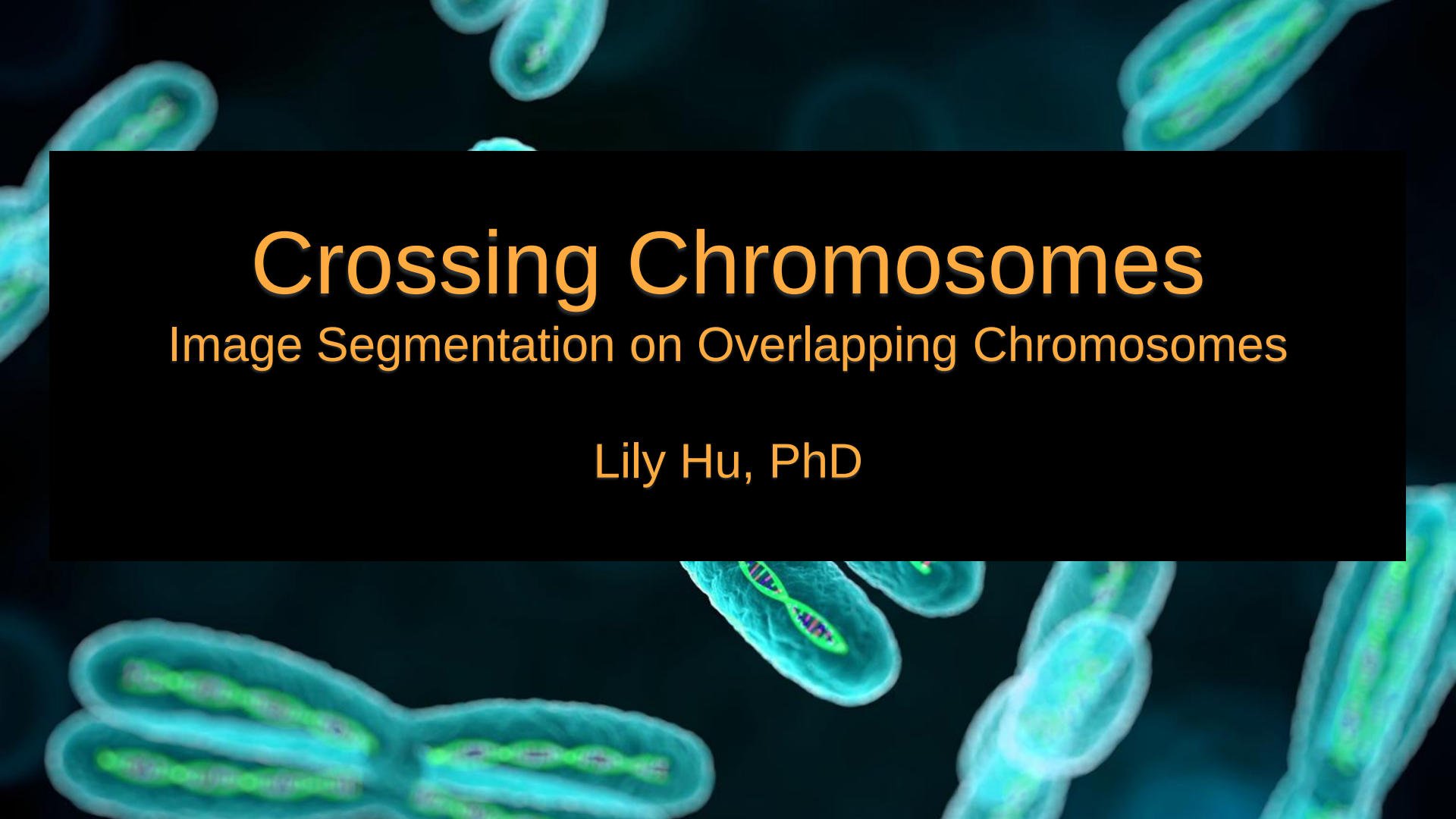


Crossing Chromosomes

Image Segmentation on Overlapping Chromosomes

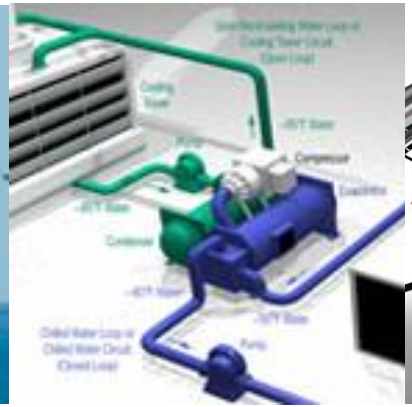
Lily Hu, PhD

What Led Me to this Project

Berkeley
UNIVERSITY OF CALIFORNIA

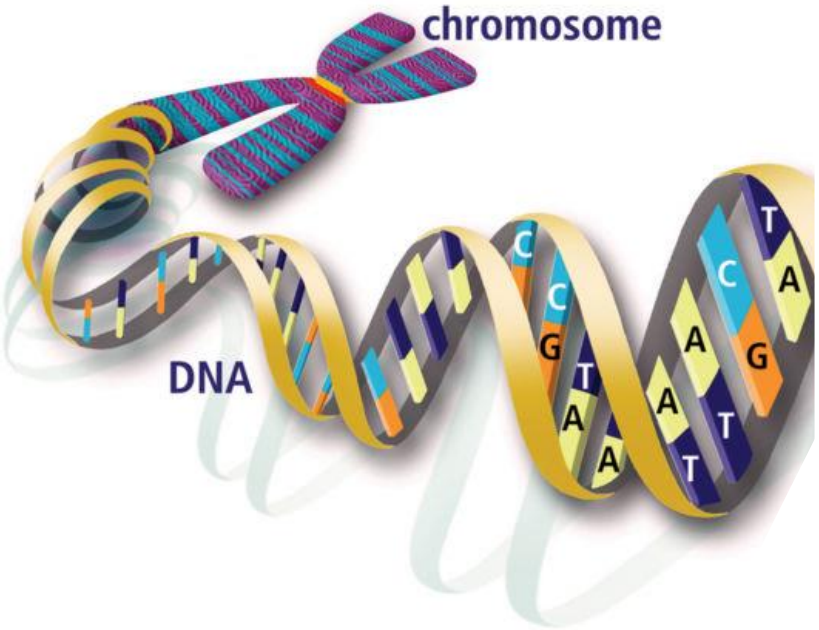
BERKELEY LAB

PhD Mechanical Engineering



Machine learning on sensor data for performance and health monitoring

Motivation

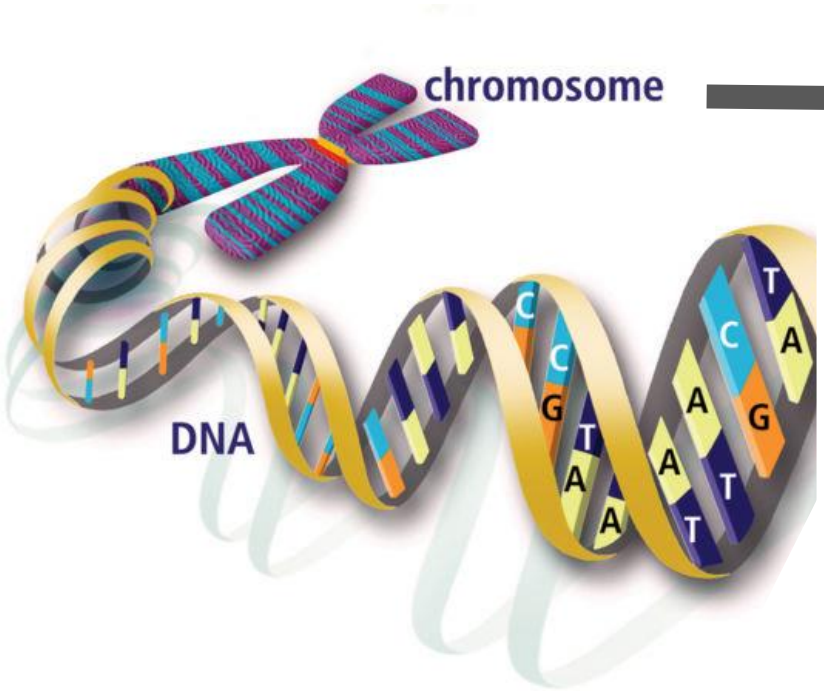


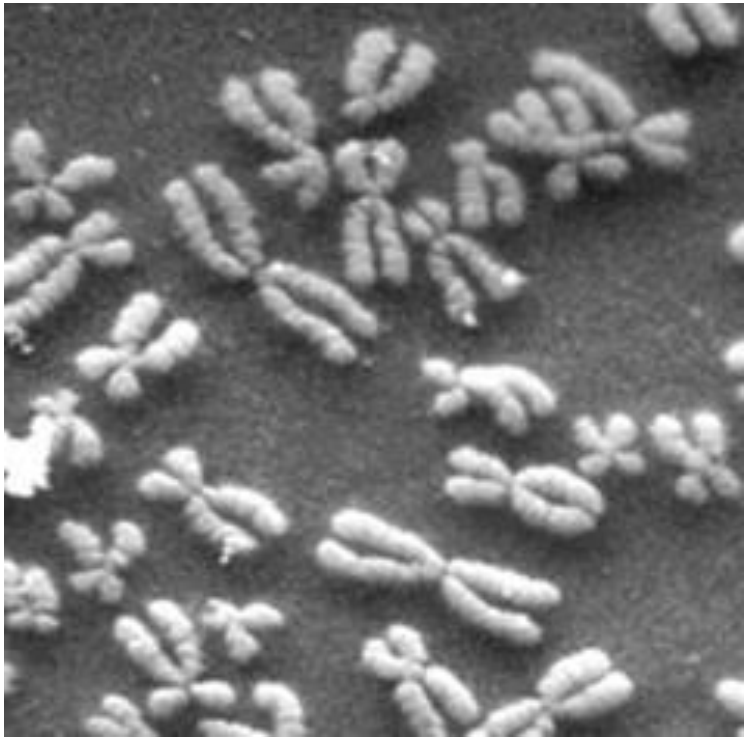
Medical diagnostics

Drug development

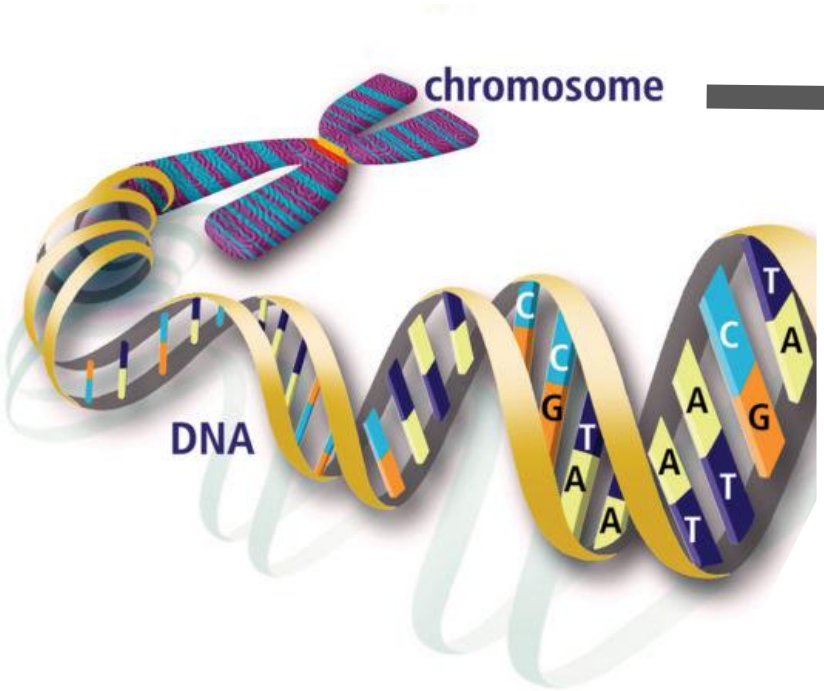
Biomedical research

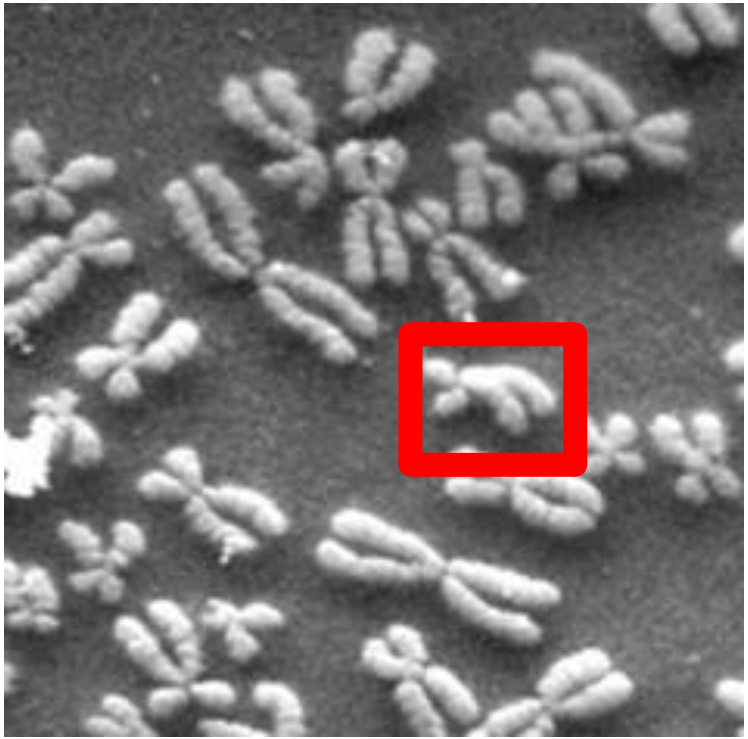
Motivation



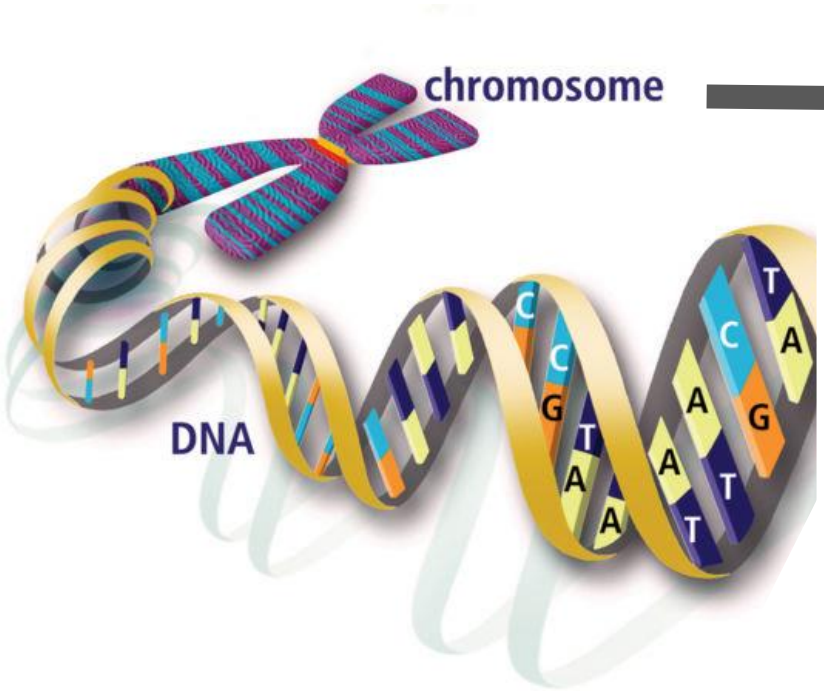


Motivation



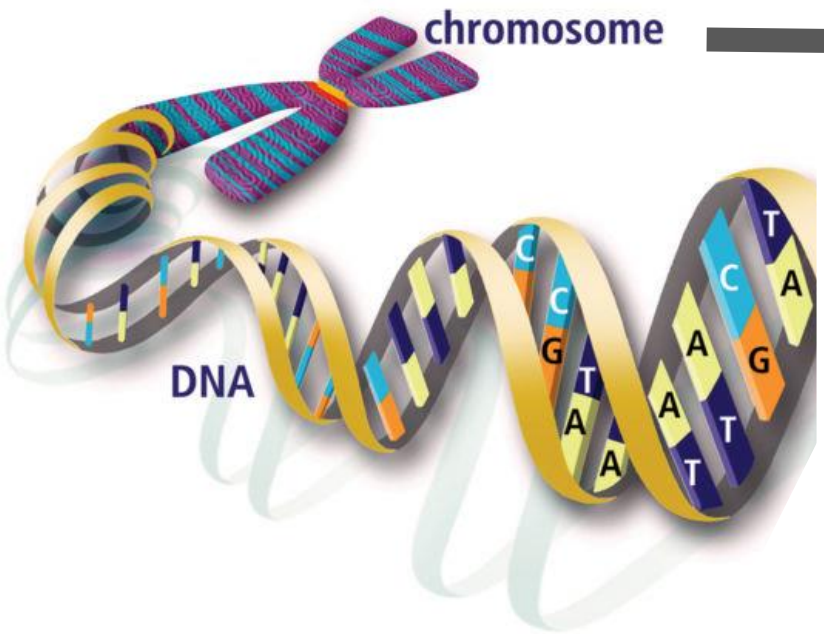


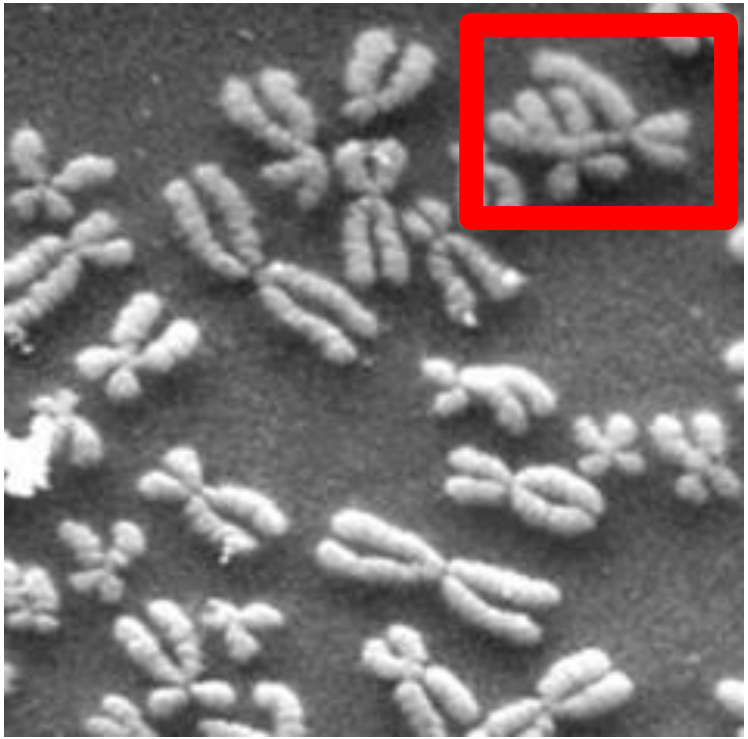
Motivation



Motivation

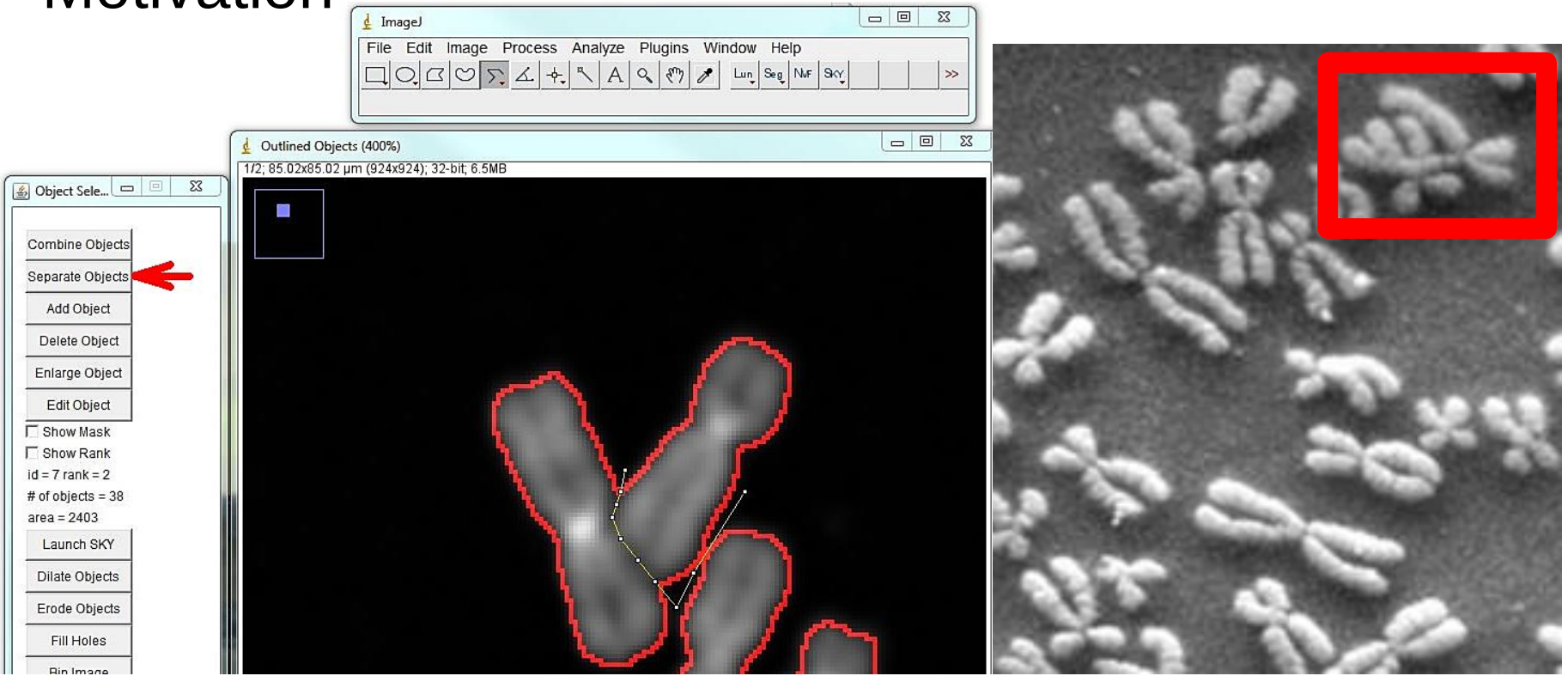
Problem: Overlap





Motivation

Problem: Overlap



http://research.stowers.org/imagejplugins/KISS_analysis.html

Images of Chromosomes → Data Preprocessing → New Convolutional Neural Network → Seperated Chromosomes

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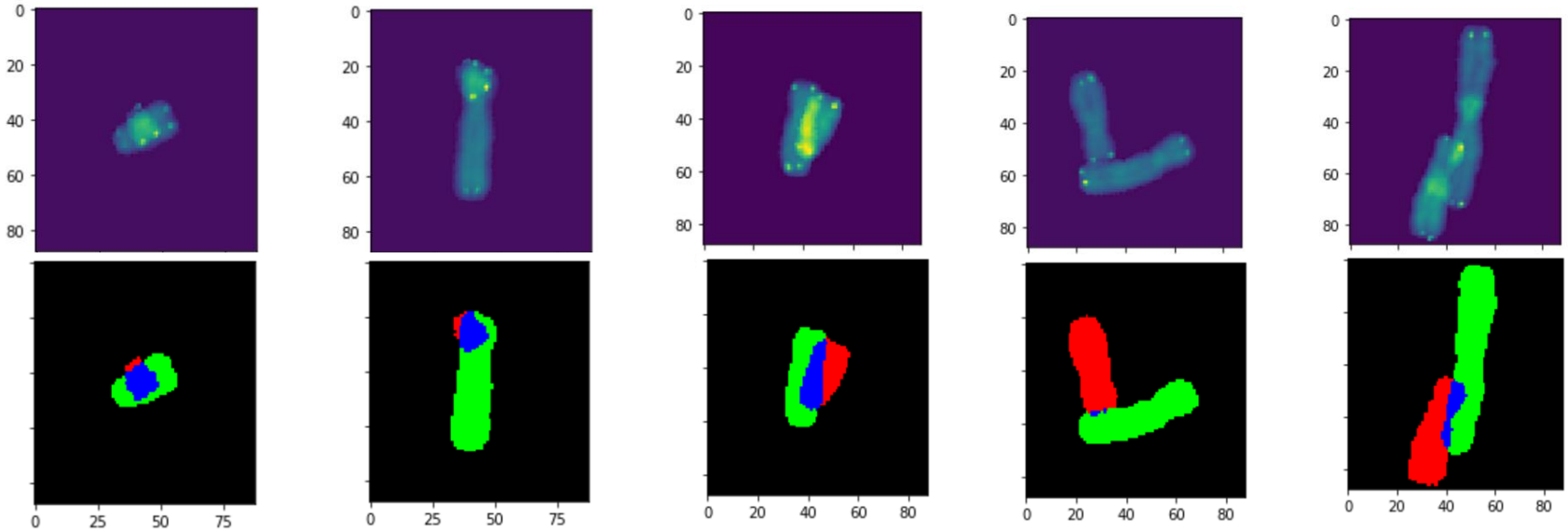

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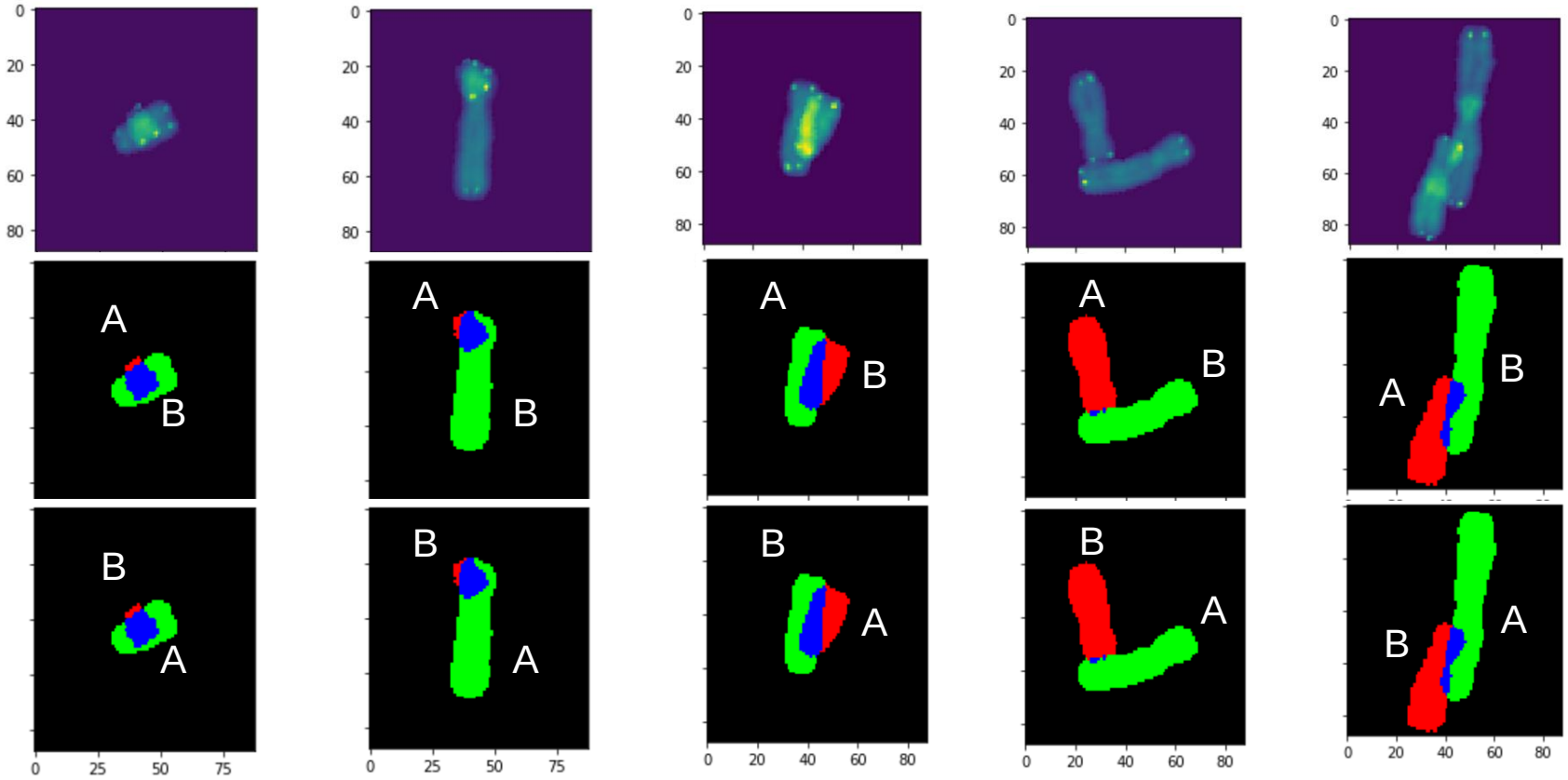


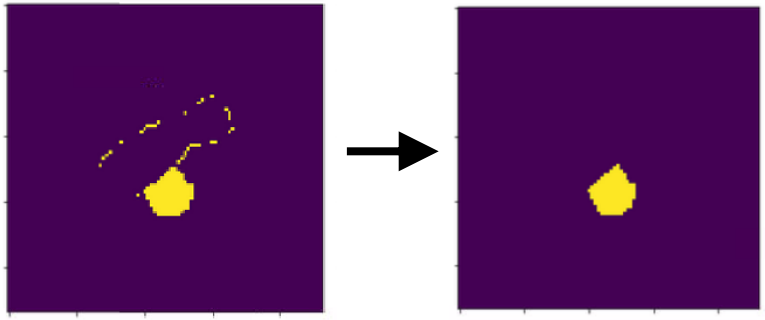
Images of Chromosomes → Data Preprocessing → New Convolutional Neural Network → Seperated Chromosomes

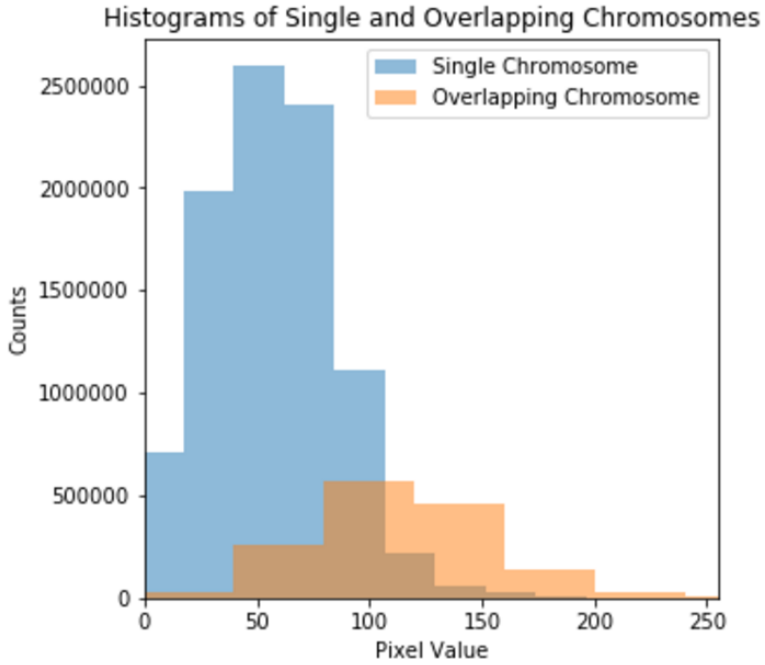
Clean labels

Crop images to factors/powers of 2

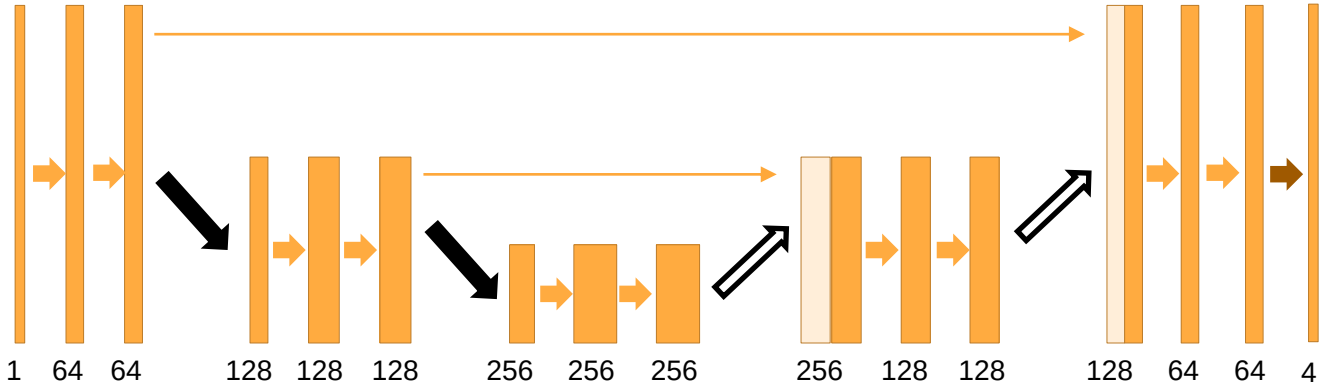
Process labels

Small image size (94x93 pixels)





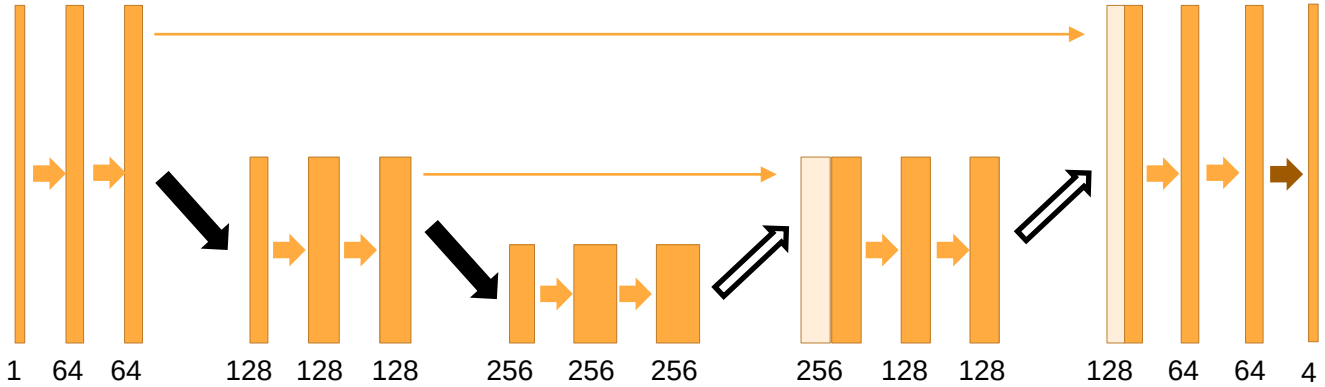
Images of Chromosomes → Data Preprocessing → New Convolutional Neural Network → Seperated Chromosomes



Legend

- Convolution (3x3, ReLu)
- Maxpool (2x2)
- Deconv (3x3)
- Copy and concatenate
- Convolution (1x1, Softmax)

Images of Chromosomes → Data Preprocessing → New Convolutional Neural Network → Seperated Chromosomes



Legend

- Convolution (3x3, ReLu)
- Maxpool (2x2)
- Deconv (3x3)
- Copy and concatenate
- Convolution (1x1, Softmax)

Model design driven by:

Inspired from image segmentation neural networks

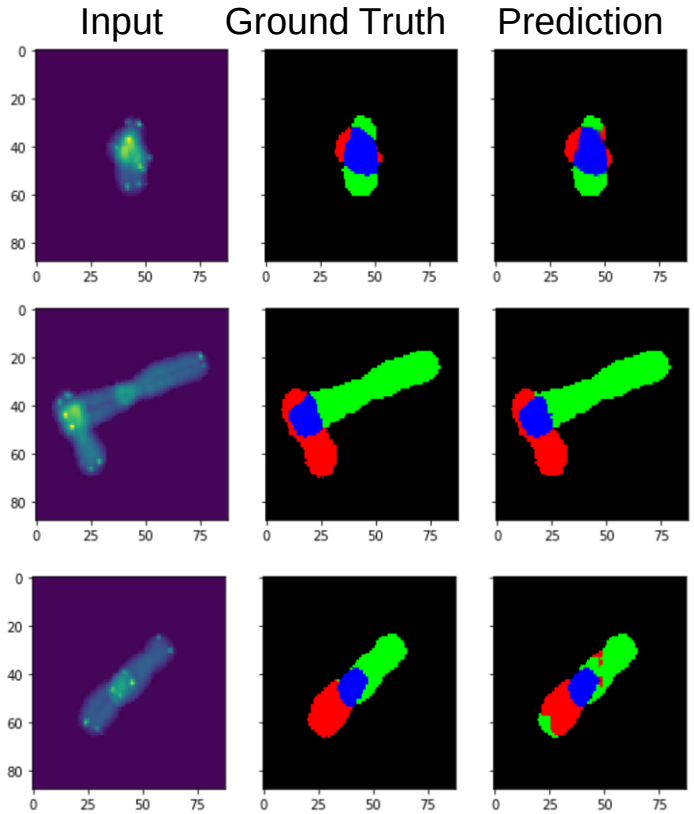
Small input image dimension

Preserve dimensions of the output image

Reduce size of model

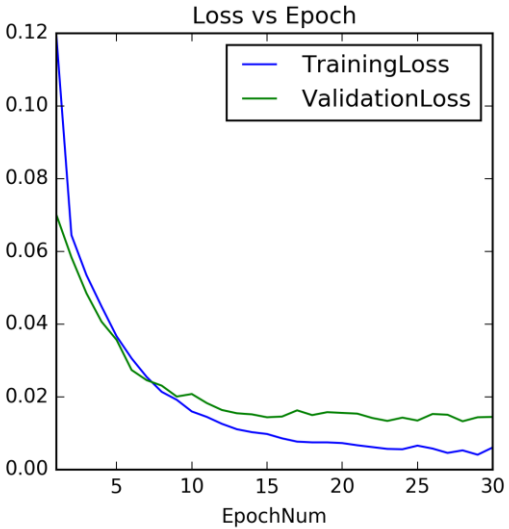
Segmentation classes: overlap only, integer encodings, etc.

Images of Chromosomes → Data Preprocessing → New Convolutional Neural Network → Seperated Chromosomes



97.6% Mean Intersection over Union on Training Set

94.3% Mean Intersection over Union on Test Set



Wrap-Up

Challenge posed by AI Open Networks

Delivered documentation

Pull request on Github

https://github.com/LilyHu


Thank you

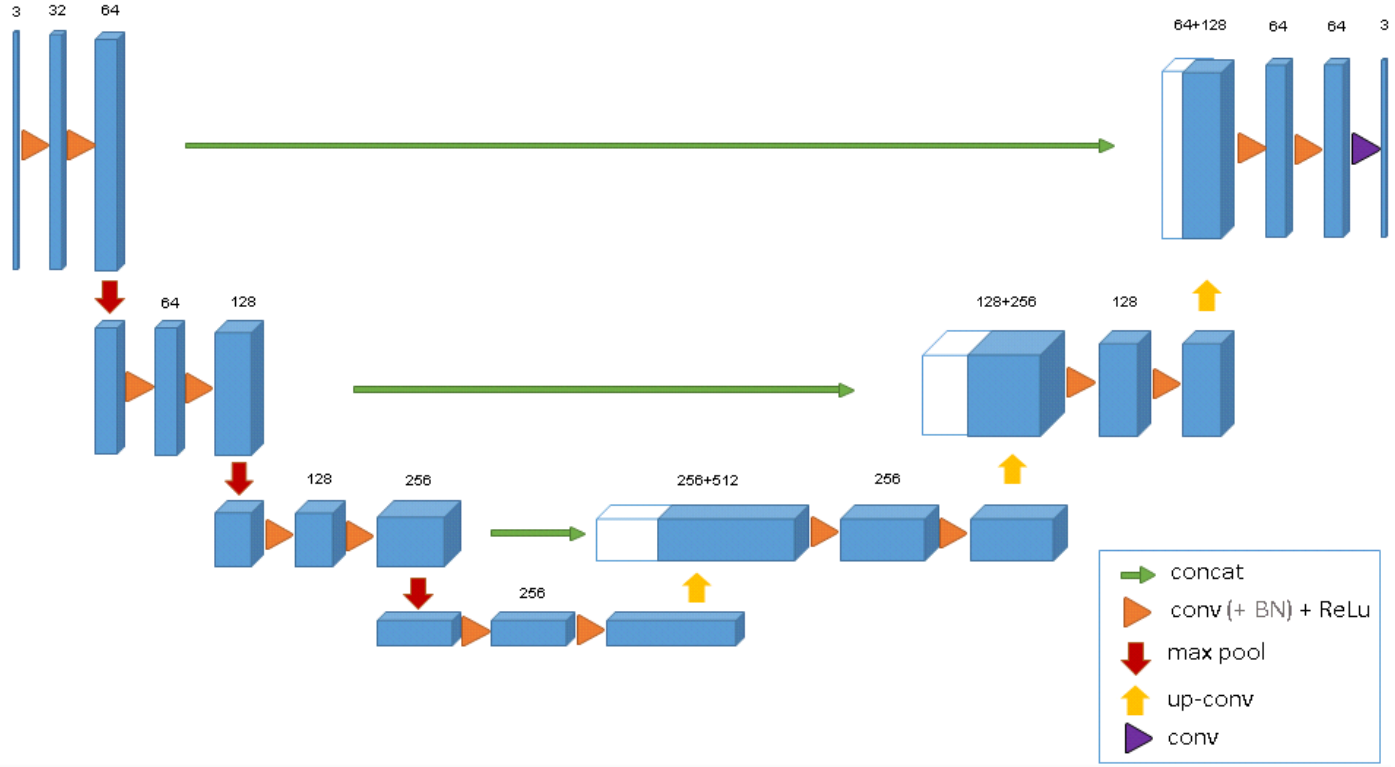
Thank you

Backup

Model – Modified U-Net

Previously used for medical image segmentation

Reduced number of layers



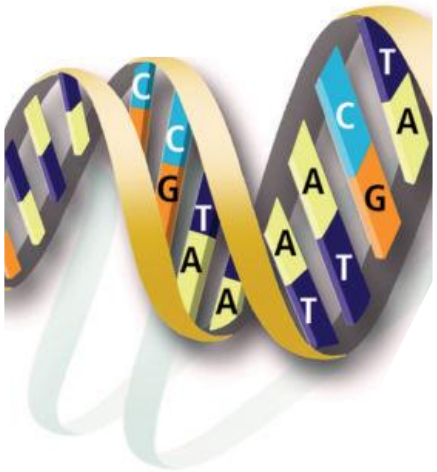
Crossing Chromosomes

Image Segmentation on Overlapping Chromosomes

Lily Hu, PhD

Motivation

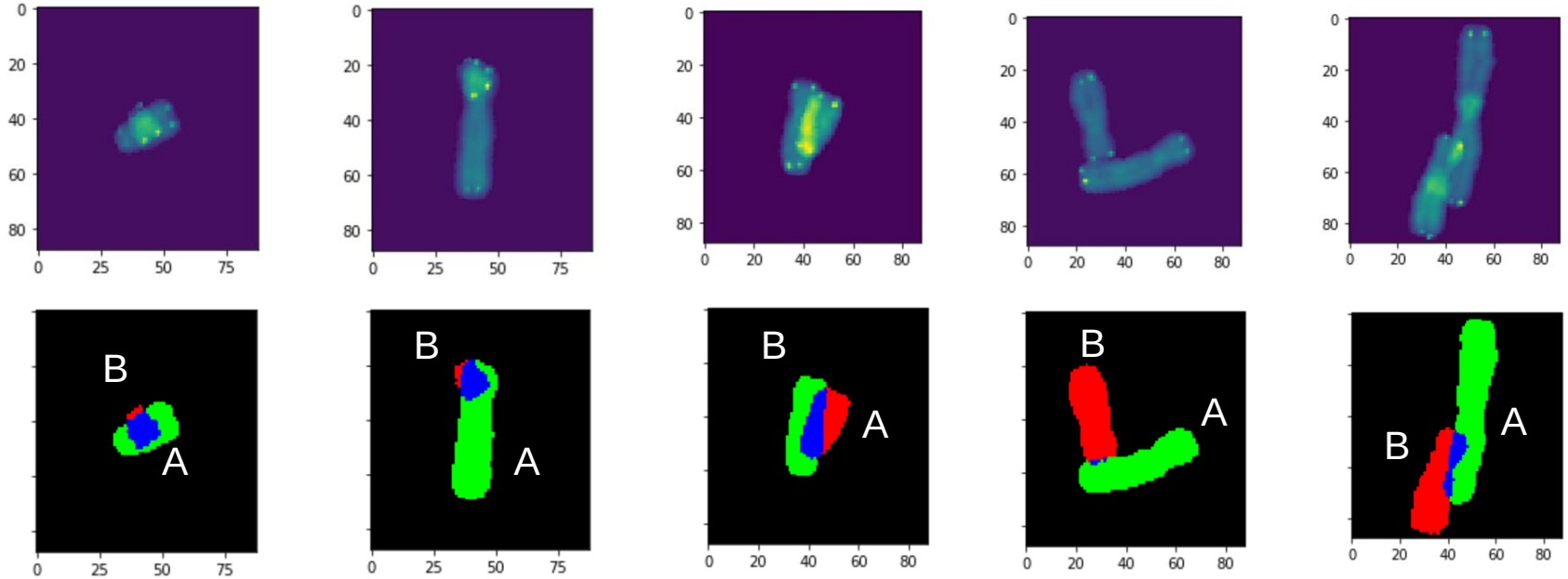
DNA



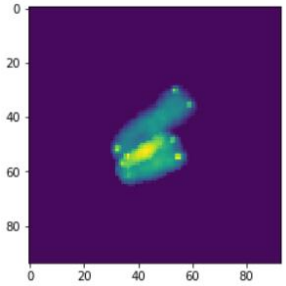
Medical diagnostics

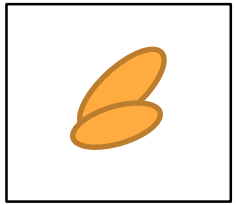
Drug development

Biomedical research


B
A
B
A
B
A
B
A
B
A

Images of Chromosomes → Data Preprocessing → New Convolutional Neural Network → Seperated Chromosomes





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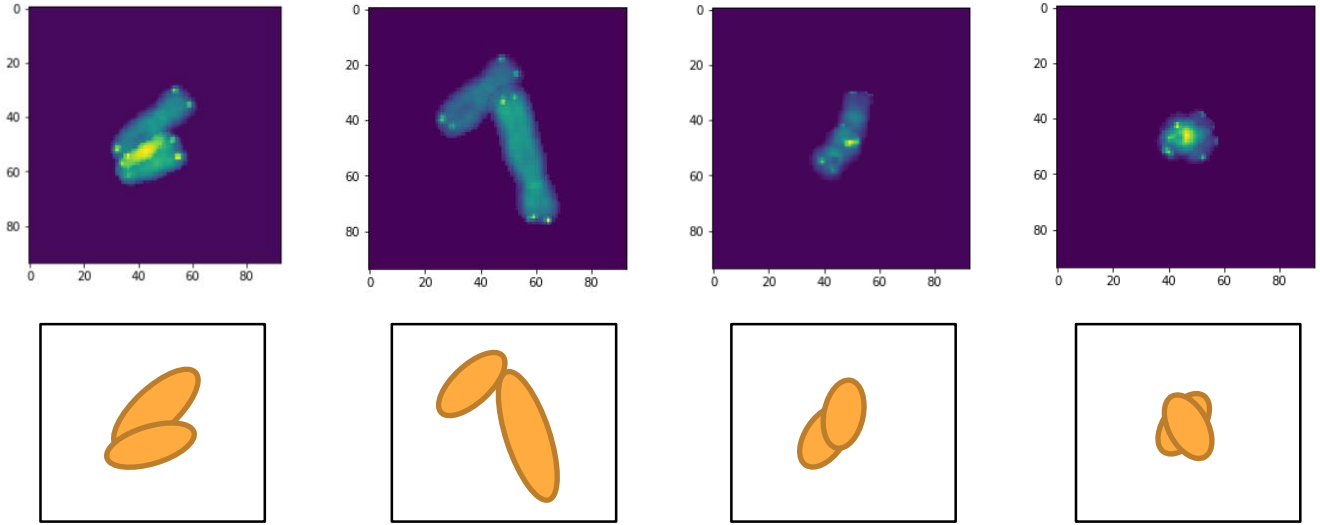

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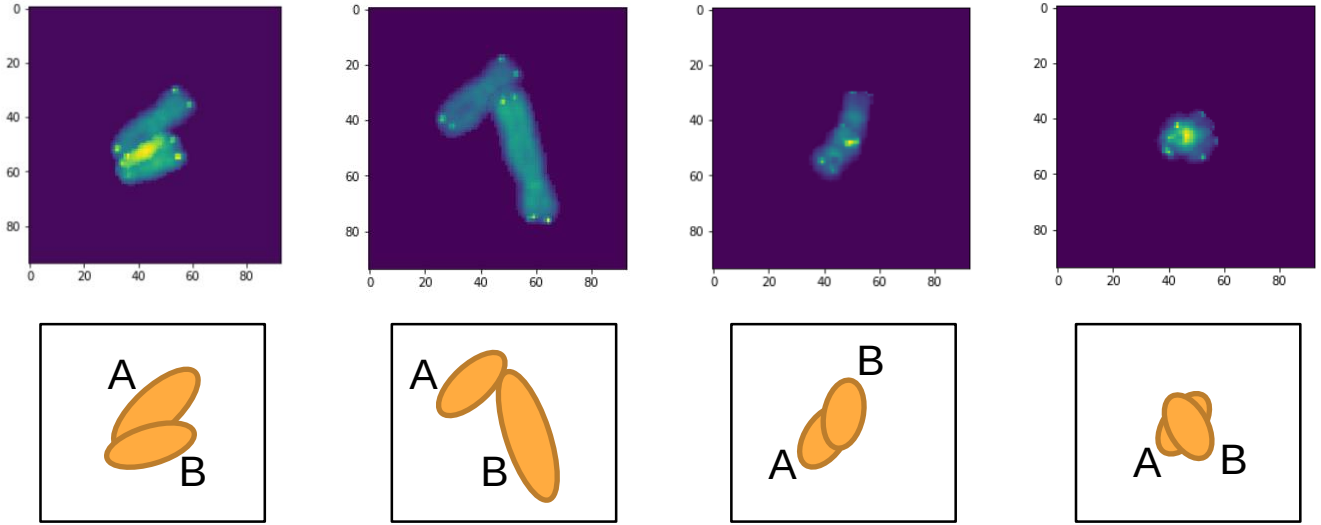

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