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Table S1 Literature search strategy

1.Pubmed

Search number	Query
#1	parkinson disease[MeSH Terms]
#2	"Parkinson Disease"[Title/Abstract] OR "Parkinson's Disease"[Title/Abstract] OR "Primary Parkinsonism"[Title/Abstract] OR "Parkinsonism, Primary"[Title/Abstract] OR "Paralysis Agitans"[Title/Abstract] OR "idiopathic parkinsonism"[Title/Abstract] OR "paralysis agitans"[Title/Abstract] OR "Parkinson dementia complex"[Title/Abstract] OR "Parkinsons disease"[Title/Abstract] OR "primary parkinsonism"[Title/Abstract]
#3	#1 OR #2
#4	machine learning[MeSH Terms]
#5	"machine learning"[Title/Abstract] OR "Transfer Learning"[Title/Abstract] OR "Deep learning"[Title/Abstract] OR "Learning, Transfer"[Title/Abstract] OR "Ensemble Learning"[Title/Abstract] OR "artificial intelligence"[Title/Abstract] OR "Prediction model"[Title/Abstract] OR "random forest"[Title/Abstract] OR "artificial neural network"[Title/Abstract] OR "ANN"[Title/Abstract] OR "Support vector machine"[Title/Abstract] OR "SVM"[Title/Abstract] OR "Gradient Boosting Machine"[Title/Abstract] OR "GBM"[Title/Abstract] OR "Nomogram"[Title/Abstract] OR "XGboost"[Title/Abstract] OR "Decision tree"[Title/Abstract] OR "Development and validation"[Title/Abstract] OR "Risk Prediction"[Title/Abstract] OR "Risk-Prediction"[Title/Abstract]
#6	#4 OR #5
#7	Cognitive Dysfunction[MeSH Terms]
#8	"Cognitive Dysfunction"[Title/Abstract] OR "Cognitive Dysfunctions"[Title/Abstract] OR "Dysfunction, Cognitive"[Title/Abstract] OR "Dysfunctions, Cognitive"[Title/Abstract] OR "Cognitive Impairments"[Title/Abstract] OR "Cognitive Impairment"[Title/Abstract] OR "Impairment, Cognitive"[Title/Abstract] OR "Impairments, Cognitive"[Title/Abstract] OR "Mild Cognitive Impairment"[Title/Abstract] OR "Cognitive Impairment, Mild"[Title/Abstract] OR "Cognitive Impairments, Mild"[Title/Abstract] OR "Impairment, Mild Cognitive"[Title/Abstract] OR "Impairments, Mild Cognitive"[Title/Abstract] OR "Mild Cognitive Impairments"[Title/Abstract] OR "Mild Neurocognitive Disorder"[Title/Abstract] OR "Disorder, Mild Neurocognitive"[Title/Abstract] OR "Disorders, Mild Neurocognitive"[Title/Abstract] OR "Mild Neurocognitive Disorders"[Title/Abstract] OR "Neurocognitive Disorder, Mild"[Title/Abstract] OR "Neurocognitive Disorders, Mild"[Title/Abstract] OR "Cognitive Decline"[Title/Abstract] OR "Cognitive Declines"[Title/Abstract] OR "Decline, Cognitive"[Title/Abstract] OR "Declines, Cognitive"[Title/Abstract] OR "Mental Deterioration"[Title/Abstract] OR "Deterioration, Mental"[Title/Abstract] OR "Deteriorations, Mental"[Title/Abstract] OR "Mental Deteriorations"[Title/Abstract] OR "cognitive defect"[Title/Abstract] OR "cognition disorder"[Title/Abstract] OR "cognition disorders"[Title/Abstract] OR "cognitive defects"[Title/Abstract] OR "cognitive deficit"[Title/Abstract] OR "cognitive disability"[Title/Abstract] OR "cognitive disorder"[Title/Abstract] OR "cognitive disorders"[Title/Abstract] OR "cognitive dysfunction"[Title/Abstract] OR "cognitive impairment"[Title/Abstract] OR "overinclusion"[Title/Abstract] OR "response interference"[Title/Abstract]
#9	#7 OR #8
#10	#3 AND #6 AND #9

2.Cochrane

Search number	Query
#1	MeSH descriptor: [Parkinson Disease] explode all trees
#2	('Parkinson Disease' OR 'Primary Parkinsonism' OR 'Parkinsonism, Primary' OR 'Paralysis Agitans' OR 'idiopathic parkinsonism' OR 'paralysis agitans' OR 'Parkinson dementia complex' OR 'Parkinsons disease' OR 'primary parkinsonism'):ti,ab,kw
#3	#1 OR #2
#4	MeSH descriptor: [Machine Learning] explode all trees

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#5	('machine learning' OR 'Transfer Learning' OR 'Deep learning' OR 'Learning, Transfer' OR 'Ensemble Learning' OR 'artificial intelligence' OR 'Prediction model' OR 'random forest' OR 'artificial neural network' OR 'ANN' OR 'Support vector machine' OR 'SVM' OR 'Gradient Boosting Machine' OR 'GBM' OR 'Nomogram' OR 'XGboost' OR 'Decision tree' OR 'Development and validation' OR 'Risk Prediction' OR 'Risk-Prediction'):ti,ab,kw
#6	#4 OR #5
#7	MeSH descriptor: [Cognitive Dysfunction] explode all trees
#8	'Cognitive Dysfunction' OR 'Cognitive Dysfunctions' OR 'Dysfunction, Cognitive' OR 'Dysfunctions, Cognitive' OR 'Cognitive Impairments' OR 'Cognitive Impairment' OR 'Impairment, Cognitive' OR 'Impairments, Cognitive' OR 'Mild Cognitive Impairment' OR 'Cognitive Impairment, Mild' OR 'Cognitive Impairments, Mild' OR 'Impairment, Mild Cognitive' OR 'Impairments, Mild Cognitive' OR 'Mild Cognitive Impairments' OR 'Mild Neurocognitive Disorder' OR 'Disorder, Mild Neurocognitive' OR 'Disorders, Mild Neurocognitive' OR 'Mild Neurocognitive Disorders' OR 'Neurocognitive Disorder, Mild' OR 'Neurocognitive Disorders, Mild' OR 'Cognitive Decline' OR 'Cognitive Declines' OR 'Decline, Cognitive' OR 'Declines, Cognitive' OR 'Mental Deterioration' OR 'Deterioration, Mental' OR 'Deteriorations, Mental' OR 'Mental Deteriorations' OR 'cognitive defect' OR 'cognition disorder' OR 'cognition disorders' OR 'cognitive defects' OR 'cognitive deficit' OR 'cognitive disability' OR 'cognitive disorder' OR 'cognitive disorders' OR 'cognitive dysfunction' OR 'cognitive impairment' OR 'overinclusion' OR 'response interference'):ti,ab,kw
#9	#7 OR #8
#10	#3 AND #6 AND #9

3.Embase

Search number	Query
#1	'parkinson disease'/exp
#2	'parkinson disease':ti,ab,kw OR 'parkinsonism, primary':ti,ab,kw OR 'idiopathic parkinsonism':ti,ab,kw OR 'paralysis agitans':ti,ab,kw OR 'parkinson dementia complex':ti,ab,kw OR 'parkinsons disease':ti,ab,kw OR 'primary parkinsonism':ti,ab,kw
#3	#1 OR #2
#4	'machine learning'/exp
#5	'machine learning':ti,ab,kw OR 'transfer learning':ti,ab,kw OR 'deep learning':ti,ab,kw OR 'learning, transfer':ti,ab,kw OR 'ensemble learning':ti,ab,kw OR 'artificial intelligence':ti,ab,kw OR 'prediction model':ti,ab,kw OR 'random forest':ti,ab,kw OR 'artificial neural network':ti,ab,kw OR 'ann':ti,ab,kw OR 'support vector machine':ti,ab,kw OR 'svm':ti,ab,kw OR 'gradient boosting machine':ti,ab,kw OR 'gbm':ti,ab,kw OR 'nomogram':ti,ab,kw OR 'xgboost':ti,ab,kw OR 'decision tree':ti,ab,kw OR 'development and validation':ti,ab,kw OR 'risk prediction':ti,ab,kw OR 'risk-prediction':ti,ab,kw
#6	#4 OR #5
#7	'cognitive defect'/exp
#8	'cognitive dysfunctions':ti,ab,kw OR 'dysfunction, cognitive':ti,ab,kw OR 'dysfunctions, cognitive':ti,ab,kw OR 'cognitive impairments':ti,ab,kw OR 'impairment, cognitive':ti,ab,kw OR 'impairments, cognitive':ti,ab,kw OR 'mild cognitive impairment':ti,ab,kw OR 'cognitive impairment, mild':ti,ab,kw OR 'cognitive impairments, mild':ti,ab,kw OR 'impairment, mild cognitive':ti,ab,kw OR 'impairments, mild cognitive':ti,ab,kw OR 'mild cognitive impairments':ti,ab,kw OR 'mild neurocognitive disorder':ti,ab,kw OR 'disorder, mild neurocognitive':ti,ab,kw OR 'disorders, mild neurocognitive':ti,ab,kw OR 'mild neurocognitive disorders':ti,ab,kw OR 'neurocognitive disorder, mild':ti,ab,kw OR 'neurocognitive disorders, mild':ti,ab,kw OR 'cognitive decline':ti,ab,kw OR 'cognitive declines':ti,ab,kw OR 'decline, cognitive':ti,ab,kw OR 'declines, cognitive':ti,ab,kw OR 'mental deterioration':ti,ab,kw OR 'deterioration, mental':ti,ab,kw OR 'deteriorations, mental':ti,ab,kw OR 'mental deteriorations':ti,ab,kw OR 'cognitive defect':ti,ab,kw OR 'cognition disorder':ti,ab,kw OR 'cognition disorders':ti,ab,kw OR 'cognitive defects':ti,ab,kw OR 'cognitive deficit':ti,ab,kw OR 'cognitive disability':ti,ab,kw OR 'cognitive disorder':ti,ab,kw OR 'cognitive disorders':ti,ab,kw OR 'cognitive dysfunction':ti,ab,kw OR 'cognitive impairment':ti,ab,kw OR 'overinclusion':ti,ab,kw OR 'response interference':ti,ab,kw
#9	#7 OR #8
#10	#3 AND #6 AND #9

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4.Web of science

Search number	Query
#1	Parkinson Disease (Topic) OR Parkinson's Disease (Topic) OR Primary Parkinsonism (Topic) OR Parkinsonism, Primary (Topic) OR Paralysis Agitans (Topic) OR idiopathic parkinsonism (Topic) OR paralysis agitans (Topic) OR Parkinson dementia complex (Topic) OR Parkinsons disease (Topic) OR primary parkinsonism (Topic)
#2	machine learning (Topic) OR Transfer Learning (Topic) OR Deep learning (Topic) OR Learning, Transfer (Topic) OR Ensemble Learning (Topic) OR artificial intelligence (Topic) OR Prediction model (Topic) OR random forest (Topic) OR artificial neural network (Topic) OR ANN (Topic) OR Support vector machine (Topic) OR SVM (Topic) OR Gradient Boosting Machine (Topic) OR GBM (Topic) OR Nomogram (Topic) OR XGboost (Topic) OR Decision tree (Topic) OR Development and validation (Topic) OR Risk Prediction (Topic) OR Risk-Prediction (Topic)
#3	Cognitive Dysfunction (Topic) OR Cognitive Dysfunctions (Topic) OR Dysfunction, Cognitive (Topic) OR Dysfunctions, Cognitive (Topic) OR Cognitive Impairments (Topic) OR Cognitive Impairment (Topic) OR Impairment, Cognitive (Topic) OR Impairments, Cognitive (Topic) OR Mild Cognitive Impairment (Topic) OR Cognitive Impairment, Mild (Topic) OR Cognitive Impairments, Mild (Topic) OR Impairment, Mild Cognitive (Topic) OR Impairments, Mild Cognitive (Topic) OR Mild Cognitive Impairments (Topic) OR Mild Neurocognitive Disorder (Topic) OR Disorder, Mild Neurocognitive (Topic) OR Disorders, Mild Neurocognitive (Topic) OR Mild Neurocognitive Disorders (Topic) OR Neurocognitive Disorder, Mild (Topic) OR Neurocognitive Disorders, Mild (Topic) OR Cognitive Decline (Topic) OR Cognitive Declines (Topic) OR Decline, Cognitive (Topic) OR Declines, Cognitive (Topic) OR Mental Deterioration (Topic) OR Deterioration, Mental (Topic) OR Deteriorations, Mental (Topic) OR Mental Deteriorations (Topic) OR cognitive defect (Topic) OR cognition disorder (Topic) OR cognition disorders (Topic) OR cognitive defects (Topic) OR cognitive deficit (Topic) OR cognitive disability (Topic) OR cognitive disorder (Topic) OR cognitive disorders (Topic) OR cognitive dysfunction (Topic) OR cognitive impairment (Topic) OR overinclusive (Topic) OR response interference (Topic)
#4	#1 AND #2 AND #3

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Table S2 Characteristics of the included literature

No.	Title	First author	Year	Country	Research type	Patient origin	Total number	Validation	Missing value	Variable selection methods	Model
1	Topologically convergent and divergent morphological gray matter networks in early-stage Parkinson's disease with and without mild cognitive impairment	Xueling Suo (1)	2021	China	case-control	Single center	70	NA	NA		SVM
2	Exploring Parkinson's Disease Predictors based on Basic Intelligence Quotient and Executive Intelligence Quotient	Haewon Byeon (2)	2021	Korea	case-control	Single center	368	5-fold cross-validation	NA		LR/SVM/RF
3	Predicting motor, cognitive & functional impairment in Parkinson's	Christine Lo (3)	2019	UK	case-control	Single center	110	10-fold cross-validation	NA		RF/NB/LDA
4	Predicting early cognitive decline in newly-diagnosed Parkinson's patients:A practical model	Olivia Hogue (4)	2018	USA	case-control	PPMI database	351	NA	NA	Stepwise regression	LR
5	Optimization of cognitive assessment in Parkinsonisms by applying artificial intelligence to a comprehensive screening test	Paola Ortelli (5)	2022	Italy	case-control	Multicenter	500	10-fold cross-validation	NA	Single-factor ROC analysis	LR
6	In vivo cholinergic basal forebrain atrophy predicts cognitive decline in de novo Parkinson's disease	Nicola J. Ray (6)	2018	UK	case-control	Multicenter	61	Random Sampling	NA	The decrease in the GINI coefficients.	RF/NLG/NB
7	Multi-Class Diagnosis of Neurodegenerative Diseases: A Neuroimaging Machine Learning based Approach	Gurpreet Singh, Meet Vadera (7)	2019	USA	case-control	Multicenter	2540	10-fold cross-validation	NA	Fischer Discriminant Ratio scores	LR
8	Machine learning-based prediction of cognitive outcomes in de novo Parkinson's disease	Joshua Harvey, BSc (8)	2022	UK	case-control	PPMI1 database	209	10-fold cross-validation	excluded 175 cases showing missing values or indeterminate diagnoses.	Recursive feature elimination (RFE) /Shapley values	RF/SVM/ElasticNet
9	Machine learning trained with quantitative susceptibility mapping to detect mild cognitive impairment in Parkinson's disease	Haruto Shibata (9)	2022	Japan	case-control	Multicenter	163	10-fold cross-validation	NA		RF/XGBoost
10	Learning Classification Models of Cognitive Conditions from Subtle Behaviors in the Digital Clock Drawing Test	William Souillard-Mandar (10)	2016	USA	case-control	Multicenter	653	5-fold cross-validation	NA		SVM/RF/CART/ C4.5/XGBoost/LR
11	Is the Random Forest Algorithm Suitable for Predicting Parkinson's Disease with Mild Cognitive Impairment out of Parkinson's Disease with Normal Cognition?	Haewon Byeon (11)	2020	Korea	case-control	Registered Database	368	NA	NA		RF/DT
12	Identification of metabolic correlates of mild cognitive impairment in Parkinson's disease using magnetic resonance spectroscopic imaging and machine learning	Sevim Cengiz (12)	2022	Turkey	case-control	Single center	76	NA	NA		XGBoost/SVM
13	Gait-Based Machine Learning for Classifying Patients with Different Types of Mild Cognitive Impairment	Pei-Hao Chen1,2 (13)	2020	China	case-control	Single center	81	NA	The MATLAB package was used to perform SVR to address the missing data;	SVM	SVM
14	Factor analysis-derived cognitive profile predicting early dementia conversion in PD	Seok Jong Chung, (14)	2020	Korea	case-control	Single center	350	5-fold cross-validation	NA	Factor analysis/Cox regression	Cox
15	Electroencephalography-Based Machine Learning for Cognitive Profiling in Parkinson's Disease: Preliminary Results	Nacim Betrouni, (15)	2019	France	case-control	Single center	118	10-fold cross-validation	NA	Analyses of variance	SVM/KNN
16	Discriminating cognitive status in Parkinson's disease through functional connectomics and machine learning	Alexandra Abós (16)	2017	Spain.	case-control	Single center	108	10-fold cross-validation	NA		SVM
17	Cortical Thickness from MRI to Predict Conversion from Mild Cognitive Impairment to Dementia in Parkinson Disease: A Machine Learning–based Model	Na-Young Shin (17)	2021	Korea	case-control	Single center	141	Random Sampling	NA		RF/SVM
18	Cognitive signature of brain FDG PET based on deep learning:domain transfer from Alzheimer's disease to Parkinson's disease	Hongyoon Choi (18)	2020	Korea	case-control	Single center	62	NA	NA		RF/NB/LDA
19	Best early-onset Parkinson dementia predictor using ensemble learning among Parkinson's symptoms, rapid eye movement sleep disorder, and neuropsychological profile	Haewon Byeon (19)	2020	Korea	case-control	Registered Database	368	NA	NA		CNN
20	Application of Machine Learning Technique to Distinguish Parkinson's Disease Dementia and Alzheimer's Dementia: Predictive Power of Parkinson's Disease-Related Non-Motor Symptoms and Neuropsychological Profile	Haewon Byeon (20)	2020	Korea	case-control	Registered Database	368	10-fold cross-validation+Random Sampling	NA	Univariate	RF
21	An SBM-based machine learning model for identifying mild cognitive impairment in patients with Parkinson's disease	Jiahui Zhang (21)	2020	China	case-control	Single center	113	5-fold cross-validation	NA		SVM
22	An individualized prediction of time to cognitive impairment in Parkinson's disease: A combined multi-predictor study	Chunyan Tang (22)	2021	China	case-control	PPMI1 database	108	4-fold cross-validation	NA	LASSO	LR
23	Accuracy of Machine Learning Using the Montreal Cognitive Assessment for the Diagnosis of Cognitive Impairment in Parkinson's Disease	Junbeom Jeon (23)	2022	Korea	case-control	PPMI1 database	397	Random Sampling	exclude：SGDS results missing (n = 4) 3) MDS-UPDRS Score missing (n = 7)	Univariate	SVM/RF/LR
24	A Novel Machine Learning Algorithm Predicts Dementia With Lewy Bodies Versus Parkinson's Disease Dementia Based on Clinical and Neuropsychological Scores	Anastasia Bougea, (24)	2022	Greece	case-control	Multicenter	140	NA	NA		K-NNs/SVM/NB/LR
25	Brain connectivity markers in advanced Parkinson's disease for predicting mild cognitive impairment	Hai Lin (25)	2021	China	case-control	PPMI1 database	179	10-fold cross-validation	NA		RF
26	Distinct manifestation of cognitive deficits associate with different resting-state network disruptions in non-demented patients with Parkinson's disease	Kazuya Kawabata (26)	2018	Japan	case-control	Single center	96	Random Sampling	NA		SVM
27	Clinical variables and biomarkers in prediction of cognitive impairment in patients with newly diagnosed Parkinson's disease: a cohort study	Anette Schrag (27)	2017	London	case-control	PPMI1 database	568	10-fold cross-validation+Random Sampling	We repeated analyses by imputing missing predictor variable data with means. These missing data did not alter the overall results of any analysis (data not shown).		LR
28	Combining quantitative susceptibility mapping to radiomics in diagnosing Parkinson's disease and assessing cognitive impairment	Jin Juan Kang (28)	2022	China	case-control	Single center	149	Random Sampling	NA	LASSO	LR/SVM
29	Development and Validation of a Prognostic Model for Cognitive Impairment in Parkinson's Disease With REM Sleep Behavior Disorder	Fangzheng Chen (29)	2021	China	case-control	Single center	338	Random Sampling	NA		LR
30	Identifying Parkinson's disease with mild cognitive impairment by using combined MR imaging and electroencephalogram	Jiahui Zhang (30)	2021	China	case-control	Single center	113	Random Sampling	NA	Univariate analysis	SVM
31	Plasma extracellular vesicles tau and β - amyloid as biomarkers of cognitive dysfunction of Parkinson's disease	Chen- Chih Chung (31)	2021	China	case-control	Single center	162	4-fold cross-validation+Random Sampling	NA	Univariate analysis	ANN
32	Prediction of cognition in Parkinson's disease with a clinical–genetic score: a longitudinal analysis of nine cohorts	Ganqiang Liu (32)	2017	USA	case-control	Multicenter	1350	NA	NA	The lowest Akaike information criterion	Cox

note: ANN, artificial neural networks; Cox, cox proportional-hazards model; DT, Decision Tree; KNN, K-Nearest Neighbor; LDA, Linear Discriminant Analysis; LR, logistic regression; NB, Naïve Bayes; RF, Random Forest; SVM, support vector machines; NA, not applicable.