ABSTRACT:

Leveraging AI Disruptions in Nanomaterial Synthesis, Device Design, and System Integration

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Artificial intelligence-(AI) based innovations and inventions have exponentially increased over the past decade. With generative AI, the world is now at a pivotal point as researchers seek to establish how this evolutionary leap in technology can be most practically integrated into our ongoing research. As advances in AI improve, the rate of innovations is expected to accelerate. The use of AI has emerged as a fundamental tool in various research domains, including materials discovery and synthesis. Convergence between AI and nanotechnology has the potential to significantly alter the trajectory of many technological innovations that rely on AI-enabled explorations and algorithmic optimization based on new computer architectures, data, and hybrid technologies that use a large variety of related disciplines. The field is continuously expanding with an in-depth understanding of the classification of material properties at the nanoscale, theoretical approaches and simulations in nanoscience, design consideration of nanodevices, and material synthesis at the nanoscale with controlled morphology. This has led to the development of size- and shape-controlled nanomaterials. Despite current progress, more robust synthesis and validation procedures that use current and future trends that can boost AI-based applications are still lacking. It is anticipated that the intersection of AI and nanotechnology can shape the path for many technological developments using nanomaterials. The presentation provides an overview of recent progress and potential pathways for new developments that highlight the synergism of AI and innovations for the development of novel nanomaterials, and its unique applications in electronics, optics, catalysis, medicine, agriculture, and sustainability.

Keywords: AI, nanomaterials, innovations, electronics, optics, catalysis, sustainability