Supplementary

Table S1 The name of radiomics features and filter parameters

Radiomic features	Number of features	Filters parameters	
		LoG	Wavelet
Shape	2D =10, 3D =16	α=0.5, α=1.0 α=2.0, α=4.0	LLH, LHL LHH, HLL, HLH HHL, HHH, LLL
First-order	19		
Second-order features	gray-levelco-occurrencematrix (GLCM) =24		
	gray-levelrun-lengthmatrix (GLRLM) =16		
	gray-levelsize-regionmatrix (GLSZM) =16		
	adjacentgray-leveldifferencematrix (NGTDM) =5		
	gray-leveldependencematrix (GLDM) =14		

Table S2 The optimised parameters of each classifier

Methods	Parameters	Lasso	RFE	mRMR
SVM	C	5	1	8
	CW	None	Balanced	None
	Ga	0.01	Scale	0.05
	Ke	Linear	Poly	Sigmoid
RF	Cl	None	Balanced-subsample	None
	Cr	Entropy	Entropy	GINI
	MD	32	16	32
	MSL	4	5	12
	MSS	6	16	8
	NE	100	5	10
LR	C	0.05	0.5	0.01
	Cl	None	None	None
	Pe	l2	l2	l2
	Tol	1e−05	1e−05	1e−05

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Table S3 The average model performance of the training set under 5-fold cross-validation

Model	AUC (95% CI)		Accuracy		Sensitivity		Specificity		Precision		F1-score	
	Training	Testing	Training	Testing	Training	Testing	Training	Testing	Training	Testing	Training	Testing
Lasso												
SVM	0.985 (1–1)	0.963 (0.931–1)	1	0.898	1	0.878	1	0.918	1	0.922	1	0.896
RF	0.983 (0.992–1)	0.939 (0.868–1)	0.971	0.885	0.982	0.861	0.958	0.914	0.965	0.94	0.973	0.883
LR	0.975 (0.973–1)	0.962 (0.924–1)	0.936	0.873	0.952	0.853	0.917	0.889	0.93	0.889	0.941	0.872
mRMR												
SVM	0.929 (0.869–0.99)	0.925 (0.806–1)	0.872	0.821	0.893	0.806	0.848	0.829	0.876	0.881	0.883	0.818
RF	0.957 (0.919–0.99)	0.865 (0.693–1)	0.885	0.768	0.917	0.831	0.848	0.696	0.875	0.759	0.895	0.789
LR	0.957 (0.921–0.99)	0.952 (0.871–1)	0.888	0.883	0.881	0.875	0.896	0.886	0.909	0.925	0.894	0.883
RFE												
SVM	0.995 (1–1)	0.949 (0.87–1)	0.99	0.858	0.982	0.858	1	0.857	1	0.892	0.991	0.868
RF	0.96 (0.926–0.99)	0.901 (0.757–1)	0.872	0.845	0.876	0.831	0.868	0.857	0.887	0.873	0.88	0.843
LR	0.976 (0.955–1)	0.938 (0.843–1)	0.92	0.91	0.935	0.906	0.903	0.914	0.918	0.935	0.926	0.916

Table S4 Model performance under the combination of each feature selection method and classifier

	Lasso			mRMR			RFE		
	SVM	RF	LR	SVM	RF	LR	SVM	RF	LR
AUC (95% CI)	0.786 (0.617–0.954)	0.801 (0.648–0.955)	0.823 (0.674–0.972)	0.797 (0.634–0.96)	0.821 (0.678–0.964)	0.831 (0.691–0.97)	0.739 (0.566–0.911)	0.821 (0.673–0.969)	0.820 (0.666–0.972)
ACC (95% CI)	0.697 (0.515–0.848)	0.727 (0.576–0.879)	0.758 (0.606–0.879)	0.727 (0.576–0.879)	0.727 (0.576–0.879)	0.697 (0.545–0.848)	0.667 (0.515–0.818)	0.758 (0.607–0.909)	0.697 (0.545–0.848)
F1 (95% CI)	0.688 (0.461–0.85)	0.690 (0.444–0.869)	0.733 (0.522–0.889)	0.690 (0.444–0.857)	0.690 (0.5–0.864)	0.667 (0.421–0.839)	0.686 (0.5–0.839)	0.733 (0.519–0.897)	0.667 (0.444–0.833)
YI	0.418	0.451	0.523	0.418	0.418	0.398	0.383	0.523	0.398

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Table S5 The Delong test among Radiomics, Clinical, and Combined models

Models contrast	Delong (P value)	
	Internal	External
Radiomics *vs.* Clinical	<0.01	<0.01
Radiomics *vs.* Combined	0.64	0.90
Combined *vs.* Clinical	<0.01	<0.01

Table S6 P value calibration, effect size and statistical power for age and headache

	BH* P (<0.05)	Cohen's d*	Cramer's V*	Power
Age	0.16	0.42		0.59
Headache	0.18		0.19	0.51

BH*: Benjamini-Hochberg. Cohen's d*: 0.2 indicates a small effect; 0.5 indicates a moderate effect; 0.8 indicates a large effect. Cramer's V*: 0.1–0.3 indicates a weak association; 0.3–0.5 indicates moderate association; 0.5–1 indicates strong association.

Table S7 Statistical analysis of age and headache

	P value (<0.05)			BH* P (<0.05)		
	Main (111)	Branch (30)	Total (141)	Main (111)	Branch (30)	Total (141)
Age	0.02	0.29	0.016	0.03	0.29	0.03
Headache	0.045	0.45	0.033	0.067	0.45	0.067

BH*: Benjamini-Hochberg.

Table S8 The significance, effect size and statistical power of each radiomic feature under external test set

Feature	Data distribution	Cohen's d*	Cliffs Delta*	P value (<0.05)	BH*_P (<0.05)	Power
A-log_glcm_log-sigma–1-0-mm-3D-Autocorrelation	Non-normal		0.67	0.0019	0.009	0.38
A-log_glszm_log-sigma-2-0-mm-3D-HighGrayLevelZoneEmphasis	Normal	1.60		0.0002	0.002	0.98
F-wavelet_glrlm_wavelet-LHL-LongRunLowGrayLevelEmphasis	Non-normal		0.24	0.2628	0.394	0.1
I-log_glszm_log-sigma–1-0-mm-3D-HighGrayLevelZoneEmphasis	Non-normal		0.62	0.0040	0.012	0.3
I-wavelet_firstorder_wavelet-HHL-Skewness	Non-normal		0.02	0.9339	0.934	0.04
I-wavelet_glcm_wavelet-LLL-ClusterShade	Normal	0.08		0.8327	0.934	0.05
T1C-log_glszm_log-sigma–1-0-mm-3D-SizeZoneNonUniformity	Non-normal		0.12	0.5626	0.723	0.05
T1-wavelet_glszm_wavelet-LLH-ZoneEntropy	Normal	0.58		0.1234	0.222	0.335
T2-log_glszm_log-sigma-2-0-mm-3D-ZoneEntropy	Normal	0.88		0.0234	0.053	0.64

Cohen's d*: 0.2 indicates a small effect; 0.5 indicates a moderate effect; 0.8 indicates a large effect. Cliffs Delta*: 0–0.147 indicates a small difference; 0.147–0.33 indicates a moderate degree of difference; >0.33 indicates a large difference. BH*: Benjamini-Hochberg

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