ms Vani. "A SURVEY PAPER ON LEARNING DISABILITY PREDICTION USING MACHINE LEARNING.", International Journal of Information and Computing Science, **Volume 6, Issue 5, pp. 481-485. May 2019.**
[22] Dcruz, Francis, Vijitashw Tiwari, and Mayur Soni. "Using Machine Learning to Help Students with Learning Disabilities Learn."*International Conference on Sustainable Communication Networks and Application*. Springer, Cham, **2019**.
[23] Hamid, Siti Suhaila Abdul, et al. "Engagement Prediction in the Adaptive Learning Model for Students with Dyslexia." *Proceedings of the 4th International Conference on Human-Computer Interaction and User Experience in Indonesia, CHIuXiD'18*. **2018**.
[24] Rezvani, Z., et al. "Machine learning Classification of Dyslexic Children based on EEG Local Network Features." *bioRxiv* **: 569996, 2019.**
[25] Mehigan, T., and I. Pitt. "ENGAGING LEARNERS THROUGH EMOTION IN ARTIFICIALLY INTELLIGENT ENVIRONMENTS." *Proceedings ofEDULEARN19 Conference 1st-3rd Palma, Mallorca, Spain,* ***pp. 5661-5668. July 2019,***
[26] Kaisar, Shahriar. "Developmental dyslexia detection using machine learning techniques: A survey." *ICT Express*, **2020**.
[27] Chakraborty, Ms Vani, and Meentachi Sundaram. "Machine learning algorithms for prediction of dyslexia using eye movement." *Journal of Physics: Conference Series*. Vol. 1427. No. 1. IOP Publishing, **2020**.
[28] Knoop-van Campen, Carolien AN, Eliane Segers, and Ludo Verhoeven. "Effects of audio support on multimedia learning processes and outcomes in students with dyslexia." *Computers & Education* **150: 103858, 2020**
[29] Trivedi, Mr Viraj, et al. "Detecting the Severity and the Type of Learning Disability with Pattern Extraction Using Machine Learning." *dyslexia* 16: 18.
[30] Low, Spencer. "Applying Machine Learning to Neuroimaging Data to Identify Predictive Models of Reading Disorder (RD)." **2020**.
[31] Usman, Opeyemi Lateef, and Ravie Chandren Muniyandi. "CryptoDL: Predicting Dyslexia Biomarkers from Encrypted Neuroimaging Dataset Using Energy-Efficient Residue Number System and Deep Convolutional Neural Network." *Symmetry* **12.5: 836, 2020.**
[32] Fellman, Daniel, et al. "Predicting visuospatial and verbal working memory by individual differences in e-learning activities."*Frontiers in Education*. **Vol. 5.** Frontiers**, 2020.**
[33] Martinez-Murcia, Francisco J., et al. "EEG Connectivity Analysis Using Denoising Autoencoders for the Detection of Dyslexia." *International Journal of Neural Systems***: 2050037, 2020.**
[34] Razzaque, Anjum, and Allam Hamdan. "*Internet of things for Learning Styles and Learning Outcomes Improve e-Learning: A Review of Literature*." Joint European-US Workshop on Applications of Invariance in Computer Vision. Springer, Cham, **2020.**
[35] Vinutha K.N and K.S.Sampada "*Survey of Automated Recommender System for Web Application",s* International Journal of Computer Science and Engineering Vol.**4** , Issue **3**, pp. **36-39 , 2016.**

AUTHORS PROFILE

Mrs.V.Kala is working as an Assistant Professor in Department of Computer Science at K. P National College of arts and science, Batlagundu, Tamilnadu.
Email: kalamurali.p@gmail.com

Dr.S.Vimala , Associate Professor, Department of Computer Science, Mother Teresa Women's University, Kodaikanal, Tamil Nadu. She was a Liaison Officer for the Search Committee for the Appointment of Vice –Chancellor during Feb 2019. NMEICT Nodal Officer. Coordinator, Incubation and Technology Transfer Centre (ITCC). Coordinator, Internal Quality Assurance Cell (IQAC).
Email: vimalaharini@gmail.com

