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Navigating the AI Landscape: Comprehensive Applications in Drug Development and Pharmaceutical Dosage Formulation

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This study explores the transformative role of Artificial Intelligence (AI) in drug development and pharmaceutical dosage form development amidst healthcare challenges posed by pandemics and regional conflicts. Through an extensive review of approximately 20,800 studies, we highlight AI's growing influence across drug development phases, from discovery leveraging machine learning and neural networks, to formulation using predictive modeling. Notably, AI's application in drug discovery promotes efficiency and aligns with green chemistry principles, as evidenced by the collaboration of MIT with 13 firms in the Machine Learning for Pharmaceutical Discovery and Synthesis Consortium. We also discuss an innovative NLP method that efficiently identifies potential drug repurposing candidates by transforming scientific texts into structured drug-disease pairs. Additionally, a session on "Modeling and Artificial Intelligence Approaches" revealed advances in IVIVC predictability using symbolic regression and genetic programming, though its complexity limits current practical application. Our findings underscore AI's capacity to significantly improve drug development's efficiency and sustainability, marking a critical shift towards more advanced pharmaceutical processes, despite challenges related to data quality and model validation.

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