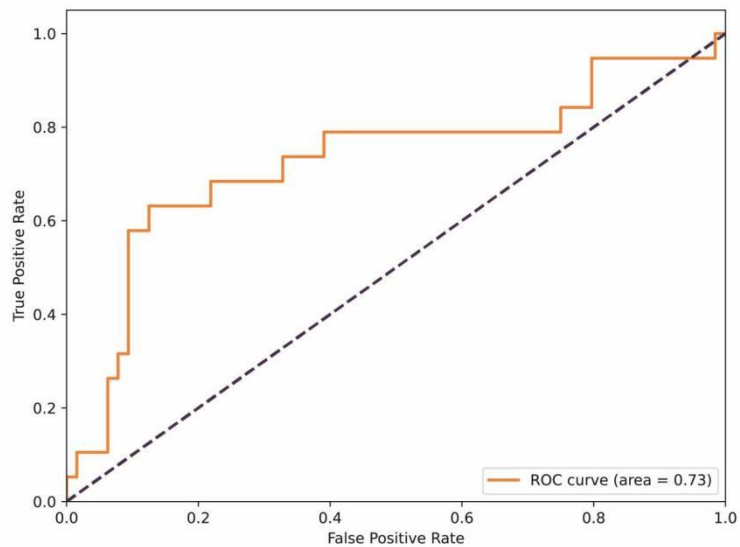
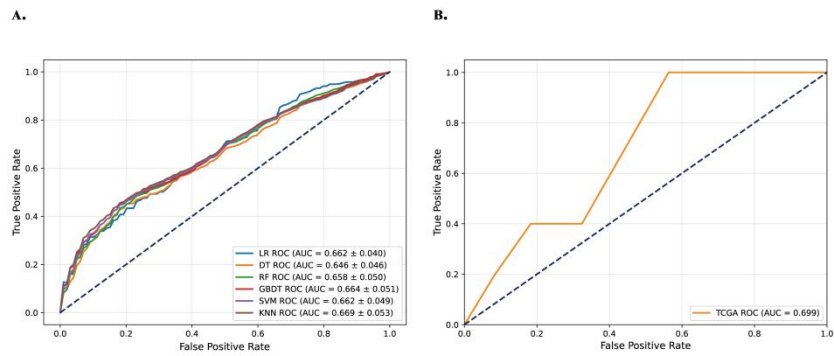


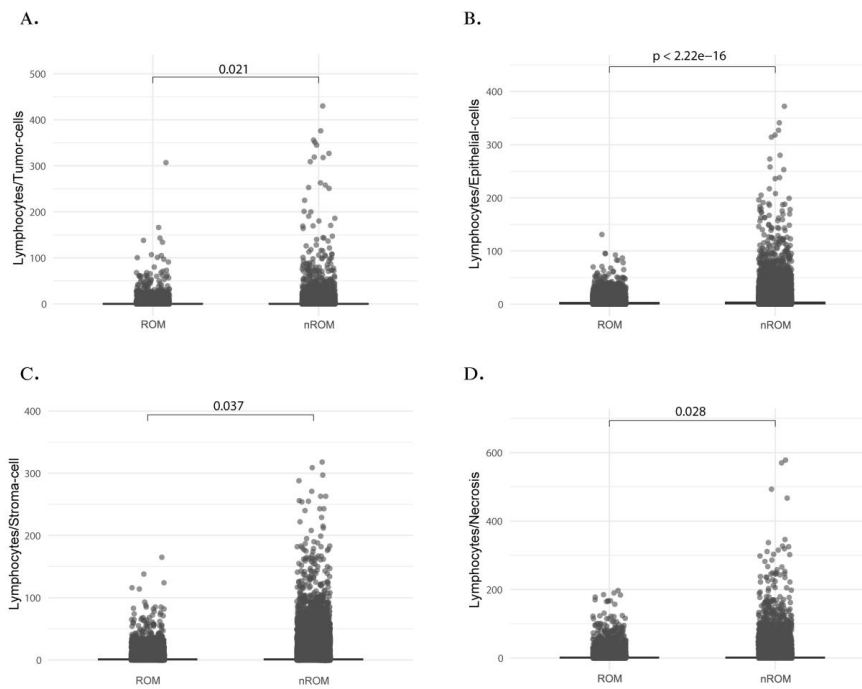
Supplementary Figure S1. Comparison of manually annotated ROIs on different WSIs by two pathologists. (A–C) Manually annotated ROIs by Pathologist 1 for Case 8 and Case 16; (B–D) Manually annotated ROIs by Pathologist 2 for Case 8 and Case 16.



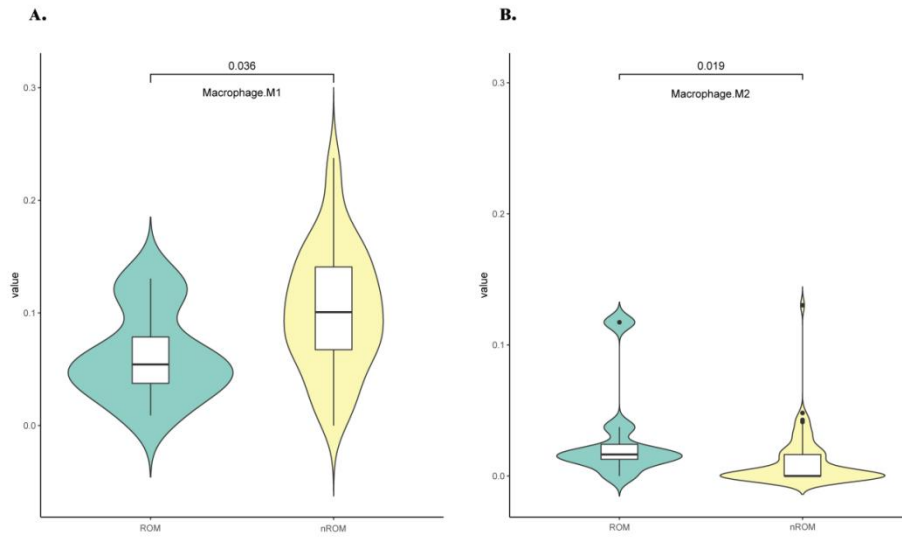
Supplementary Figure S2. Independent validation of the prognostic prediction model based on WSIs from Early-Stage HER2-Positive patients.



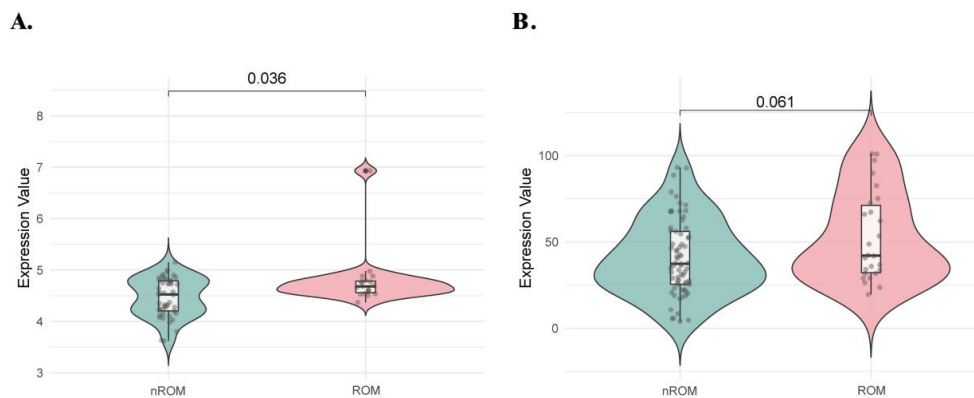
Supplementary Figure S3. Prediction results of the model derived from clinicopathological features. (A) Performance of the prediction model in the training cohort; (B) Performance of the prediction model in the external validation cohort; LR, Logistic Regression; DT, Decision Tree; RF, Random Forest; GBDT, Gradient Boosting Decision Trees; SVM, Support Vector Machine; KNN, K-Nearest Neighbors.



Supplementary Figure S4. Comparison of lymphocyte ratios between ROM and nROM groups. (A) lymphocytes vs. tumor cells; (B) lymphocytes vs. epithelial cells; (C) lymphocytes vs. stromal cells; (D) lymphocytes vs. necrotic cells. ROM, recurrence or metastasis; nROM, non-recurrence or metastasis.



Supplementary Figure S5. Differential immune cell composition between ROM and nROM groups based on xCell analysis. (A) Macrophage.M1; (B) Macrophage.M2; ROM, recurrence or metastasis; nROM, non-recurrence or metastasis.



Supplementary Figure S6. Differential Expression of HES5 Between ROM and nROM Groups in GEO database. (A) Differential Expression of HES5 in the GSE21653 Dataset; (B) Differential Expression of HES5 in the GSE58812 Dataset; ROM, recurrence or metastasis; nROM, non-recurrence or metastasis.

Supplementary Table S1. Inter-observer DICE coefficients for manual ROI annotations on the same WSIs by different pathologists

Case	Dice
1	0.9591528525052299
2	0.9337753133595246
3	0.8713019086664512
4	0.8409562012935907
5	0.9321138549590399
6	0.9001096901840776
7	0.9350292112303658
8	0.9725335759415191
9	0.9388931799734018
10	0.9559013153288494
11	0.8903998322711985
12	0.867215859210279
13	0.9186066486133315
14	0.9667203583513324
15	0.8932091703101858
16	0.9807698490645679
17	0.9587753114841269
18	0.9277953224111523
19	0.9466497800947459
20	0.9412210168155413

Supplementary Table S2. Correlation analysis between WSIs' texture features and prognosis in TNBC

Texture Features	ROM (<i>n</i> = 8)	nROM (<i>n</i> = 73)	<i>P</i>
SGSDA (SD)	0.00543 (0.00173)	0.00506 (0.00102)	0.036
SGBDA (SD)	0.00148 (0.00057)	0.00132 (0.00033)	0.022
GLA (SD)	14.09574 (1.17019)	14.08071 (0.54481)	< 0.001
DLA (SD)	1.40873 (0.15260)	1.45559 (0.23097)	0.515
GLMSE (SD)	12.70311 (1.56894)	13.44795 (1.49892)	0.825
DLMSE (SD)	3.35236 (0.81650)	3.72056 (1.23806)	0.527
Correlation (SD)	5.67410 (2.24010)	6.24914 (3.21273)	0.533
Regulation (SD)	13.09574 (1.17019)	13.08071 (0.54481)	< 0.001
Contrast (SD)	170.01844 (24.53334)	168.00043 (11.07310)	< 0.001
IDM (SD)	0.00872 (0.00204)	0.00860 (0.00086)	< 0.001
Entropy (SD)	3.21195 (0.62480)	3.43742 (0.36629)	0.019

Note. ROM, recurrence or metastasis; nROM, non-recurrence or metastasis.