

A Novel End-To-End Learning Framework Based on Optimised Residual Gated Units and Stacked Pre-Trained Layers in an Layers for-layers for Detection of Autism Spectrum Disorders (ASD)



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The diagnostic bottleneck.

Early ASD detection relies on EEG signals, but their lengthy, non-linear nature creates massive massive computational overhead gradient explosion in standard deep learning models.

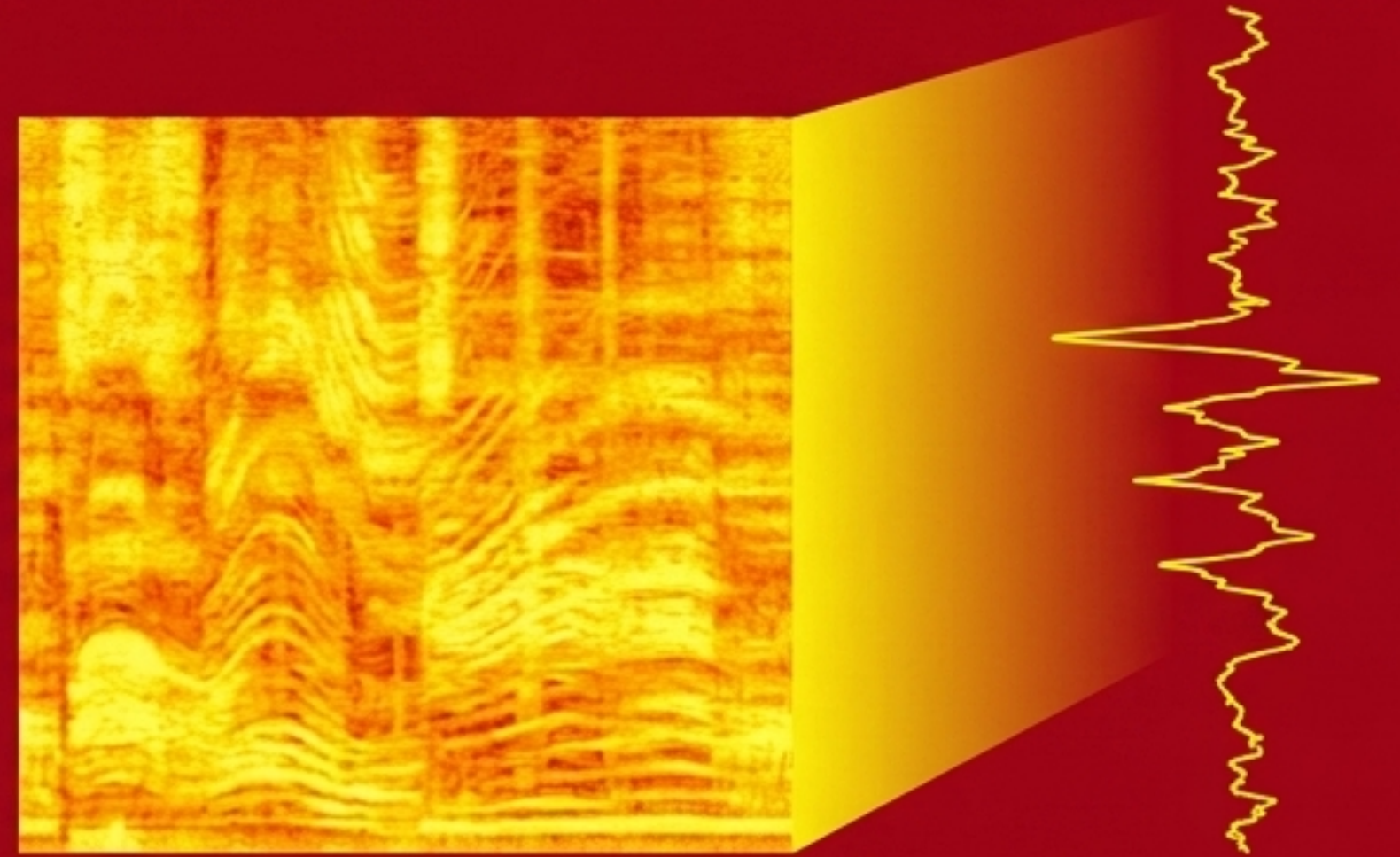


A 4-stage hybrid framework.



Raw signals to spatial features.

EEG data is converted to 2D spectrograms using Short Time Fourier Transform (STFT), then processed through stacked, lightweight pre-trained models.



Modified Residual GRU.

Residual skip connections are embedded into Gated Recurrent Units to capture long-term temporal dependencies without vanishing gradients.



Chaotic Cat Swarm Optimisation.

Bio-inspired algorithms, enhanced with chaotic maps, perfectly tune the network's hyperparameters to avoid local optimum traps.



Unprecedented accuracy.

Baseline (MobileNets)	~83.5%
Current Best (HCLA-Bi-GRU)	~92.9%
Proposed Model	98.7% (98.2% Precision, 98.3% F1-Score)

The future of early detection.

By lowering computational complexity while achieving 98.7% accuracy, this framework offers a highly reliable, data-driven clinical biomarker for rapid ASD diagnosis.