Supplementary Materials

Radiological features

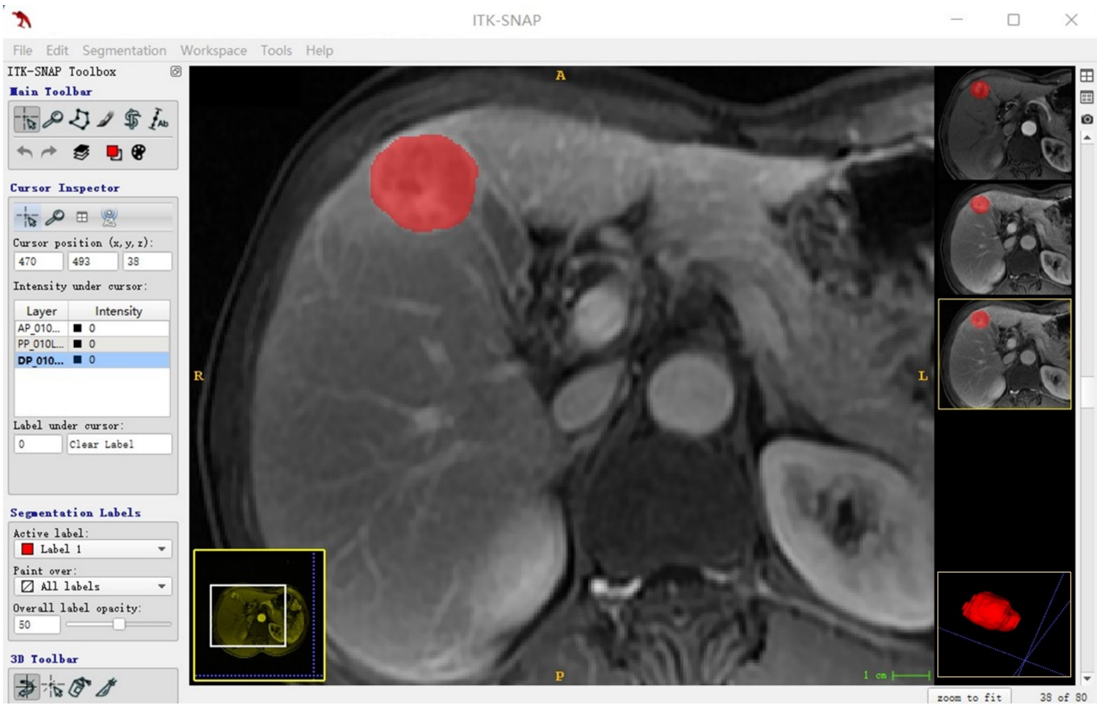
Supplementary Table 1 Detailed descriptions of radiological features

Radiological features	Descriptions
Tumour size	The largest cross-sectional diameter of HCC on T_1WI obtained at portal phase.
Tumour shape	Irregular tumours were defined as nonnodular tumours, such as focal or crescent extra-nodular extension beyond the capsule, multinodular confluence appearance, and focal infiltrative margin.
Intratumor fat	Decreased opposed-phase T_1-weighted signal intensity compared with in-phase T_1-weighted signal intensity.
Intratumor necrosis	A central area of high-signal intensity on fat-suppressed T_2WI without enhancement on postcontrast T_1WI and involving at least 20% of the tumour area at the level of the largest cross-sectional diameter.
Intratumor haemorrhage	Hyperintense area on T_1WI, with variable signal intensity on T_2WI.
Enhancing capsule	Peripheral rim of smooth hyperenhancement in the portal phase or delay phase.
Tumour-to-liver ADC ratio	Tumour ADC, ROI encompassing the HCC, but avoiding the areas identified as substantial necrosis on ADC images at the level of the largest cross-sectional diameter; Liver ADC, ROI measuring 200-300 mm^2 placed on adjacent liver parenchyma avoiding vessels; The tumour-to-liver ADC ratio were calculated.

Note. HCC: hepatocellular carcinoma; T_1WI: T_1-weighted imaging; T_2WI: T_2-weighted imaging; ADC: apparent diffusion coefficient; ROI: region of interest.

Image segmentation process

The DCE images were imported into ITK software, and the whole liver cancer was manually segmented layer by layer to determine the volume of interest. Supplementary Figure 1 shows the representative results of the whole tumour on AP, PP, and DP sequences using ITK software. Three-dimensional volumetric reconstruction of the segmented lesion is shown at the bottom right.



Supplementary Figure 1 Image segmentation process using ITK software.

RSD calculation

RSD is the absolute value of the coefficient of variation and is usually expressed as a percentage according to the following formula.

$$RSD = \frac{\sigma_{AUC}}{\mu_{AUC}} \times 100\%$$

where σ_{AUC} and μ_{AUC} are the standard deviation and mean of the 500 AUC values, respectively. It should be noted that higher stability corresponds to lower RSD values. For each machine learning algorithm, we trained the model on a subsampled training cohort (size N/2) from the training set and evaluated the performance on the remaining data using AUC of the receiver operating characteristic curve. Subsampling of the training was performed 500 times using a bootstrap approach.

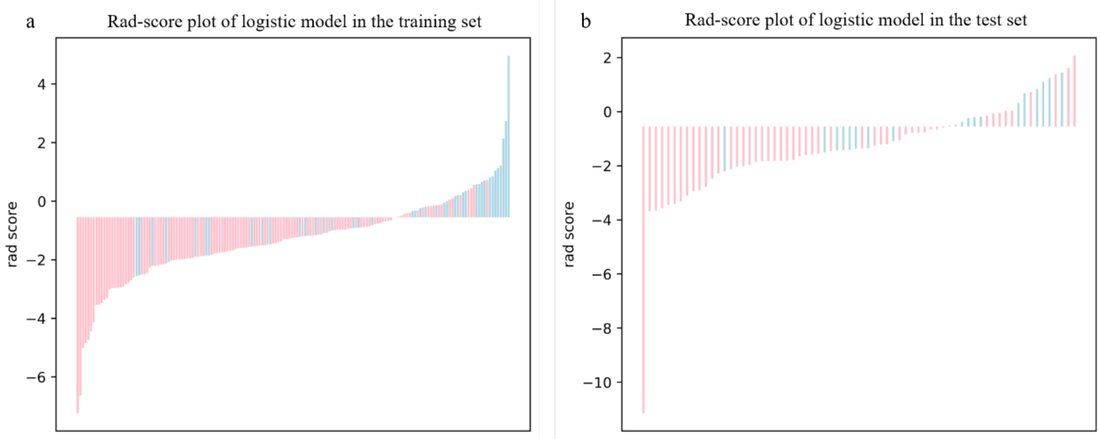
Radiomics features and Rad-score

Supplementary Table 2 Details of retained radiomics features

Sequences	Coefficients	Features
AP (n = 9)	-0.066	Shape-sphericity
	-0.427	GLCM-MCC
	0.195	LoG-sigma-3-0-mm-3D_firstorder_90Percentile
	0.302	LoG-sigma-3-0-mm-3D_firstorder_Kurtosis
	0.221	wavelet-LLH_firstorder_Kurtosis
	-0.120	wavelet-LHL_firstorder_Skewness
	0.299	wavelet-LHH_gldm_DependenceNonUniformityNormalized
	-0.541	wavelet-HHL_glcm_Correlation
	-0.563	wavelet-HHH_firstorder_Median
PP (n = 9)	-0.141	First order-Kurtosis
	0.211	GLCM-ClusterShade
	0.132	LoG-sigma-2-0-mm-3D_glcm_ClusterShade
	0.248	LoG-sigma-2-0-mm-3D_glcm_MCC
	-0.084	wavelet-LHL_glcm_Correlation
	-0.430	wavelet-HLL_glcm_MCC
	0.192	wavelet-HLH_firstorder_Skewness
	-0.027	wavelet-HHL_glcm_MCC
	-0.111	wavelet-HHL_glszm_LowGrayLevelZoneEmphasis

	0.021	First order-Minimum
	0.096	wavelet-LHL_glcm_MCC
	-0.687	wavelet-LHH_firstorder_Median
	0.328	wavelet-HLL_firstorder_Kurtosis
DP (n = 9)	0.470	wavelet-HLL_glcm_Correlation
	0.104	wavelet-HLH_glcm_ClusterShade
	-0.340	wavelet-HHL_firstorder_Mean
	0.035	wavelet-HHL_firstorder_Skewness
	-0.173	wavelet-HHH_firstorder_Median

Note. Intercept = -1.302; the corresponding rad-score of radiomics signature was calculated.



Supplementary Figure 2 Rad-score plot of the radiomics signature in the training (A) and test (B) sets.

Model score

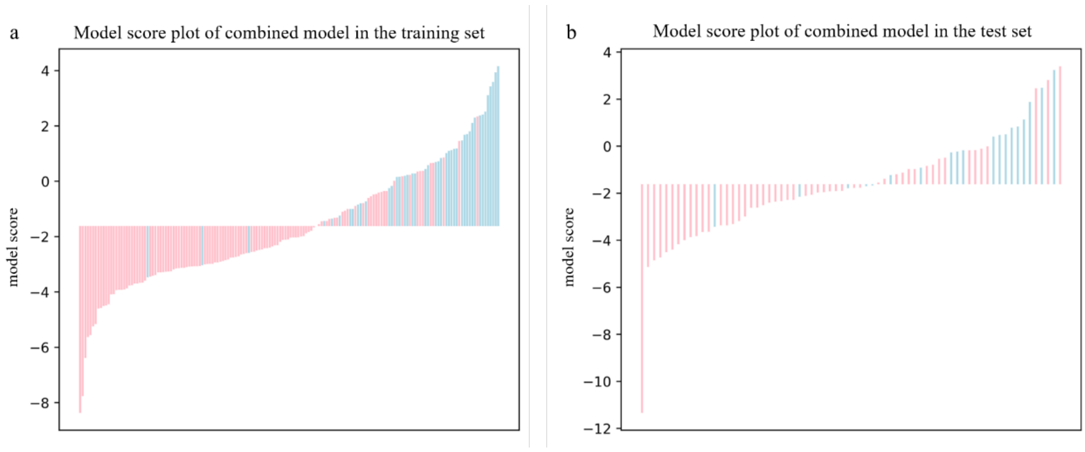
Model score = 1.695 - 0.034×Age

+ 2.452×AFP

+ 0.197×Tumour size

-1.020×Tumour-to-liver ADC ratio

+ 0.941×Rad-score



Supplementary Figure 3 Model score plot of the combined model in the training (A) and test (B) sets.