# University at Buffalo develops AI tool to rapidly detect dyslexia and dysgraphia in young learners



A transformative approach to screening for dyslexia and dysgraphia in young students has emerged from a recent study led by researchers at the University at Buffalo. This innovative tool harnesses artificial intelligence to analyse handwriting samples from children in grades K-5, detecting a range of indicators, including behavioral cues, spelling errors, motor difficulties, and cognitive issues, with impressive accuracy. The need for such advancements has never been more pressing, as current traditional screening methods are both time-consuming and often focused on only one condition at a time.

The study, published in SN Computer Science, explores the potential of AI not just to facilitate faster screening processes but also to address the significant shortage of speech-language pathologists and occupational therapists. According to Venu Govindaraju, the study's lead author and a SUNY Distinguished Professor, “Catching these neurodevelopmental disorders early is critically important.” He highlights that timely identification can significantly mitigate the adverse effects these conditions can have on a child’s educational and emotional growth, particularly in underserved areas where resources are scarce.

The tool’s unique framework builds on decades of previous research in handwriting analysis, which has historically favoured conditions like dysgraphia due to its observable physical components in writing. In contrast, dyslexia has posed a greater challenge for detection because it primarily affects reading and speech. By incorporating machine learning and natural language processing, the new system identifies not only visible aspects of handwriting—such as letter formation and spacing—but also deeper cognitive issues indicated by grammar and vocabulary use.

In order to develop this advanced AI model, the research team collected handwriting samples from various school settings, specifically targeting kindergarten through fifth grade. This rigorous approach involved collaboration with educators and therapists to ensure that the AI systems were both practical and effective in real educational environments. Sahana Rangasrinivasan, a co-author and PhD student, emphasises the importance of aligning these tools with the needs of end users: “It is critically important to examine these issues from the standpoint of those who will apply the tools most.”

Importantly, the initiative also aims to address the shortage of accessible and effective screening tools. Current methods often require substantial time and financial investment, limiting their applicability. The new AI tool offers a promising alternative, potentially streamlining processes for educators and clinicians alike. Notably, it utilises a multi-modal approach that distinguishes between visual, motor, and cognitive elements—allowing for a comprehensive assessment of a child's handwriting abilities.

Cumulative research shows that early intervention is crucial; studies indicate that children identified as ‘at-risk’ for learning disabilities are more likely to benefit from timely educational strategies. For instance, a recent advancement in AI for handwriting analysis achieved high precision levels, confirming the reliability of technology in identifying dyslexia. Similarly, research using deep learning techniques with sensor-equipped devices showed remarkable accuracy in detecting dysgraphia, underscoring AI's expanding role in educational diagnostics.

The initiative represents not only a significant step forward in research but also a societal call to address learning disabilities with urgency and empathy. As Sumi Suresh, another co-author of the study, notes, “This work highlights how AI can be leveraged for the public good, providing vital resources to those in need.” The potential of AI to revolutionise dyslexia and dysgraphia detection paves the way for a future where children can receive the assistance they need to thrive academically and emotionally, irrespective of their circumstances.

As the team continues refining this innovative tool, the focus remains on ensuring that it not only meets the technical requirements for identifying learning disabilities but also adheres to ethical considerations surrounding data privacy and application in sensitive educational contexts.

### Reference Map

1. Paragraphs 1, 2, 3, 4, 5, 6, 7: [[1]](https://neurosciencenews.com/ai-handwriting-dyslexia-28925/)
2. Paragraphs 4, 5, 6: [[2]](https://link.springer.com/article/10.1007/s42979-025-03927-0)
3. Paragraph 6: [[3]](https://arxiv.org/abs/2410.19821)
4. Paragraph 6: [[4]](https://arxiv.org/abs/2210.07659)
5. Paragraph 6: [[5]](https://dl.acm.org/doi/10.1016/j.procs.2024.09.186)
6. Paragraph 6: [[6]](https://www.mdpi.com/2075-1729/13/3/598)
7. Paragraphs 1, 4, 7: [[7]](https://neurosciencenews.com/ai-handwriting-dyslexia-28925/)

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## Bibliography

1. <https://neurosciencenews.com/ai-handwriting-dyslexia-28925/> - Please view link - unable to able to access data
2. <https://link.springer.com/article/10.1007/s42979-025-03927-0> - This study presents a framework for developing AI-integrated screening tools to identify behavioral indicators of dyslexia and dysgraphia in children's handwriting. The proposed system analyzes visual, motor, and cognitive elements of handwriting, aiming to streamline early detection and intervention processes. By leveraging machine learning and natural language processing, the tool seeks to enhance the efficiency of current screening methods, making them more accessible and effective, especially in underserved areas. The research emphasizes the importance of early identification to mitigate the impact of these learning disabilities on children's academic and social development.
3. <https://arxiv.org/abs/2410.19821> - This research introduces an explainable AI framework for detecting dyslexia through handwriting analysis, achieving a test precision of 99.65%. The system integrates transfer learning and transformer-based models to identify handwriting features associated with dyslexia, ensuring transparency via Grad-CAM visualizations. Its adaptability to various languages and writing systems highlights its global applicability. The study demonstrates that handwriting analysis, supported by explainable AI, can serve as a reliable diagnostic tool for early detection, fostering trust among stakeholders and enabling personalized educational strategies.
4. <https://arxiv.org/abs/2210.07659> - This paper explores the use of deep learning for automated detection of dysgraphia, a handwriting-related learning disability. Utilizing the SensoGrip smart pen, which captures handwriting dynamics, the study achieves over 99% accuracy in predicting the SEMS score, a measure of handwriting capabilities. The approach emphasizes automatic feature extraction and selection, moving beyond traditional methods that rely on manual processes. By employing deep learning with sensor-equipped devices, the research offers a promising avenue for early and precise detection of dysgraphia, potentially improving intervention strategies.
5. <https://dl.acm.org/doi/10.1016/j.procs.2024.09.186> - This study proposes a novel solution for early detection of learning disabilities, including dyslexia and dysgraphia, through handwriting script analysis combined with advanced machine learning techniques. Utilizing the 'Handyg23' dataset, which comprises handwriting samples from both neurodegenerative and healthy controls, the research employs the Beta-elliptic segmentation theory to extract spatial, temporal, and kinematic features. The experiments demonstrate high accuracy, achieving 99% with gradient boosting, indicating the potential of this approach for timely and effective identification of learning disabilities.
6. <https://www.mdpi.com/2075-1729/13/3/598> - This research presents a solution for early screening of dysgraphia by analyzing handwriting characteristics before formal handwriting instruction begins. Using the Play-Draw-Write iPad application, data from children in the last year of kindergarten through the second year of elementary school were collected. A deep learning-based meta-model, incorporating dimensionality reduction and Procrustes Analysis, achieved 84.62% accuracy and 100% precision in identifying 'at-risk' children more than two years earlier than current diagnostic techniques. This approach offers a proactive method for monitoring handwriting-related characteristics and preventing negative consequences associated with dysgraphia.
7. <https://neurosciencenews.com/ai-handwriting-dyslexia-28925/> - A new AI-driven tool developed by researchers could revolutionize how educators and clinicians screen for dyslexia and dysgraphia in children. By analyzing handwriting samples from K–5 students, the system detects behavioral cues, spelling errors, motor difficulties, and cognitive issues with remarkable precision. Unlike traditional screening, which is time-intensive and often condition-specific, this method is faster, scalable, and could ease the burden on the nation’s limited speech and occupational therapy workforce. The research underscores the value of using artificial intelligence for early intervention, particularly in underserved communities.