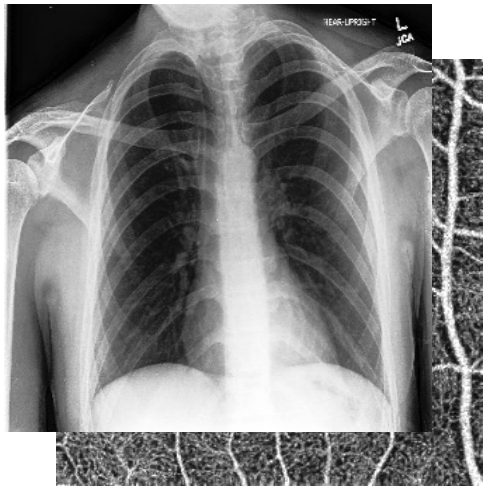
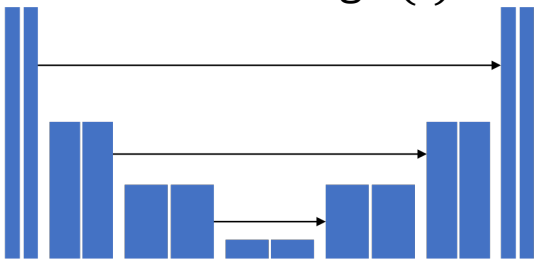
Data-Driven Medical Image Segmentation

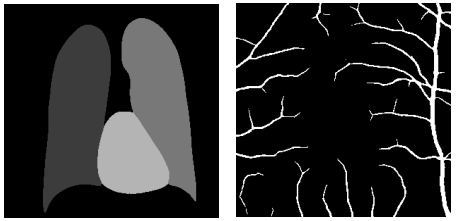


Medical Image ($\mathbf{I}$)

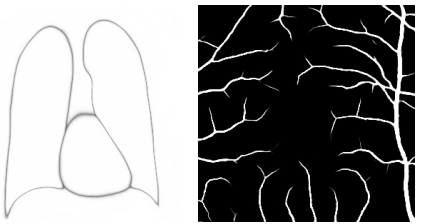


Trained U-Net Model (f_θ)

Augmented Image Representation



Segmentation Mask ($\hat{y}$)



Probability Measure, etc.

row	col	I	class	prob	id
0	1	100	heart	0.99	1
0	2	108	lung	0.96	2
1	0	96	heart	0.99	1
1	1	91	heart	0.99	1

ISL Image Logic Monitoring

Aug. Image, Φ

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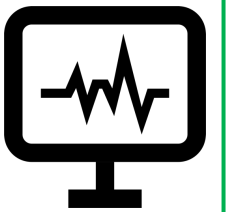
ISL Monitoring Algorithm



Pixel-level formula:

$$\boldsymbol{\varphi_p} \coloneqq (\boldsymbol{class} = \boldsymbol{Left\ Lung} \wedge \boldsymbol{prob} \geq \mathbf{0.9})$$

Region-level formula:

$$\boldsymbol{\Phi_R} \coloneqq \boldsymbol{\Phi_1} \rightarrow (\boldsymbol{\Phi_{\tau_1}} \vee \boldsymbol{\Phi_{\tau_2}})$$

✅ $(M_1, \tau) \vDash \Phi; \rho_r = 1.403$

❌ $(M_2, \tau) \nvDash \Phi; \rho_r = -0.005$