

Supplementary Materials

Table 1: Clinical Variables of patients in the training group and validation group.

Variables	Total (n = 164)	Training group (n = 114)	Validation group (n = 50)	P
Age(year), Mean $\pm$ SD	59.34 $\pm$ 8.47	59.34 $\pm$ 8.00	59.32 $\pm$ 9.55	0.988
WBC(*10 ⁹ /L), M (Q ₁ , Q ₃)	5.40 (3.90, 6.70)	5.20 (3.92, 6.38)	5.60 (3.97, 7.00)	0.164
RBC(*10 ¹²), Mean $\pm$ SD	4.35 $\pm$ 0.62	4.38 $\pm$ 0.64	4.29 $\pm$ 0.55	0.355
HGB(g/L), M (Q ₁ , Q ₃)	137.50 (124.75, 150.00)	139.00 (125.25, 150.00)	134.50 (123.50, 145.50)	0.176
PLT(*10 ⁹ /L), M (Q ₁ , Q ₃)	155.50 (111.00, 203.25)	152.50 (111.00, 200.00)	160.00 (121.00, 218.25)	0.149
ALT(U/L), M (Q ₁ , Q ₃)	26.87 (19.12, 40.84)	27.07 (20.29, 42.44)	24.49 (17.75, 38.22)	0.192
AST(U/L), M (Q ₁ , Q ₃)	26.62 (21.24, 39.60)	26.92 (20.93, 40.76)	25.93 (22.10, 37.52)	0.996
TBIL(umol/L), M (Q ₁ , Q ₃)	12.80 (9.65, 16.15)	12.50 (9.83, 16.25)	13.50 (7.43, 15.78)	0.625
DBIL(umol/L), M (Q ₁ , Q ₃)	3.70 (2.80, 5.60)	3.70 (2.80, 5.07)	3.65 (2.70, 6.00)	0.964
IBIL(umol/L), M	8.70	8.75	8.60	0.398

Variables	Total (n = 164)	Training group (n = 114)	Validation group (n = 50)	P
(Q ₁ , Q ₃)	(6.07, 11.38)	(6.30, 11.60)	(4.90, 11.02)	
GGT(U/L), M (Q ₁ , Q ₃)	50.06 (30.19, 99.39)	44.36 (30.06, 94.31)	56.50 (30.91, 114.05)	0.298
AKP(U/L), M (Q ₁ , Q ₃)	85.01 (69.99, 103.85)	84.31 (70.25, 104.22)	87.58 (69.92, 103.57)	0.477
TBA(umol/L), M (Q ₁ , Q ₃)	8.35 (5.00, 14.48)	9.05 (5.20, 14.82)	6.95 (4.93, 13.85)	0.263
PT(s), M (Q ₁ , Q ₃)	13.50 (12.70, 14.39)	13.60 (12.72, 14.40)	13.25 (12.55, 14.28)	0.285
INR(s), M (Q ₁ , Q ₃)	1.06 (1.00, 1.13)	1.06 (1.01, 1.13)	1.04 (1.00, 1.12)	0.294
APTT(s), M (Q ₁ , Q ₃)	35.30 (30.35, 38.62)	35.30 (30.12, 38.68)	35.40 (30.75, 38.18)	0.840
FIB(g/L), M (Q ₁ , Q ₃)	2.79 (2.32, 3.31)	2.72 (2.32, 3.27)	2.84 (2.25, 3.41)	0.651
TT(s), , Mean ± SD	17.29 ± 1.14	17.26 ± 1.13	17.34 ± 1.16	0.713
AFP(IU/ml), M (Q ₁ , Q ₃)	22.70 (4.35, 209.33)	22.12 (4.46, 187.30)	26.75 (4.12, 247.05)	0.940
CNLC, n(%)				0.320
Ia	68 (41.46)	53 (46.49)	15 (30.00)	
Ib	63 (38.41)	40 (35.09)	23 (46.00)	

Variables	Total (n = 164)	Training group (n = 114)	Validation group (n = 50)	<i>P</i>
II a	30 (18.29)	19 (16.67)	11 (22.00)	0.651
II b	1 (0.61)	1 (0.88)	0 (0.00)	
IIIa	2 (1.22)	1 (0.88)	1 (2.00)	
BCLC, n(%)				
A	131 (79.88)	93 (81.58)	38 (76.00)	0.920
B	31 (18.90)	20 (17.54)	11 (22.00)	
C	2 (1.22)	1 (0.88)	1 (2.00)	
Gender, n(%)				
Female	27 (16.46)	19 (16.67)	8 (16.00)	0.151
Male	137 (83.54)	95 (83.33)	42 (84.00)	
Hepatitis B, n(%)				
Negative	45 (27.44)	27 (23.68)	18 (36.00)	
Positive	119 (72.56)	87 (76.32)	32 (64.00)	0.224
Hepatitis C, n(%)				
Negative	141 (85.98)	101 (88.60)	40 (80.00)	
Positive	23 (14.02)	13 (11.40)	10 (20.00)	
Drink, n(%)				0.997
No	100 (60.98)	69 (60.53)	31 (62.00)	
Yes	64 (39.02)	45 (39.47)	19 (38.00)	
Smoke, n(%)				
No	86 (52.44)	58 (50.88)	28 (56.00)	0.664
Yes	78 (47.56)	56 (49.12)	22 (44.00)	
Cirrhosis, n(%)				
Absent	110(67.07)	77(67.54)	33(66.00)	
Present	54(32.93)	37(32.46)	17(34.00)	

SD,standard deviation; M,median;Q1,1st quartile; Q3,3st quartile; WBC,white blood cell; RBC,red blood cell; HBG,hemoglobin; PLT, platelet; ALT, alanine aminotransferase; AST, aspartate aminotransferase; TBIL, total bilirubin; DBIL, directed bilirubin; IBIL,indirect bilirubin; GGT,gamma glutamyl transferase; AKP,alkaline phosphatase; TBA,total bile acids; PT, prothrombin time; INR, international normalized ratio; APTT, activated partial thromboplastin time; FIB,fibrinogen; TT,thrombin time; AFP, alpha fetoprotein; CNLC,China Liver Cancer Staging ;BCLC,Barcelona Clinic Liver Cancer.

Table 2:Features of models

Model	Feature
Intratumoral model	exponential_firstorder_Skewness
	exponential_glcml_Icn
	lbp_3D_m2_glcml_ClusterShade
	lbp_3D_m2_glrml_HighGrayLevelRunEmphasis
	lbp_3D_m2_glszm_HighGrayLevelZoneEmphasis
	lbp_3D_m2_glszm_LowGrayLevelZoneEmphasis
	square_firstorder_Skewness
	wavelet_HLL_firstorder_Median
	wavelet_LHH_firstorder_Skewness
	wavelet_LLL_firstorder_RobustMeanAbsoluteDeviation
Peritumoral model	exponential_glcml_ClusterShade
	lbp_3D_m1_firstorder_Skewness
	lbp_3D_m1_glszm_LargeAreaHighGrayLevelEmphasis
	logarithm_ngtdm_Busyness
	squareroot_glszm_SmallAreaLowGrayLevelEmphasis
	wavelet_HHH_glcml_DifferenceVariance
	wavelet_HLH_firstorder_Skewness
	wavelet_HLH_glrml_ShortRunEmphasis
	wavelet_HLH_glszm_LargeAreaEmphasis
	wavelet_LHH_glcml_ClusterShade
	wavelet_LHH_glszm_SmallAreaHighGrayLevelEmphasis
	wavelet_LHL_glszm_SmallAreaHighGrayLevelEmphasis

Model	Feature
Fusion model	hasis
	wavelet_LLL_glcm_Correlation
	wavelet_LLL_glcm_DifferenceVariance
	exponential_firstorder_Skewness
	lbp_3D_m1_glszm_GrayLevelVariance
	lbp_3D_m2_glszm_LowGrayLevelZoneEmphasis
	square_firstorder_Skewness
	squareroot_glcm_Correlation
	wavelet_HHH_glcm_Correlation
	wavelet_LHL_firstorder_Median

Table 3:Univariate and multivariate logistic regression analyses

Variables	Univariate		Multivariate	
	OR(95%CI)	p	OR(95%CI)	p
AFP	1.001(1.000-1.002)	0.021	1.001(1.000-1.003)	0.135
HGB	1.003(1.001-1.005)	0.023	0.970(0.935-1.005)	0.162
PLT	1.003(1.001-1.005)	0.007	1.009(0.999-1.018)	0.120
GGT	1.004(1.001-1.008)	0.034	1.001(0.994-1.008)	0.820
AKP	1.005(1.001-1.008)	0.022	1.003(0.993-1.013)	0.608
TBA	1.005(0.989-1.021)	0.598		
Age	1.007(1.001-1.012)	0.043	1.023(0.969-1.080)	0.492
APTT	1.011(1.002-1.020)	0.046	1.039(0.971-1.111)	0.353
ALT	1.012(1.004-1.020)	0.010	1.050(1.010-1.092)	0.040
AST	1.012(1.004-1.020)	0.016	0.984(0.939-1.030)	0.569
TBIL	1.023(1.003-1.044)	0.062		
TT	1.024(1.006-1.043)	0.031	0.884(0.629-1.241)	0.549
PT	1.027(1.003-1.050)	0.059		
IBIL	1.036(1.004-1.068)	0.061		
DBIL	1.058(1.001-1.117)	0.094		
WBC	1.088(1.029-1.150)	0.012	1.093(0.861-1.390)	0.541
RBC	1.105(1.029-1.188)	0.021	2.879(0.859-9.650)	0.150
FIB	1.147(1.034-1.274)	0.031	0.565(0.287-1.111)	0.164
Drink	1.368(0.833-2.248)	0.299		
BCLC	1.402(0.706-2.784)	0.417		
INR	1.427(1.068-1.906)	0.043	0.007(0.000-0.620)	0.069
CNLC	1.554(1.143-2.113)	0.018	0.880(0.490-1.579)	0.719
Hepatitis_C	1.600(0.626-4.088)	0.410		
Gender	1.639(1.157-2.321)	0.019	0.356(0.080-1.589)	0.256
Smoke	1.947(1.224-3.099)	0.018	1.541(0.603-3.939)	0.449
Hepatitis_B	2.107(1.445-3.074)	0.001	8.294(2.651-25.946)	0.002

	Univariate		Multivariate	
Variables	OR(95%CI)	p	OR(95%CI)	p
Cirrhosis	2.700(1.468-4.963)	0.007	6.698(2.008-22.354)	0.009
Radscore	2.583(1.619-4.121)	0.001	12.828(2.467-66.686)	0.011

OR(95%CI), Odds Ratio (95% Confidence Interval); WBC,white blood cell; RBC,red blood cell; HBG,hemoglobin; PLT, platelet; ALT, alanine aminotransferase; AST, aspartate aminotransferase; TBIL, total bilirubin; DBIL, directed bilirubin; IBIL,indirect bilirubin; GGT,gamma glutamyl transferase; AKP,alkaline phosphatase; TBA,total bile acids; PT, prothrombin time; INR, international normalized ratio; APTT, activated partial thromboplastin time; FIB,fibrinogen; TT,thrombin time; AFP, alpha fetoprotein; CNLC,China Liver Cancer Staging ;BCLC,Barcelona Clinic Liver Cancer.

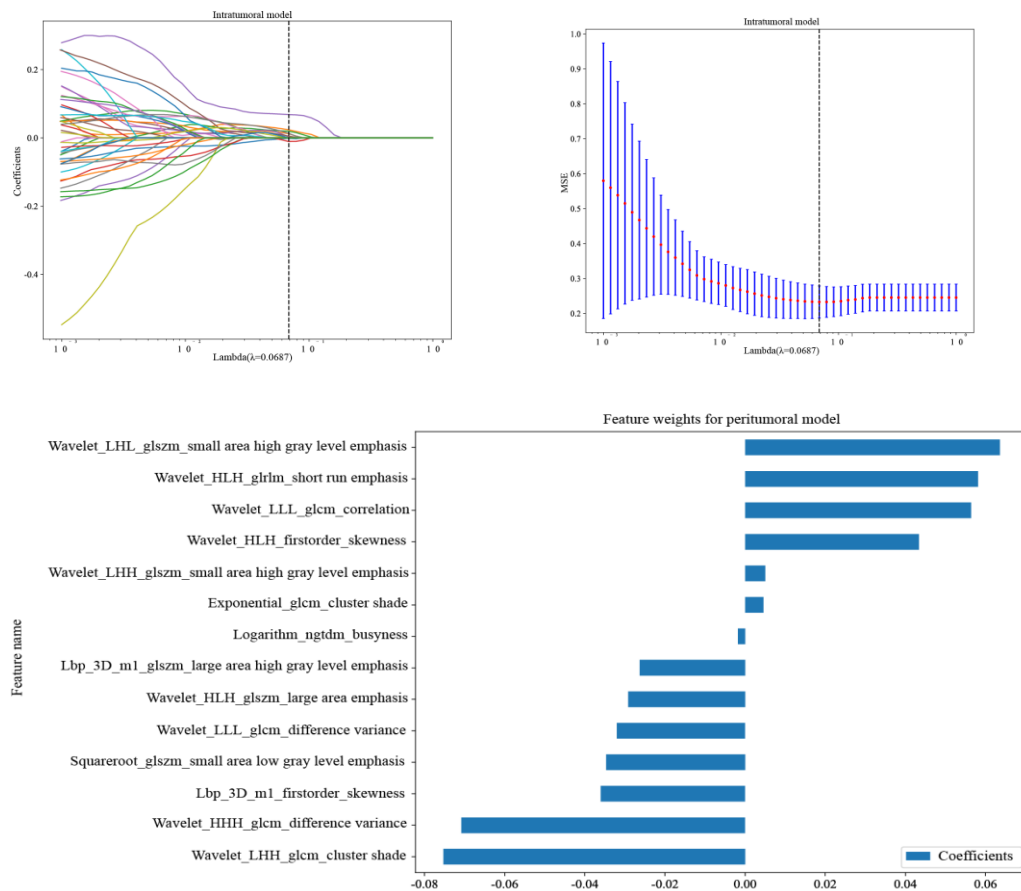


Figure 1 LASSO results of intratumoral model

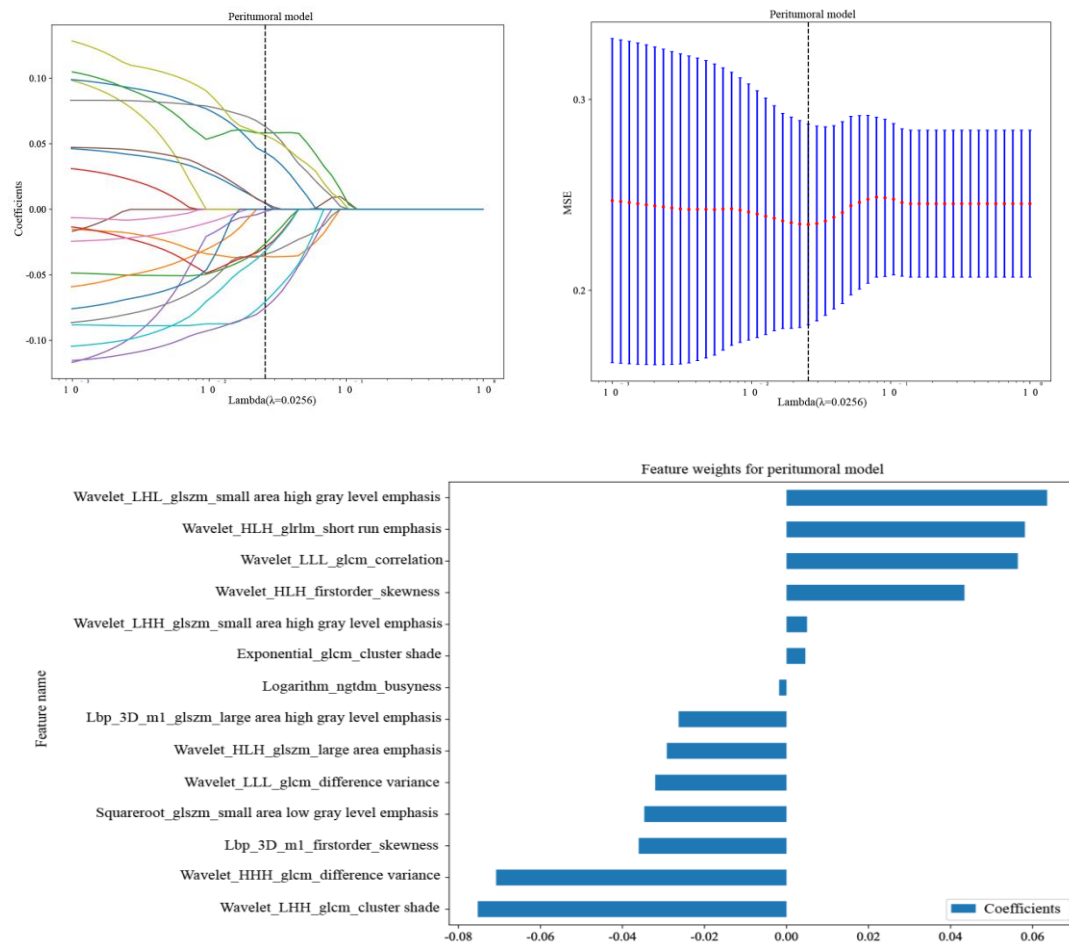
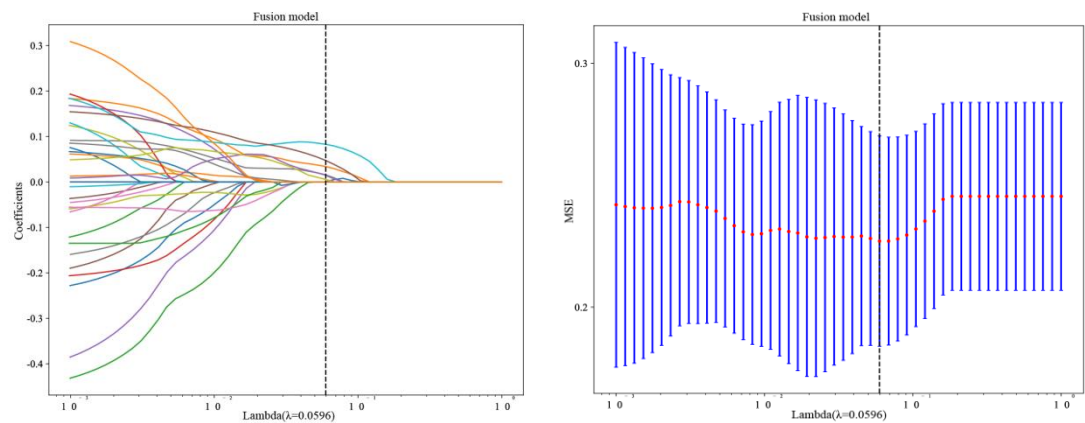


Figure 2 LASSO results of peritumoral model



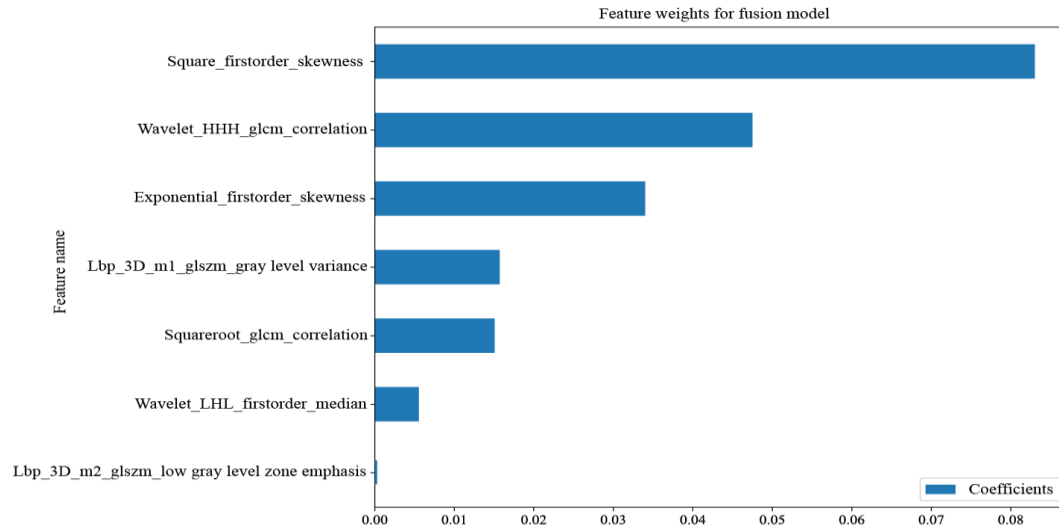


Figure 3 LASSO results of fusion model

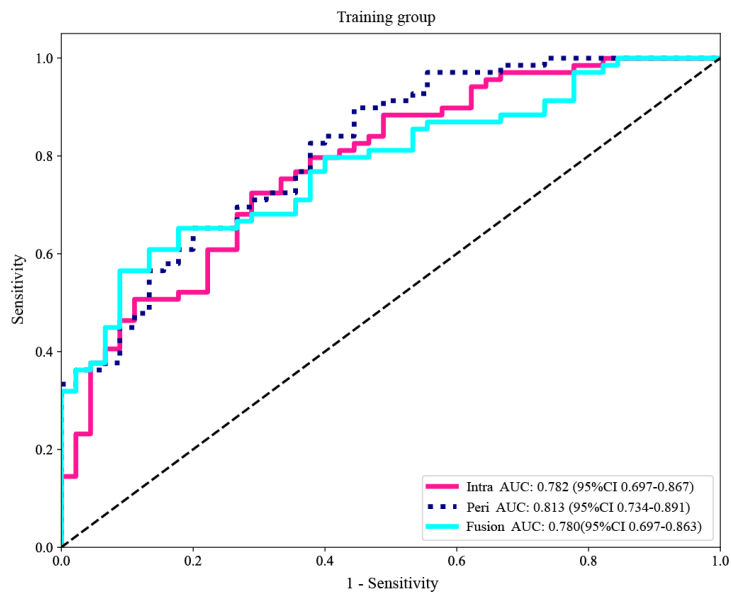


Figure 4 The ROC curve for the training group

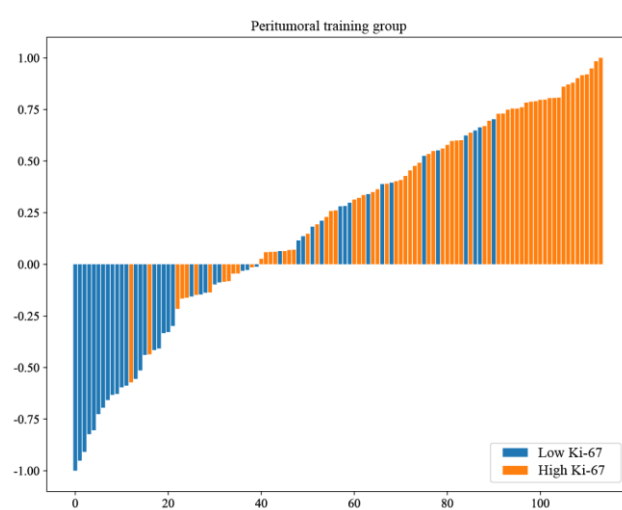
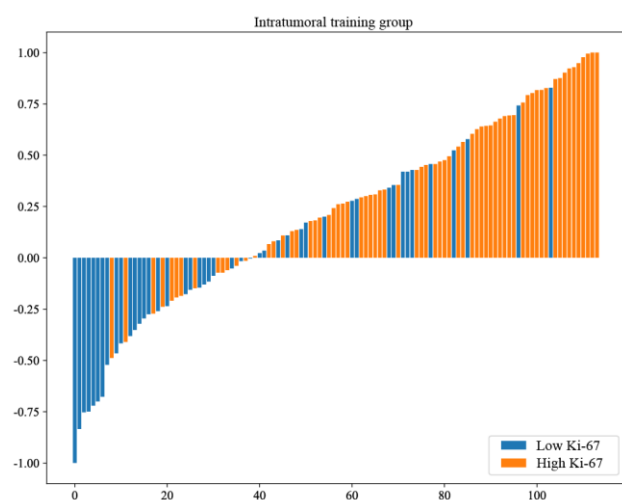


Figure 5 The training group's waterfall diagram

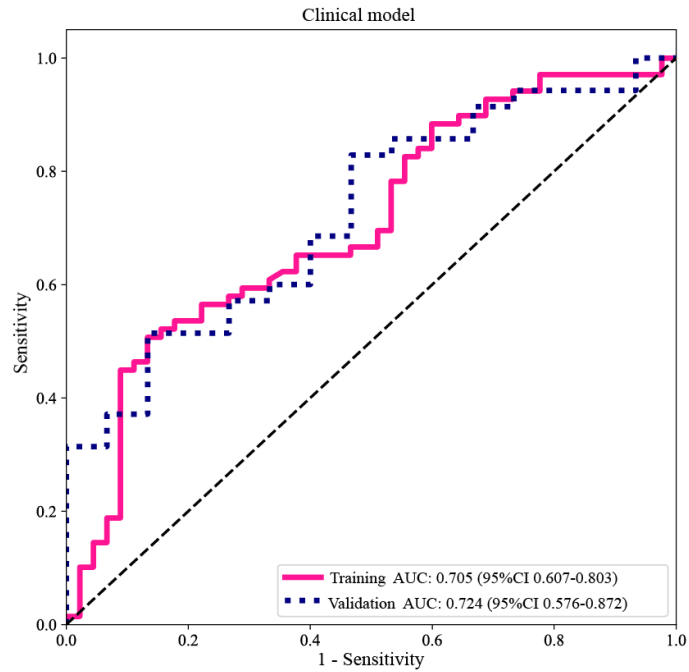


Figure 6 The ROC curve for the clinical model

Appendix S1. Radiomics score calculation formulae.

$$\begin{aligned}
 \text{Radscore} = & 0.6052631578947368 + 0.034000 * \text{exponential_firstorder_Skewness} \\
 & + 0.015691 * \text{lbp_3D_m1_glszm_GrayLevelVariance} + 0.000012 * \\
 & \text{lbp_3D_m2_glszm_LowGrayLevelZoneEmphasis} + 0.083010 * \\
 & \text{square_firstorder_Skewness} + 0.015080 * \text{squareroot_glcm_Correlation} \\
 & + 0.047482 * \text{wavelet_HHH_glcm_Correlation} + 0.005522 * \\
 & \text{wavelet_LHL_firstorder_Median}
 \end{aligned}$$