Comprehensive analysis of lung cancer pathology images to discover tumor shape and boundary features that predict survival outcome

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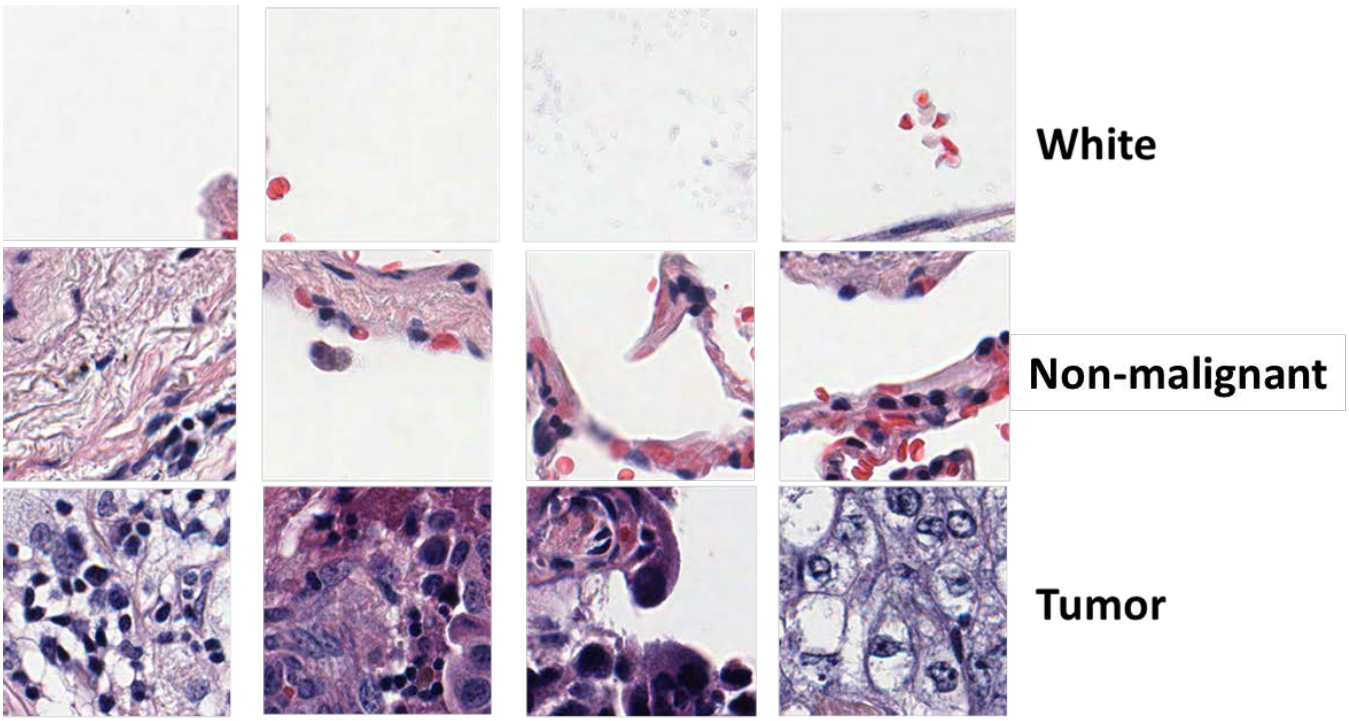
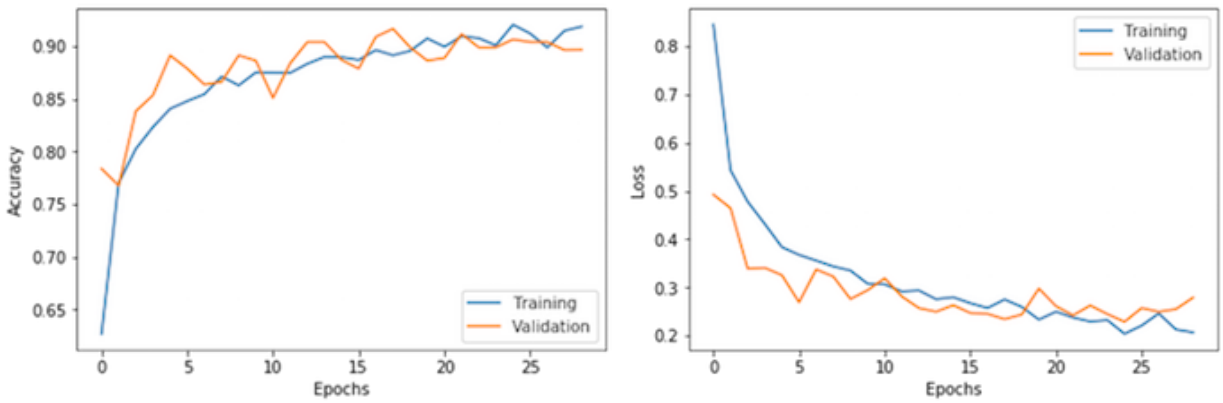
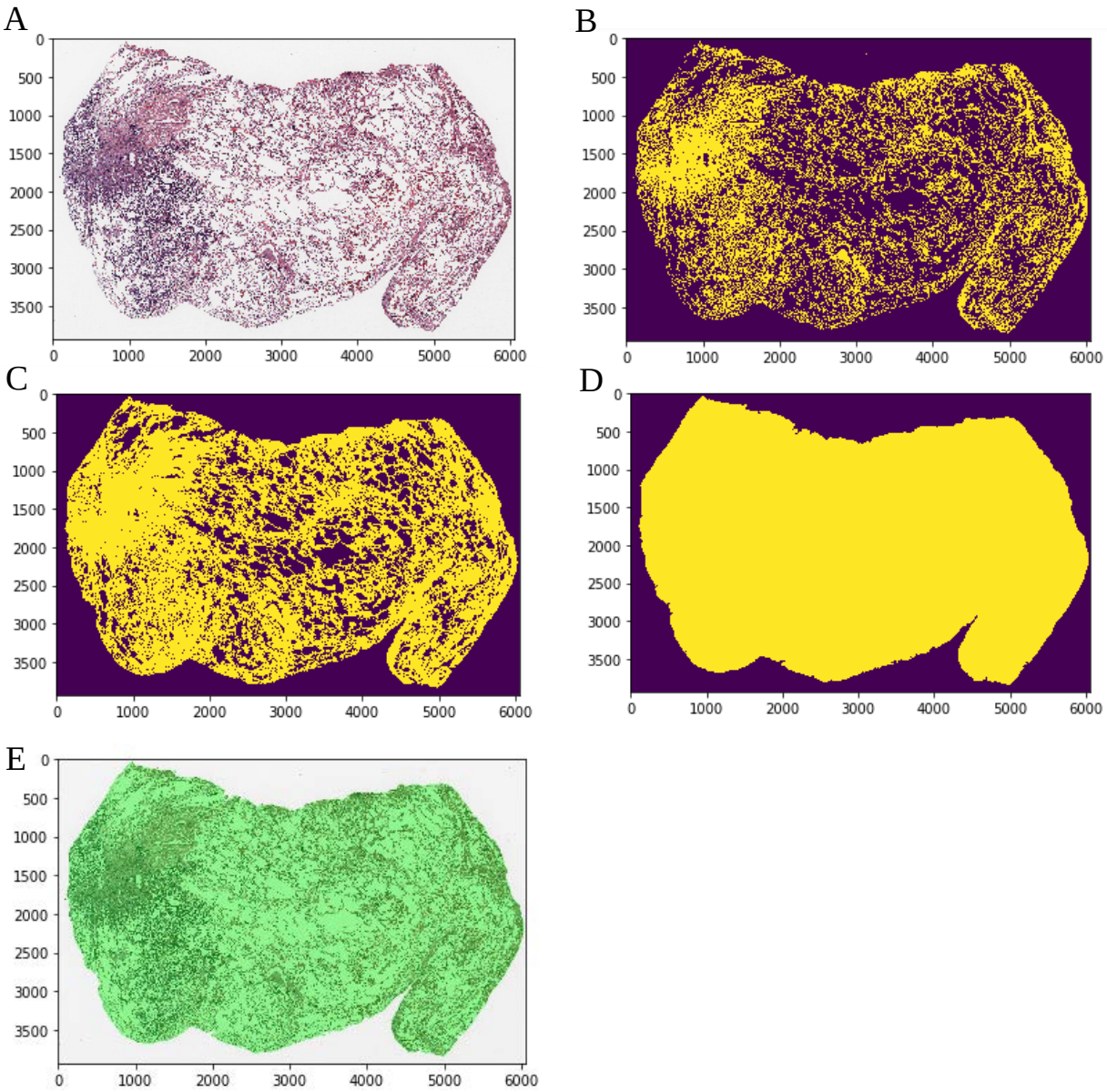
Supplementary material



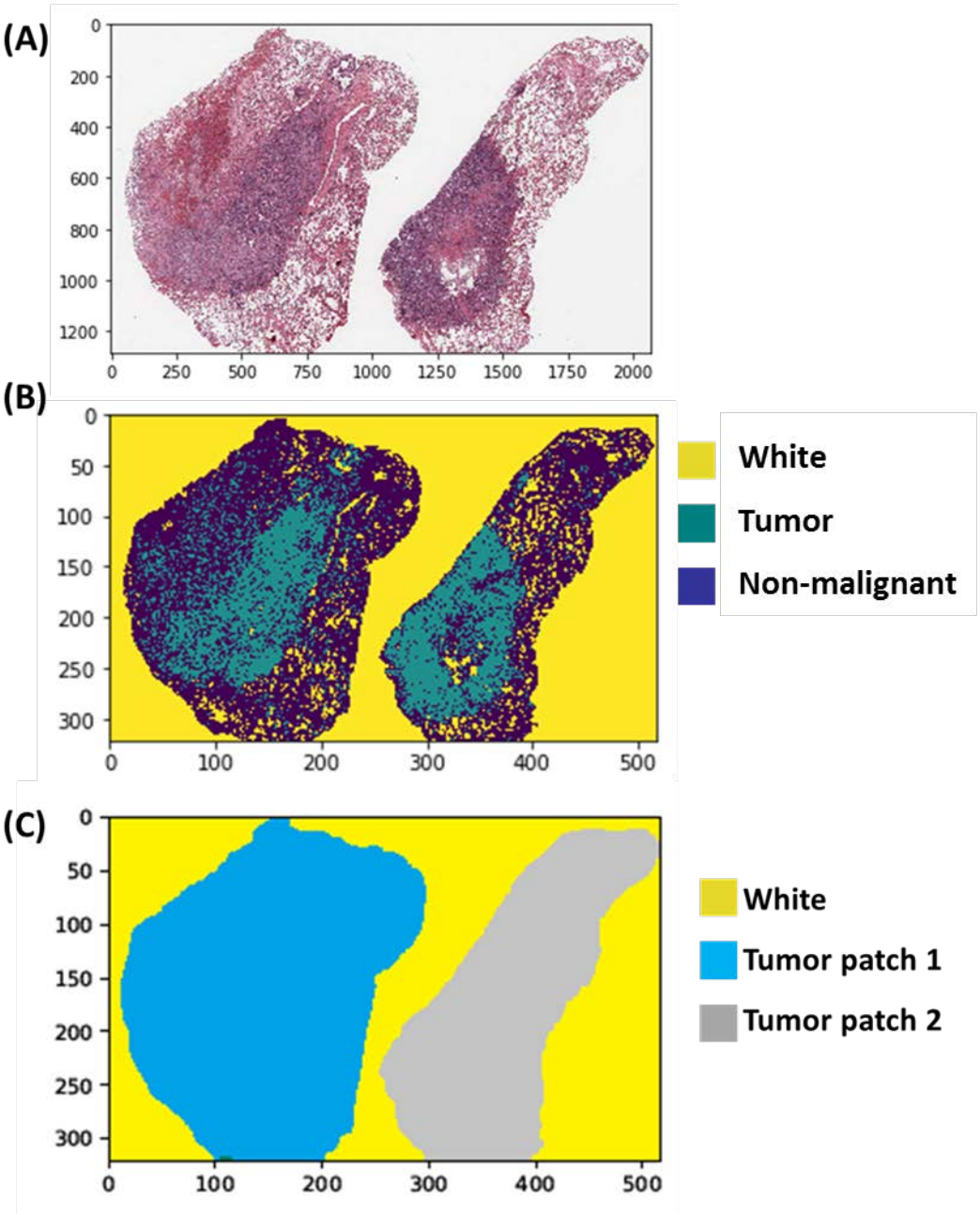
Supplemental Figure 1. Example of image patches from “white” (empty regions, upper panel), “non-malignant” (middle panel) and “tumor” (bottom panel) categories. Patch size: 300 × 300 pixels.



Supplemental Figure 2. Convolutional Neural Network learning curves in both training and validation datasets. Left, accuracy versus epochs; right, loss versus epochs.



Supplemental Figure 3. Otsu thresholding and image morphological operations to speed up image-level prediction process. (A) The original image. (B) The image mask after Otsu thresholding. (C) The image mask after dilation and removal of small objects of the mask in (B). (D) The final mask after dilation, erosion, and filling up holes of mask in (C). (E) Overlap final image mask and original pathology image.



Supplemental Figure 4. Tissue region identification in case of multiple tissue samples within one image. **(A)** Original image. **(B)** Predicted patch-level tumor, non-malignant and white heatmap. **(C)** Disconnected tissue samples identified by image processing. Yellow, background; blue, first tissue patch; gray, second tissue patch.

Supplemental Table 1. Confusion matrix for image patch classification.

Ground Truth\Predicted Value	*Non-malignant*	*Tumor*	*White*
Non-malignant	400 (93.5%)	24 (5.6%)	4 (0.9%)
Tumor	58 (11.7%)	436 (88.1%)	1 (0.2%)
White	21 (14.4%)	1 (0.7%)	124 (84.9%)

Supplemental Table 2. Comparison of patient characteristics between high-risk and low-risk groups in TCGA validation dataset.

	Low-risk	*High-risk*	*p-value*
No. of patients	195	194	
Age	65.50 ± 10.11	64.45 ± 10.54	0.31
Gender			0.20
Male	81 (41.5)	94 (48.5)	
Female	114 (58.5)	100 (51.5)	
Smoking status			0.89
Yes	135 (69.2)	132 (68.0)	
No	60 (30.8)	62 (32.0)	
Stage			0.005
I	127 (65.1)	95 (49.0)	
II	44 (22.6)	52 (26.8)	
III	17 (8.7)	32 (16.5)	
IV	7 (3.6)	15 (7.7)	