

Supporting Information for
**Cell cycle stage classification using
phase imaging with computational specificity**

Yuchen R. He^{1, 2, †}, Shenghua He^{3, †}, Mikhail E. Kandel^{1, 2, †}, Young Jae Lee^{2, 4}, Chenfei Hu^{1, 2}, Nahil Sobh^{2, 5}, Mark A. Anastasio^{1, 2, 6*}, and Gabriel Popescu^{1, 2, 6*}

¹Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Urbana, Illinois, 61801, USA

²Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, Urbana, Illinois, 61801, USA

³Department of Computer Science & Engineering, Washington University in St. Louis, St. Louis, Missouri, 63130, USA

⁴Neuroscience Program, University of Illinois at Urbana-Champaign, Urbana, Illinois, 61801, USA

⁵NCSA Center for Artificial Intelligence Innovation, University of Illinois at Urbana-Champaign, Urbana, Illinois, 61801, USA

⁶Department of Bioengineering, University of Illinois at Urbana-Champaign, Urbana, Illinois, 61801, USA

[†]These authors contributed equally to this work

* Corresponding authors: Gabriel Popescu and Mark Anastasio

Email: gpopescu@illinois.edu and maa@illinois.edu

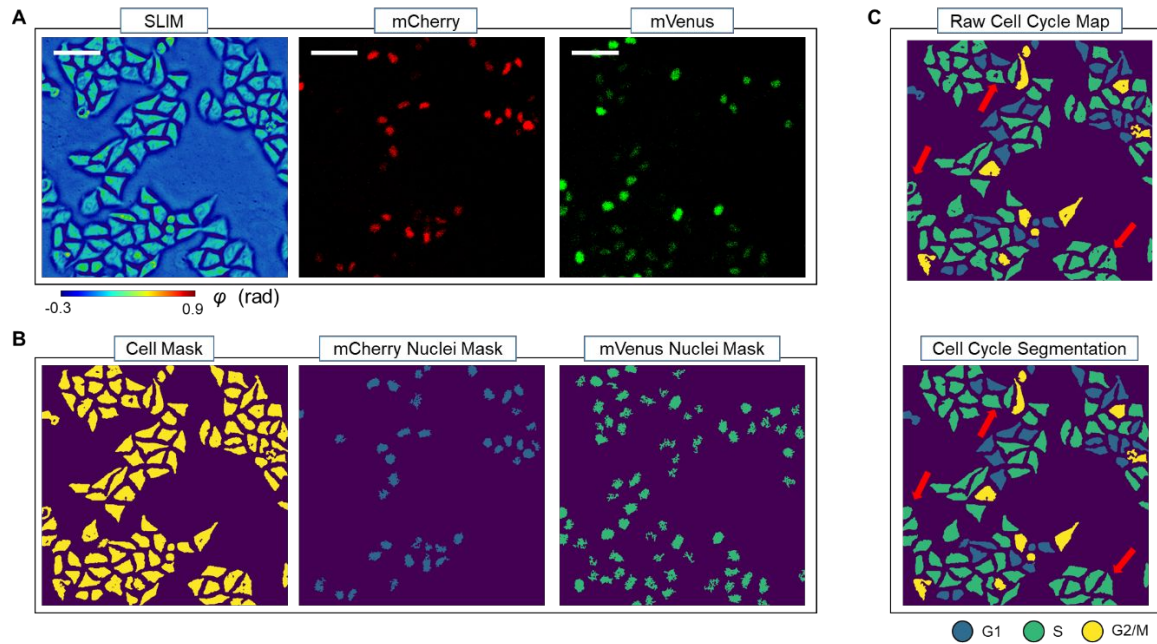


Fig. S1. Ground truth mask generation workflow. (A) Images from the SLIM channel (left), mCherry channel (middle) and the mVenus channel (right). (B) Preliminary masks generated from the SLIM and fluorescence images using adaptive thresholding. (C) Combining three masks in (B). Holes in cell masks were removed during analysis to avoid errors in cell dry mass and area. Scale bar is 100 μm .

Prediction \ True Label	Background	G1	S	G2/M
Background (n = 204,426,215)	99.75%	0.03%	0.17%	0.05%
G1 (n = 5,149,858)	1.50%	70.27%	26.21%	2.01%
S (n = 8,687,486)	1.88%	10.14%	75.12%	12.87%
G2/M (n = 2,748,409)	1.37%	6.42%	30.19%	62.02%
Precision	99.86%	76.34%	72.13%	56.13%
Recall	99.75%	70.27%	75.12%	62.02%
F1 Score	99.81%	73.18%	73.59%	58.93%

Fig. S2. PICS performance evaluated at a pixel level.

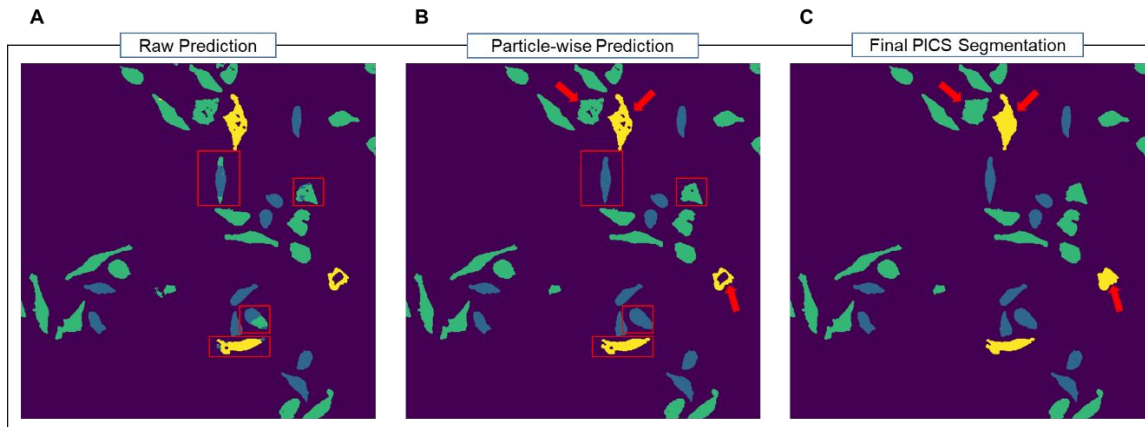


Fig. S3. Post-processing workflow. (A) Raw prediction from PICS. (B) Prediction map after enforcing particle consistency and removing small particles. A few examples were shown in the red rectangles. (C) Prediction map after filling in the holes in the masks. Masks at this stage were used for analysis.

A

	Prediction	
True Label	G1/S	G2/M
G1/S (n = 10893)	93.23%	6.77%
G2/M (n = 1787)	39.79%	60.21%
Precision	93.46%	59.35%
Recall	93.23%	60.21%
F1 Score	93.35%	59.78%
Overall Accuracy	88.58%	

B

	Prediction	
True Label	G1	S/G2/M
G1 (n = 4651)	73.98%	26.02%
S/G2/M (n = 8029)	11.81%	88.19%
Precision	78.40%	85.41%
Recall	73.98%	88.19%
F1 Score	76.13%	86.78%
Overall Accuracy	82.98%	

Fig. S4. Confusion matrix after merging two labels together. (A) Confusion matrix after we merge “G1” and “S” into one class. **(B)** Confusion matrix after we merge ‘S’ and “G2/M” into one class.