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[IEEE Access](#) • Open Access • Volume 11, Pages 48392 - 48409 • 2023
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**Source type**

Journal

**ISSN**

21693536

**DOI**

10.1109/ACCESS.2023.3276439

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# Personalized Adaptive Learning Technologies Based on Machine Learning Techniques to Identify Learning Styles: A Systematic Literature Review

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Artificial intelligence (AI) approaches have been used in personalised adaptive education systems to overcome the limitations of statically determined learning styles (LSs). These approaches utilise algorithms from machine learning (ML) to tackle the challenge of personalising e-learning by mapping students' behavioural attributes to a particular LS automatically and dynamically to optimise the individual learning process. Motivated by the many influential studies in this field and the current developments in ML and AI, a comprehensive systematic literature review was conducted from 2015 to 2022. Influential scientific literature was analysed to identify the emerging trends and gaps in the literature in terms of LS models and possible ML techniques employed for personalised adaptive learning platforms. The outcomes of this paper include a review and analysis of the current trends of this emerging field in terms of the applications and developments in using ML approaches to implement more intelligent and adaptive e-learning environments to detect learners' LSs automatically for enhancing learning. In addition, the following issues were also investigated: the platforms that stimulated research; identifying LS models utilised in e-learning; the evaluation methods used; and the learning supports provided. The results indicated an increasing interest in using artificial neural network approaches to identify LSs. However, limited work has been conducted on the comparison of deep learning methods in this context. The findings suggest the need to consider and stimulate further empirical investigation in documenting the adoption and comparison of deep learning algorithms in classifying LSs to provide higher adaptability. © 2013 IEEE.

**Author keywords**

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Artificial intelligence; e-learning; learning style; machine learning; personalized adaptive learning; systematic literature review

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