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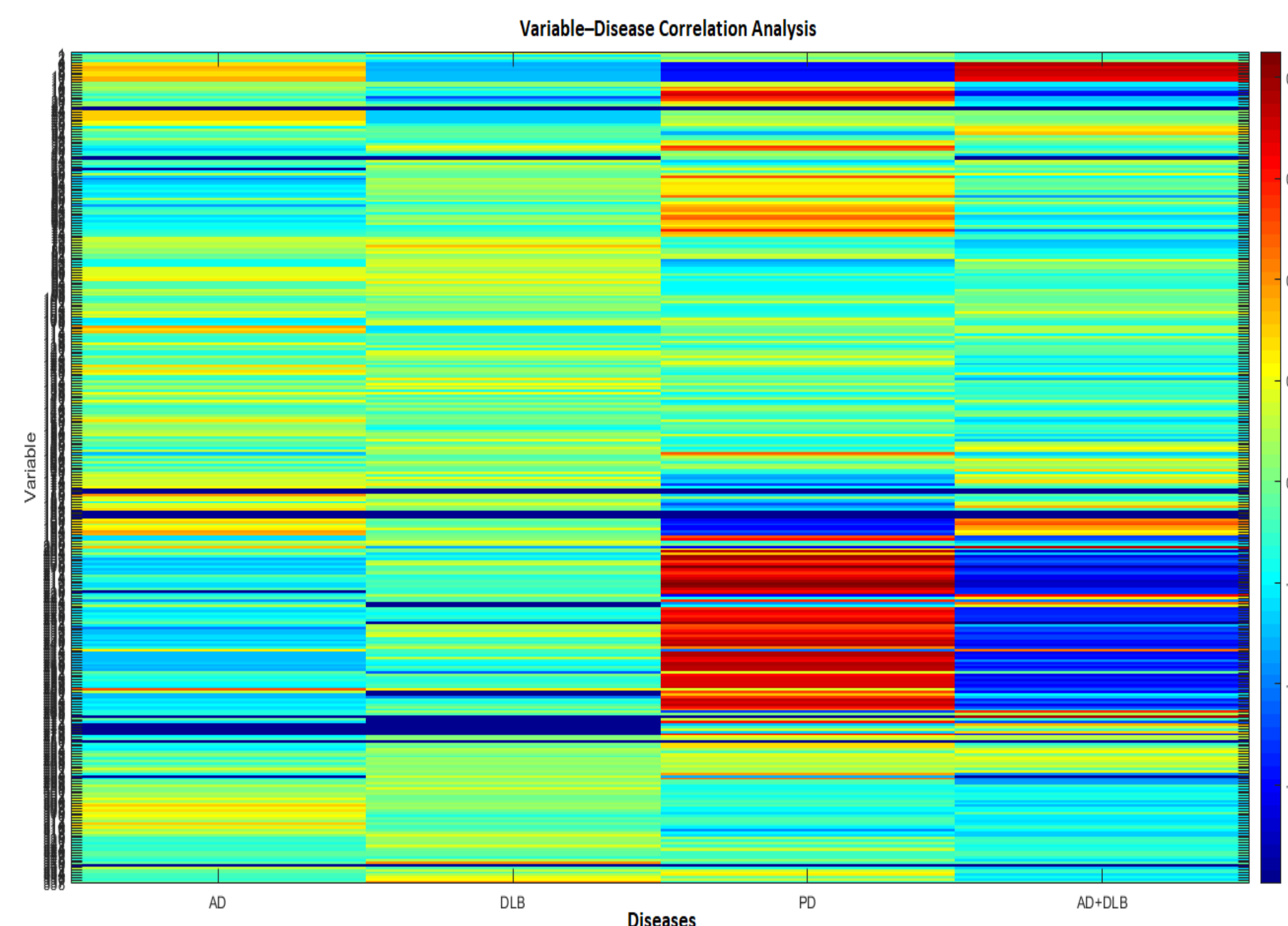
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Results

- The proposed diagnostic framework achieved an overall classification accuracy of 94%, with class-specific success rates of 90.1% for Alzheimer's disease (AD), 96.4% for dementia with Lewy bodies (DLB), 95.1 for mixed AD and DLB pathology, and 95.2% for Parkinson's disease (PD). The integrated methodology successfully identified a parsimonious set of discriminatory biomarkers. Statistical tests revealed significant inter-group differences in cognitive, motor, and imaging parameters. Random Forest importance scores highlighted key features for multi-class separation. The combined approach effectively reduced data dimensionality and isolated robust, interpretable diagnostic signatures for each condition.

- ❖ We analyzed a population of 45 patients, divided into five groups: AD (n=7), PD (n=16), DLB (n=5), mixed AD and DLB (n=10) and other (n=7).
- ❖ A three-step analytical pipeline was implemented: (1) Initial screening using p-value analysis (Kruskal-Wallis and Mann-Whitney U tests) to identify parameters with significant differences across and between groups (100 parameters were analyzed). (2) Correlation analysis (Pearson's coefficient) to evaluate linear associations between clinical variables and each diagnostic class. (3) Feature importance ranking via a Random Forest classifier to capture non-linear interactions and rank parameters by their diagnostic contribution.



True class	None	19					100.0%	
	AD	1	3				75.0%	25.0%
	DLB			6			100.0%	
	PD				25		100.0%	
	ADandDLB		1		2	12	80.0%	20.0%
		95.0%	75.0%	100.0%	92.6%	100.0%		
	5.0%	25.0%		7.4%				
	None	AD	DLB	PD	ADandDLB			

1- Sensations Decrease	11- WCST failure to maintain Set
2- B/A 6PM	12- WCST total errors
3- CPAP	13- WCST perseverative errors
4- Drowsiness	14- WCST non perseverative errors
5- Sleep during day	15- WCST # conceptual responses
6- Ability to focus during the day	16- Sit w/o back support
7- Ability to remember recent information	17- Clinical State
8- Comprehension	18- Dyskinesia Impact B
9- WMS-III Spatial span backward	19- WMS-III percent retention
10- Trailmaking Part B	20- ADL inventory score: Eating

Abbreviations:
B/A 6PM: RLS symptoms worse before or after 6pm
WCST: Wisconsin Card Sorting Test
WMS-III: Wechsler Memory Scale third edition

The integrated framework enhances the differentiation of AD, PD, and DLB by combining statistical rigor with machine learning. It improves diagnostic model performance and provides clinically interpretable insights by highlighting disease-specific parameter variations. This methodology supports the development of more precise diagnostic tools for complex neurodegenerative disorders.