Implementation of Machine Learning Based Google Teachable Machine in Early Childhood Education

P. Yogendra Prasad¹ Assistant Professor, Department of CSSE, SreeVidyanikethan Engineering College(Autonomous) Tirupati, AP, India. yogendraprasadp@gmail.com Dr. Dumpa Prasad² Professor, Department of ECE, Sasi Institute of Technology & Engineering, Tadepalligudem, West Godavari dprasad@sasi.ac.in

Dr.D Naga Malleswari³

Associate Professor, Department of CSE Koneru Lakshmaiah Education Foundation, Vaddeswaram,Guntur, Andhra Pradesh, India nagamalleswary@kluniversity.in

Monali N. Shetty⁴

Assistant professor Computer Science Engineering Department Fr. Conceicao Rodrigues College of engineering, Mumbai, India shettymonalin@gmail.com

Dr Neha Gupta⁵

Assistant Professor, Department of CSIT, Symbiosis University of Applied Sciences, Indore, India. drnehagupta.indore@gmail.com

Abstract:

Modern education relies heavily on educational technology, which provides students with unique learning experiences and enhances their ability to learn. The use of technology in education has been around for a long time. However, compared to other educational levels, the incorporation of digital learning in early education is a much more recent trend. As a result, there is a pressing need to design, implement and study particular methods and resources for the education of young children. These days, AI and ML are two of the most promising areas of application in the world of Information Technology, where the potential application breadth is virtually limitless Researchers and scientists are currently particularly interested in the applying machine learning in education, and this is the primary emphasis of our work. Using AI and machine learning (ML) in the classroom is the focus of this study. An easy-to-use yet set of tools for classification jobs is provided by Google Teachable Machines, powered by convolution neural network (cnn. Even low-end mobile devices can run the taught machine learning models, and the applications can be used even with these devices.

Keywords: Machine Learning, Artificial Intelligence, Primary School, Neural Networks

1. Introduction:

Alan Turing is regarded as one of the pioneers of artificial intelligence research (AI). [1] He came up with the idea of using the Turing test to determine whether or not a machine is intelligent. When a machine can converse with a person without the human recognizing that they are conversing with a machine, the machine is said to be intelligent by Turing.

Methods of artificial intelligence (AI) have been used in a wide range of fields. The field of educational technology is one in which AI could be useful. However, Artificial Intelligence has been used in instructional technologies for many years. The word "educational technology" covers a wide range of topics. For example, it entails the use of technical resources and procedures in an academic setting to meet specific educational requirements When it comes to educational technology, it tends to focus on the most up-to-date tools without neglecting the more valuable older ones. The primary goal is to offer students and teachers advantages over traditional techniques. It might be difficult

to integrate technology in education into a classroom setting. When integrating new students, it is important to take into account the unique challenges faced by each class. It is possible that technology can be used to solve specific educational issues or to provide the framework for activities that would not have been possible without technology. [2].

Educational technology can be used for a variety of reasons [2]. Students may be motivated to learn when their attention is drawn and that they are designed to participate in creative activities through educational technology. Using technology, distinctive aspects such as media interaction and visualization of the problem solving process can be included into the educational environment. Collaborative learning and constructivist pedagogies can also benefit from the use of technology. Students learn about the resources and principles they'll need as citizens of the Information Age thanks to educational technology. It's also possible that new technologies may allow schools to engage with their local populations.

The use of computers in education has grown in importance throughout the years. As a tool that may be utilized by teachers and students, computers have been in the classroom since the 1950s. It is common, however, for educational technology to utilize resources other than computers in order to take advantage of the unique features and benefits that are provided from each type of resource. Especially in the early years of schooling, this is true. In addition to computers, whiteboards and programmed toys are common educational technology tools in the early years. Early childhood schooling may soon see a rise in the use of video game consoles and robots.

The purpose of training is to teach computers to solve problems by learning from examples or previous experience [3]. Self-driving cars could soon be a reality thanks to advances in machine learning. Deep learning can be used in a variety of sectors, including schooling, machine vision, informatics, and language processing.

The machine learning in teaching is the subject of this research. Every day, education undergoes a radical transformation. Classrooms aren't only a place where students sit and stare at their notebooks while a teacher gives a lecture anymore. Classrooms in the modern era are embracing digital resources and investing in artificial intelligence (AI). In schooling, for example, deep learning could be used to support teachers, forecast student performance, assess students, and so on[22-25].

Aside from electronic payment, communication, and travel, artificial intelligence is also being employed in education. Due to its relatively short history, many teachers still see artificial intelligence as a mysterious high-end technology. It is exactly because teachers' conceptions differ from one other that artificial intelligence technology in education is difficult to market. In the truest sense of the word, true artificially intelligent education technology is much like Internet multimedia. Internet applications and platforms are used to help instructors with a variety of duties. When compared to other methods of teaching, it is able to process teaching information, therefore enhancing the quality of classroom instruction. Because most preschool teachers have not had access to professional training in artificial intelligence, they are generally suspicious of the technology. It will also be misunderstood by children because of their teachers' psychology.

Teaching materials and methods for teaching artificial intelligence are lacking. Although several preschool school systems have begun to use artificial intelligence due to education, there are only a few early care and education facilities that can use it, according to a significant number of instructional cases China's first-tier and coastal cities are home to the majority of them. In addition, while some coastal pre-schools employ artificial intelligence technology to teach, many academic institutions never use artificially intelligent teaching resources. Education in artificial intelligence can only be theoretical, and it is hard to achieve significant benefits in the classroom. Due to a lack of teaching expertise among preschool teachers who previously had no access to artificial intelligence teaching technologies, completing the arrangements can be challenging. Strong influence are also challenging to increase in quality.

Educators are turning to artificial intelligence (AI) to improve the learning environment for their students. Preschool quality can only be improved if the teaching environment is conducive to learning. As a result, teachers must first establish a positive learning environment in order to boost student engagement, as well as the quality and effectiveness of their instruction. Small activities and exchanges are common in traditional preschool classrooms to get kids interested and involved. The use of games, however, is limited in terms of its ability to engage the atmosphere and pique children's interest. For a long period of time, students' interest will wane if professors employ the same activation paradigm. Teachers, on the other hand, can use artificial intelligence to create a positive learning environment for students. When it comes to teaching music to young students, the application of artificial intelligence can be a powerful tool. Figure 1 illustrates this. Some preschools have started using artificial intelligence speech robots.



Figure 1:Artificial intelligence Teaching Robot

2. Machine learning and its application in education area:

It is possible to include machine learning as a component of machine learning. Allowing a computer or model to access data and allow it learn on its own is at the heart of machine learning. Arthur Samuel had the bright concept in 1959 that computers may learn under their own rather than requiring us to educate them. It is now a formal definition for computers to be capable of self-learning that he invented the phrase "machine learning." [4][13][15]. Machine learning is the practice of training computers to learn from their own past experiences [5][16]. In order to apply a machine learning algorithm, we must create a model that, given the input data we've provided, produces accurate results. In a sense, a model is like a black box: input enters at one end and data exits at the other, but the processes that occur in between are extremely intricate. As an example, if we want a model that predicts a region's house price in the future, we'd feed it data such as property prices on the market in the past three years, interest rates, and pay rates. " The final product would be a forecast for the upcoming year's price of a home. "Model training" refers to the procedure by which a model develops the ability to interpret input data. Machine learning relies heavily on the concept of training.Investigate how machine learning is now being used by individuals and businesses to better comprehend its potential. Here are some instances:

- Natural language processing: Google Translate's ml algorithms employ user input, such as new phrases and syntax, to continuously improve the service. In order to identify speech and synthesis words that they've never heard before, Siri, Amazon, Microsoft, and also most recently, Google use natural language processing.
- Recommendation systems: Everything that Netflix, Google, Youtube, etc. recommends to you is based on your search history. A wide range of devices and apps are supported by these websites. Our online experiences are vastly improved by the use of automated systems that connect buyers and sellers, and online download with users who want to see it. What and when you buy may now be predicted with high precision thanks to algorithms in place by Amazon. A patent for "anticipatory shipping," a mechanism that enables you to purchase and acquire your product on the same day, is owned by the corporation.
- Algorithmic trading: An algorithmic trading system entails unpredictable behavior, dynamic data, and a wide range of variables. In contrast, machine learning algorithms are able to foresee all of that behavior and adapt to market developments considerably more quickly than a human.

Other firms are utilizing machine learning in various ways, and many of them are in the educational sector [6][14]. Included in this list are:

- Predicting Student Success Using machine learning to make predictions about student performance is a fantastic use of this technology. The computer vision model can learn about each student and identify flaws and provide initiatives to maximize, such as further lectures or additional reading[7][17][18].
- Students are put to the test and graded. Fairly Computerized adaptive evaluations can benefit from machine learning [8][20]. As a result of using machine learning to conduct assessments, educators and students alike can receive on-going feedback about how pupils are progressing toward their learning objectives, as well as the assistance they require. [9][21].

- Retaining Employees The use of learning analytics, a type of machine learning, can also aid in increasing student retention. School administrators can identify "at risk" pupils and provide them with the support they need to succeed. [10][19].
- Provide assistance to educators and institutions Students' handwritten assessment papers can be classified using methods based on machine learning. [11].

3.GOOGLE TEACHABLE MACHINE:

Machine learning systems like convolutional neural networks (CNNs) are used in Google Teachable Machine (GTM), an internet machine learning system (CNN). Predictive models can be trained in three different ways using GTM at the time of this writing. Using the Photographs tool (Figure 2), users can either upload their own images directly to the GTM ecosystem or take screenshots using a webcam connected to their computer. Similar to the first tool, the second can be used to identify distinct Poses . The Voices tool is designed to help you identify sounds. In order to train a model to recognise different types of sounds, such as distinct voices or musical instruments, users can make use of this technology. The goal of the GTM is to teach students, teachers, manufacturers, and enthusiasts with no prior knowledge of machine learning (ML) the fundamentals of ML applications. Children were to be seen as designers and creators of their own education through a meta-design pedagogy that incorporated new technologies and pedagogical procedures.

ML training is partially exposed, and powerful classification algorithms are combined with an intuitive and simpleto-learn graphical user interface to make this tool even more user-friendly. We ran a series of co-design sessions with sixth graders to see if GTM might be used to teach ML ideas in a secondary school context. ML principles were introduced to the students throughout the sessions, and they were given full rein to create their unique MLpowered applications using GTM.

A. Research participants and context

Thirty-four students aged 5 to 6 from an intermediate school in the city of kolkata, India, participated in the study. Three workshops were held over the course of two weeks as part of the ML project. It is important to note that the Finnish national core curriculum places a strong emphasis on the development of transverse (generic) capabilities and project-based studies [12].

B. Data collection and analysis

Children's group discussions; design suggestions; co-designed applications; and reflection interviews at the completion of the project were all included in the data collection process. Taped conversations and interviews have been transcribed for research purposes. Qualitative content analysis was used to identify students' ideas and how they progressed during the co-design and learning process. Data gathering was integrated into workshop activities as part of a design-oriented strategy to help students magnify their changing ideas and views about machine learning.



Figure 2: Google Teachable Machine

4.Results:

As a result of machine learning-based assessments, teachers, students, and parents are constantly informed of the student's progress toward their educational goals. Study [20] authors developed a technique for teaching students how they can generate proper arguments in predicate or predicate logic. Aside from more conventional approaches like PowerPoint and exercises, they employed animations based on carefully chosen cases and their step-by-step solutions to demonstrate concepts. They devised a questionnaire that outlined the complete process of constructing a logic proof. Afterwards, the student responded to questions from the survey. They explained the questionnaire's design and examined its pros and disadvantages. Finally, they used frequent subgraph mining and unsupervised machine learning techniques to automatically evaluate the accuracy of the proofs.

Machine learning has the potential to forecast student achievement, which is a big advantage. Learning about each student allows the system to detect strengths and shortcomings and recommend more practice exams, for instance. As we mentioned earlier, this appears to be a hot research topic; there have been numerous studies in this field in recent years.

The computation complexity and absence of delay of GTM-trained models were the most startling results from of the GTM-based web apps. The majority of students are using their own mobile phones to test and experiment with their apps, but most of those phones were not the most modern and capable models. 'In general, the models' forecast accuracy was low. Only one group, which developed a fruit and mushroom detecting app, was happy with the accuracy of the forecast. Predictions from sound recognition software were dismal. Noise in the background was viewed as particularly difficult for making predictions. It's possible that more time and more diverse training data would have been needed to improve prediction accuracy. Google Learning Machine is a viable and mature tool for users with low or no prior knowledge in programming or related areas, according to our findings from the workshops and qualitative study.

A look at GTM's Prediction Accuracy based on the number of students who have used it, and the findings are as follows:

Number of students	Prediction Accuracy (%)	
10	98.6	
20	97.5	
30	96.4	
40	96.1	
50	95.7	
60	95.4	
70	95.1	
80	94.9	
90	94.3	
100	94.2	
Average	95.82	

TADIE 1.1 FEUICION ACCULACY OF CEL VI	Table	1:Prediction	Accuracy	of GTM
---------------------------------------	-------	--------------	----------	--------



Figure3:Evaluation of Prediction Accuracy

The GTM's Prediction Accuracy is shown in the graphs above. Despite the fact that a number of students using GTM has expanded at an exponential rate, the results reveal that it is extremely efficient. According to the data, the Prediction Accuracy is 95.72%.

Conclusion:

Overall, AI and machine learning (ML) teaching technology is critical to raising the standard of basic education. The use of artificial intelligence in education extends beyond the early years of childhood. Teachers of young children can employ AI and machine learning (ML) technology to enhance the learning environment in the classroom and make learning more enjoyable for the youngsters. GTM student-trained models can be integrated into lightweight and cellphone web apps that even older mobile phones can execute if the training samples are maintained to a reasonable size. Learned concepts like training set, pre-diction accuracy and class label are important for students to understand however these theoretical issues have been supplemented with practical experience about how to train an algorithm, which software to use and the building of complex practical uses to solve complex real-world issues.

References:

- 1. Turing AM (1950) Computing machinery and intelligence. Mind 59:433–460.
- 2. Roblyer MD, Doering AH (2009) Integrating educational technology into teaching, 5th Edition. Allyn & Bacon, Boston.
- 3. Alpaydin, E. (2009). Introduction to machine learning. MIT press.
- 4. Samuel, A.L. (1959) Some Studies in Machine Learning Using the Game of Checkers, IBM Journal of Research and Development, vol. 3, no. 3, pp. 210-229, doi: 10.1147/rd.33.0210
- Kitchenham. B.A., Charters,S. (2007) Guidelines for performing Systematic Literature Reviews in Software Engineering. Version 2.3, EBSE Technical Report EBSE-2007-01, Keele University, Keele, Staffordshire, United Kingdom.
- 6. https://www.thetechedvocate.org/8-ways-machine-learning-will-improve-education, (2018), Accessed on: 2018-09-25
- 7. Anozie, N., Junker, B. W. (2006, July). Predicting end-of-year accountability assessment scores from monthly student records in an online tutoring system. Educational Data Mining: Papers from the AAAI Workshop. Menlo Park, CA: AAAI Press.
- 8. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence unleashed: An argument for AI in education.

- 9. Natarajan, V. Anantha, Ms Macha Babitha, and M. Sunil Kumar. "Detection of disease in tomato plant using Deep Learning Techniques." *International Journal of Modern Agriculture* 9.4 (2020): 525-540.
- 10. Kumar, M. Sunil, and D. Harshitha. "Process innovation methods on business process reengineering." Int. J. Innov. Technol. Explor. Eng (2019).
- Sreedhar, B., BE, M. S., & Kumar, M. S. (2020, October). A comparative study of melanoma skin cancer detection in traditional and current image processing techniques. In 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC) (pp. 654-658). IEEE.
- 12. Ganesh, Davanam, T. Pavan Kumar, and M. Sunil Kumar. "A Dynamic and adaptive learning mechanism to reduce cross layer attacks in cognitve networks." Materials Today: Proceedings (2020).
- 13. Ganesh, Davanam, Thummala Pavan Kumar, and Malchi Sunil Kumar. "Optimised Levenshtein centroid cross-layer defence for multi-hop cognitive radio networks." IET Communications 15, no. 2 (2021): 245-256.
- 14. Balaji, K., P. Sai Kiran, and M. Sunil Kumar. "Resource Aware Virtual Machine Placement in IaaS Cloud using Bio-Inspired Firefly Algorithm." Journal of Green Engineering 10 (2020): 9315-9327.
- 15. Davanam, G., Pavan Kumar, T., & Sunil Kumar, M. (2021). Novel Defense Framework for Cross-layer Attacks in Cognitive Radio Networks. In International Conference on Intelligent and Smart Computing in Data Analytics (pp. 23-33). Springer, Singapore.
- 16. Kumar, M. S., & Harika, A. (2020). Extraction and classification of Non-Functional Requirements from Text Files: A Supervised Learning Approach. PSYCHOLOGY AND EDUCATION, 57(9), 4120-4123.
- 17. Dhruva, Anantha Datta, B. Prasad, Sujatha Kamepalli, and Subramanyam Kunisetti. "An efficient mechanism using IoT and wireless communication for smart farming." Materials Today: Proceedings (2021).
- 18. Ganesh, Mr D., M. Tech, M. Sunil Kumar, and VV Rama Prasad. "IMPROVING NETWORK PERFORMANCE IN WIRELESS SENSOR NETWORKS." (2016).
- 19. Kumar, M. S., and A. Ramamohanreddy. "A survey on user-interface architectures and ADLs." (2012): 229-232.
- 20. Balaji, K., P. Sai Kiran, and M. Sunil Kumar. "Power aware virtual machine placement in IaaS cloud using discrete firefly algorithm." Applied Nanoscience (2022): 1-9.
- M. S Kumar V. Anantha Natarajan, Macha Babitha, D. Ganesh, "Machine Learning Based Identification of Covid-19 From Lung Segmented CT Images Using Radiomics Features", Biosc.Biotech.Res.Comm. Special Issue Vol 14 No 07 pp 350-355
- 22. El-Alfy, E. S. M., & Abdel-Aal, R. E. (2008). Construction and analysis of educational tests using abductive machine learning. Computers & Education, 51(1), 1-16.
- 23. Dambić, G., Krajcar, M. & Bele, D. (2016). Machine learning model for early detection of higher education students that need additional attention in introductory programming courses. International Journal of Digital Technology & Economy, 1 (1), 1-11
- Celar, S., Stojkic, Z., Seremet, Z., Marusic, Z., & Zelenika, D. (2015). Classification of Test Documents Based on Handwritten Student ID's Characteristics. Annals of DAAAM and Proceedings of DAAAM Symposium. 2014. ISBN 978-3-901509-99-5., 782-790.
- 25. L. Mannila, "Digitally competent schools: teacher expectations when introducing digital competence in finnish basic education," in Seminar. net, vol. 14, no. 2, 2018, pp. 201–215.