A Review on Artificial Intelligence in Education for Learning Disabled Children

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ABSTRACT
"Science & technology has played an crucial role in day-to-day life, whether it be a personal life or educational. Computers has made every one life easy, where doing work in faster way. Involvement of Artificial Intelligence (AI) in today's technology has created an impact. Where AI is getting added in various field. Many research is going on AI which helps new technologies to do automation process. AI also has created an impact in education. It helps both students & teachers by creating an environment related to study. Using AI, teachers as well as students can get most out of AI, as they can learn more & make use out of it."
 Keywords: Artificial Intelligence, AI, Teachers, Students, Learning Disabilities, Disabilities, Computers, Education

1. Introduction

A.I. has made an impact in many areas including education, where A.I. with the help machine gives an additional advantage to education.

Many issues that come under AI While in research are natural language, understanding knowledge, representation planning, expert system & learning. A link between A.I. & education helps students with learning disabilities which needs some tools & methods to get good feedback. These tools can be used in school, home as well as parents. To understand this we will broadly classify in to two categories [4]. First section introduce applications to find learning disabilities and second section includes intervention based tools. A.I. can be use in education through learning program, games and software. The education system has treated all students same, where as A.I. has made some customize in learning for students depend on its strength & weaknesses.

1.1. Identifying Learning Disabilities

Identifying weaknesses of children in many areas & finding proper solution to the problem is very difficult. However diagnosing various L.D. needs understanding of scholar research and finding personal interactions of patient. While this process may take more time. As not all people are comfortable in saying or expressing their sign to researcher. A lot of systems were developed and used, as expert performance is much better in identifying L.D [2].

Artificial neural network (ANN) and Support vector machine (SVM) is mostly used in AI with respect to L.D. As they both have never been used in any L.D. children. As SVN was consistent whereas ANN was having proper results. One can easily get detailed of knowledge using gaming technologies. So once problem is identified by system. We can improve child's interaction with family. [2]

1.2. Intervention based tools

Cognitive Science studies play a crucial role in L.D. Studies with the help of external hardware such as sensors etc. Many universities helps in giving feedback so that we can get improvements. Where in universities teachers as well as students can have base knowledge and understanding tools made for disability students. Disabilities in kids are intellectual, physical and visual/hearing areas.

2. Literature Review

The method of learning A.I. in diagnosing L.D. was an issue. There were many other issues found between both boys and girls related to its symptoms and nature. Georgopoulos in 2003, represented a map called fuzzy cognitive by using a symbolic representation as a description & modeling of complex systems. As this tool is specialist in diagnosing of SLI in dyslexia and autism. Where SLI is hard to understand. [1]

In 2004 Rebolledo-Mendez and freitas presented Neurosky Mindset (MS) which helps to combine performance data with user generated data. It contains a headset with 3 electrodes, which is placed below ears and on forehead. In

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neurosky's algorithm electric signal's fetch above location's to gain attention. So work of A.I. here is to pose questions and have conversation with users. As this tool is easy to use, with a low-cost and in a non-clinical way. As this model was tested on various undergraduated students and a positive results has outcome. [1]

Arthi and Tamilarasi (2008) came up with a model, which uses Artificial Neural Networks (ANN) technique to diagnose autism in children. Where model work is to convert original data into suitable fuzzy member value and input from these goes in neural network architecture. So an algorithm is developed for predicting autistic disorder. As this algorithm support for medical practitioners, psychologists and special educators. [1]

Hernàndez in 2009 introduced SEDA (Sistema Experto de Dificultades para el Aprendizaje' or 'Expert System for Learning Difficulties' in English) made a diagnose tool for L.D. in children basic education, which is made using expert systems which make use of identifying the relationships between variables (e.g. age, gender and in education system) and output systems to pyschometer. As Expert systems is better rated systems which provides 80% better results. [1]

Jain in 2009 made a model called a Perceptron based Learning Disability Detector (PLEDDOR) is an ANN identifying problem in dyslexia (Reading), Writing (dysgraphia) and mathematics (dyscalculia) by expert people. While this tool consists of single input and output layer, with 11 units & tested on at least 240 children from various schools & hospitals in India. [1]

Kohli in 2010 made an approach for identifying reading (dyslexia) at a crucial stage by using ANN. As it was different from other because it is build on test data, getting evaluation results. As it is different from other because it is based on test data covering dyslexic children in between 2003-2007. Where output data comes in two categories (dyslexic and non-dyslexic). While the results came out was fairly accurate and better. [1]

Anuradha in 2010 developed a system which was more accurate and can take less time in diagnosing disorder called as ADHD (Attention Deficit Hyperactivity Disorder). While she used an A.I. algorithm called as Support vector machines (SVM) algorithm. As SVM is best for classification and regression. This Data-set was verified by doctor which contained many questionnaire using SVM module. This method was well tested on children between 6 to 11 years old and results gain a percentage of 88.67% success in getting diagnose. [1]

3. Methodology
3.1 Expert System in Artificial Intelligence
Expert system helps in decision-making as human-expert. As it is designed to solve complex problems. It is mainly focus on problem of one domain such as: medicine, science, engineering, etc. Where knowledge of expert is also known as knowledge base. Here system is much tested and loaded which makes it experience. As expert systems knowledge help in adding knowledge to the rules. As more experience gets in to expert system, performance gets improve.

An expert system helps new comer, or less experience people in problem solving which helps to designed & assist. It does not have human capabilities, as it use knowledge of particular domain, & bring out facts particular situation in hand.

It also contains a heuristic knowledge which is used by human expert in the domain.

3.1.1 Characteristics of Expert Systems
Classification – Finding an object stated on characteristics
Diagnosis Systems – Conclude disease from data.
Monitoring – Comparing data from original behavior.
Process Control – Control a process that is based on while monitoring data.
Scheduling & Planning – Making or changing in action plan.
Generation of Options – Getting another solution to a problem

3.2 Use of Robots and Humanoids
Latest study shows that while comparing both disability and normal child, normal child shows better results then the child with disability when we use humanoids during interaction with AI same regions of brain were activated in normal child. Child with disability cannot see difference between AI & Human agent. While comparing both AI & human agents, AI proved to be better emotionally stable. [1]
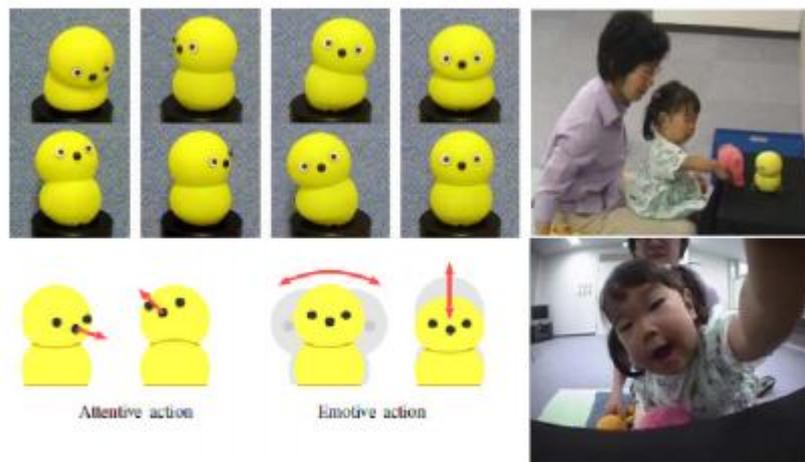
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Figure 3.1 Keepon movement examples(left) and pitures with interaction with the child (right) [2]

A well designed robot keep on providing two modes:
Automatic Modes & Manual Modes
Where in automatic modes there is face detection, location, color & movement, where as in manual mode it contains human operator robot. While in social interactions & facial expressions it uses robots, pictures & DVDs as primary technique.
An Italian researchers, made an humanoid robot for FACE(Facial Automation for Conveying Emotions) detection, where researchers has to say picture & dvd therapies provide effective way in some scenarios. While face is more better leaning tool for disability kids & adults.
Face is made with six basic facial expressions & can be controlled by algorithm or an operator. So all the expressions here is observed & gets recorded. It is based on neural approach, which is much better than human therapist, as it can easily captured all process & data & this has been successfully tested on disable students. As cost of robots are so high so author has made an affordable for home use
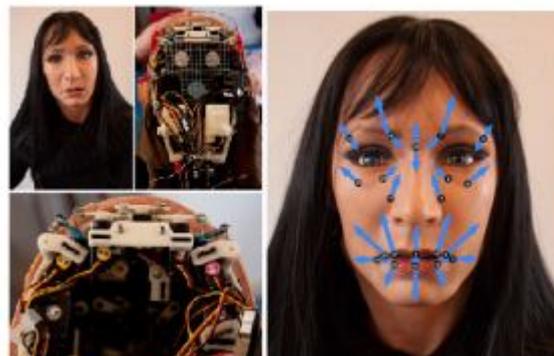

Figure 3.2 Face humanoid developed made by Italian researchers [Source https://www.faceteam.it] [2]

Authors had made a prototype called PABI (Penguin for Autism Behavioural Intervention). Which looks like cartoonish. It has two modes:

9. Interact with child independently
10. Interact with child through guidance of therapist.

3.3 Use of Virtual Characters
A team of developers from Portuguese developed an expert system game called LIFEisGAME. It is an interactive game for disability children which uses facial expressions for interactions. This game is based on mainly on four main activities: Recognize facial expression, build facial expression, play with avatar and identifying perfect facial expression in real life. All these activities are represented in sequential manner, where a small camera is use for onitoring and analyze student expressions. This game creates high interest in disabled children. This game even has some limitations and it needs more customizations features sounds etc. [2]

4. Analysis & Research Finding

Predicting students with L.D. is very difficult, and research has not been yet to that mark. Geiman & Nolte in 1990 and Hofmeister & ferrara in 1986 made a success in identifying students with L.D. As per the National health interview survey atleast 8% of children have L.D. [3]

SEC (Special Education Centres) has reported that there are large number people who have speech impairments in Czech Republic. Thus they divided those groups in to two parts. First part contains people with single kind of disabilities which contains disabilities such as speech, hearing, asd etc). Where four centres has given to only single disability. The second part consists of many disabilities. Even person without disability has given tiny part of client's centres, & they just get screening services only. [2]

While in the survey, mostly people shows up with low disability. There are high range of people with speech impairments at the east part of country. [2]
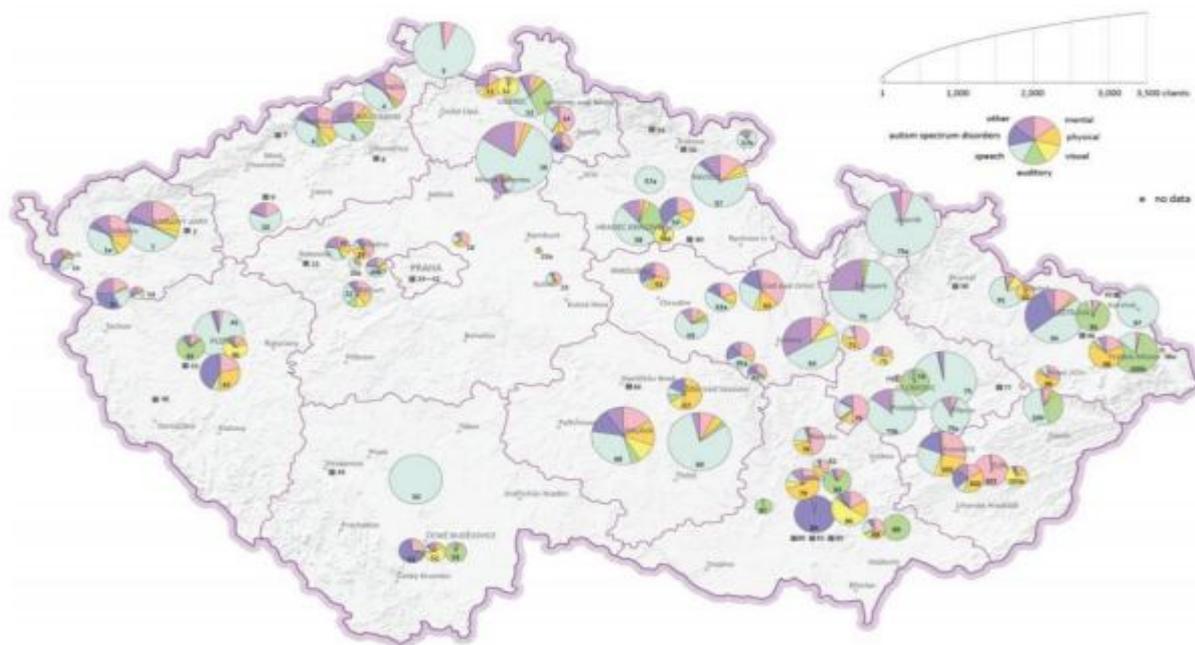

Figure. 4.1. Clients of SECs according to their disabilities [Source adapted from [4]]

5.Future Enhancement

AI can easily cover future of education. As most of students are comfortable with Digital technology. Making there digital knowledge better in school, can help in exploring more content in digital technology. In future there can be more games develop for Disabled students which can help students with L.D. to interact more. As with the help of A.I., people can improve their life, with a better results. Even voice assistant & smart speakers such as google, amazon etc. can help students with L.D. Many other tools such as text-to-speech and speech-to-text can make a vital role in disability students, as they can convey their part to other people

6. Conclusions

AI has many techniques which help in solving various problem related to every field & even in education too. AI which is broadly used in every field, has helped in getting out of those sever problems and finding a better solution. AI can be easily help in assisting teachers as well as students, to gain or to learn new knowledge. AI has a huge contribution when it's related to disabilities students, getting valid and correct data. But still AI technologies are not so 100% accurate and perfect when it comes related to diagnosing, still a further study are being done in AI technologies. Even research done on AI has given a positive feedback and still we can expect more from AI.

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