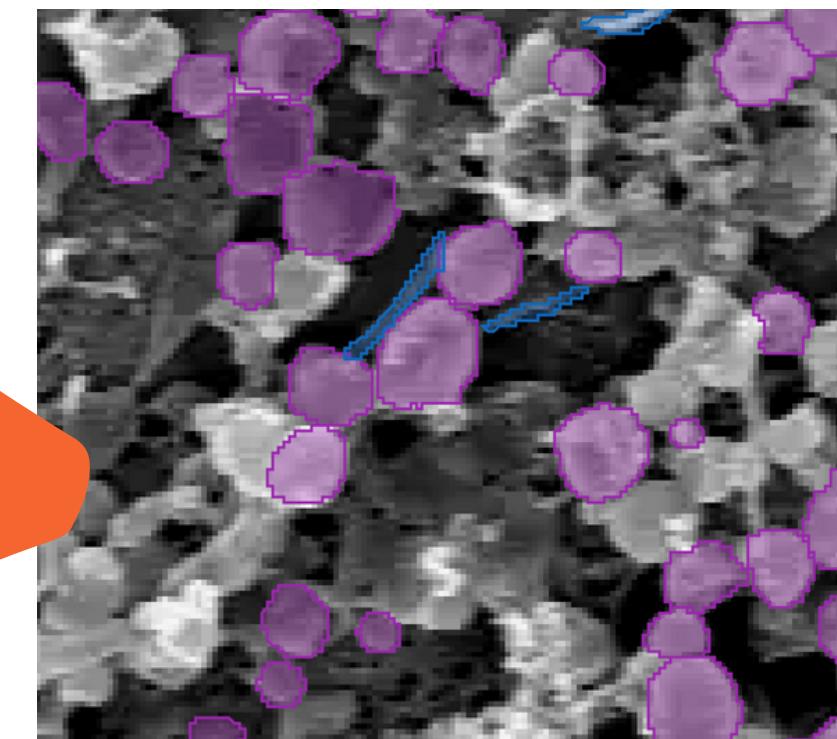
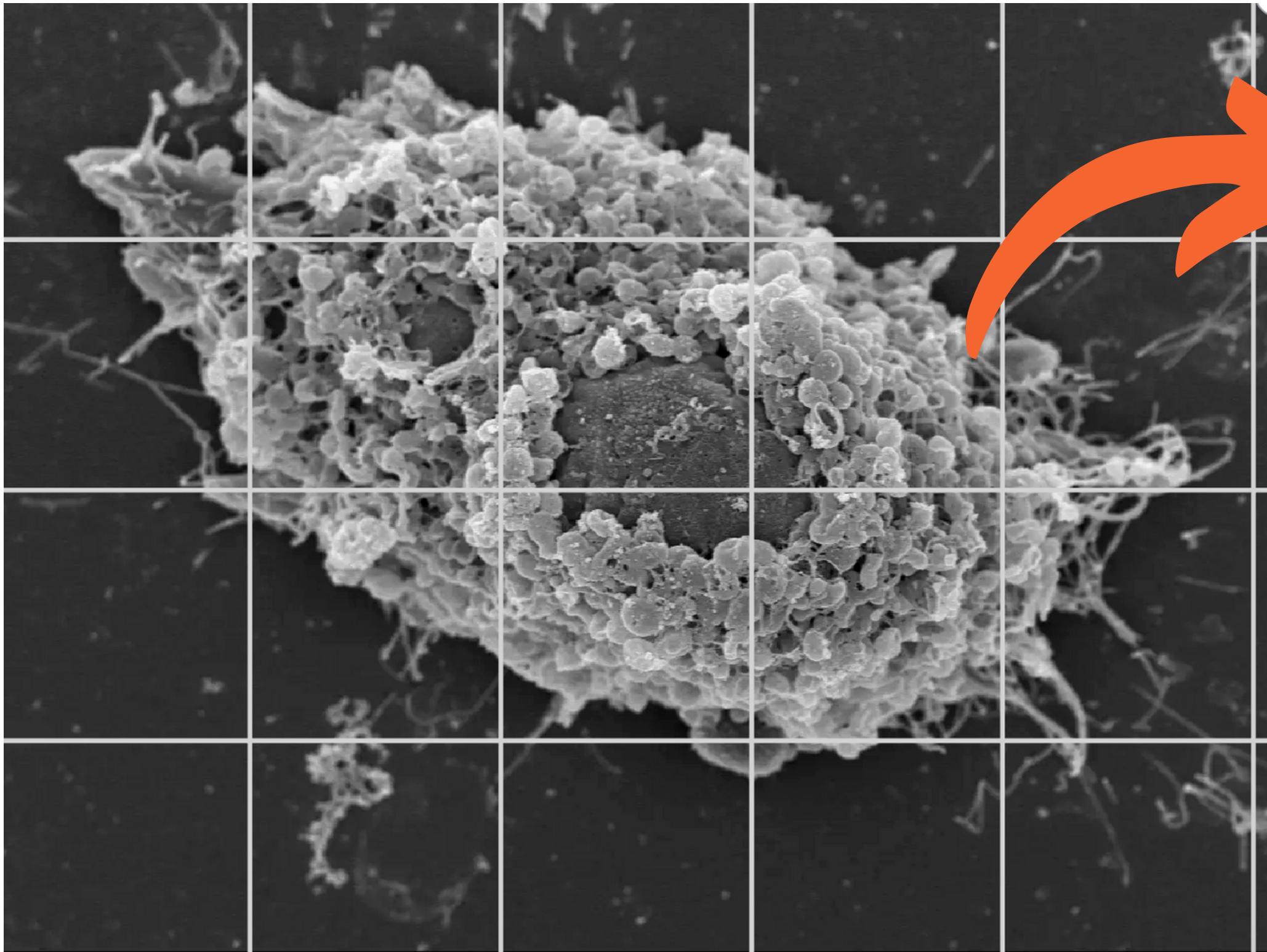


BLEBS AND TUBES QUANTIFICATION

PROGRESS REPORT

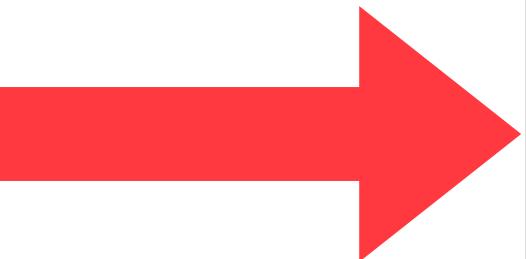
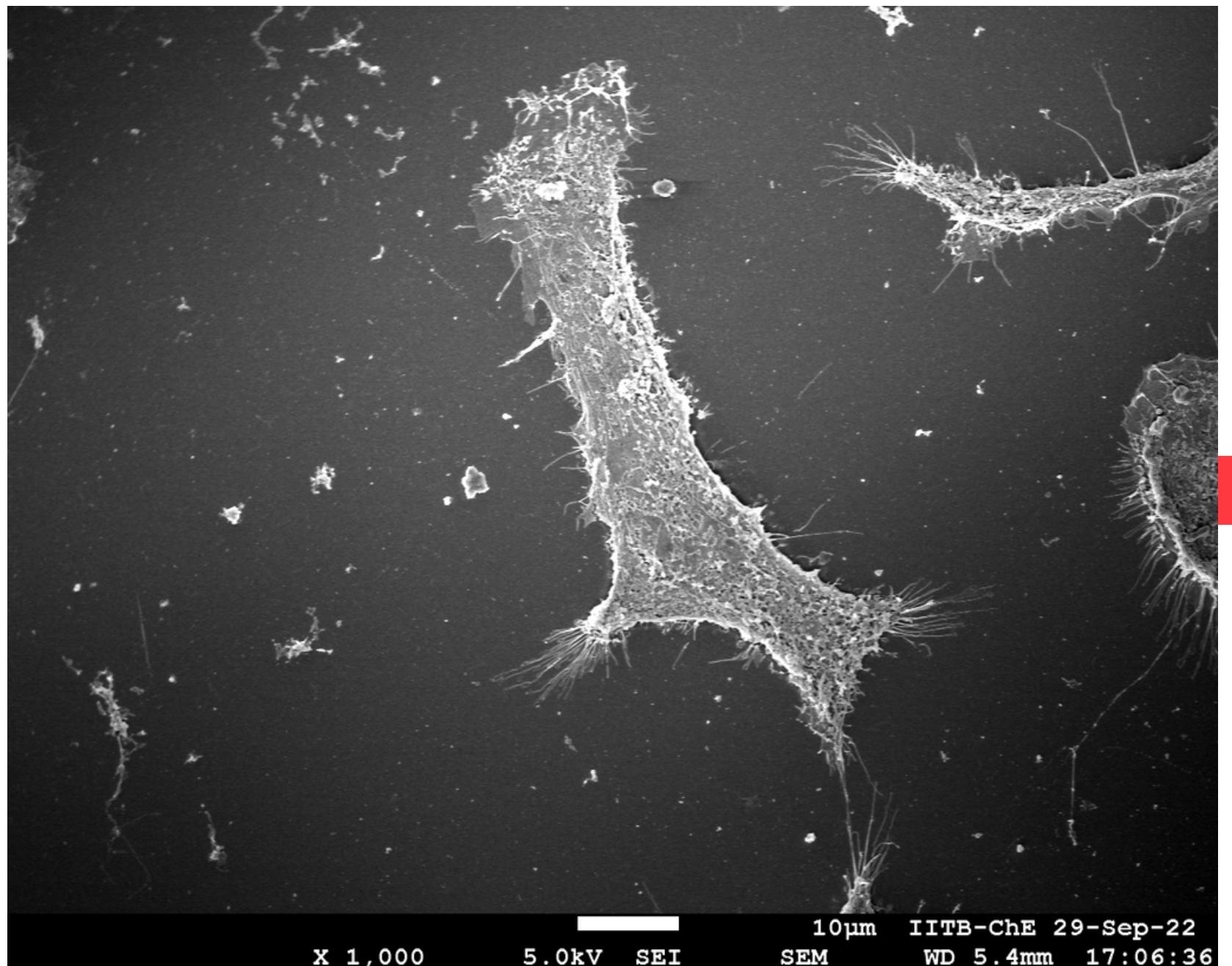
MAHIMA SRIVASTAVA

What are we segmenting?



**blebs and tubes
in cells**

Software used



Biodock
End-to-end deep AI for biological images

Home · Biodock

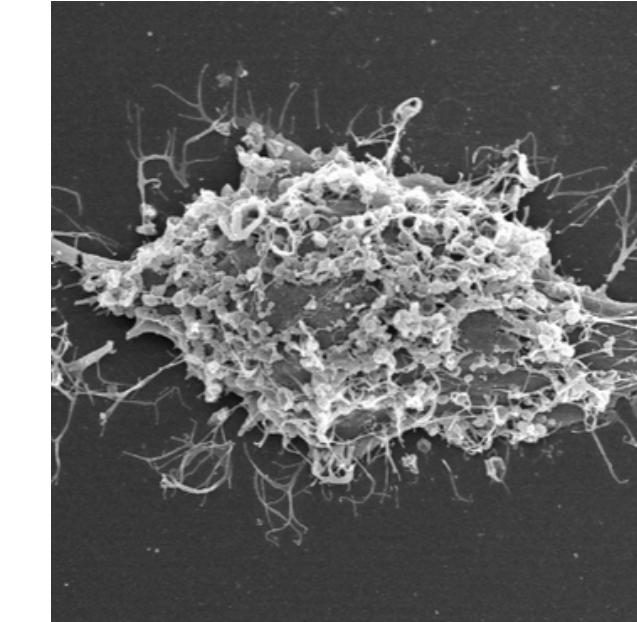
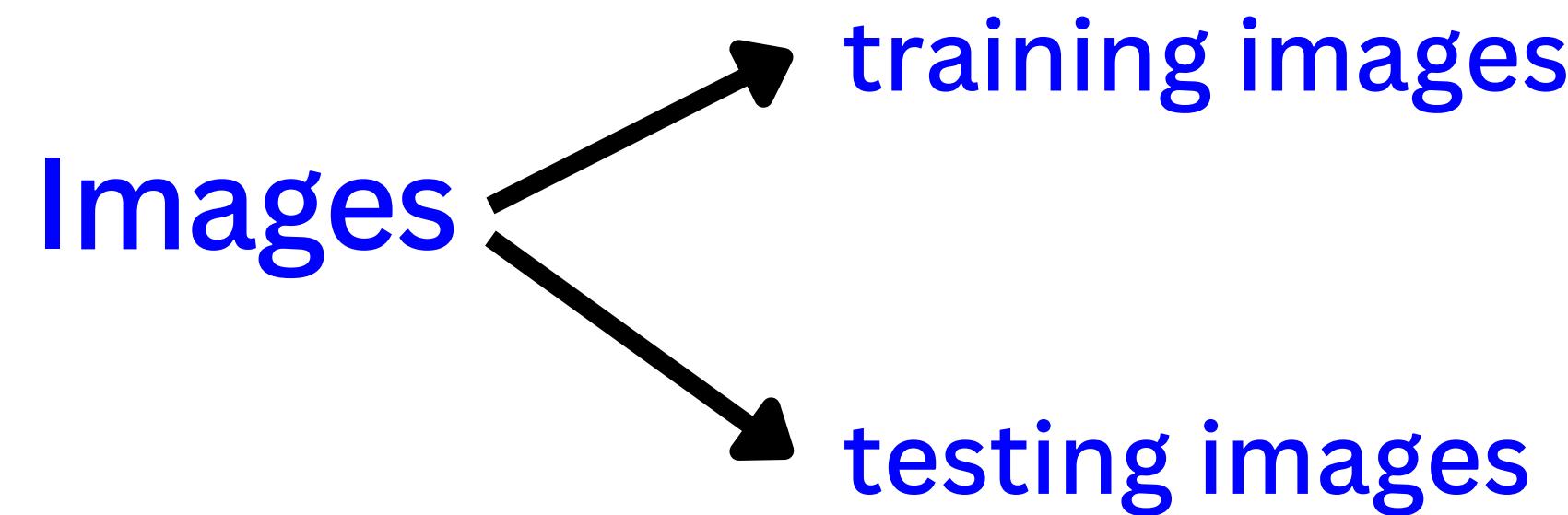
Biodock makes deep AI easy to train, run, and interpret on biological images, dramatically accelerating your R&D analysis.

biodock.ai

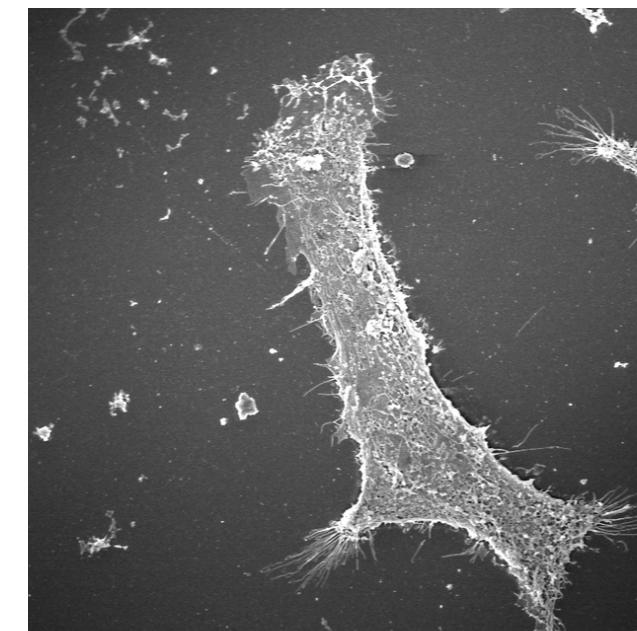
The image shows the homepage of the Biodock software. It has a dark blue header with the Biodock logo and tagline. Below the header is a white navigation bar with a 'Home' button. The main content area is white with black text, describing the software's purpose as making deep AI easy to train, run, and interpret on biological images, which accelerates R&D analysis. At the bottom is a footer with the Biodock logo and the URL 'biodock.ai'.

Procedure

1

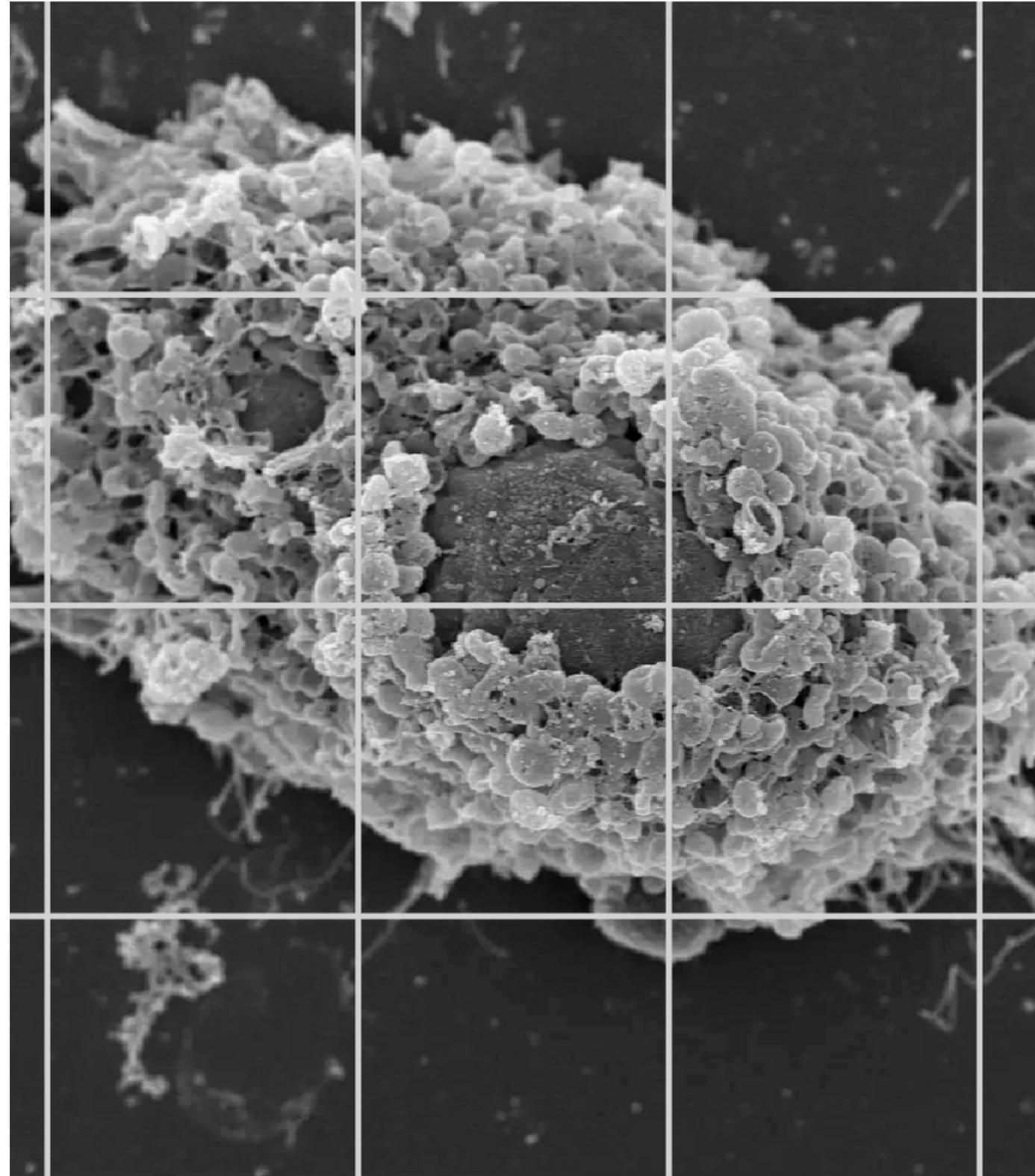


33 images taken from switch experiments
with clearer blebs and tubes.
used to train the model



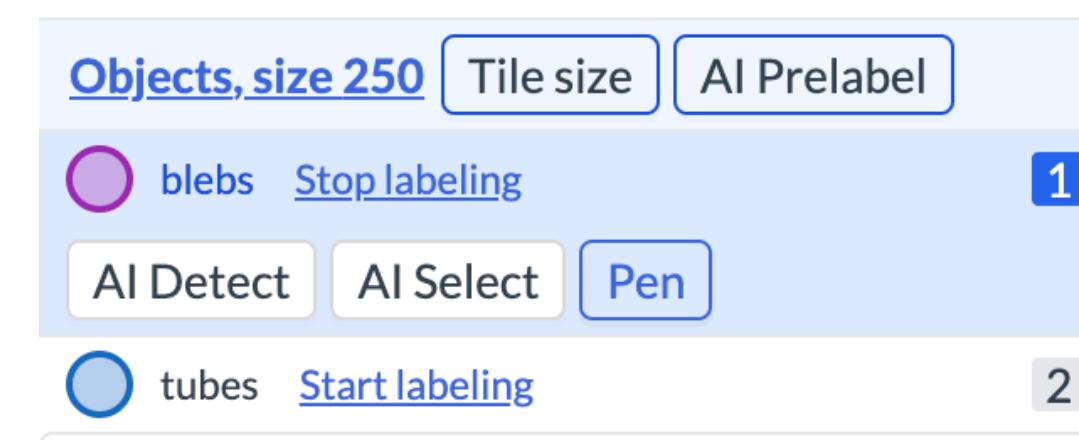
30 images belonging to each of the following
categories -
no glucose, low glucose, high glucose.
Used for running model analysis

3. Instance segmentation



Instance segmentation is a computer vision technique used in image processing and deep learning to identify and delineate individual objects within an image. In instance segmentation, the goal is to precisely segment and differentiate each object instance present in an image.

To segment blebs and tubes, we divide the image into 250x250 pixel boxes.
Each box is treated as an individual image / tile.



Labelling of training images/tiles

Three different tools can be used to label images : AI Detect, AI Select, and Pen

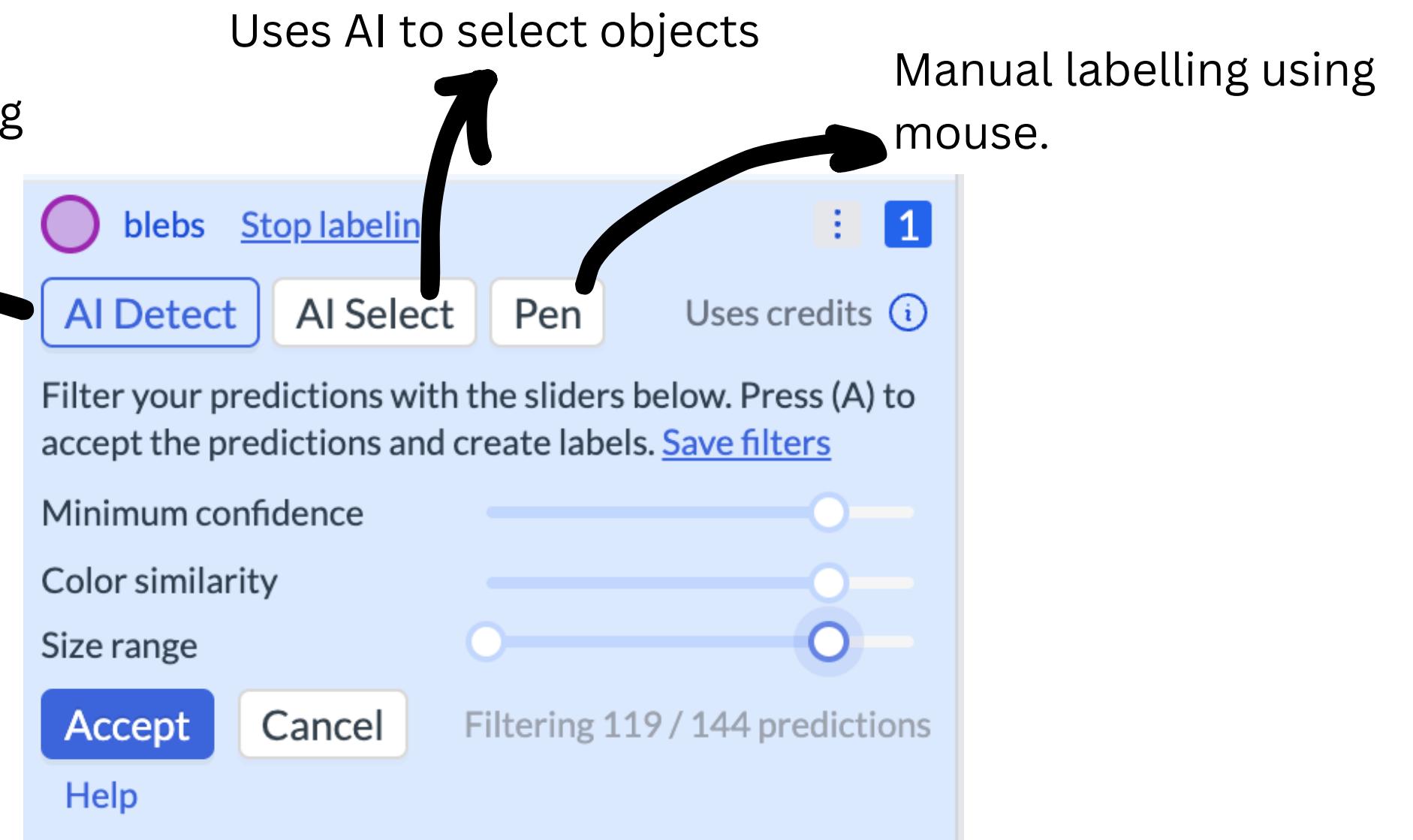
Drag a tight box around one example of your object, using the crosshairs to help you. AI will locate the position of similar-looking objects, and also segment them.



The confidence score slider controls the model score threshold at which objects are filtered out.

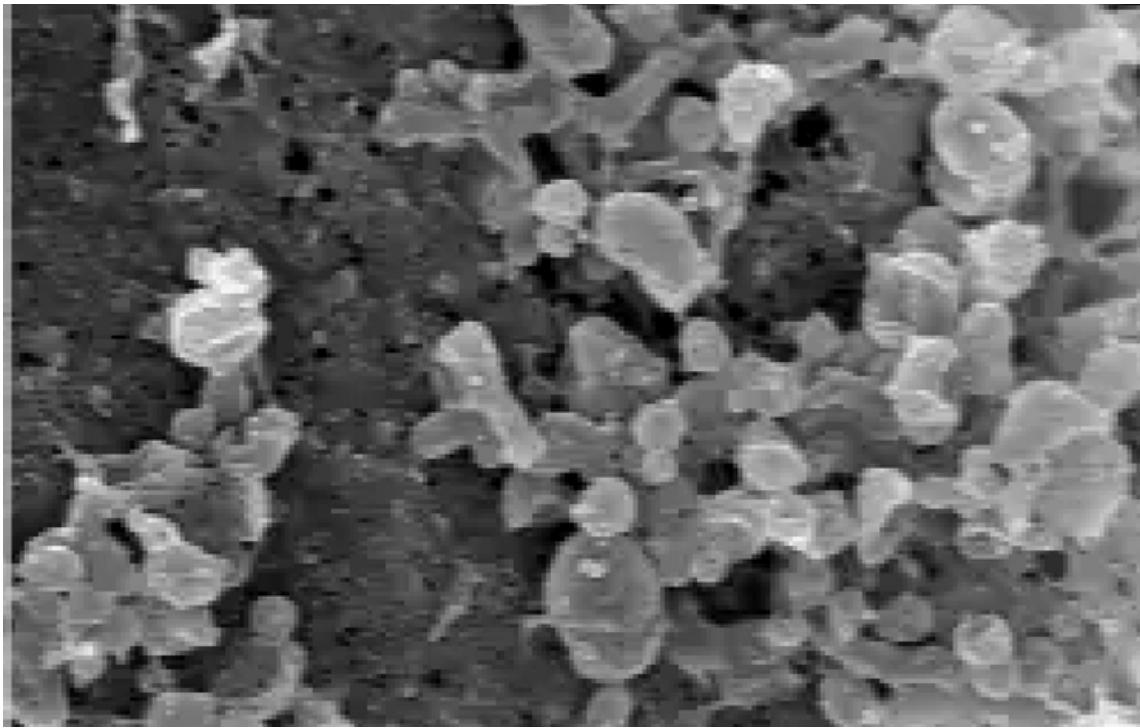
Drag higher to get fewer labels, and lower to get more labels.

The size range slider has a minimum and maximum upper bound. To filter out or include larger or smaller objects using these ranges.

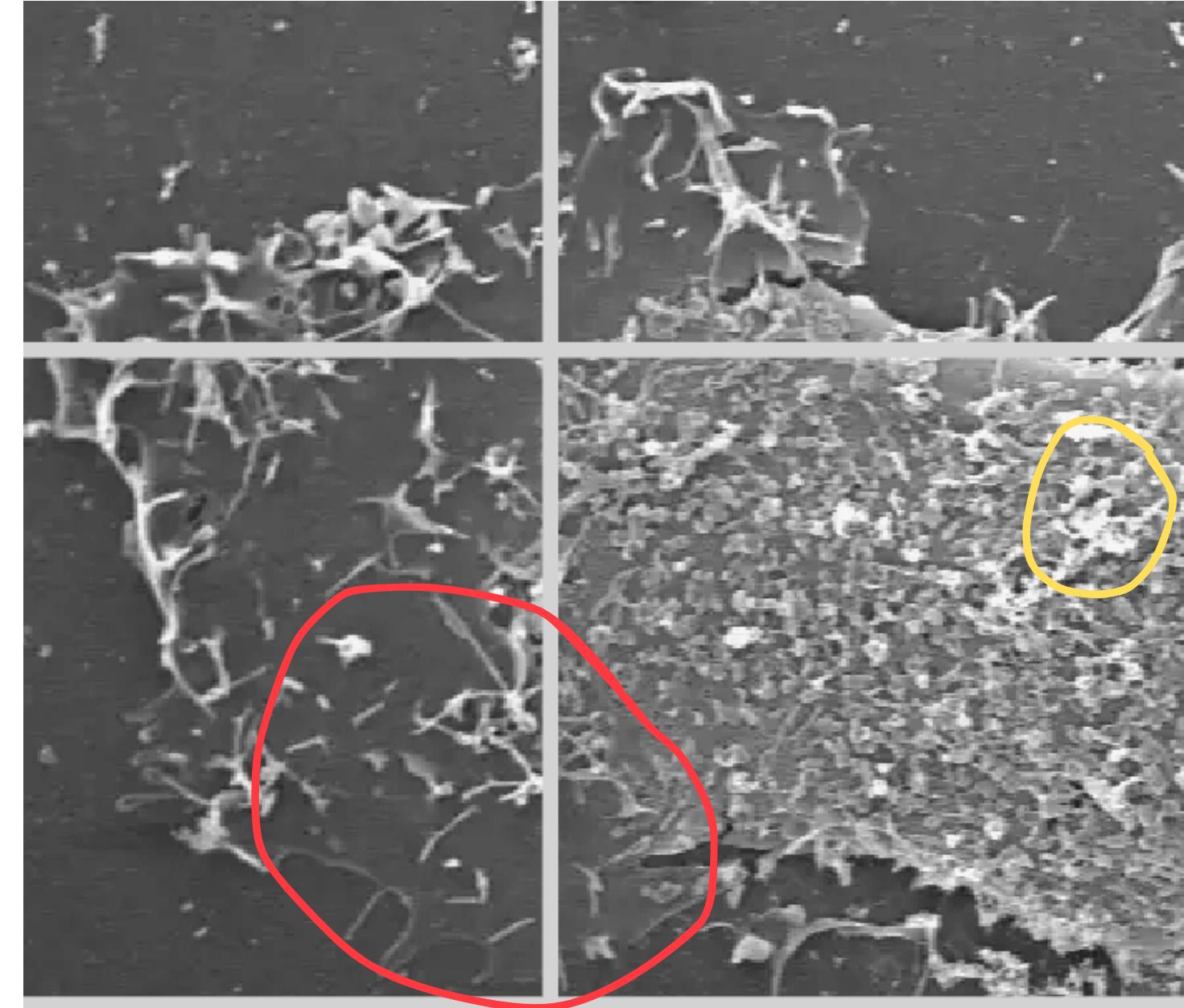


I used a combination of all the tools, keeping minimum confidence of 90, colour similarity of 80 and size ranging from 80 for all labels

criteria for labelling

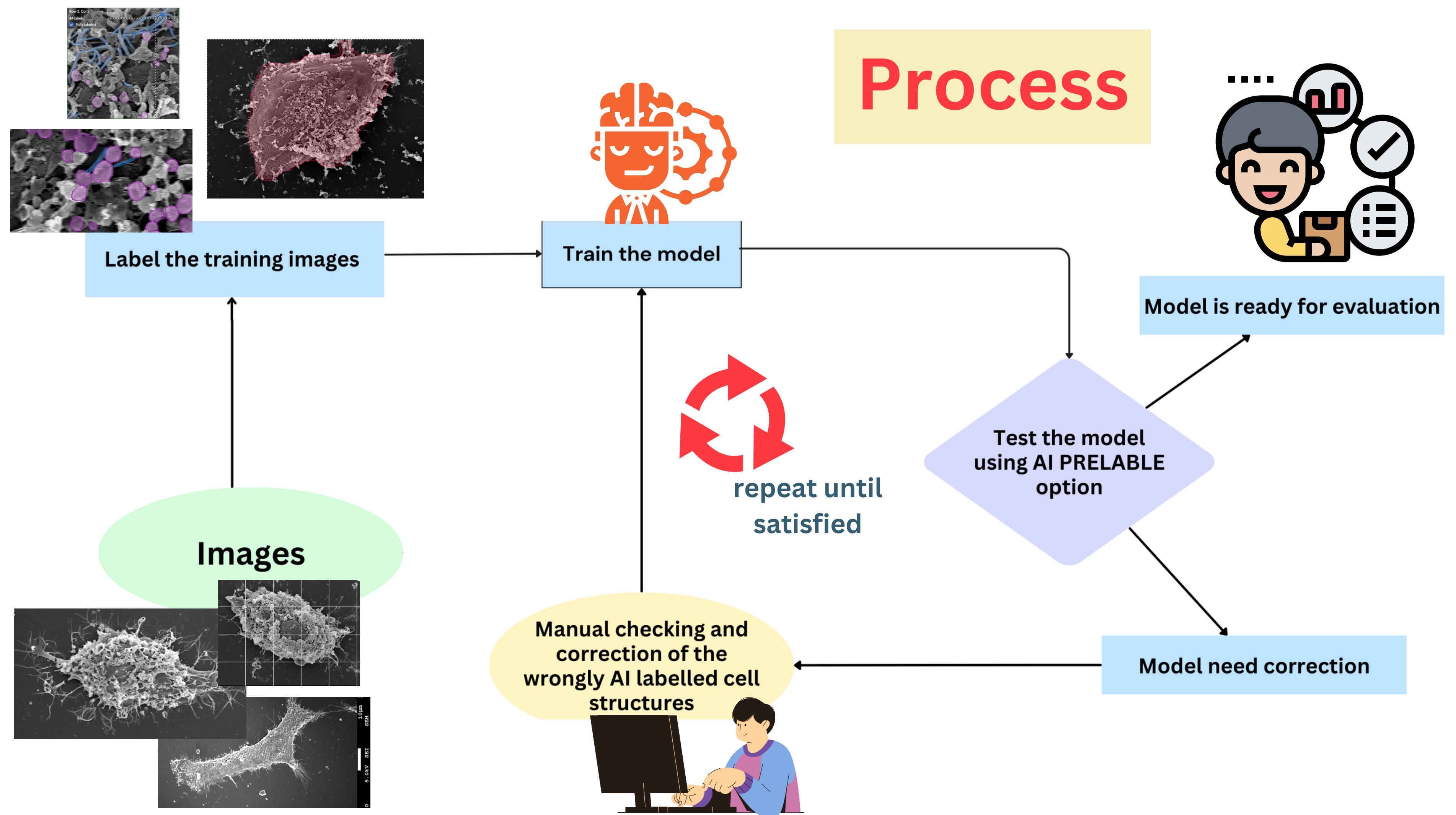


ONLY clear white complete circles without over lapping were considered blebs



blebs or tubes outside or on the edge are not considered (red)

chaotic and undifferentiated tubes/blebs are not considered



Model configurations

Overall Statistics

Total tiles:	42
Total size groups:	2
Total labels:	847
Avg. labels per tile:	20.2
Training start time:	Jan 9, 2024 at 6:16 AM
Training finish time:	Jan 9, 2024 at 7:18 AM
Time to train:	1hr 1m

Included classes (3)

blebs, object class - 566 labels
tubes, object class - 256 labels
glycocalyx, object class - 25 labels

Size group	Train/Test split	Augmentations	Transformations
Objects, tile size 250 • Model: Alligator	Total tiles: 25 Train tiles: 22 Test tile: 3 Percentage of train tiles: 88% View Details	<ul style="list-style-type: none">Random horizontal flipRandom vertical flipRandom brightnessRandom contrastRandom rotationRandom rescale	<ul style="list-style-type: none">Apply contrast normalization
Objects, tile size 2k • Model: Alligator	Total tiles: 17 Train tiles: 17 Test tile: 0 Percentage of train tiles: 100% View Details	<ul style="list-style-type: none">Random horizontal flipRandom vertical flipRandom brightnessRandom contrastRandom rotationRandom rescale	<ul style="list-style-type: none">Apply contrast normalization

model results

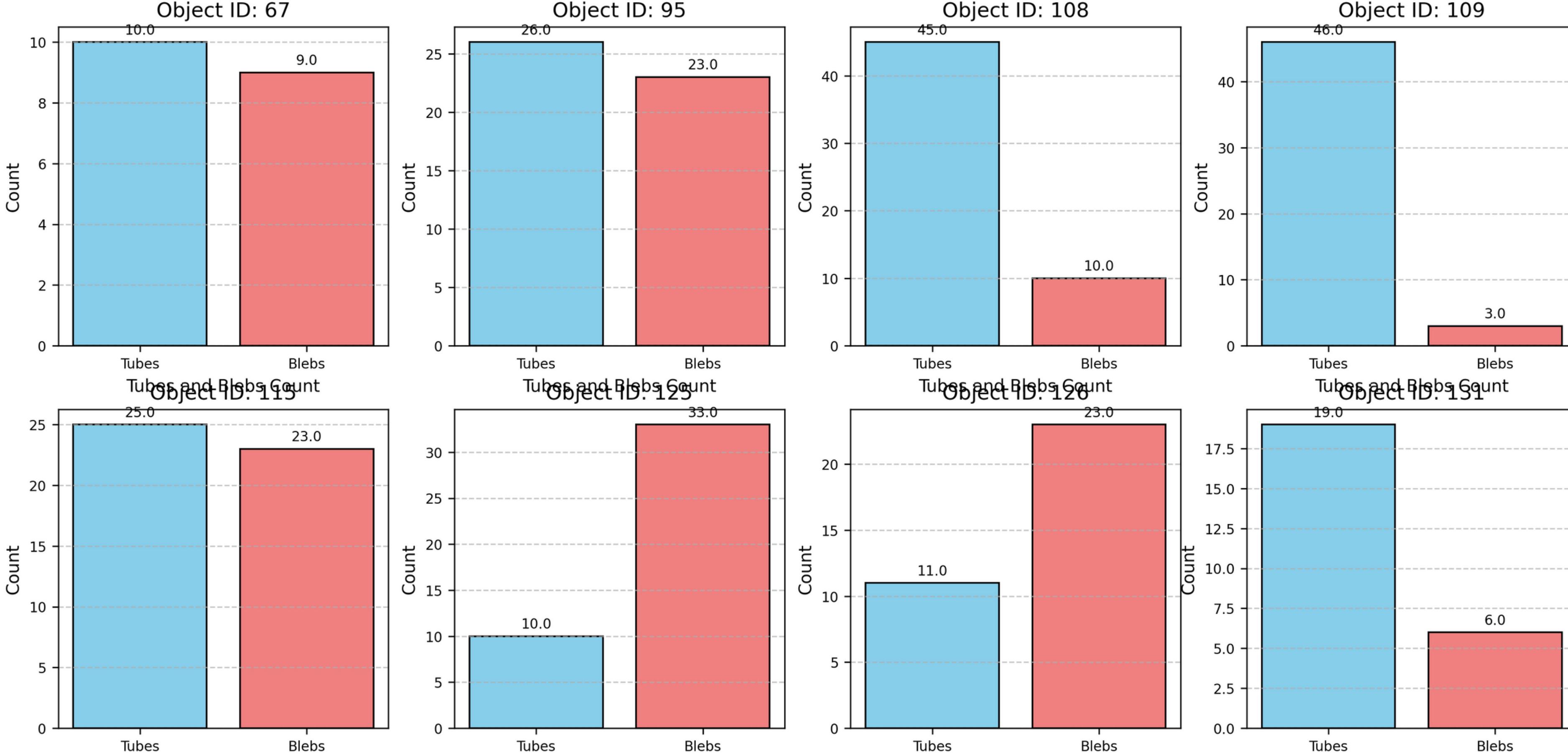
Objects, size 250

	Test Set (190 objects)		Training Set (989 objects)	
	AP (bbox)	AP (mask)	AP (bbox)	AP (mask)
Mean over IoU 0.5-0.95 ⓘ	21.2	20.7	89.7	69.9
0.5 IoU ⓘ	34.4	32.9	98.5	98.4
0.75 IoU ⓘ	22.9	22.4	97.4	84.2
Small objects (< 32x32 px) ⓘ	18.9	13.3	86.8	66.3
Medium objects (< 96x96 px) ⓘ	24.3	25.5	94.3	75.1
Large objects (> 96x96 px) ⓘ	⚠	⚠	91.3	71.4
blebs	37.9	39.2	88.5	80.8
tubes	4.6	2.2	90.8	58.9

Objects, size 2k

	Training Set (29 objects)	
	AP (bbox)	AP (mask)
Mean over IoU 0.5-0.95 ⓘ	93.5	91.7
0.5 IoU ⓘ	95.1	98.9
0.75 IoU ⓘ	95.1	95.1
Small objects (< 32x32 px) ⓘ	⚠	⚠
Medium objects (< 96x96 px) ⓘ	⚠	⚠
Large objects (> 96x96 px) ⓘ	93.5	91.7

could be better

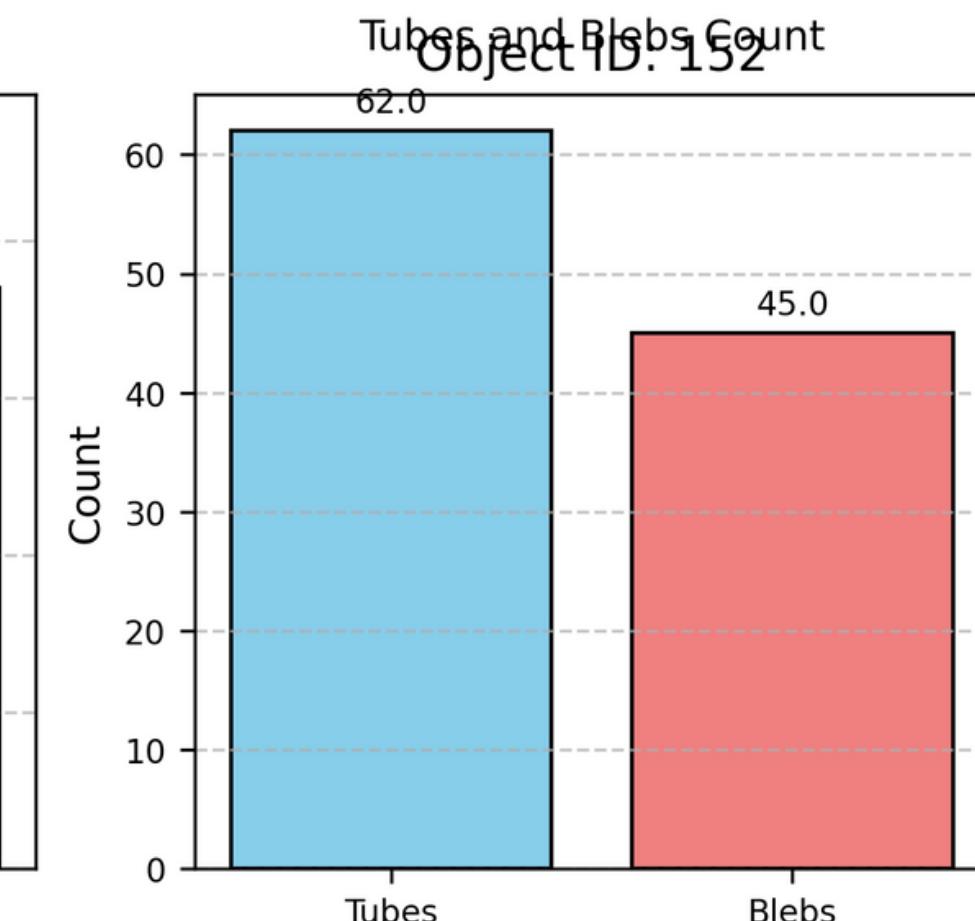
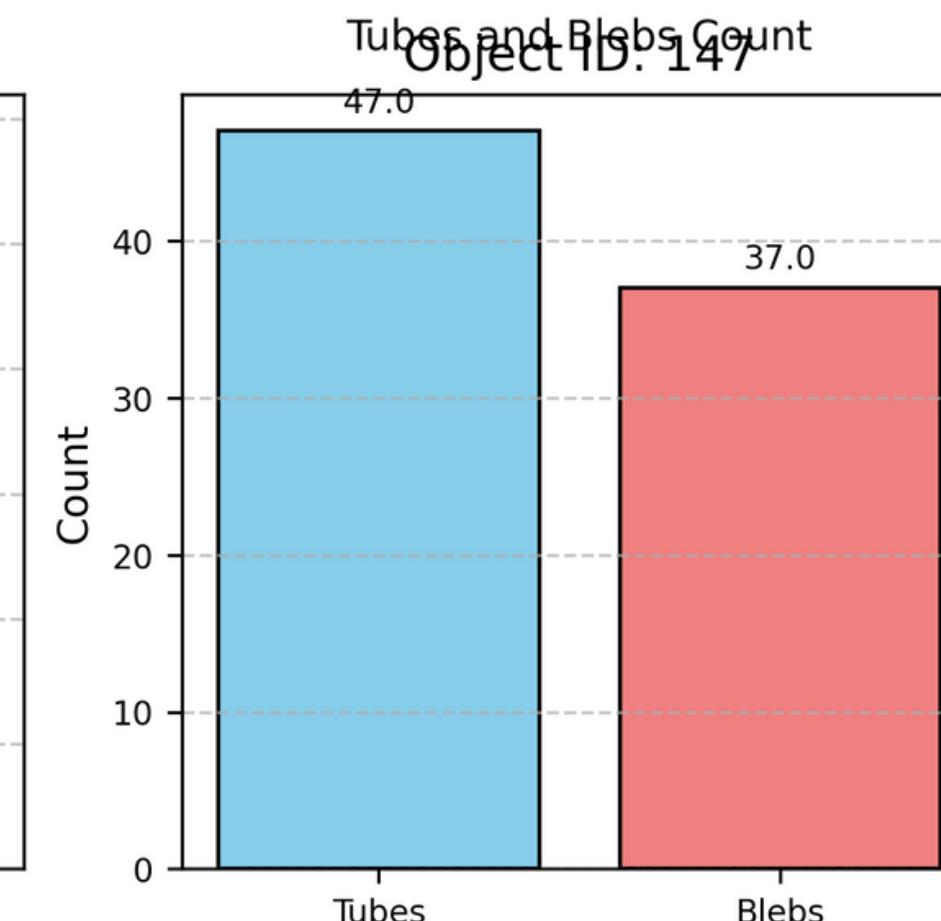
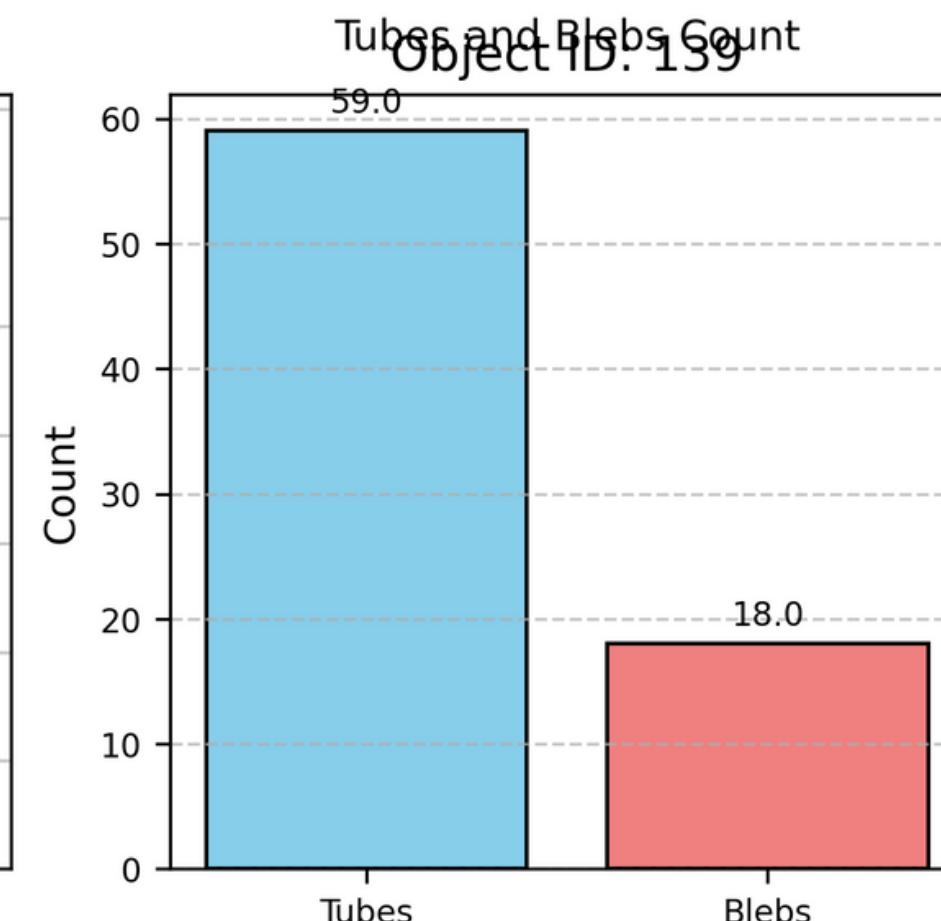
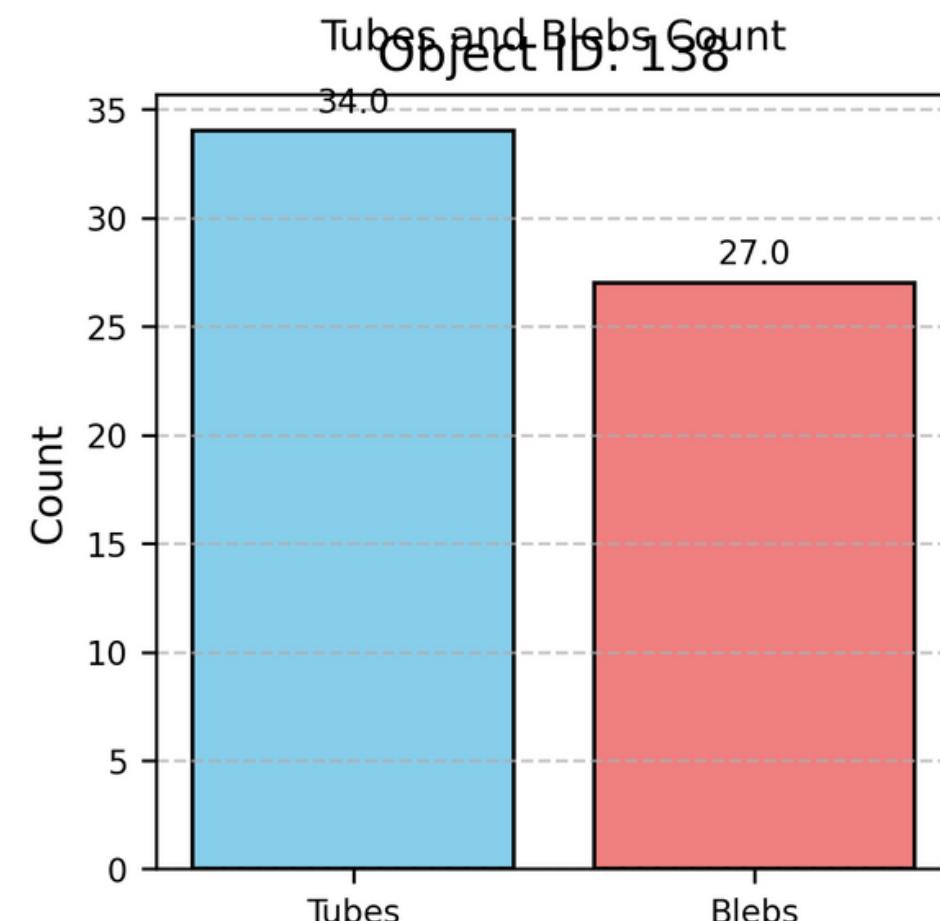
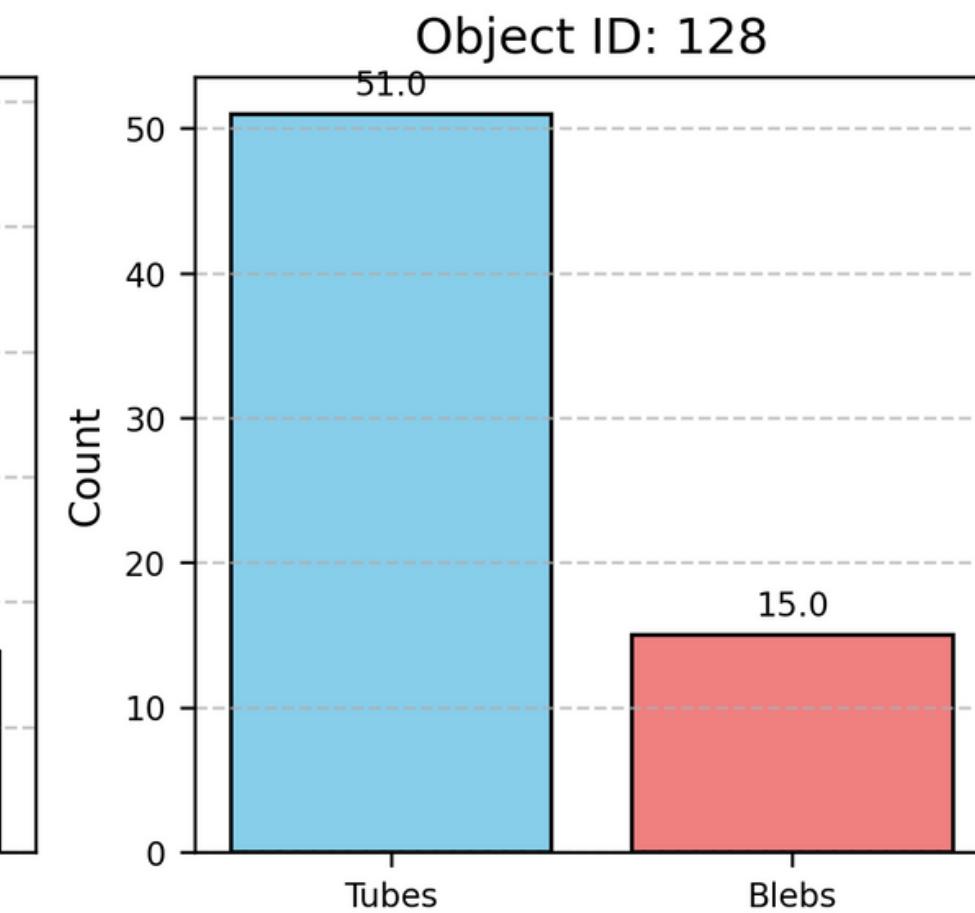
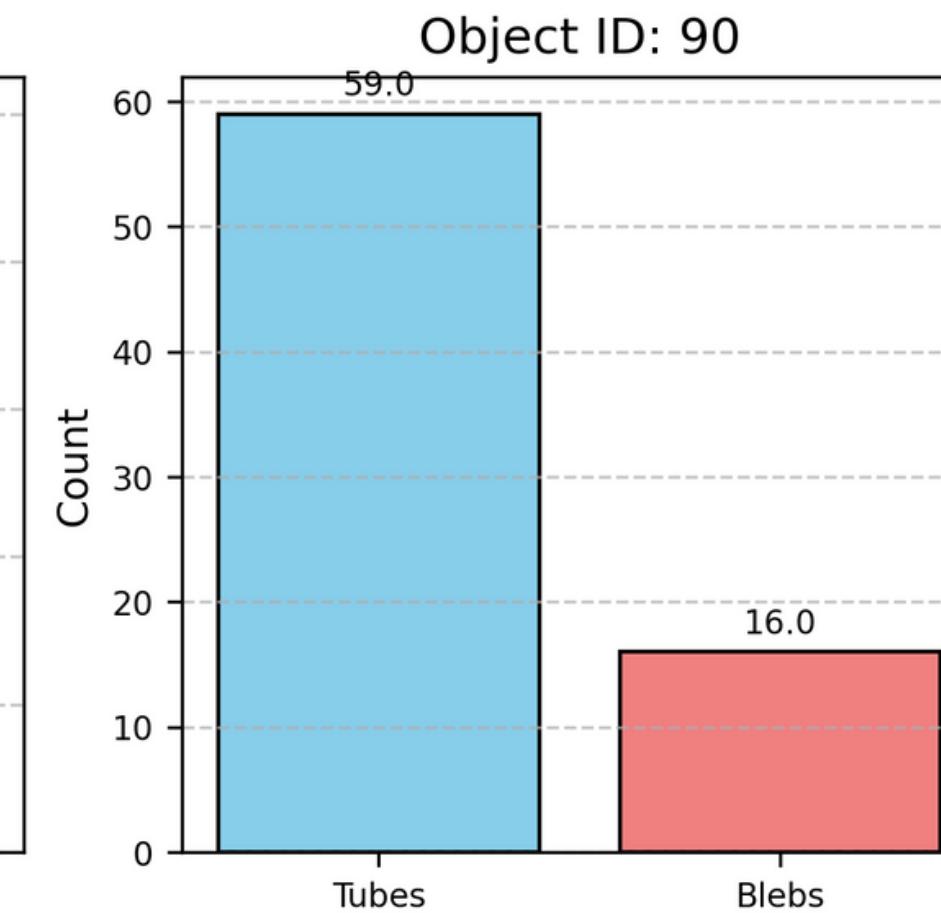
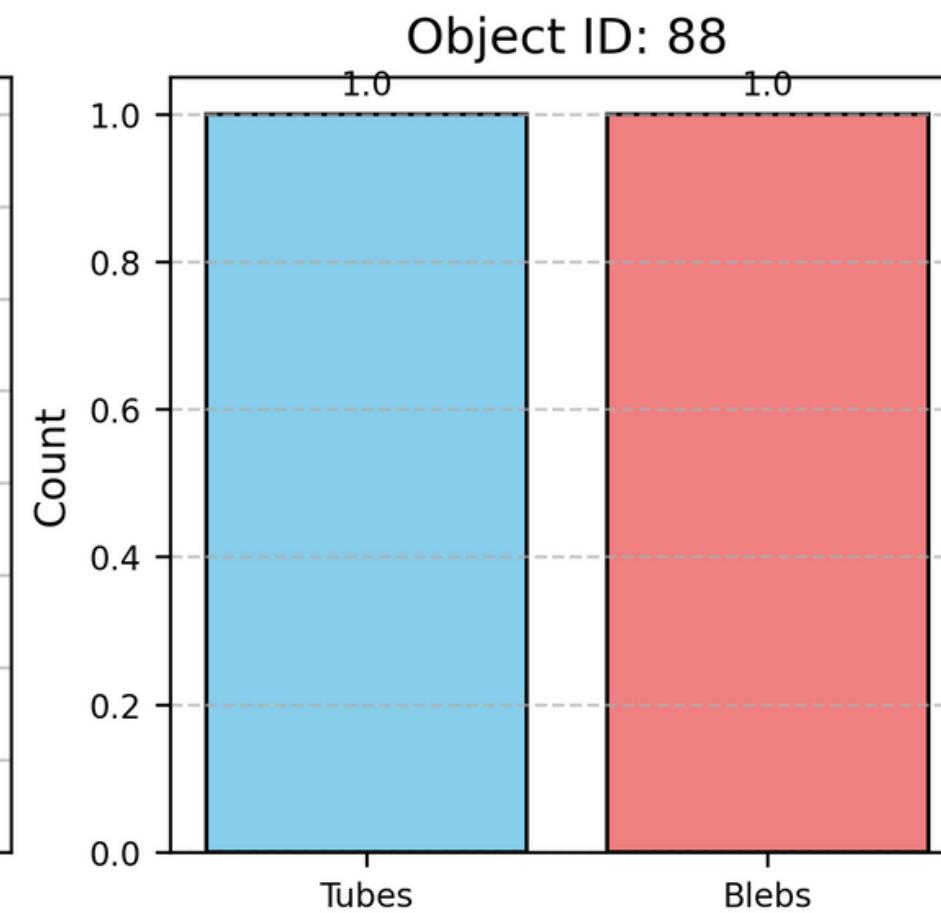
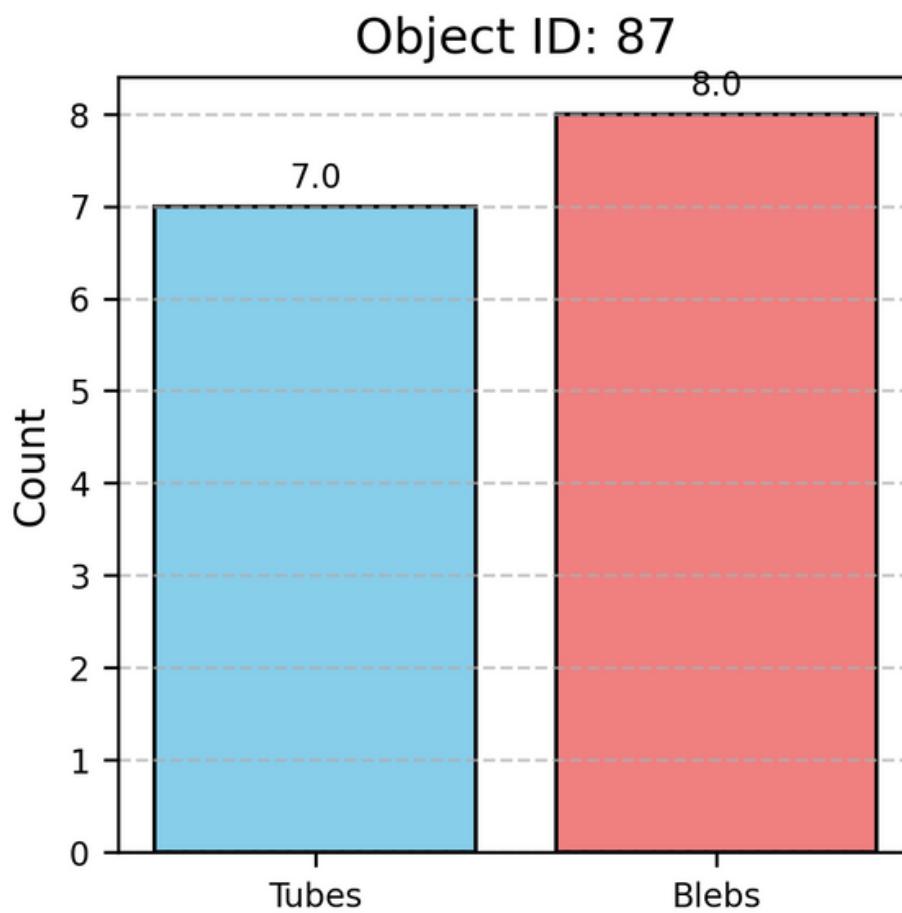


tubes and blebs per cell in no glucose condition

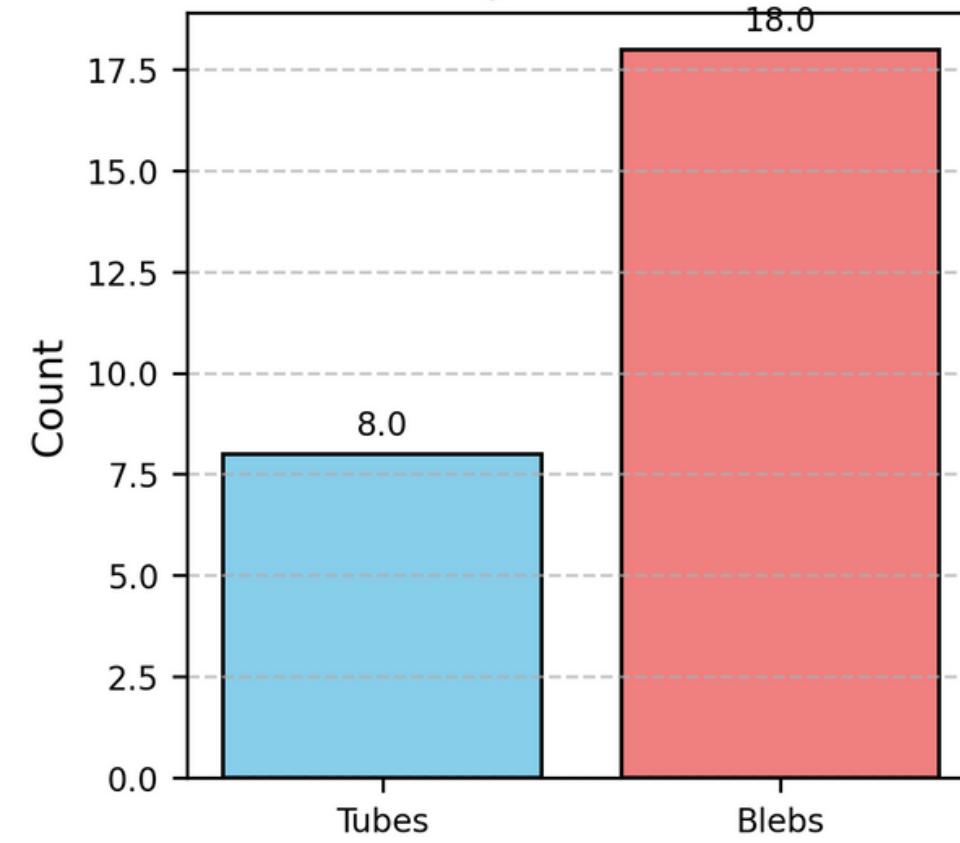
[link to full image](#)

[link to full picture](#)

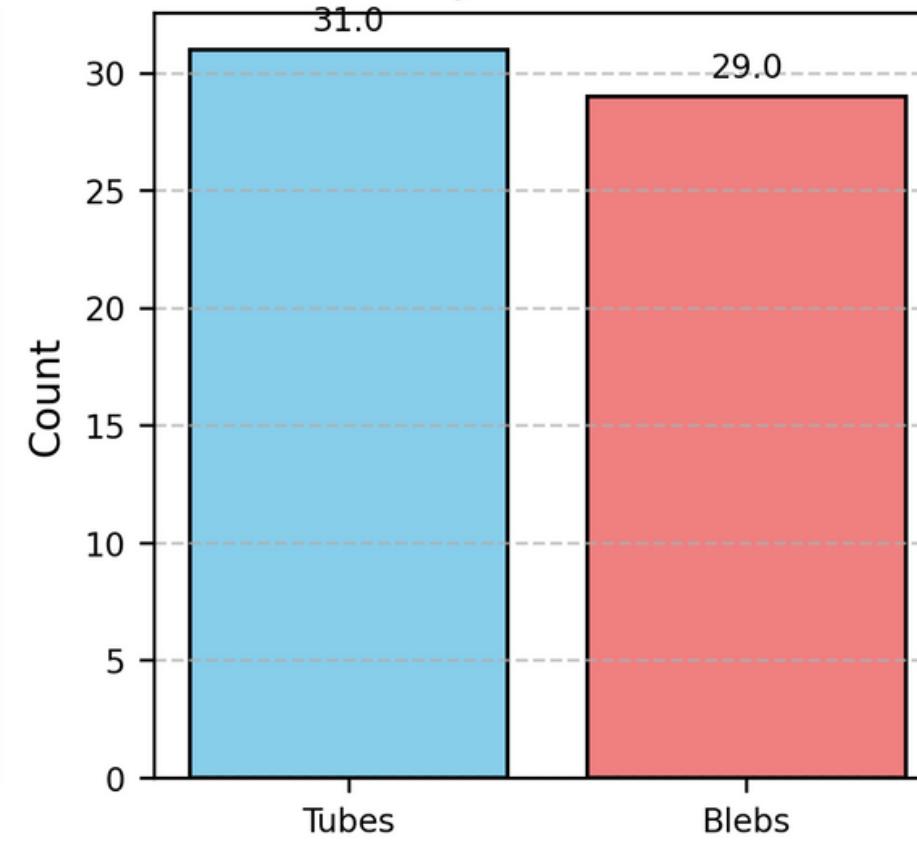
tubes and blebs per cell in low glucose condition



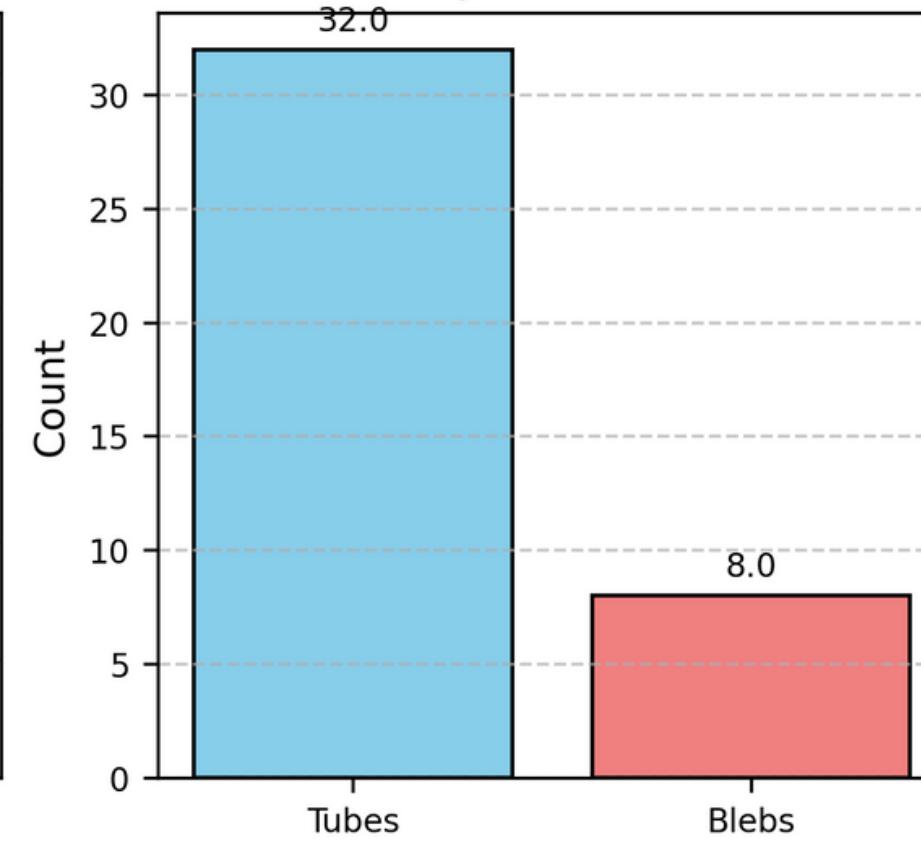
Object ID: 81



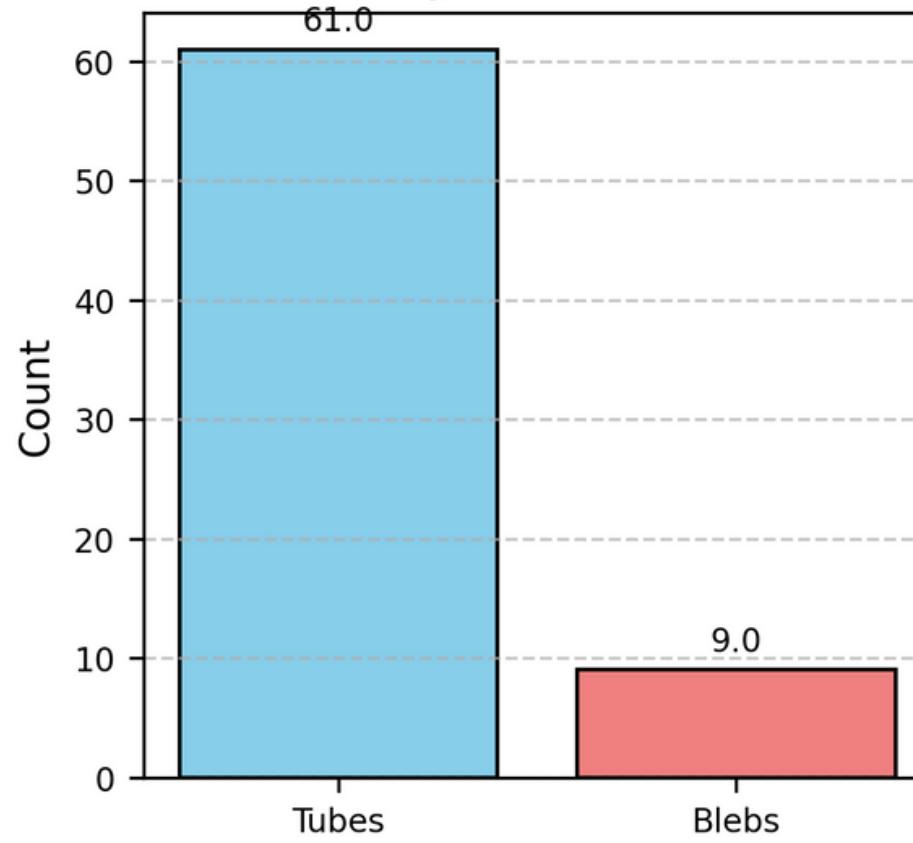
Object ID: 95



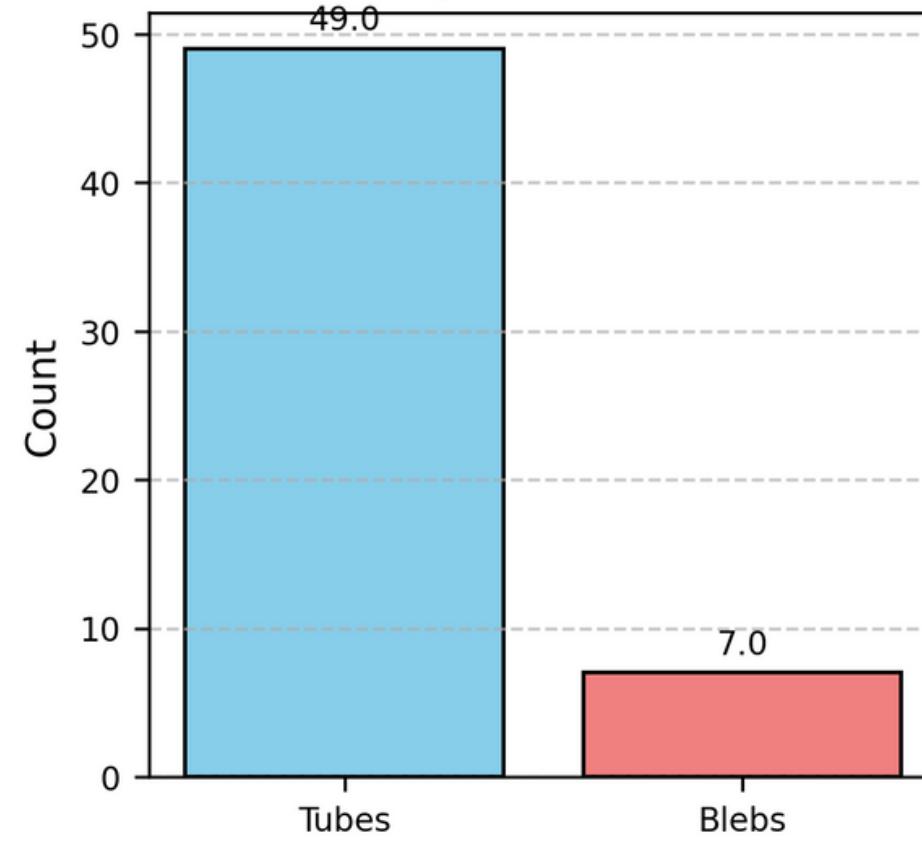
Object ID: 97



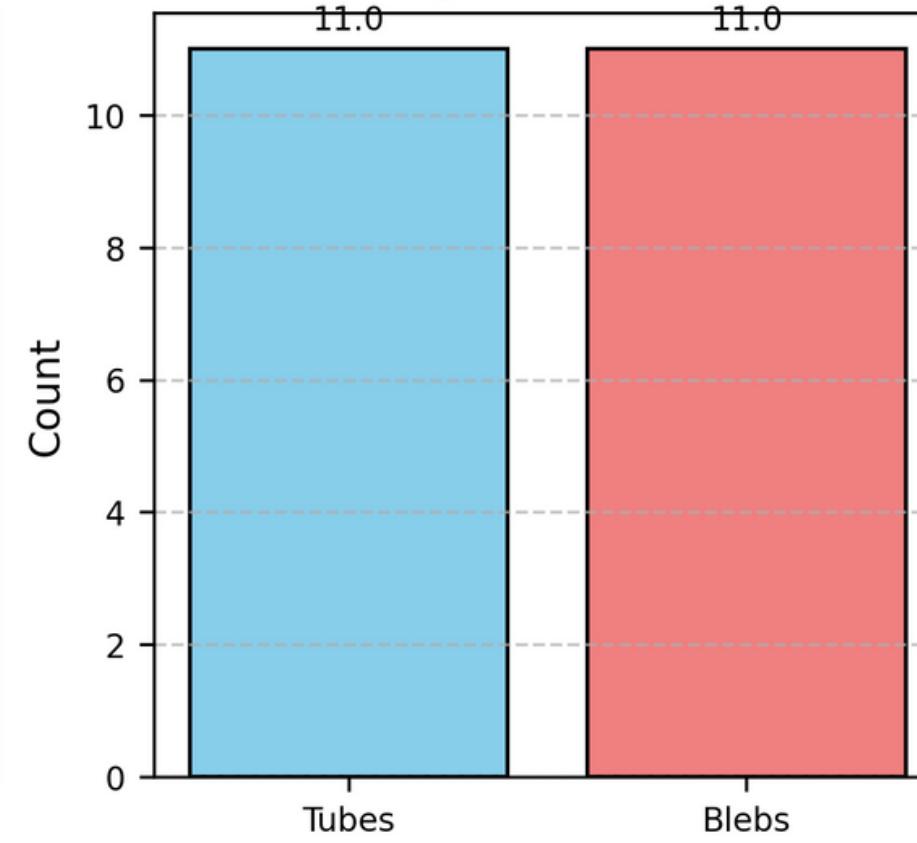
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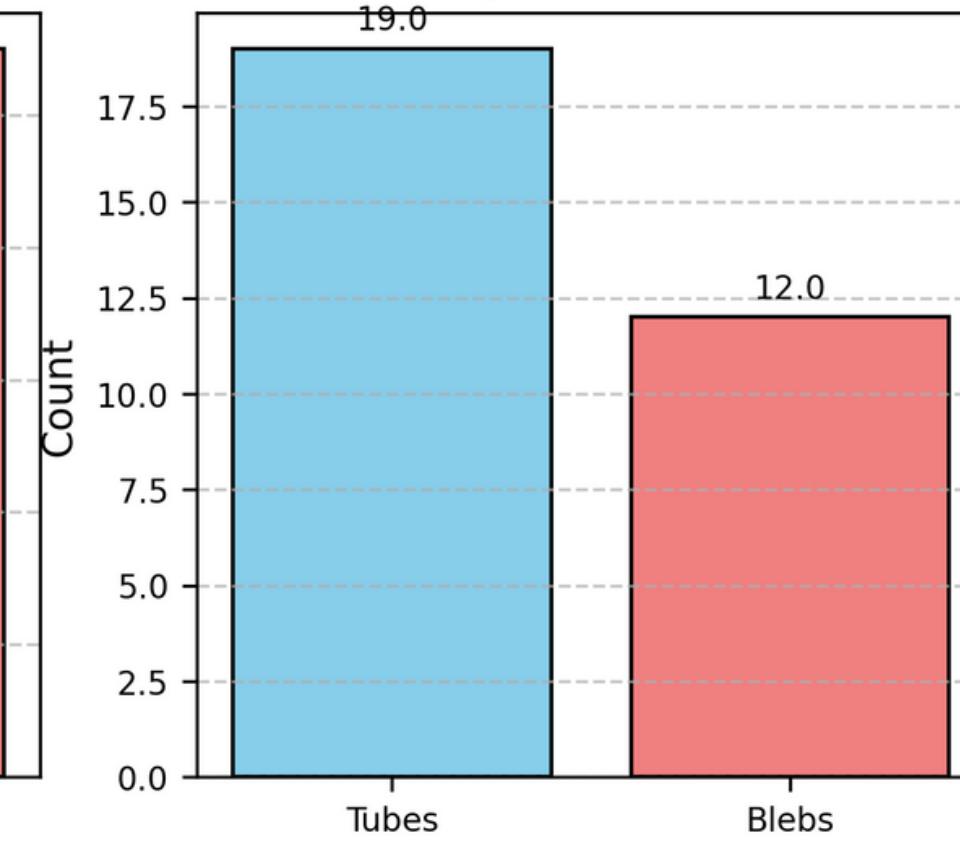
Tubes and Blebs Count



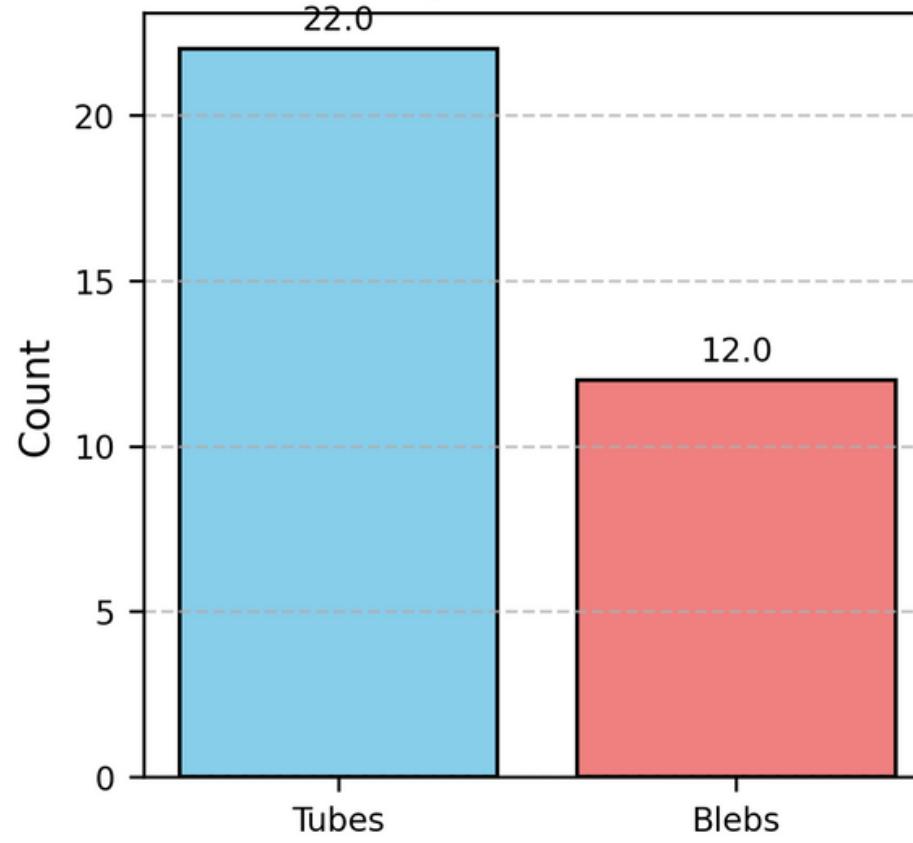
Tubes and Blebs Count



Tubes and Blebs Count

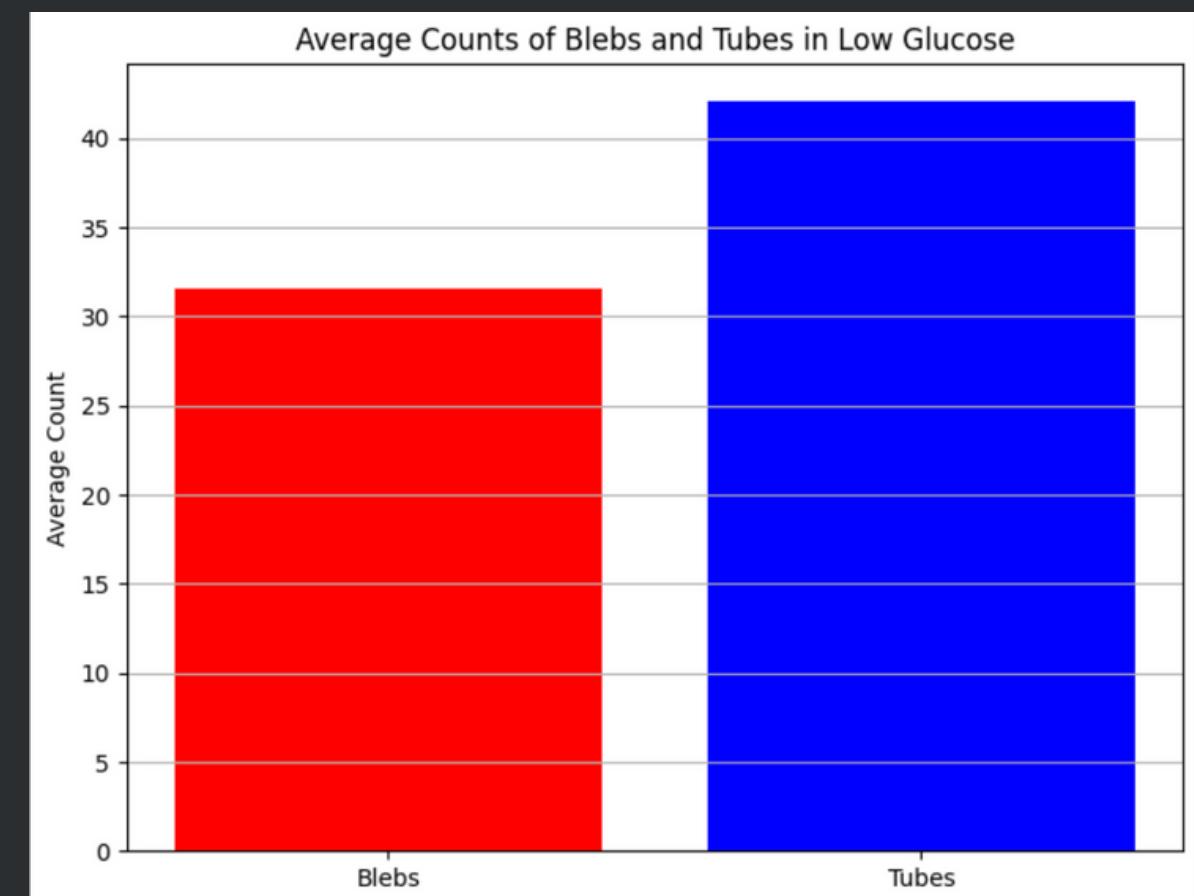
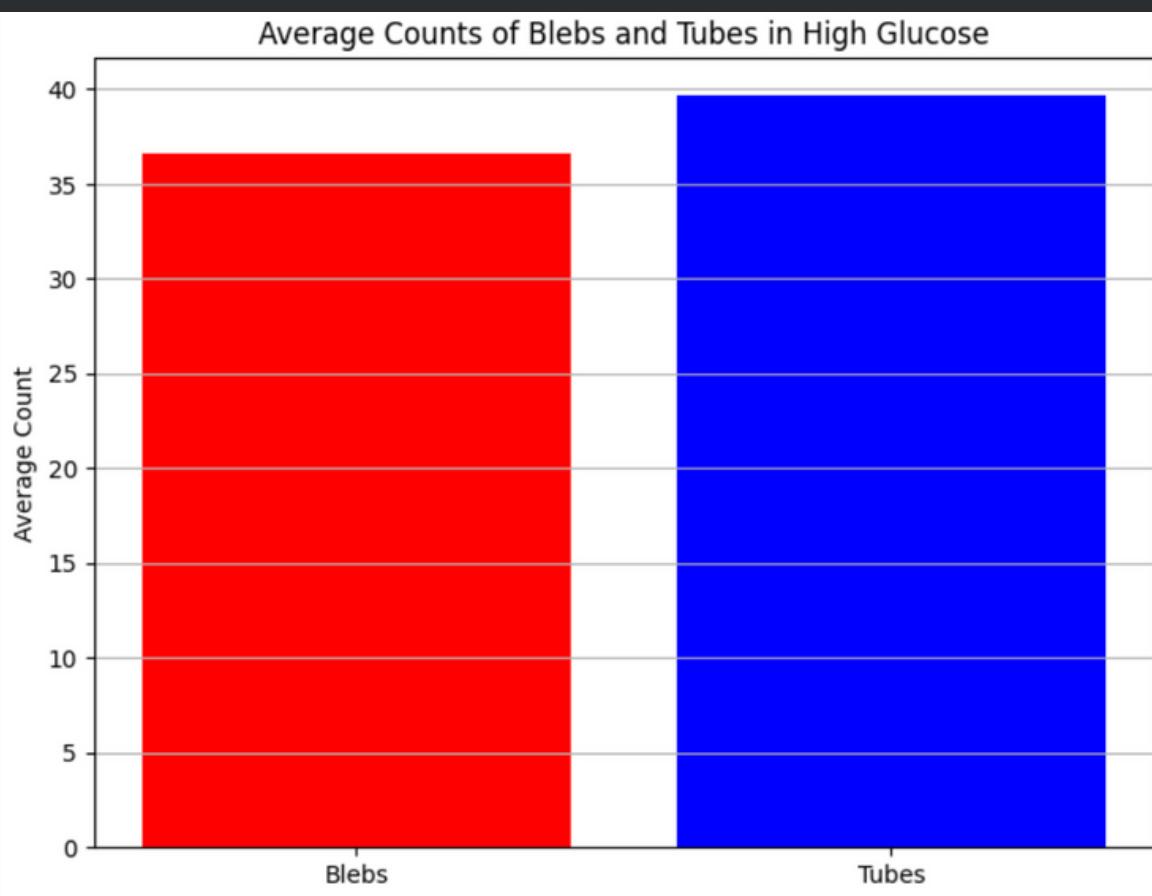
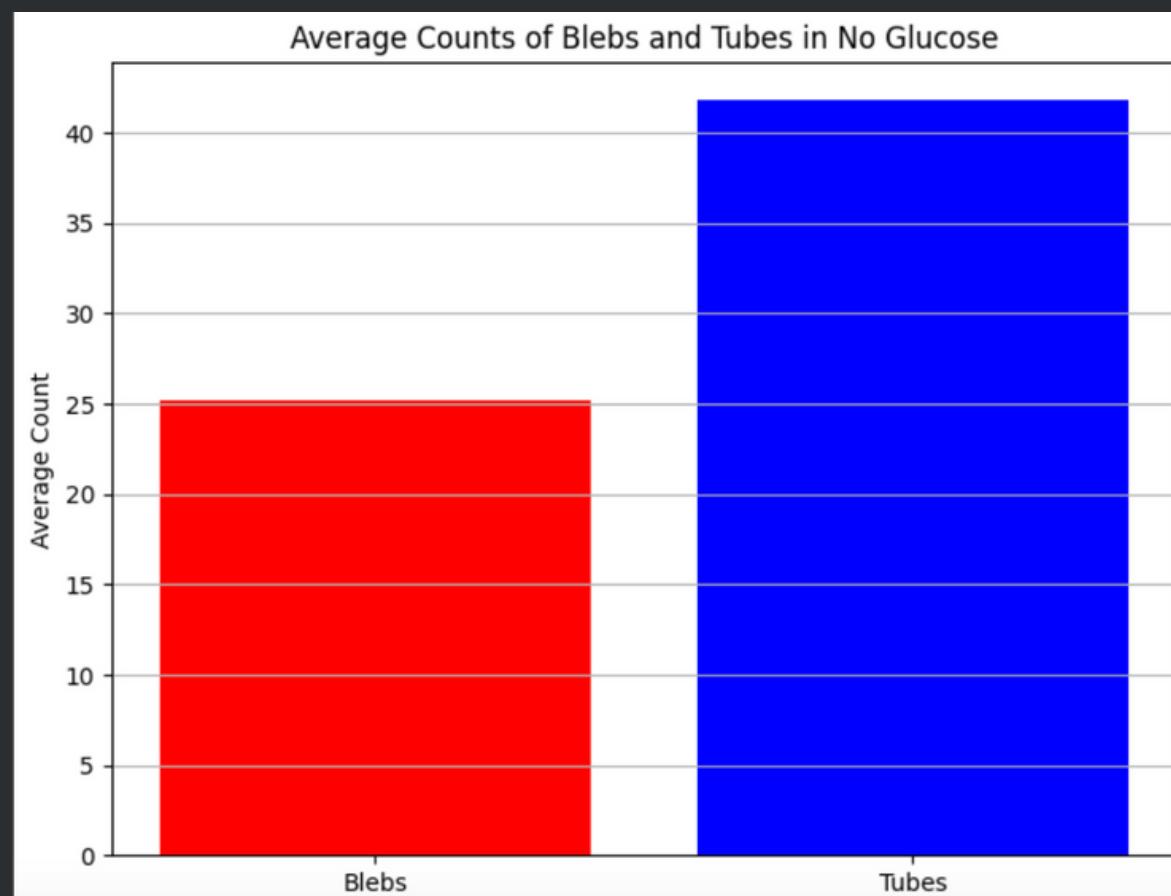


Tubes and Blebs Count

[link to full image](#)

tubes and blebs per cell in **high glucose** condition

least blebs in no glucose and highest in high glucose condition



Link to data (click on the images to be directed)

Object ID	Image origin	Class	Area
1	HG/Converted Images from 4.bmp/4-converted.tif	tubes	131
2	HG/Converted Images from 4.bmp/4-converted.tif	tubes	37
3	HG/Converted Images from 4.bmp/4-converted.tif	tubes	71
4	HG/Converted Images from 4.bmp/4-converted.tif	blebs	23
5	HG/Converted Images from 4.bmp/4-converted.tif	tubes	89
6	HG/Converted Images from 4.bmp/4-converted.tif	tubes	64

[High Glucose - output_merged.csv](#) [No Glucose - output_merged](#) [Low Gluc](#)

TITLE	LAST MODIFIED
HG_glycocalyx_counts_plot.png	1:15 pm
LG_glycocalyx_counts_plot.png	1:18 pm
NG_glycocalyx_counts_plot.png	1:18 pm
Screenshot 2024-01-10 at 2.29.00 AM.png	12:59 pm
Screenshot 2024-01-10 at 2.29.12 AM.png	12:59 pm
Screenshot 2024-01-10 at 2.29.23 AM.png	12:59 pm

[link to python code for graphs](#)

link to images

consolidated data spreadsheet

further work

- improve the model to find understand more intricate areas
- make my own deep learning model
- try analysing the changes in size of blebs in different conditions