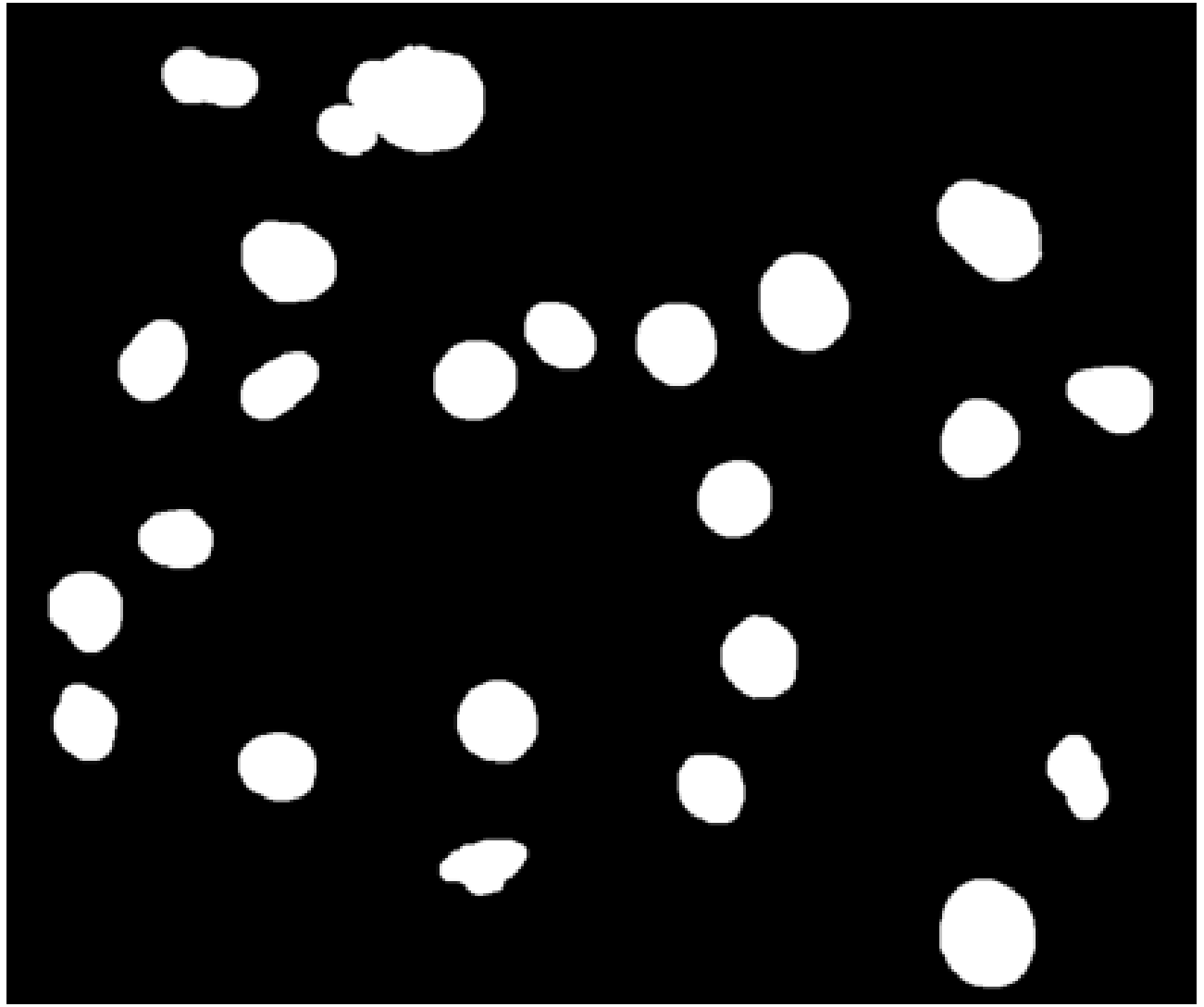
Project presentation

Implementation and evaluation of region growing

Data Analysis MoBi SS2021



Topic 04: Biomedical image analysis

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Group 04: Marie Becker, Ina Jung,
Laura Kaschnitz, Johanna Möller

21st July 2021

Structure

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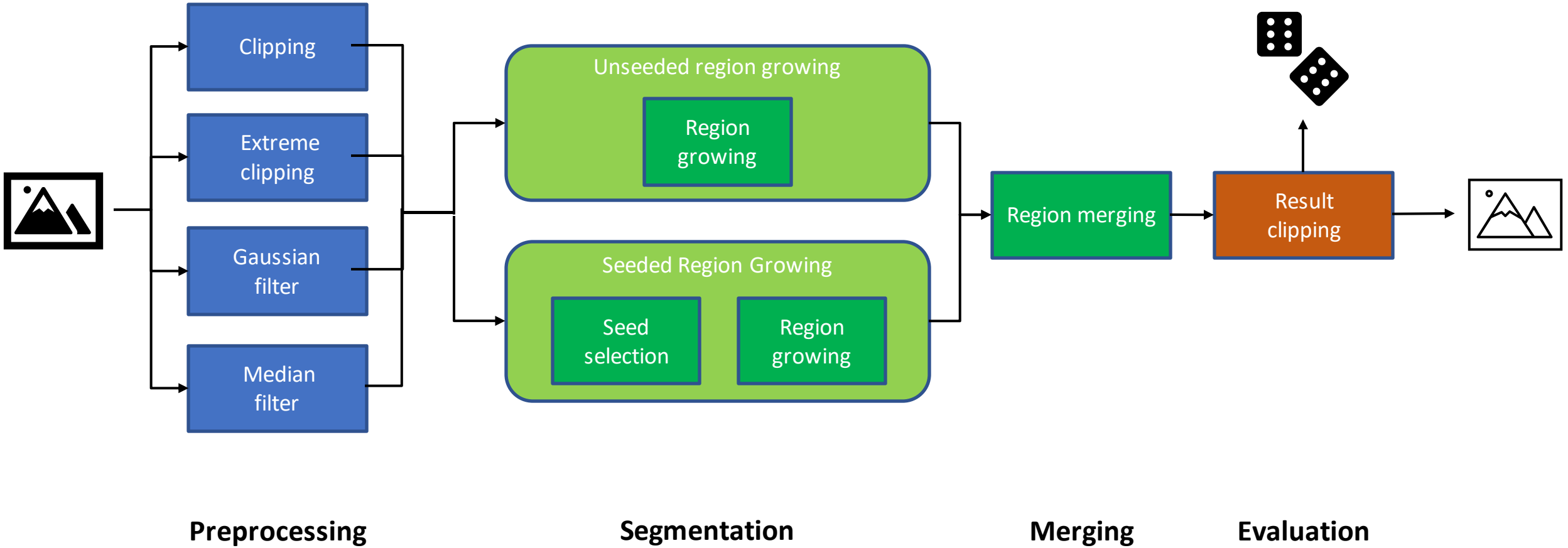
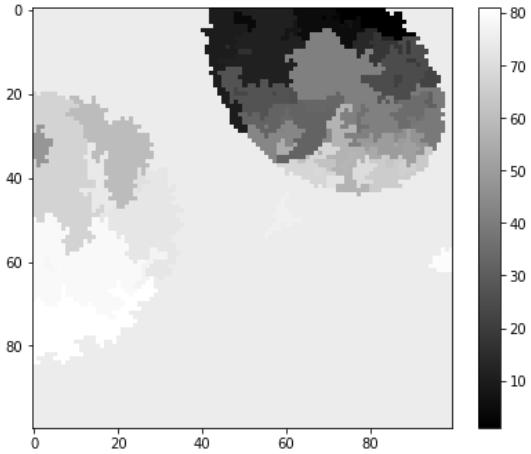
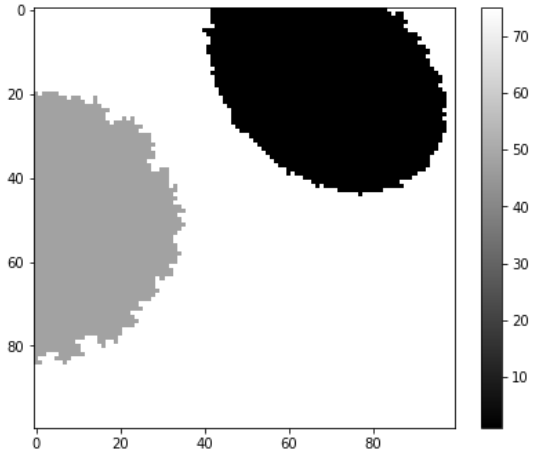
- Comparison seeded and unseeded region growing
- Dice score
- Evaluation of preprocessing
- Results N2DH-GOWT1
- Results N2DL-HeLa
- Bright spots in NIH3T3 data set
- Blurs and changing background intensities
- Results seeded region growing NIH3T3
- Seeded vs. Unseeded region growing results
- Runtime Errors and Memory Errors
- Discussion

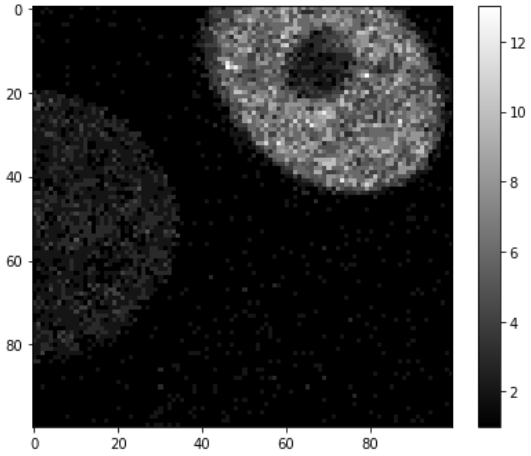
Algorithm overview

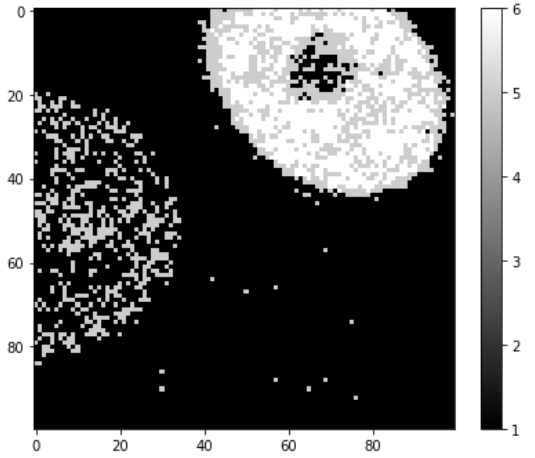


Comparison of algorithms





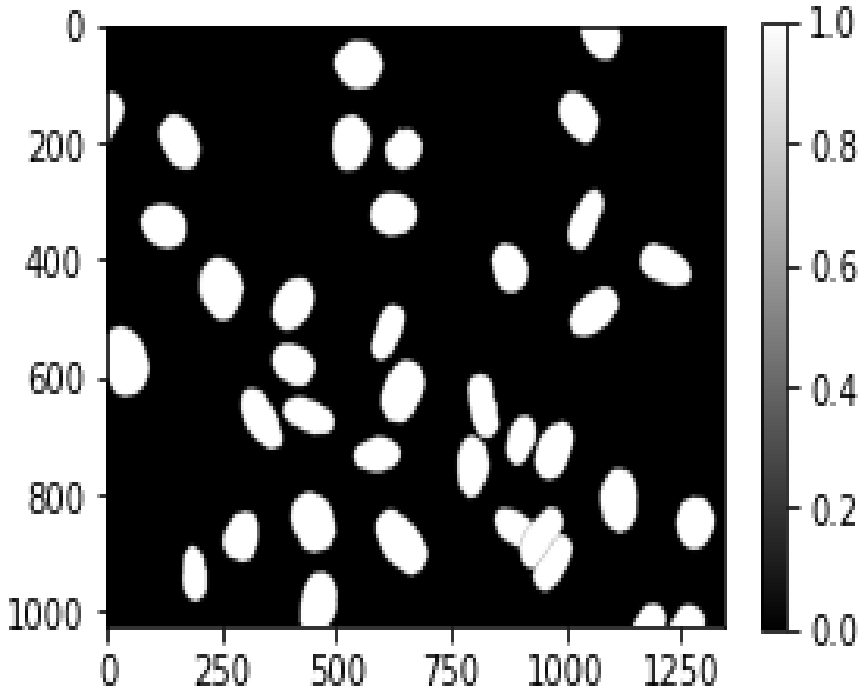


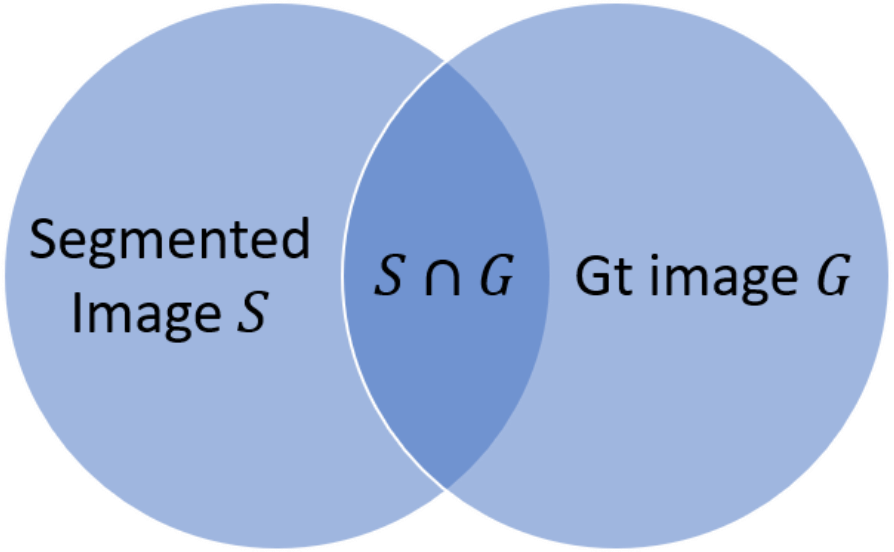


Differences between seeded and unseeded region growing:

- Number of regions
- Dependency of seeds
- Assignment of pixels
- Intensity distance

Dice score

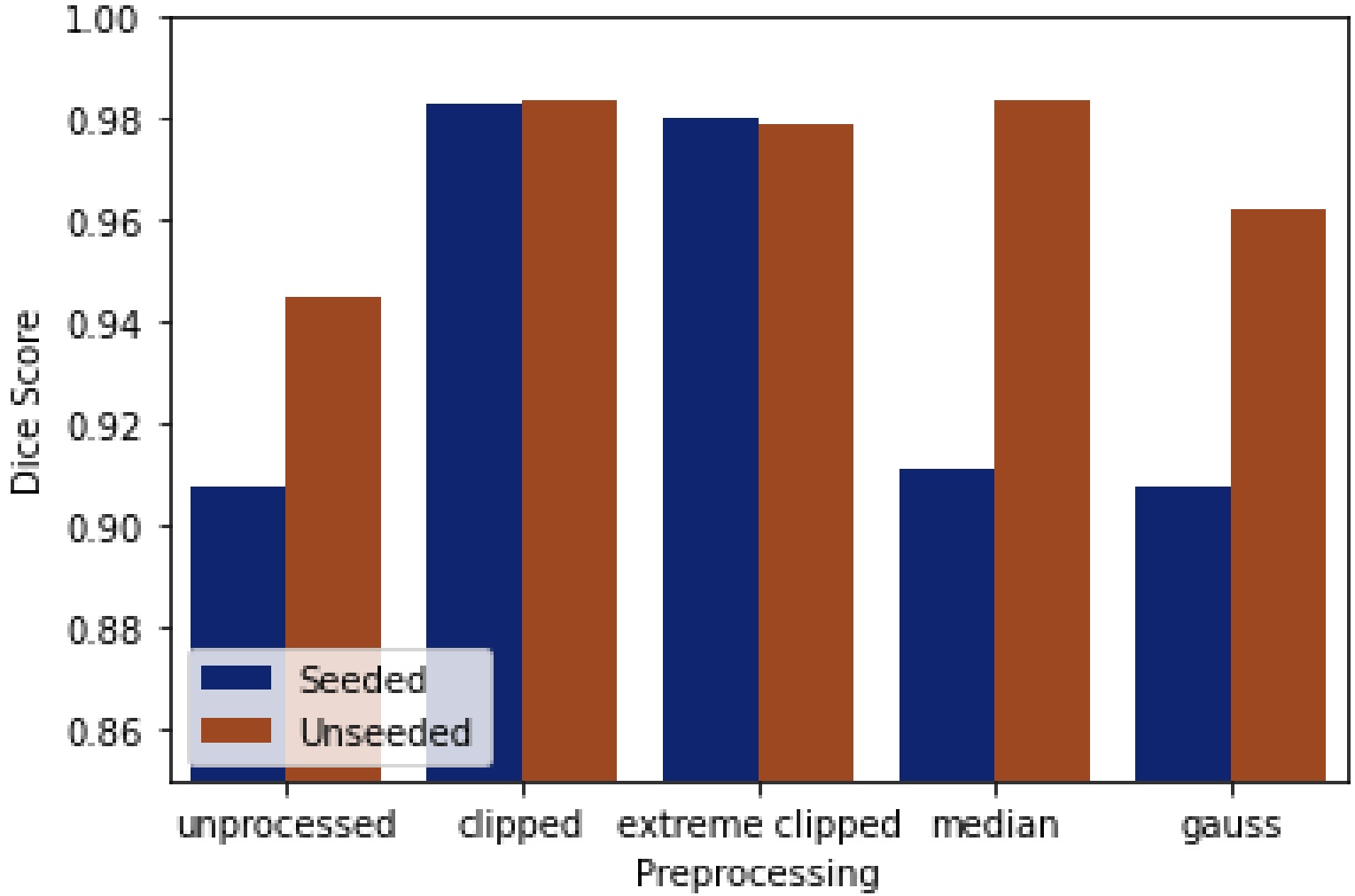




$$DSC = \frac{2 * |S \cap G|}{|S| + |G|}$$

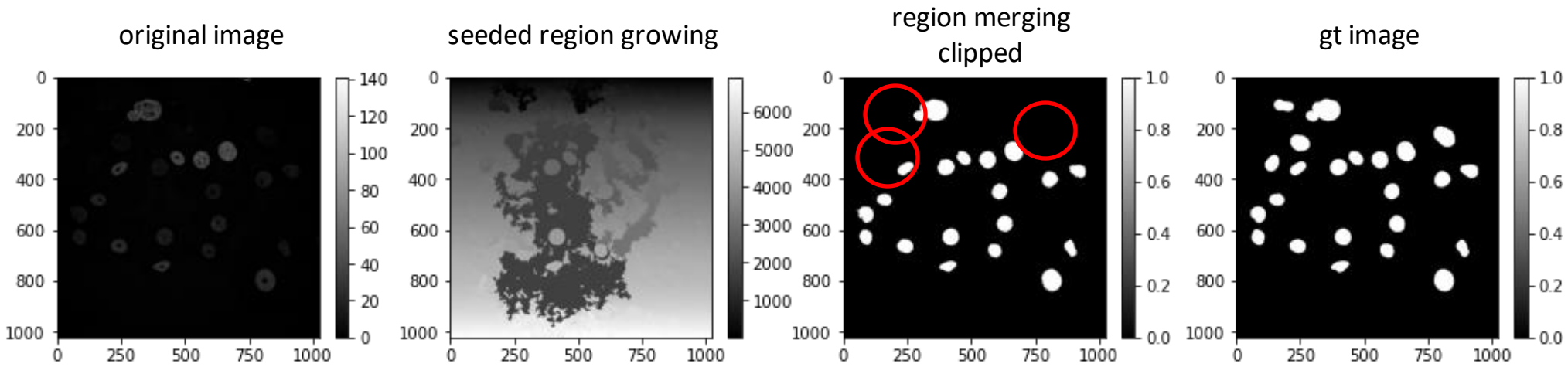
$$\overline{DSC} = \frac{1}{2} \sum_{i=1}^{2} \frac{2 * |S_i \cap G_i|}{|S_i| + |G_i|}$$

Evaluation of preprocessing



Results N2DH-GOWT1

Seeded region growing algorithm



Results N2DH-GOWT1

Seeded region growing algorithm

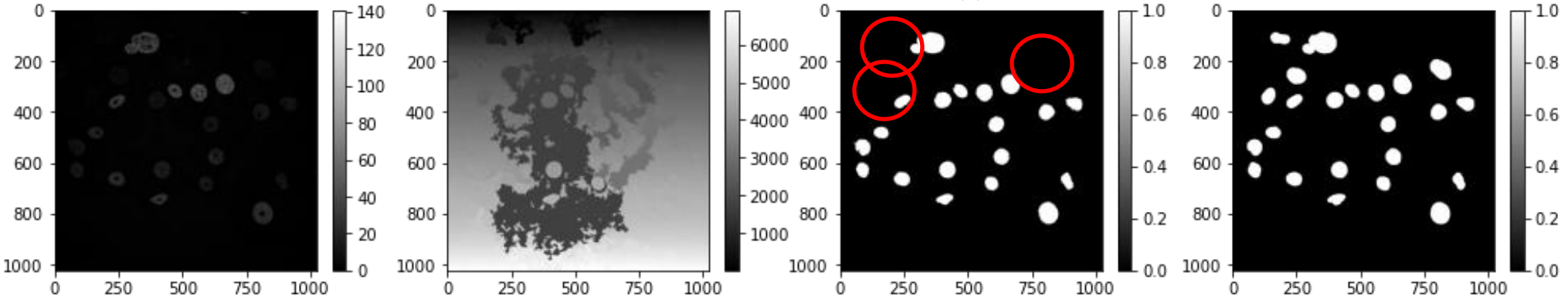
Unseeded region growing algorithm

original image

seeded region growing

region merging clipped

gt image

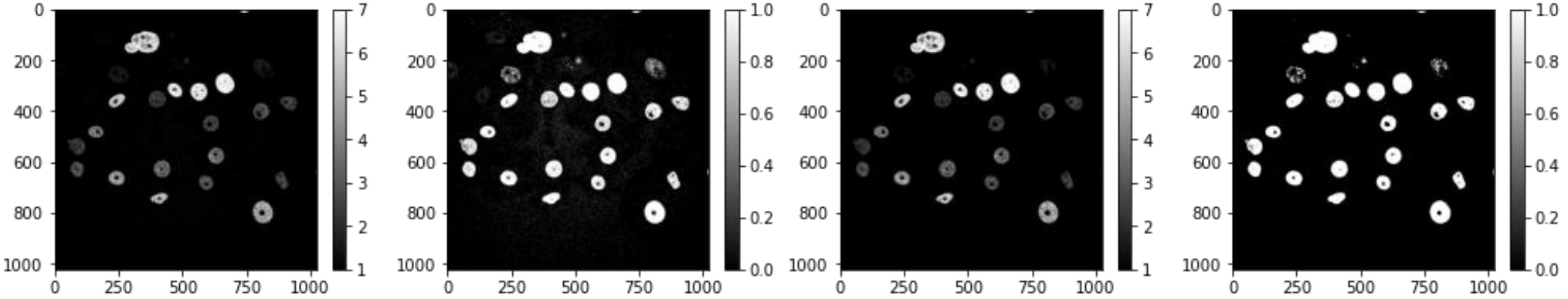


region merging

region merging clipped

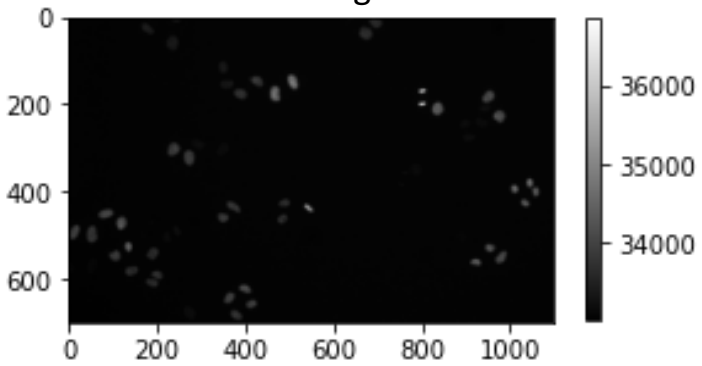
region merging filtered

region merging filtered and clipped

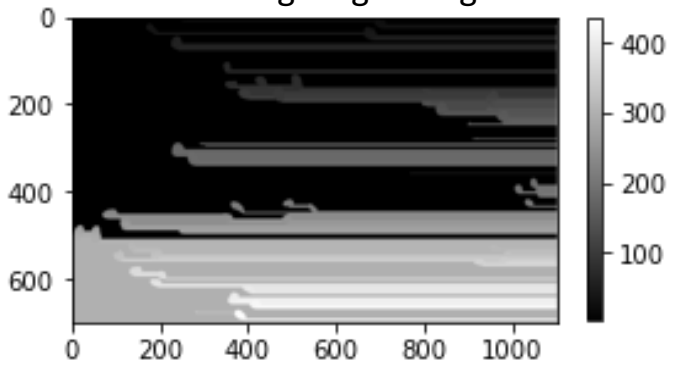


Results N2DL-HeLa

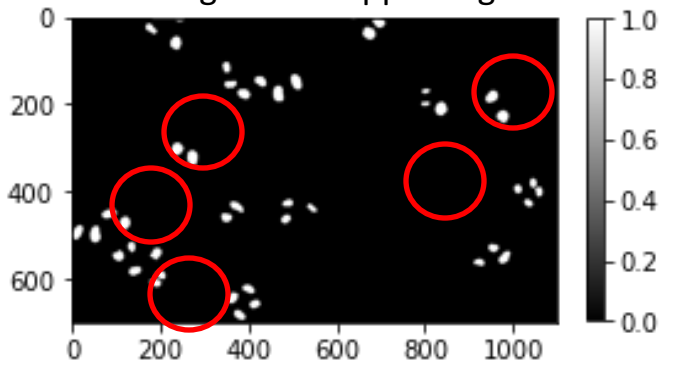
Normal image

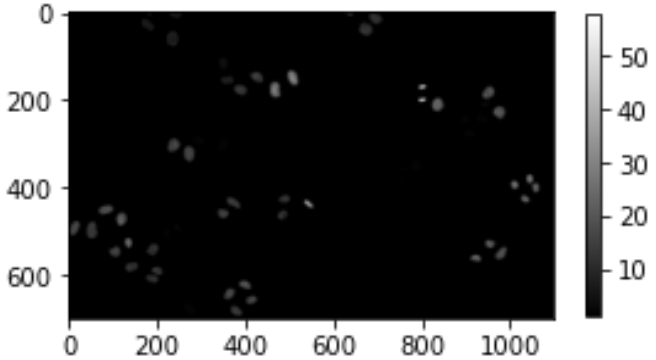


Seeded region growing

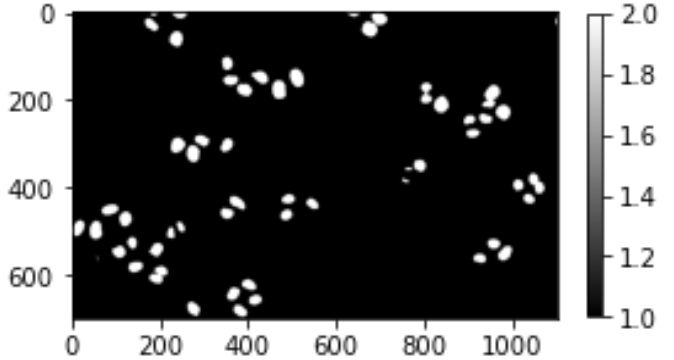


Merged and clipped srg

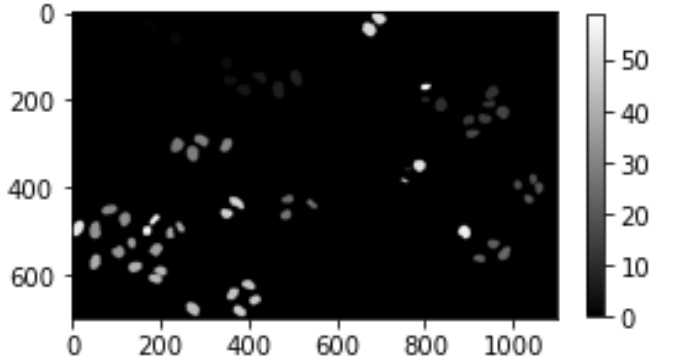




Unseeded region growing

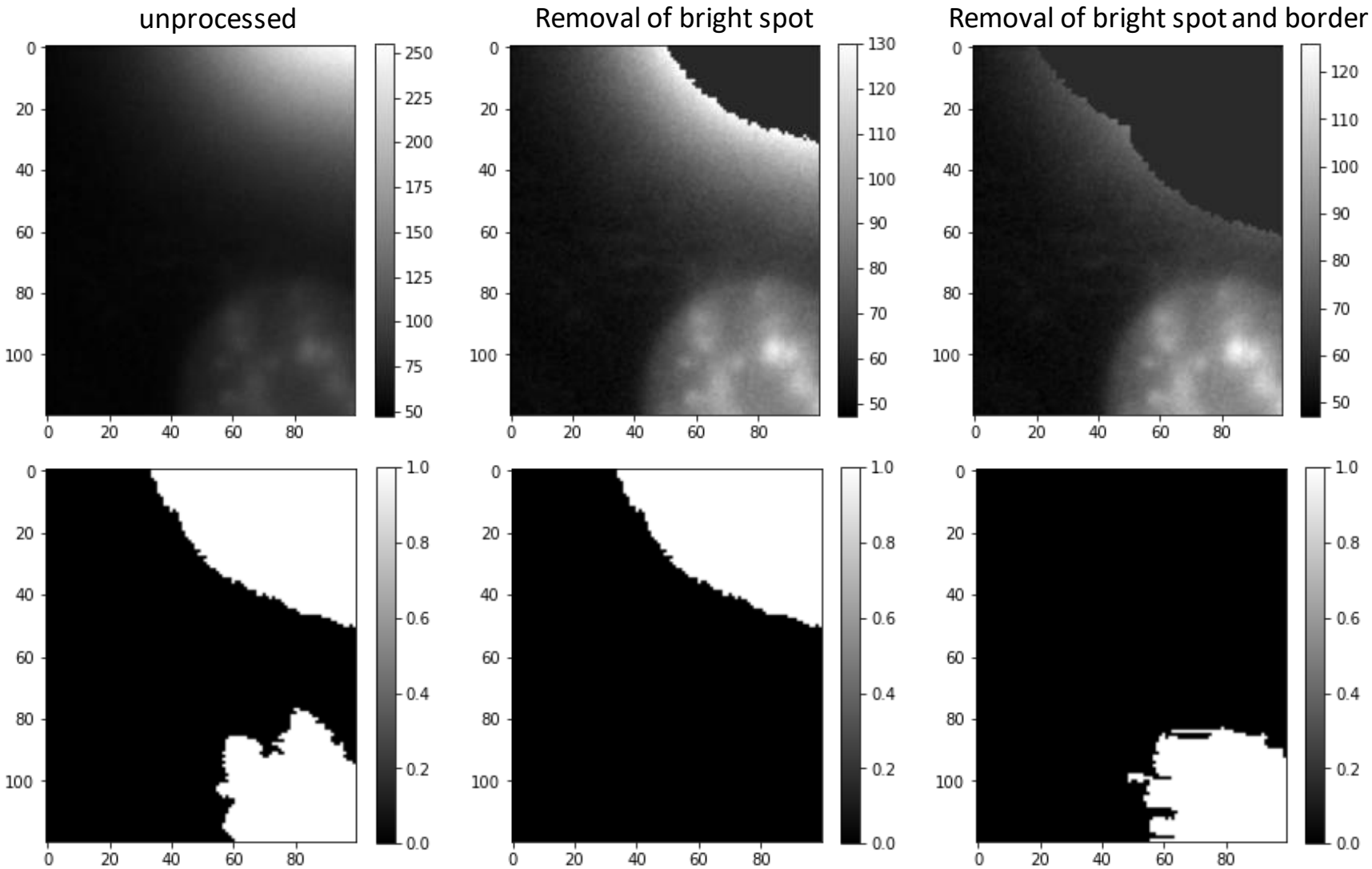


Merged and clipped urg

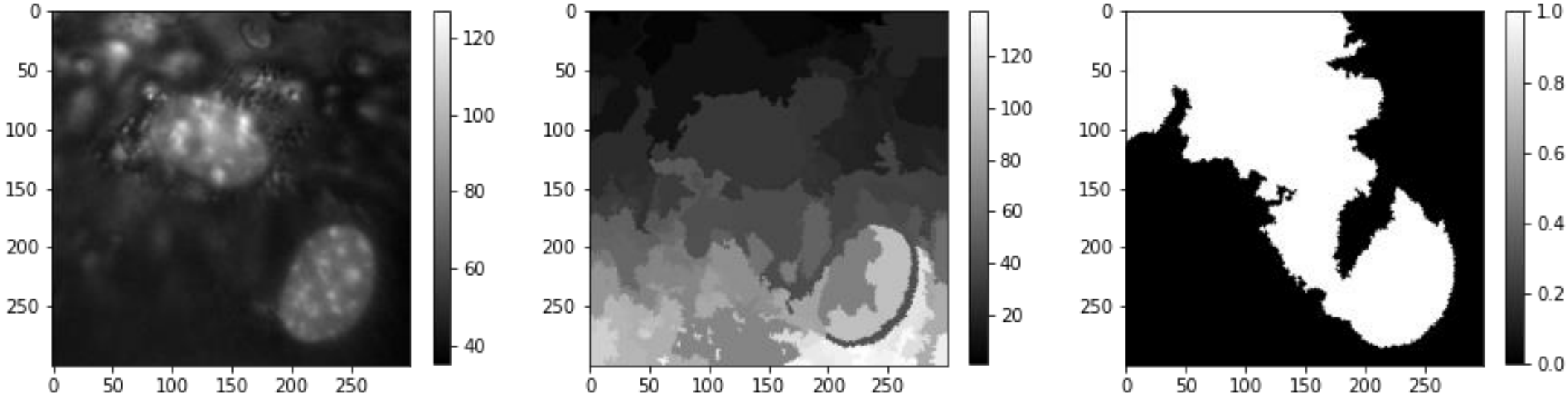


Ground truth

Bright spots in NIH3T3 data set

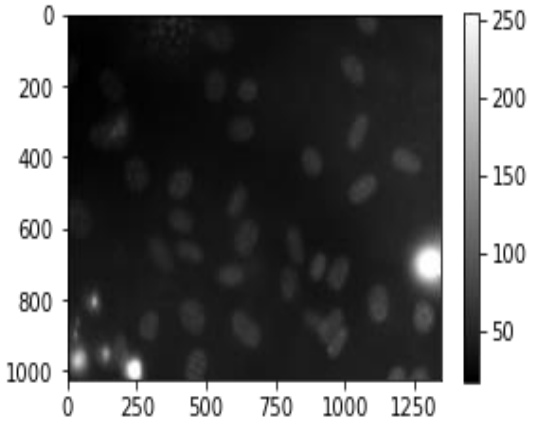


Blurs and changing background intensities

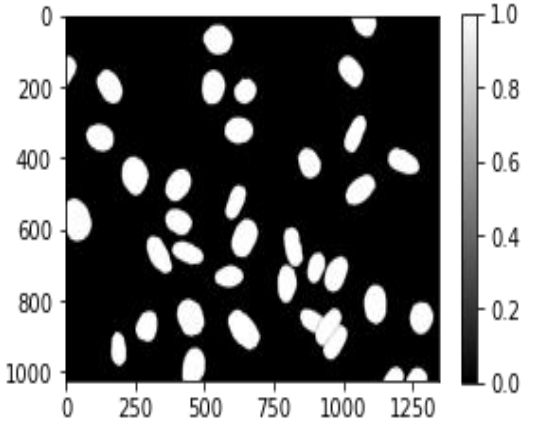


Results seeded region growing NIH3T3

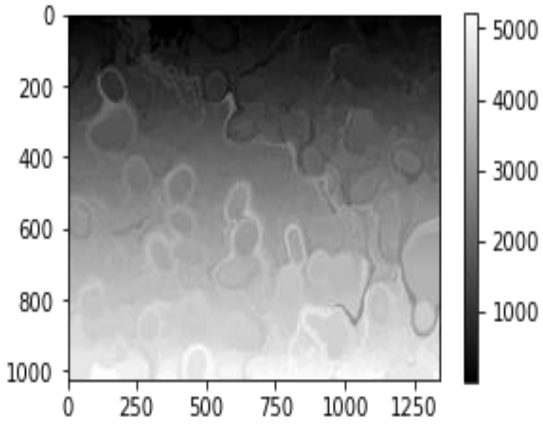
Normal image

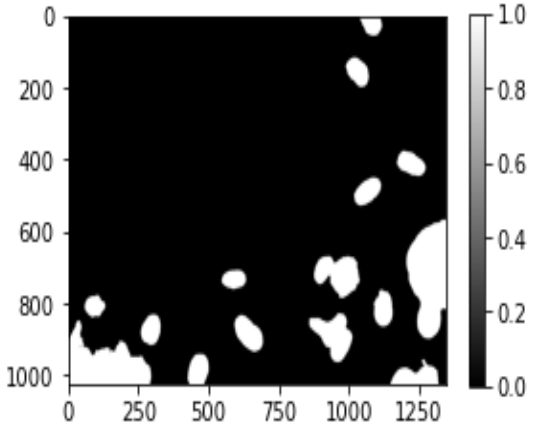


Ground truth image

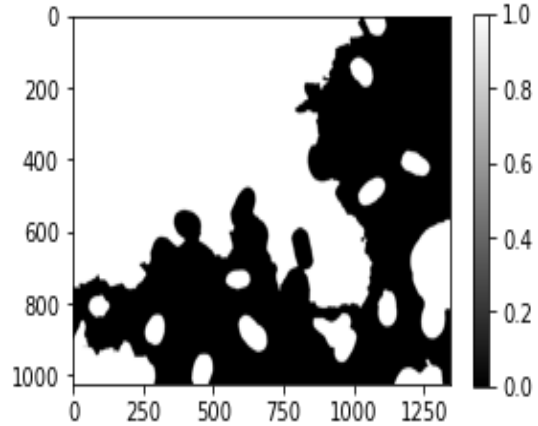


Region growing

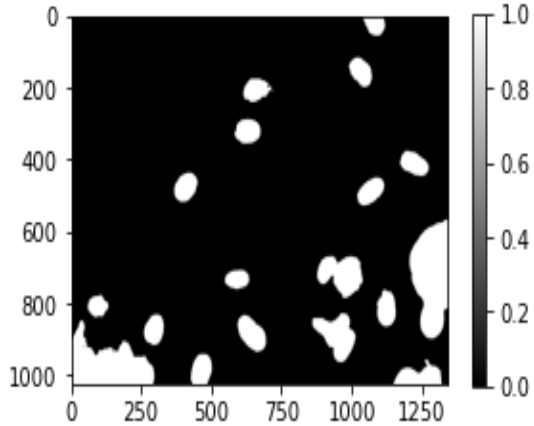




Loosing cells



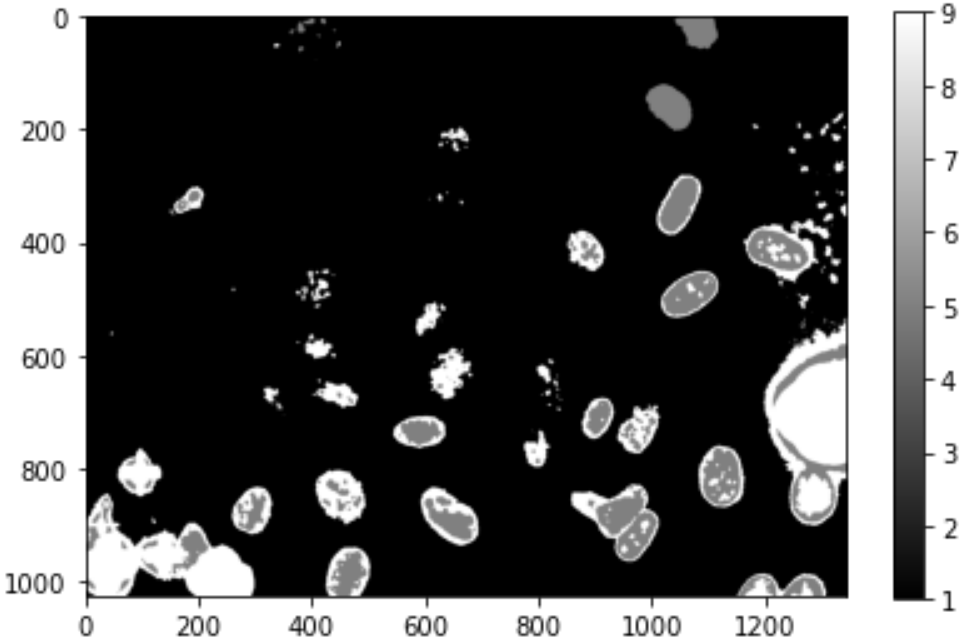
Two background regions



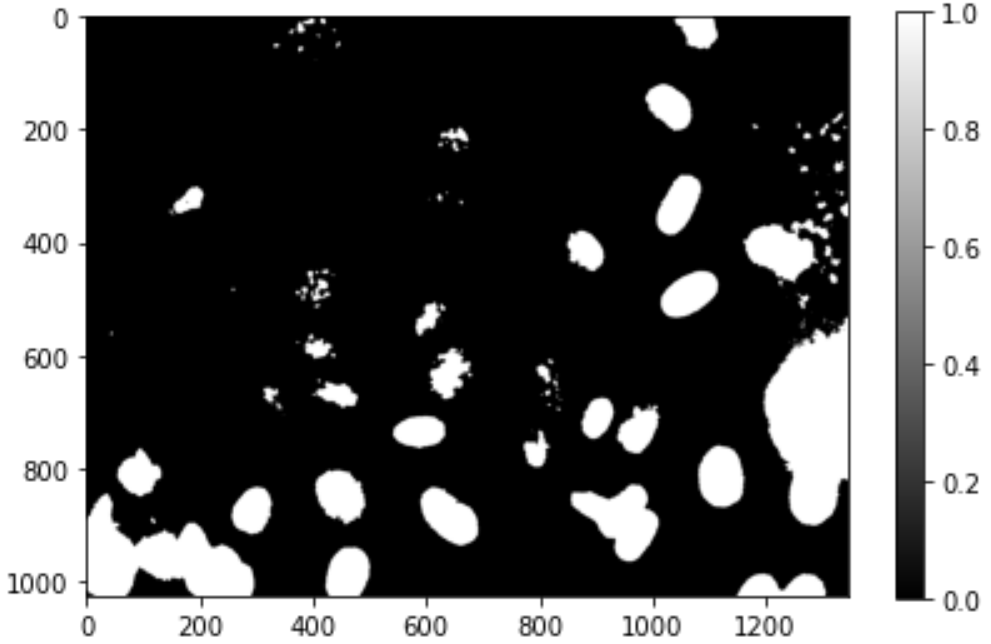
Manually merged

Results unseeded region growing NIH3T3

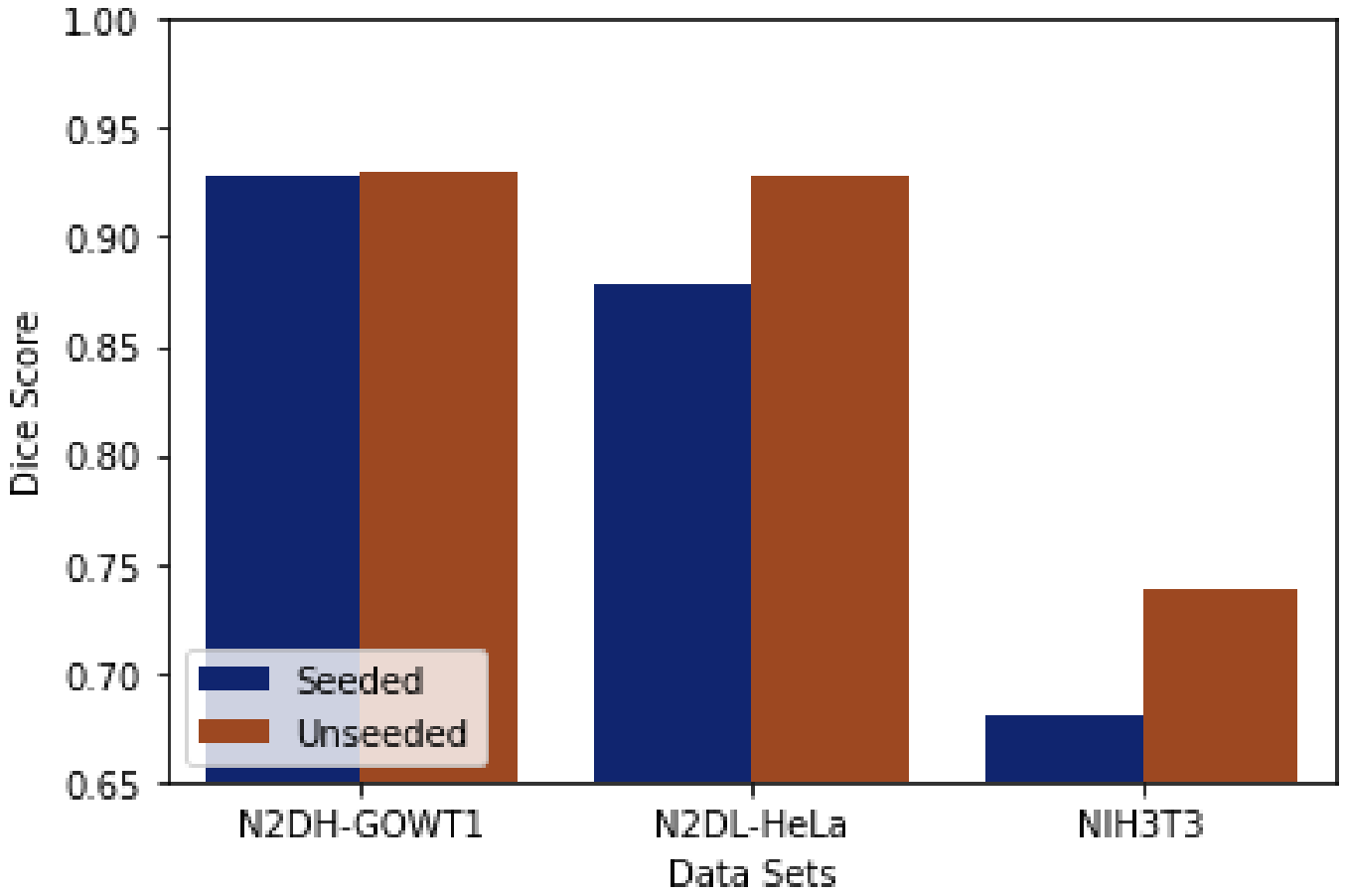
Unseeded region growing



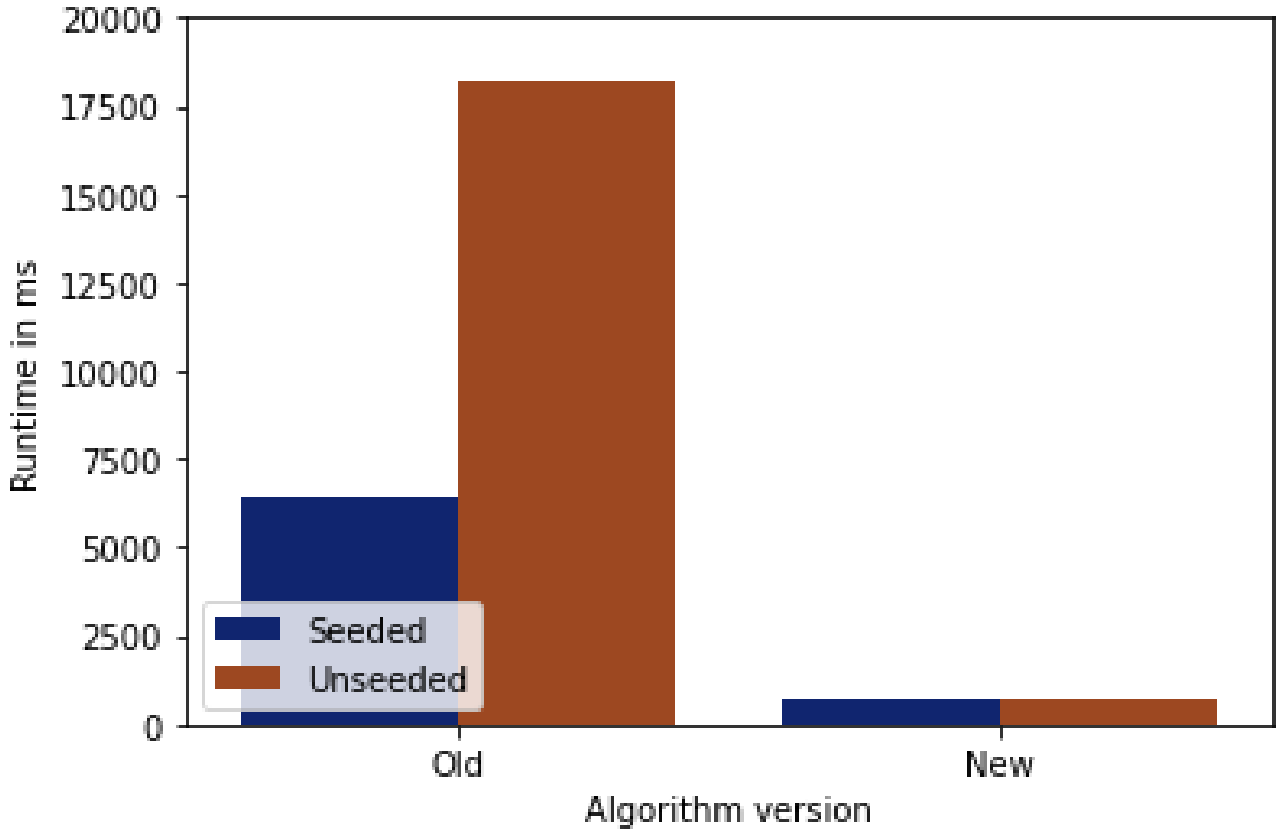
Clipped image



Seeded vs. Unseeded region growing results



Runtime Errors and Memory Errors



Runtime [ms]	Seeded	Unseeded
Old	6440	18200
New	703	672

“Unable to allocate 33.0 GiB for an array with shape (66518, 66518) and data type float64”

Discussion

High Dice scores N2DH-GOWT1 data set
High Dice scores N2DL-HeLa data set using pre-processing
Unseeded region growing more accurate on difficult images
Weighted Dice score to evaluate results

Lower dice scores on difficult images of the NIH3T3 data set
Image challenges were only solved on small images
Runtime still too long

Assign more than one pixel at a time
Determine parameters automatically
Weighted dice score can be further improved