

Supplementary Table 1. Radiomic feature families and definitions (first-order, shape, GLCM, GLRLM, GLSZM, GLDM, NGTDM)			
First-order features	Shape-based features (2D)	GLCM	NGTDM
Mean		Autocorrelation	
Median		Cluster prominence	
Entropy		Cluster shade	
Minimum		Cluster tendency	
Maximum		Contrast	
Kurtosis	Mesh surface	Correlation	
Skewness	Pixel surface	Difference average	
Uniformity	Perimeter	Difference entropy	
Energy	Perimeter to surface ratio	Difference variance	
Total energy	Sphericity	Id	Busyness
Range	Maximum 2D diameter	Idm	Coarseness
Mean absolute deviation	Major axis length	Idmn	Complexity
Robust mean absolute deviation	Minor axis length	Idn	Contrast
Root mean squared	Elongation	Imc1	Strength
10 th percentile		Imc2	
90 th percentile		Inverse variance	
Variance		Joint average	
Interquartile range		Joint energy	
		Joint entropy	
		MCC	
		Maximum Probability	
		SumAverage	
		SumEntropy	
		SumSquares	
GLSZM	GLRLM	GLDM	
Small Area Emphasis	Short Run Emphasis		
Large Area Emphasis	Long Run Emphasis		
Gray Level Non-Uniformity	Gray Level Non-Uniformity	Small Dependence Emphasis	
Gray Level Non-Uniformity Normalized	Gray Level Non-Uniformity Normalized	Large Dependence Emphasis	
Size Zone Non-Uniformity	Run Length Non-Uniformity	Gray-Level Non-Uniformity	
Size Zone Non-Uniformity Normalized	Run Length Non-Uniformity Normalized	Dependence Non-Uniformity	
Zone Percentage	Run Percentage	Dependence Non-Uniformity Normalized	
Gray-Level Variance	Gray-Level Variance	Gray-Level Variance	
Zone Variance	Run Variance	Dependence Variance	
Zone Entropy	Run Entropy	Dependence Entropy	
Low Gray-Level Zone Emphasis	Low Gray-Level Run Emphasis	Low Gray-Level Emphasis	
High Gray-Level Zone Emphasis	High Gray-Level Run Emphasis	High Gray-Level Emphasis	
Small Area Low Gray-Level Emphasis	Short Run Low Gray-Level Emphasis	Small Dependence Low Gray-Level Emphasis	
Small Area High Gray-Level Emphasis	Short Run High Gray-Level Emphasis	Small Dependence High Gray-Level Emphasis	
Large Area Low Gray-Level Emphasis	Long Run Low Gray-Level Emphasis	Large Dependence Low Gray-Level Emphasis	
Large Area High Gray-Level Emphasis	Long Run High Gray-Level Emphasis	Large Dependence High Gray-Level Emphasis	
GLCM, Gray-Level Co-occurrence Matrix; NGTDM, Neighboring Gray-Tone Difference Matrix; GLSZM, Gray-Level Size Zone Matrix; GLRLM, Gray-Level Run Length Matrix; GLDM, Gray-Level Dependence Matrix; 2D, two dimensional; MCC, maximal correlation coefficient.			

Supplementary Table 2. Most valuable features in recombined and low-energy images	
Recombined images	Low-energy images
First-order features	
Entropy	Entropy
Uniformity	Range
Mean absolute deviation	Mean absolute deviation
Robust mean absolute deviation	
Interquartile range	
Shape-based features (2D)	
	Perimeter
Perimeter	Sphericity
Sphericity	Mesh surface
Maximum 2D diameter	Pixel surface
Major axis length	Elongation
	Maximum 2D diameter
	Major axis length
GLCM	
	Contrast
Correlation	Imc1
Imc1	Idn
Imc2	Idmn
Inverse variance	Idm
MCC	Id
Sum entropy	MCC
	Difference average
	Sum average
	Joint average
NGTDM	
Busyness	-
GLSZM	
Gray-Level Non-Uniformity Normalized	
Zone entropy	Zone entropy
GLDM	
Dependence entropy	Dependence entropy
	Dependence Non-Uniformity
GLRLM	
Gray-Level Non-Uniformity Normalized	
Long Run High Gray-Level Emphasis	Run entropy
Run entropy	Run Length Non-Uniformity
2D, two dimensional; MCC, maximal correlation coefficient; GLCM, Gray-Level Co-occurrence Matrix; NGTDM, Neighboring Gray-Tone Difference Matrix; GLSZM, Gray-Level Size Zone Matrix; GLDM, Gray-Level Dependence Matrix; GLRLM, Gray-Level Run Length Matrix.	

Supplementary Table 3. Supervised machine learning classifiers, model hyperparameters, and optimization		
Classifiers	Hyperparameters	Optimization
Ensemble learnings	Ensemble method: GentleBoost; maximum number of splits: 23; number of learners: 210; learning rate: 0.46416	Optimizer: grid search; number of grid division: 10; training time limit: true; maximum training time in seconds: 300
Neural network	Number of fully connected layers: 2; activation: Sigmoid; regularization strength (lambda): 3.4364e-08; standardize data: yes; first layer size: 45; second layer size: 7	Optimizer: grid search; number of grid division: 10; training time limit: true; maximum training time in seconds: 300
Support vector machines	Kernel function: Linear; box constraint level: 100; multiclass method: one-vs.-all; standardize data: yes	Optimizer: grid search; number of grid division: 10; training time limit: true; maximum training time in seconds: 300
Decision trees	Preset: optimizable tree; maximum number of splits: 82; split criterion: maximum deviance reduction; surrogate decision splits: off	Optimizer: grid search; number of grid division: 10; training time limit: true; maximum training time in seconds: 300
Naïve Bayes	Preset: optimizable Naïve Bayes; distribution name: Kernel; Kernel type: Gaussian; support: unbounded	Optimizer: grid search; number of grid division: 10; training time limit: true; maximum training time in seconds: 300

Supplementary Table 4. Comparison of performance results of models proposed in studies using radiomics analysis for benign–malignant differentiation on CEM images in the literature				
Radiomics studies in the literature	Number of lesions/ROIs (n)	Feature number	Classifier	Performance parameters (%)
Patel et al. ¹³	50 (50 patients; 24 benign and 26 malignant)	236	SVM	AUC: 95 Accuracy: 90 Sensitivity: 88 Specificity: 92
Perek et al. ¹⁴	129 (54 patients; 73 benign and 56 malignant)	N/A	Multimodal Network	AUC: 89 Sensitivity: 100 Specificity: 66
Fanizzi et al. ¹⁵	58 (53 patients; 24 benign and 34 malignant)	12	Random Forest	AUC: 93.1 Accuracy: 87.5 Sensitivity: 87.5 Specificity: 91.7
Losurdo et al. ⁵	55 (51 patients; 29 benign and 26 malignant)	10	SVM	Accuracy: 80.91 Sensitivity: 90.28 Specificity: 71.55
Massafra et al. ⁹	58 (53 patients; 15 benign and 43 malignant)	2	Random Forest	AUC: 95.66 Accuracy: 90.52 Sensitivity: 88.37 Specificity: 100
Mateos et al. ¹⁶	68 (17 patients; 4 images each; 40 benign and 28 malignant)	17	Logistic regression	Accuracy: 87 Sensitivity: 93 Specificity: 79
Wang et al. ¹⁷	226 (192 patients; 101 benign and 125 malignant)	392	LASSO Logistic regression	AUC: 96
Present study (best-performing model)	164 (145 patients; 73 benign and 91 malignant)	102	Ensemble	AUC: 97.83 Accuracy: 91.75 Sensitivity: 91.83 Specificity: 91.66
Note: n indicates the number of lesions/ROIs (or images, where specified) analyzed in each study. Feature number is reported as N/A when a study does not use conventional hand-crafted radiomic feature extraction (e.g., deep learning-based models in which features are learned implicitly and not enumerated). ROI, region of interest; N/A, not applicable; SVM, support vector machine; AUC, area under the curve.				