

IEI EPITOME NEWS LETTER PUBLISHED MEMBERS PUBLICATION

Volume 11 • Issue 4

April 2026



IEI EPITOME

A Century of Service to the Nation

INSIDE THIS ISSUE

- 2 Notification on the IEI R&D Grant-in-Aid
- 3 Members in the News
- 3 Notification on IEI Awards
- 4 Notification on 'Certified International Professional Engineers (IntPE)' by IEI
- 4 Notification on 'Professional Engineers (PE)' Certification by IEI
- 5 Publication by Members
- 8 Articles Published in Latest Issue of IEI Journals
- 16 Notification on IEI-Springer Journals
- 17 Notification on '15th Achievement Award for Young Engineers 2027'
- 17 Notification on Corporate Air Ticketing for IEI Members
- 18 Notification on National Convention of ELDE
- 18 Notification on 'Discount at the Samsung e-store for IEI Corporate Members'
- 19 Notification on 'Prizes for Best Papers Published in IEI-Springer Journals'
- 20 Note Bene
- 24 Notification on Advertisement in IEI Epitome
- 25 Continuing Professional Development Programmes of IEI

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Published by:
The Institution of Engineers (India)
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Telephone: 033-43004000
E-mail: ieei@ieei.org
Website: <http://www.ieei.org>

Publication by Members

IEI Epitome
Volume 11 • Issue 4
April 2026



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Title of Paper: A Deep Learning and Metaheuristic Optimization Algorithm based on Parkinson's Disease Classification from MRI Images

Mathematical Biosciences and Engineering, AIMS Press, 23(4), 27 February 2026, pp 813-844, ISSN 1551-0018

DOI: <https://doi.org/10.3934/mbe.2026033>

Co-author: Balamurugan V

Abstract: Parkinson's disease (PD) is the second most common neurodegenerative disorder, characterized by the gradual deterioration of dopamine-producing neurons. The main challenge of diagnosing this disease is that physical changes in the brain begin before the patient shows outward symptoms. This leads to the necessity of developing early methods for the detection of this disease. Therefore, with the proposed model, we aimed to significantly improve the early classification of PD using MRI scans by capitalizing on advanced Artificial Intelligence (AI) and Deep Learning (DL) techniques. Our goal of the proposed model was to develop a robust medical decision-support system that enhances the diagnostic precision and supports prompt clinical intervention strategies. The method proposed was a modified Efficient Net DL model combined with the reinforcement learning optimization. This approach enabled a dynamic adjustment of model parameters to effectively minimize the misclassification rates while differentiating MRI scans of PD patients and healthy individuals. Certain performance metrics were used to calculate the performance of the proposed detection model. The results showed that the research achieved high precision, recall, and F1-score values with 98% accuracy for both classes. In the patients (class 0), the precision rate was 95%, the recall rate was 96%, and the F1-score was 98%. Similarly, for healthy individuals (class 1), the precision rate was 93%, the recall rate was 97%, and the F1-Score was 96%. Thus, the proposed Efficient Net model revealed significant enhancements in the diagnostic performance compared to the standard methods. The innovations outlined in this study emphasize the transformative power of AI in enhancing diagnostic predictions. Moreover, the convergence of a DL based Efficient Net model and reinforcement learning based metaheuristic optimization establishes a prospective implementation of predictive analytics in managing high-risk PD with the defined objective of optimizing the patient outcomes within the field of neurology.

Keywords: EfficientNet; Deep Learning; PD; Magnetic Resonance Imaging; Artificial Intelligence; Reinforcement Learning Optimization

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- 2 Notification on the 'IEI R&D Grant-in-Aid'
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- 5 Publication by Members
- 5 Notification on 'Professional Engineers (PE) Certification by IEI'
- 7 Notification on 'IEI-Springer Journals'
- 8 Notification on 'IEI Achievement Award for Young Engineers 2027'
- 8 Notification on 'Corporate AI Tie-Up for IEI Members'
- 9 Notification on 'National Convention of "ELDH"
- 9 Notification on 'Discount at the Samsung e-store for IEI Corporate Members'
- 10 Notification on 'Prizes for Best Papers Published in IEI-Springer Journals'
- 11 Note Bene
- 15 Notification on 'Advertisement in IEI Ephome'
- 16 Continuing Professional Development Programmes of HSCI

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Publisher
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Notification on the R&D

DEJ Epitome, Volume 11, Issue 6, June 2026

IEEE Explains, Volume 11, Issue 6, June 2026



© 2003 Blackwell Publishing Ltd *Journal of Internal Medicine* 253: 103–110

Design Number :	491372-001
Substation :	10-05
CHSR Number:	203959
CHSR Date:	17/02/2026
Date of Issue:	23/04/2026
Applicant Name:	1. Dr. K. Rao

DesignApplication Status: Design Accepted and Published, Journal No is 1720226 and Journal Date is: 24/04/2022