



## Artificial Intelligence–Assisted Learning of Special Functions and Their Applications in Partial Differential Equations

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### Abstract

Special functions such as Bessel functions, Legendre polynomials, Hermite functions, and hypergeometric functions play a fundamental role in solving many partial differential equations (PDEs) that arise in physics, engineering, and applied mathematics. However, understanding their properties, computational methods, and applications often presents challenges for students and researchers due to their complex analytical structures. This study explores the integration of artificial intelligence (AI) techniques to facilitate the learning, visualization, and application of special functions in the context of partial differential equations. AI-based tools, including machine learning models and symbolic computation systems, are employed to assist in pattern recognition, approximation, and automated solution strategies for PDEs involving special functions. The proposed framework enhances conceptual understanding by providing interactive learning environments, automated derivations, and numerical simulations. Furthermore, AI-driven methods help identify relationships between different classes of special functions and their roles in solving boundary value problems. The results demonstrate that AI-assisted learning can significantly improve the efficiency of studying special functions and broaden their practical applications in mathematical modeling and scientific computing. This approach offers promising opportunities for advancing mathematical education and accelerating research in differential equations and applied sciences.

