An expert system to diagnose Learning Disabilities in children

Description of the proposed project

Learning disorder is difficulty with learning despite having normal intelligence [1].It is a neurobiological disorder that disturbs the ability to think and remember of the brain [6]. People with learning disabilities usually have problems in processing speed, working memory, sequencing, auditory, visual perception, speaking language and motor skills [5].Learning disabilities cannot be cured completely [7].But alternative teaching ways and treatments are available to reduce the impact of the disabilities[5]. Some young people with learning disabilities can still reach university level while some people ended with minimal education [3]. So it is important to identify learning disability in children as early as possible because the way to teach children with disabilities is different from the normal children [5].The main objective of this expert system is to give the reliable results of diagnosing learning disabilities based on the inputs of the end users. Jayaram and Shilpa [8] developed a similar expert system to diagnose the learning abilities. They acquired the required knowledge from the human experts and the textbooks and created a knowledge base and formed a knowledge net from it and used a forward chaining rule-based for inference engine. But there was no method or ways to evaluate their expert system was described.

Dyslexia is defined as the problem with reading [4]. It's a combination of "dy" which means the difficulty or not and "slexia" which means words [2]. So it means the problem with word .The common symptoms are difficulties in reading aloud and spelling [3].

Dysgraphia is defined as the problem with writing [8]. It also shows difficulties transcription skill such as spelling, presenting thought on paper and bad handwriting [9]. The common symptom for dysgraphia is messy handwriting [10].

Dyscalculia is defined as the problem with arithmetical skill. The people with dyscalculia have problem in understanding the concepts of number, remembering arithmetic facts, calculation, reasoning of math and procedures [11].

Dyspraxia is defined as the difficulties with motor learning. The people with Dyspraxia have problem in judgment, coordination and cognitive skills as well as the immunity and nervous system of the body [10].

Possible AI Methods and Tools

The main objective of the expert system to diagnose the learning disabilities in children .The method to implement this diagnosis expert system is the backward chaining rule-based expert system using the 'e2gRuleEngine' system shell because it uses rule and prompt system to get the heuristics that is required. The rules will be obtained from various resources such as the book and human experts like psychiatrist from the related fields and are stored in the knowledge base. Backward chaining will be performed in the interfere engine. The learning disabilities and the set

of conditions that caused that learning disabilities is once identified , they will be stored as conditions in IF statement for the learning disability to occur. For example,

Learning Disability: Dyslexia		
Conditions:	Having difficulty in reading	AND
	Having difficulty in decoding single word	AND
	Having problem in reading aloud	AND
	Having confusion in reading q-p, d-b, b-d	AND
	Having spelling difficulties	AND
	Skipping the sentences sometimes or often when reading	AND
	Feeling exhausted after reading a few sentences	

User Interface: The user interface will be very simple. The user will be posed with questions relating to the symptoms of the disabilities and the answer will be in "Yes" or "No" form. The suggestion about the symptoms or questions relating to the disabilities will be in the tip form for the users. The system will use the inputs provided by the parents or teachers about the manners of the child they observed as entered conditions and if they match the conditions stored in the knowledge base for a specific learning disability, the types of learning disability is identified and proved. There will be four sessions in total to test each of the learning disabilities and a final result will be posed to the users after all the sessions.

Evaluation Method

The success of the expert system will be determined on two aspects. A pass score for both aspects will be 75%.

Accuracy: The human experts such as the learning disabilities experts or psychiatrist will test the accuracy of the system using different conditions by creating ten to fifteen learning disabilities cases which are in random. After tested by the experts, the system will be tested by a few end-users to measure the accuracy of the system in end-users. A feedback and review will be collected on both testing and the accuracy of the system will be reviewed by the human experts.

Usability: After the test done on a few end users, they will be provided with questionnaires on their experience and satisfaction on using the system to determine the usability of the system.
The final score of the expert system will be determined by the average score of each aspect combined. The test done by the human experts will be counted for the final score as well because this bench testing can provide more correct expert system in field testing as well as in the end-users' hands. As a result a more realistic results can be provided.

Approximate Time Schedule for Project

Week 1 – Collecting the knowledge base from the different sources
Week 2 – Developing the expert system using the expertise2go by using the knowledge base collected
Week 3 –Testing the expert system with human experts and selected end users for accuracy
Week 4-Testing the expert system with selected end users for usability

Week 5-Updating the expert system based on the questionnaire
Week 6 – Releasing the expert system.

References

[1]_Ninds.nih.gov. 2020. *Dyslexia-Information-Page | National Institute Of Neurological Disorders And Stroke*. [Online] Available at: <https://www.ninds.nih.gov/Disorders/All-Disorders/Dyslexia-Information-Page/2921/organizations/1002> [Accessed 2 October 2020].

[2] A. G. Kamhi and H. W. Catts, *Language and reading disabilities*. Boston: Pearson, 2014.

[3]M. J. Snowling, "Early identification and interventions for dyslexia: a contemporary view," *Journal of Research in Special Educational Needs*, vol. 13, no. 1, pp. 7–14, 2012.

[4] G. Schulte-Körne, "The Prevention, Diagnosis, and Treatment of Dyslexia," *Deutsches Aerzteblatt Online*, 2010.

[5] P. Ott, *Teaching children with dyslexia: a practical guide*. Place of publication not identified: Routledge, 2015.

[6] Acree M.A. (1999) Is there a gender difference in fingerprint ridge density? Forensic Science International, 102: 35–44

[7]P. Manghirmalani, D. More, and K. Jain, "A Fuzzy Approach to Classify Learning Disability," *International Journal of Advanced Research in Artificial Intelligence*, vol. 1, no. 2, 2012.

[8] M.A.Jayaram, Shilpa.B, Intelligent System for Diagnosing Learning Disorders in Children, proceedings of World Congress on Engineering and Computer Science 2010, San Francisco, USA 20-22 October, 2010, 70-75.

[9] "What Is Dysgraphia?" *What Is Dysgraphia? | LD Topics | LD OnLine*. [Online]. Available: http://www.ldonline.org/article/12770/. [Accessed: 30-Sep-2020].

[10]T. U. Team, "Dysgraphia: What You Need to Know," *Dysgraphia in Children*, 16-Oct-2019. [Online]. Available: https://www.understood.org/en/learning-thinking-differences/child-learning-disabilities/dysgraphia/understanding-dysgraphia. [Accessed: 30-Sep-2020].

[11] "What is Dyscalculia?" *What is Dyscalculia? - The Dyslexia Association*. [Online]. Available: https://www.dyslexia.uk.net/specific-learning-difficulties/dyscalculia/. [Accessed: 30-Sep-2020].

[12] “Dyspraxia: Causes, symptoms, and treatments,” *Medical News Today*. [Online]. Available: https://www.medicalnewstoday.com/articles/151951. [Accessed: 30-Sep-2020].