

AI-Driven Pattern Recognition in Medicinal Plants: A Comprehensive Review and Comparative Analysis

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Abstract

The pharmaceutical industry increasingly values medicinal plants due to their perceived safety and cost-effectiveness compared to modern drugs. Throughout the extensive history of medicinal plant usage, various plant parts, including flowers, leaves, and roots, have been acknowledged for their healing properties and employed in plant identification. Leaf images, however, stand out as the preferred and easily accessible source of information. Manual plant identification by plant taxonomists is intricate, time-consuming, and prone to errors, relying heavily on human perception. Artificial intelligence (AI) techniques offer a solution by automating plant recognition processes. This study thoroughly examines cutting-edge AI approaches for leaf image-based plant identification, drawing insights from literature across renowned repositories. This paper critically summarizes relevant literature based on AI algorithms, extracted features, and results achieved. Additionally, it analyzes extensively used datasets in automated plant classification research. It also offers deep insights into implemented techniques and methods employed for medicinal plant recognition. Moreover, this rigorous review study discusses opportunities and challenges in employing these AI-based approaches. Furthermore, in-depth statistical findings and lessons learned from this survey are highlighted with novel research areas with the aim of offering insights to the readers and motivating new research directions. This review is expected to serve as a foundational resource for future researchers in the field of AI-based identification of medicinal plants.

Keywords

Pattern recognition; artificial intelligence; machine learning; deep learning; image processing; plant leaf identification