Deep Science Publishing, 2025
https://doi.org/10.70593/978-93-7185-272-2_6

DeepScience
Open Access Books

Chapter 6: Artificial Intelligence in Nanotechnology: A comprehensive Review

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Abstract: The merger of artificial intelligence (AI) and nanotechnology is proving to be promising new fields in the field of science, medicine, and industry. This review unites the latest trends and the emerging literature that evidences the accelerating pace of designing, developing, and utilizing nanomaterials by AI - namely machine learning (ML) and deep learning. In the medical field, AI is making significant contributions to developing intelligent and more precise drug administration systems, and better diagnostics with the help of nano sensors. It is assisting in environmental science to understand and predict the possible toxicity of nanoparticles to a better degree-testing is becoming faster, more cost-effective, and ethically acceptable. In addition to that, AI is fine-tuning nanostructures to be applied in energy storage, quantum computing and sustainable material. Although this has been a welcome development, there remains a lot to be overcome, including how to verify the quality of data, simplify AI models to be interpreted, and the gap in knowledge across disciplines. In the future, effective cross-disciplinary collaboration will be necessary to make AI in nanotechnology maximally beneficial in terms of ethics and responsibility and in large scale.

Keywords: Artificial intelligence (AI), nanotechnology, machine learning, healthcare, Drug delivery.

6.1 Introduction

Artificial Intelligence (AI) refers to computer systems or algorithms that can perform tasks that normally require human intelligence. These include:

- Learning from data (Machine Learning, ML)
- Making decisions or predictions
- Recognizing patterns (e.g. images, text)
- Reasoning, understanding language (NLP), perception, etc.

AI has subfields like Deep Learning (DL), Neural Networks (NN), Natural Language Processing (NLP), computer vision, etc., which enable complex tasks and modelling. AI in pharmacy refers to using computational algorithms (ML/DL, etc.) to model, predict, optimize, and assist in areas like drug design, formulation, diagnostics, personalized