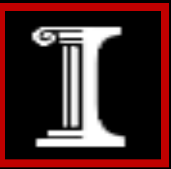


QLI Lab

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Intelligent Image Trigger Acquisition (IITA)

Sajeeb Roy Chowdhury^{*1}, Gabriel Popescu^{**1, 2,3}

¹Beckman Institute for Advanced Science and Technology, University of Illinois Urbana-Champaign, Illinois, 61801

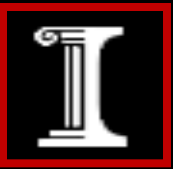
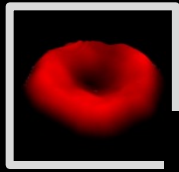
²Department of Bioengineering, University of Illinois Urbana-Champaign, Illinois, 61801

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Outline

- 1. Background and Motivation**
- 2. Imaging System Schematic**
- 3. Network Architecture and Loss Plots**
- 4. Trigger Workflow**
- 5. Results and Demo**
- 6. Summary and Future Work**



Outline

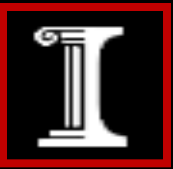
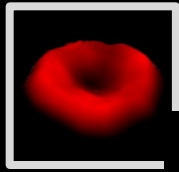
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Background

- Acquisition of frames that do not contain any information is a waste, both in terms of time and storage space.
- This is especially true when the cell cultures are sparse as most of the frames don't have any cells at all or contain very few cells that provide no benefit to the analysis.
- Other triggers - Live Cells, Cancer regions, etc.

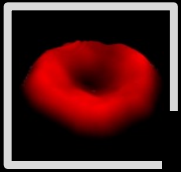
Motivation

Selectively picking which frames to acquire does not only save in storage space, but also aids biologists in only focusing on interesting frames - frames that meet a certain condition.



Outline

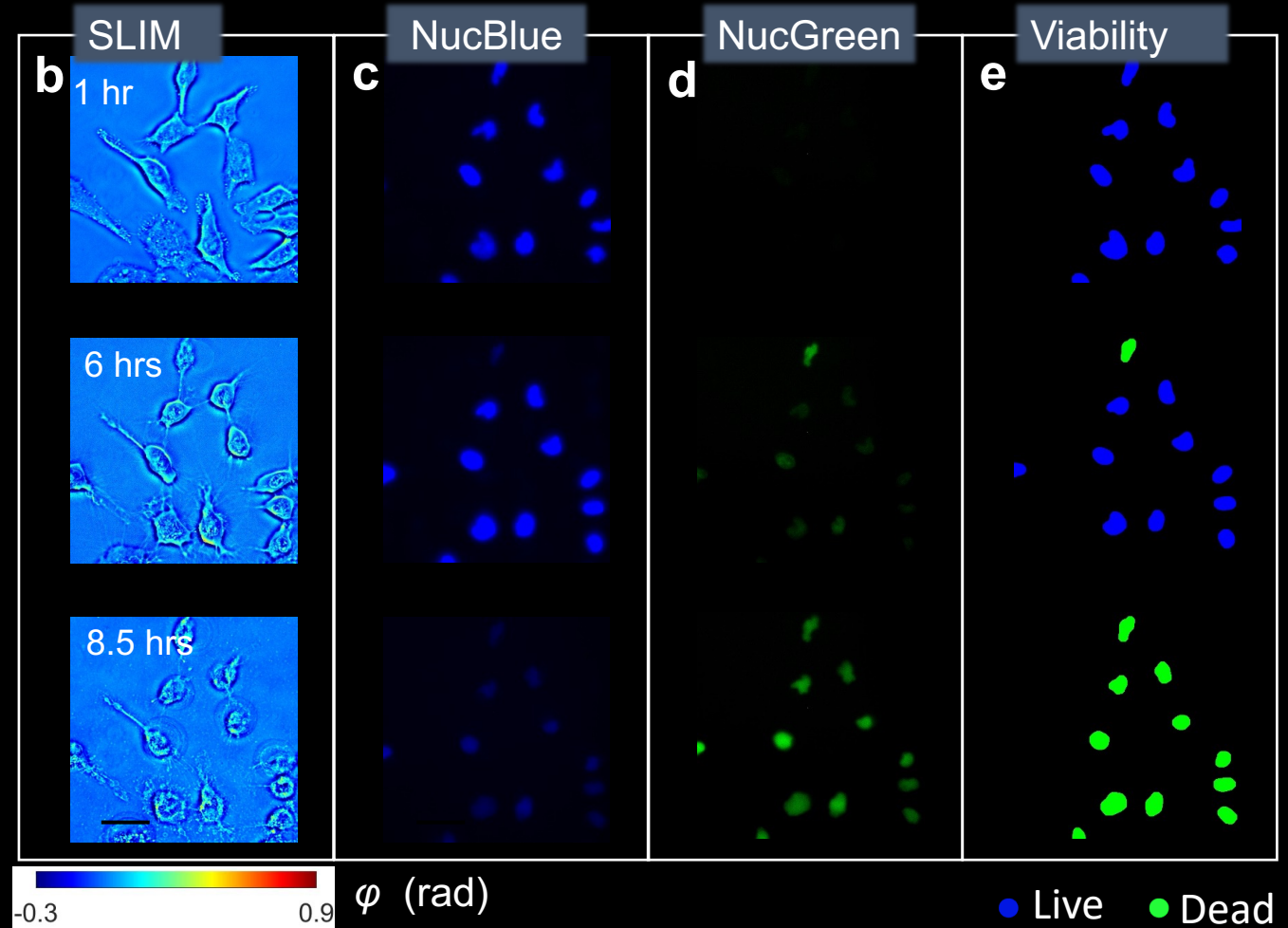
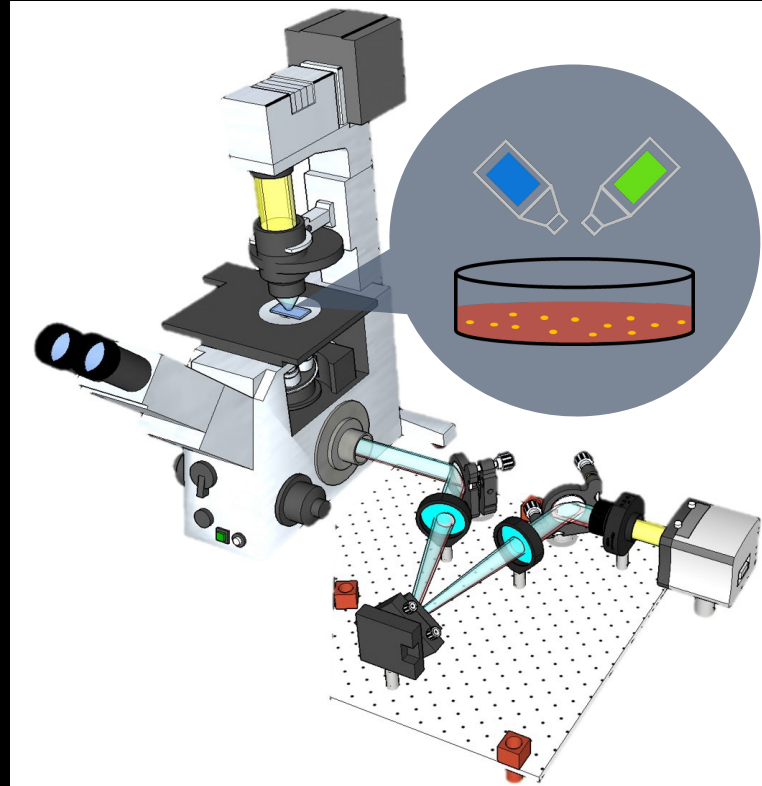
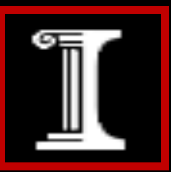
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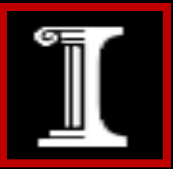
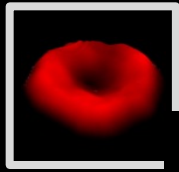


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Imaging System Schematic

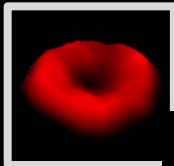
UIUC



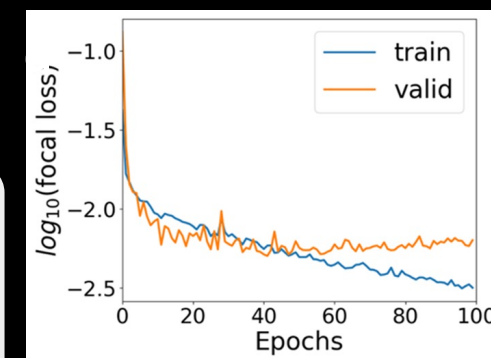
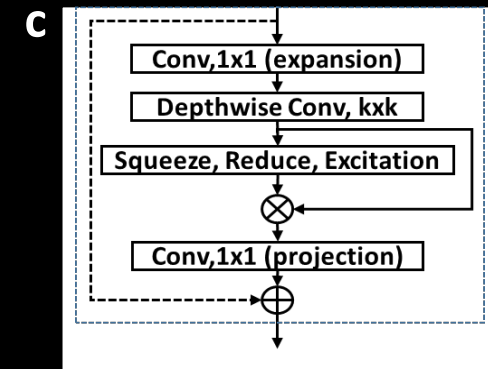
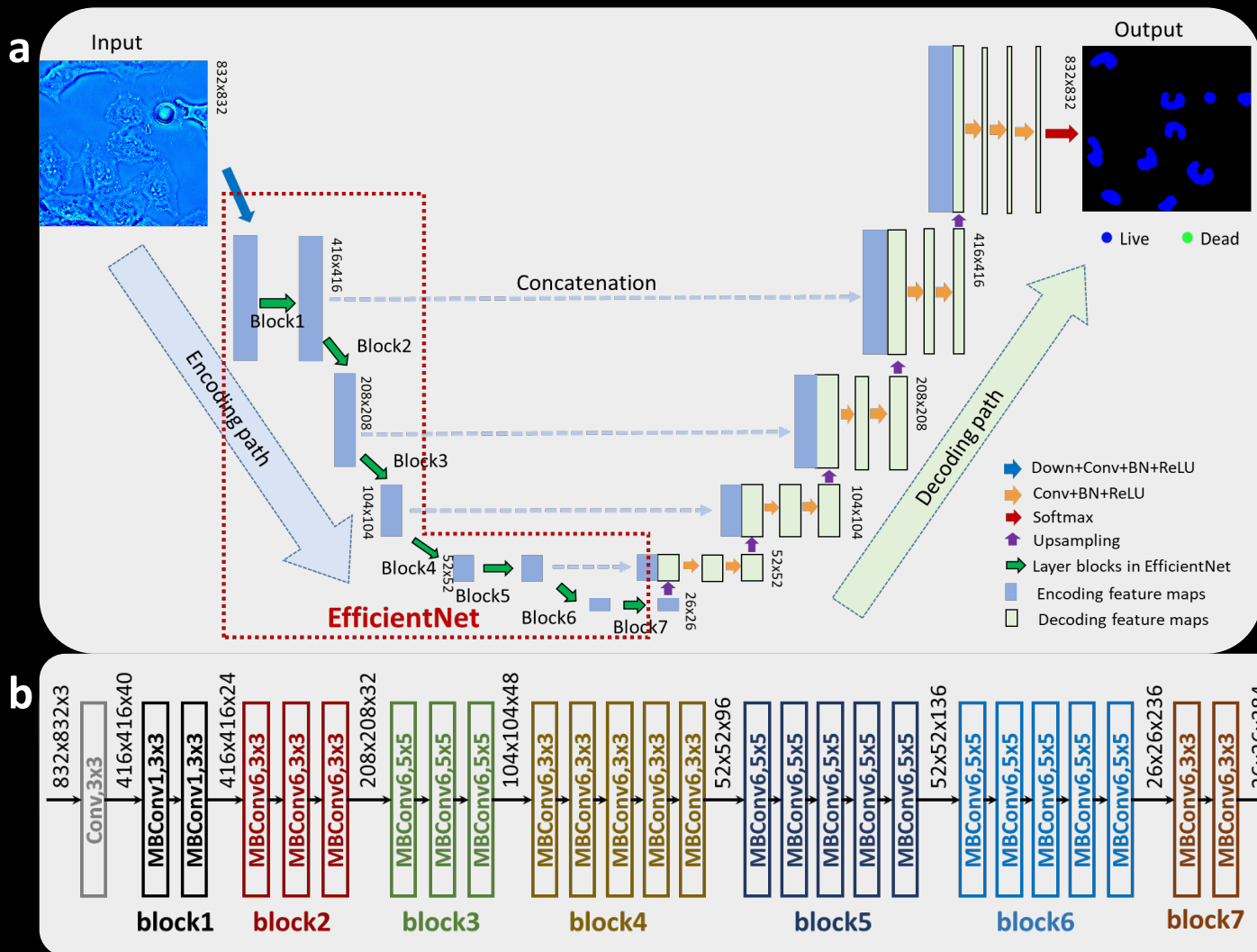


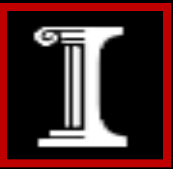
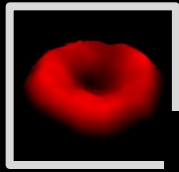
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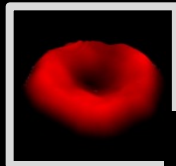
Neural Network Design : Efficient U-Net



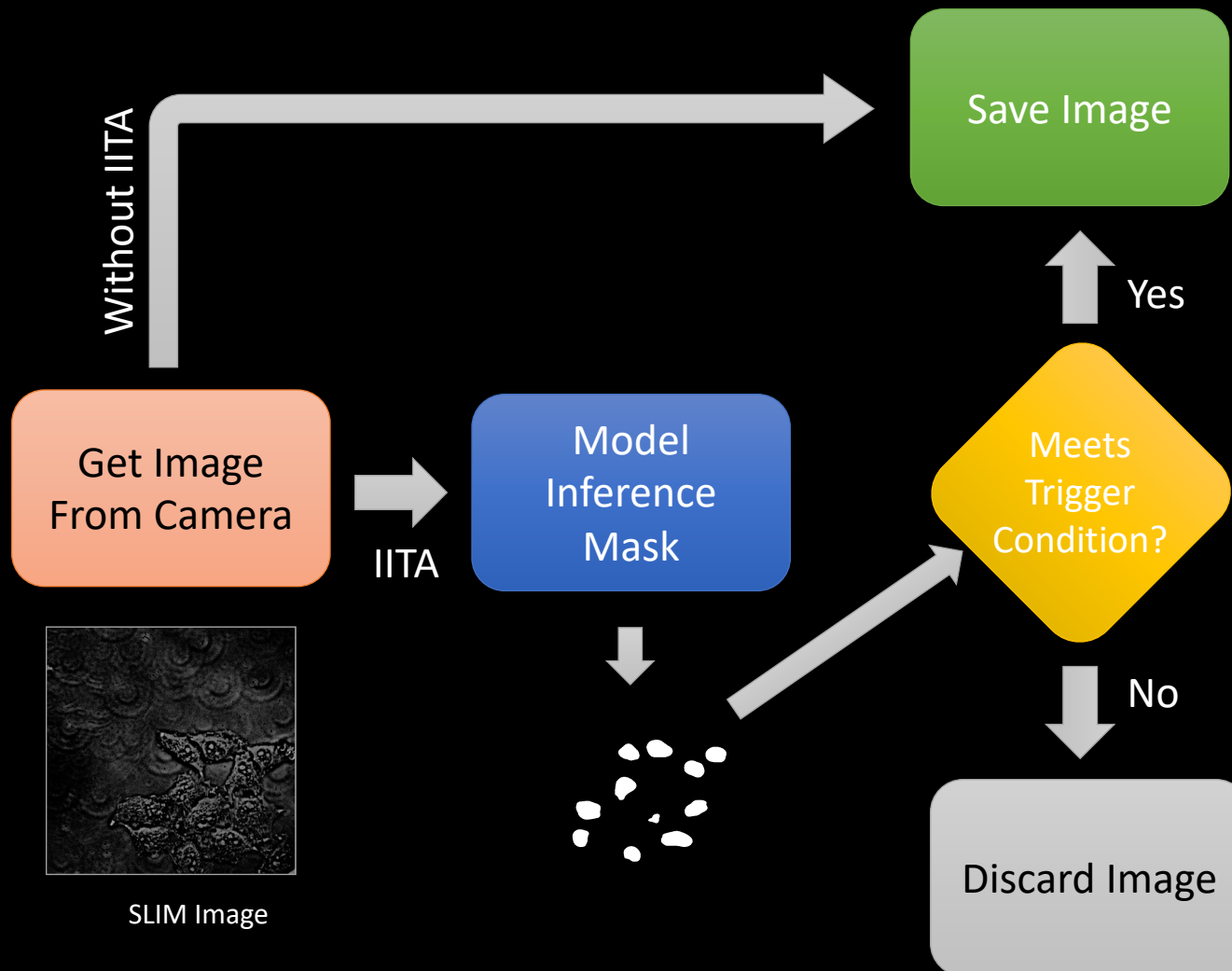


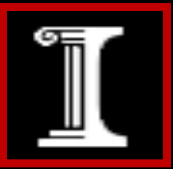
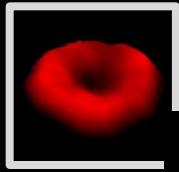
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Trigger Workflow





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Results and Demo: Real Time

Live Display

SLIM Phase Off

2064x2048 Rolling 1x1

m: -0.003
d: 0.023

Grays -0.10 0.30

30.0 30.0 30.0 30.0

30.0 30.0 30.0 30.0

0.20 600.00 DC

0 1 2 3 4 5 6 7

4 5 6 7 8

TX 0 TY 0

Snap_SLIM_Phase_#0.tif

Remappers Off

Grays 0.000 1.000

Automated Scanning

Stop

0

C:\Users\QLI\Desktop\CellVista_setting\40xph2.json

X:\Sajeeb\Test1

Phase Unspecified 0.09

NA NA NA

37610.72 37167.98 3668.80

Quit

Live Background Background Subtracted

Automated Scanning

Channel 0 SLIM 2064x2048 Rolling 1x1

SLIM Phase Off 0.20 600.00 DC

Grays -0.10 0.30

30.0 30.0 30.0 30.0

ROIs

Navigation

Insert (D) Next (S) Remove (C)

Goto (G) Set XYZ Set Z

Tomogram Top (T) Bottom (B)

Move ROI

ROI Tools

Focus Points at ROI #0

	X	Y	Z	Set?
6	38809.336	39435.643	3674.884	true
7	40007.957	38258.621	3692.758	true
8	37643.113	38247.820	3676.651	true
9	37686.309	39403.242	3668.581	true
10	39921.570	37167.984	3701.267	true
11	39986.355	39370.848	3683.798	true
12	37610.719	37167.984	3668.800	true

Acquisition

X:\Sajeeb\Test1\scan_settings.json

Storage 3.54 GB Same Folder

SLIM Background Not Set Synchronous Per ROI (RCXYZ) Fastest

Time Points = 1 Acquire

with intelligent image triggered acquisition...

62.21%

Activate Windows
Go to Settings to activate Windows.

Trigger on 7 or more cells per FOV



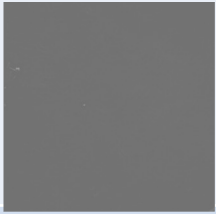
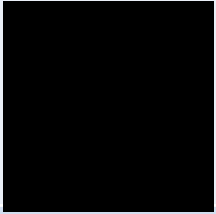
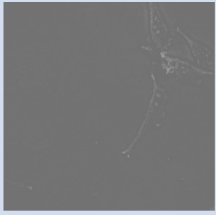
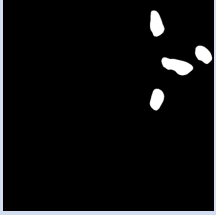
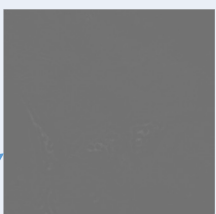
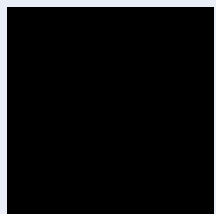
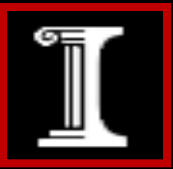
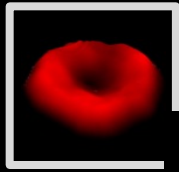
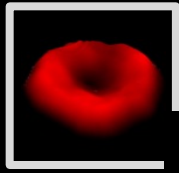
Image	Mask	Cell Count	Acquired in IITA Mode	Acquired in non-IITA mode
		7	Yes	Yes
		0	No	Yes
		4	No	Yes
		0	No	Yes

Image is out of focus



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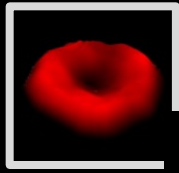


Summary and Future Work

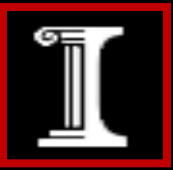
- Intelligent Image triggered → intelligent microscopy systems
- Examples: confluency threshold, viability, cell count, etc
- Reduced analysis time/ effort, storage space, etc → real-time data curation

Future Plans

- More cell lines: e.g., neurons to study the effects drug treatment
- Extend to timelapse imaging: e.g., trigger when growth-cone forms
- Develop other triggers: culture confluency, cancer regions, etc



Acknowledgements



Quantitative Light Imaging lab

- Yuchen He
- Masayoshi Sakakura
- Neha Goswami
- Young Jae Lee
- Chenfei Hu
- Shenghua He
- Edward M. Kong
- Hua Li
- Mark A. Anastasio