

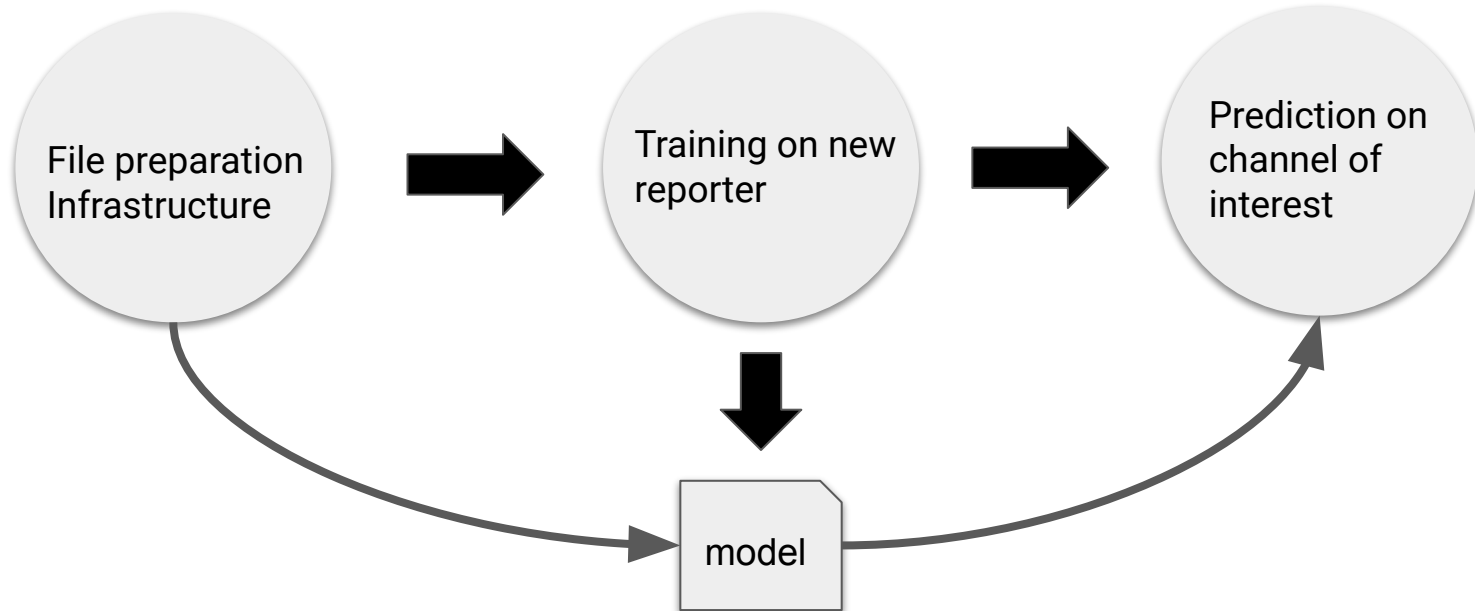
# How to train your Elephant (remotely)

**Catherine Chia**

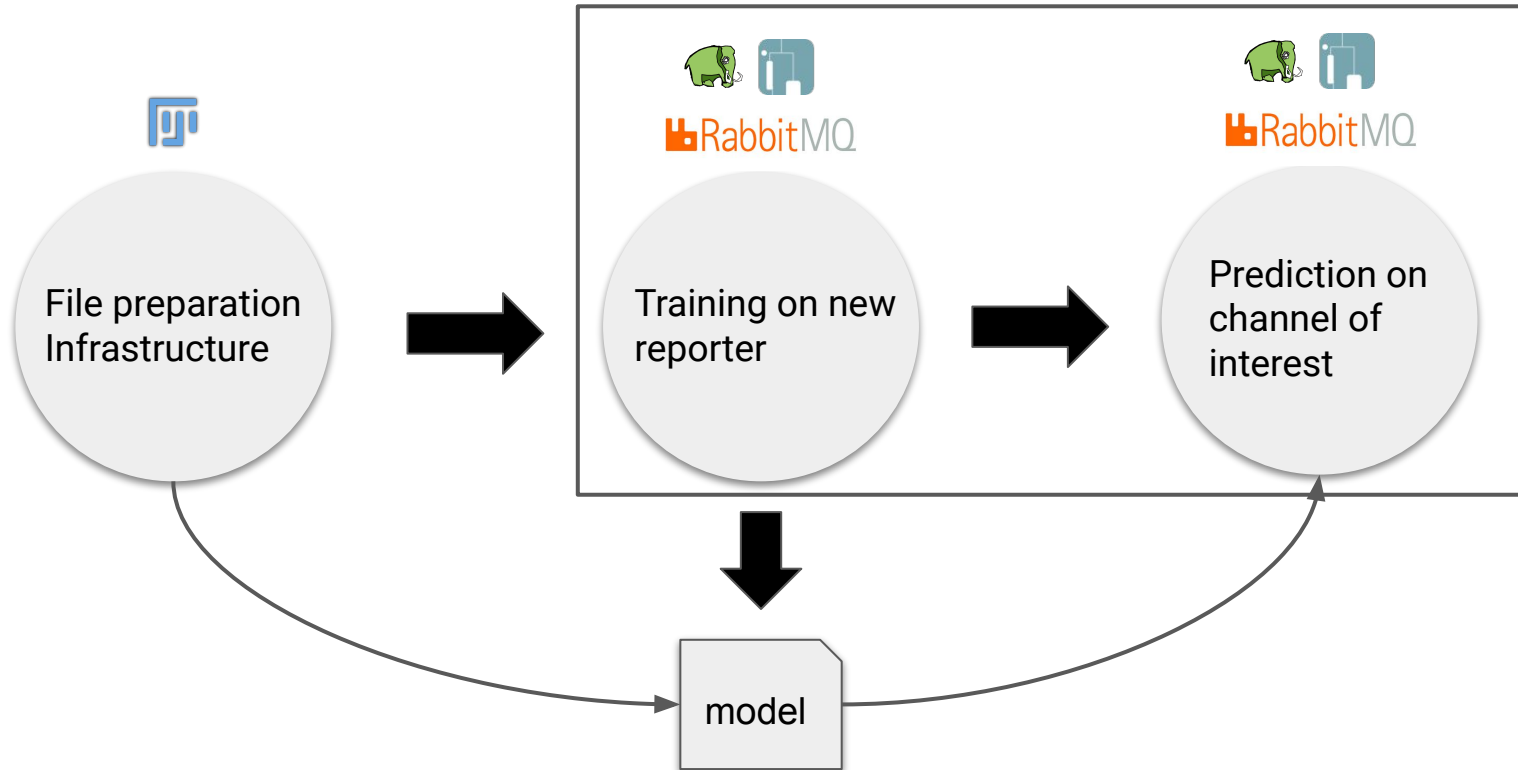
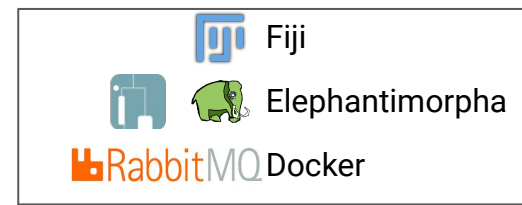
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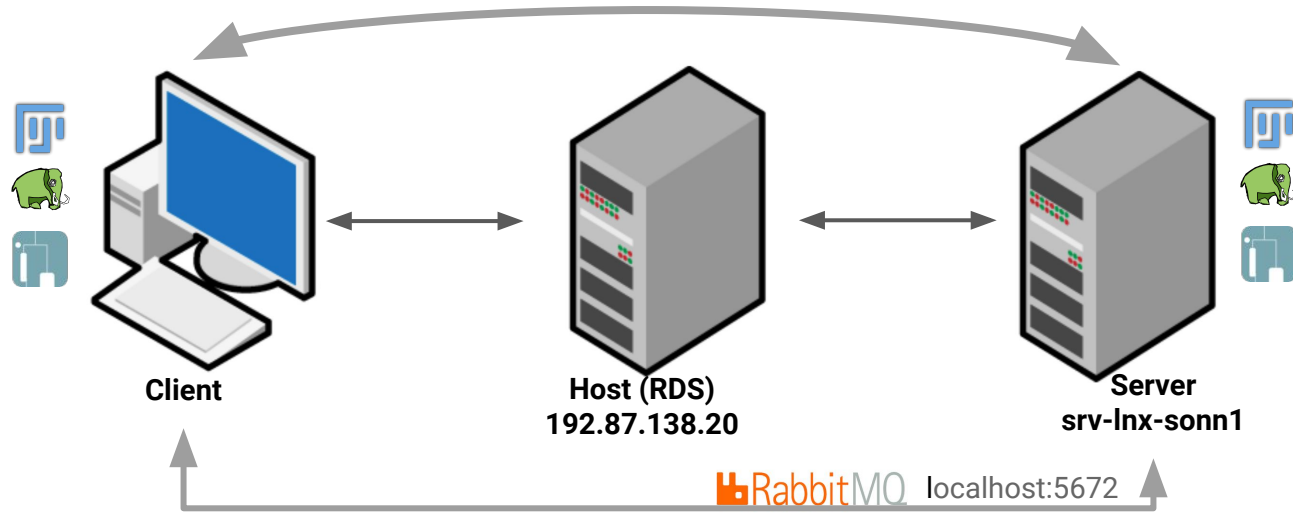
# Overview of workflow



# Tools



# Environment



# Infrastructure setup

# Steps (Page 1) - Infrastructure setup (see utilsZoo.txt)

1. Infrastructure (all done on Client PC) (see utilsZoo.txt)
  - 1.1. Setup SSH Jump Host
  - 1.2. Connect to srv-lnx-sonn1 (**Terminal 1**)
  - 1.3. Create/reattach GNU Screen (**Terminal 1**)
  - 1.4. Launch docker on the GNU screen (**Terminal 1**)
  - 1.5. Forward Elephant and RabbitMQ ports (**Terminal 2**)
    - 1.5.1. In case you need to kill the ports (e.g. frozen ports)
  - 1.6. Launch Elephant (Fiji)
2. Have your files ready (e.g. nucmem and Hes1 in separated H5/XML pairs)

# Training

# Steps (Page 2) - Training (Segmentation)

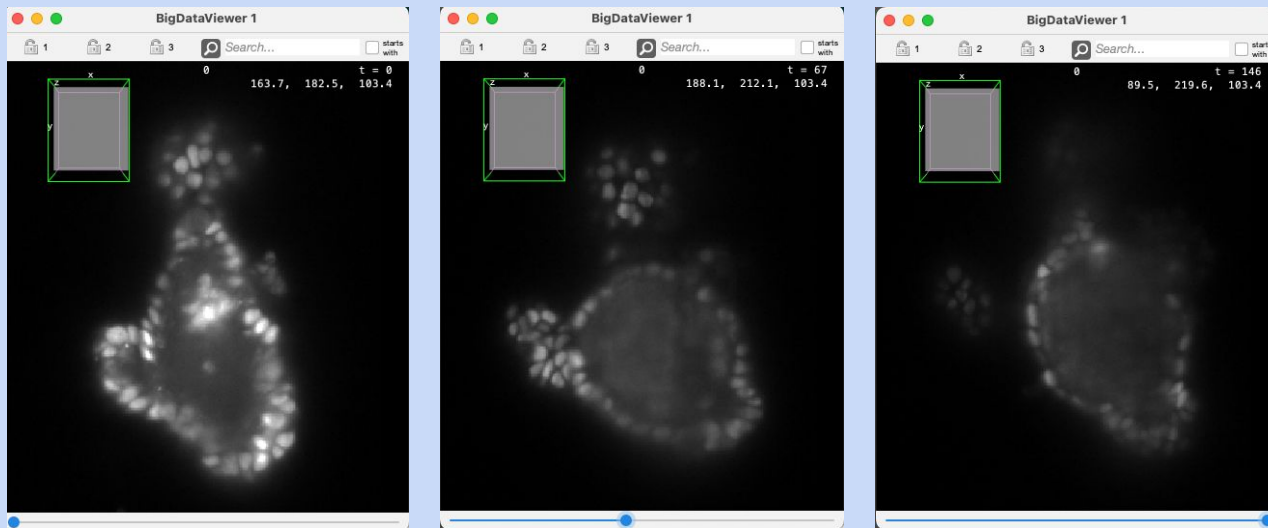
1. Launch Fiji > Mastodon (and Elephant)
2. Open training dataset (e.g. nucmem H5/XML)
3. Check Elephant Control Panel for successful connections
4. Plan for a training strategy



# An example of training strategy (Segmentation)

## Requirements:

1. Manual annotations: True Positive (crypt nuclei), True Negative (background)
2. Covers suitable ranges of morphological/signal changes (first 10, middle 10, last 10 timepoints)
3. Control sample (so that the trained model is “neutral” or “unbias”)

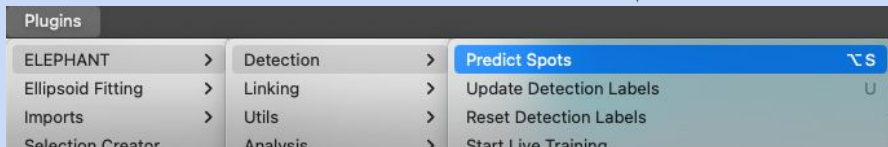
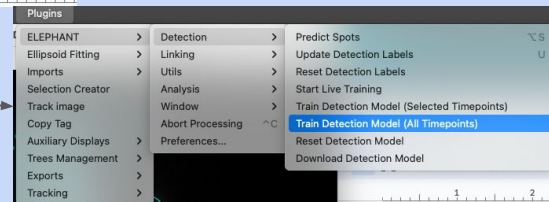
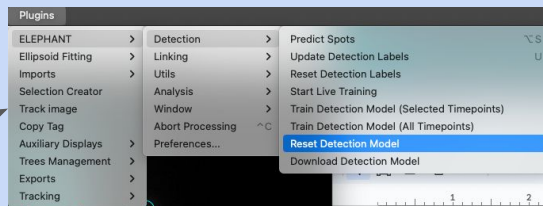


# Steps (Page 2) - Training (Segmentation)

1. Launch Fiji > Mastodon (and Elephant)
2. Open training dataset (e.g. nucmem H5/XML)
3. Check Elephant Control Panel for successful connections
4. Plan for a training strategy
5. Manual annotations + incremental training

# Manual annotations + incremental training

1. Configure tags
  - 1.1. tp = True Positive (nuclei)
  - 1.2. tn = True Negative (background)
2. Annotate [https://elephant-track.github.io/#/v0.5/?id=\\_2-shortcuts](https://elephant-track.github.io/#/v0.5/?id=_2-shortcuts)
3. Assign tags
4. Assign training parameters
5. Reset detection model > Versatile
6. Training
7. Incremental training (repeat step 3)



# Retraining hyperparameters

prediction with patches	<input checked="" type="checkbox"/>
prediction patch size x	384
prediction patch size y	384
prediction patch size z	16
number of crops	5
number of epochs	10
time range	147
auto BG threshold	1
learning rate	0.001
probability threshold	0.7
suppression distance (um)	3
min radius (um)	4
max radius (um)	10
NN linking threshold (um)	4
NN max edges	2
use optical flow for linking	<input checked="" type="checkbox"/>
use interpolation for linking	<input checked="" type="checkbox"/>

file/dir on the server

dataset dir (relative path from /workspace/datasets/)	CC_i2n_treatment2000_pos5_nucmem_unp
detection model file (relative path from /workspace/models/)	Example_Versatile_Retrained_detection.pth
flow model file (relative path from /workspace/models/)	Example_Versatile_Retrained_flow.pth
detection Tensorboard log dir (relative path from /workspace/logs/)	Example_Versatile_Retrained_detection_log
flow Tensorboard log dir (relative path from /workspace/logs/)	Example_Versatile_Retrained_flow_log

Full  
time  
range

Be strict  
during  
training

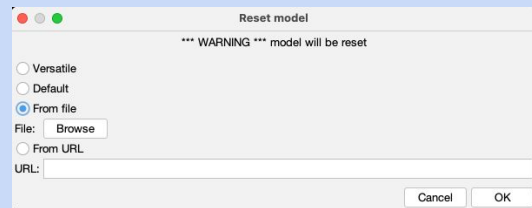
# Prediction

# Steps (Page 3) - Prediction (segmentation) and tracking

1. Download the trained model (\_elephant\_server/workspace/models)
2. Open new nucmem file on Mastodon (that you wanna have the spots predicted)
3. Predict!

# Predict!

1. Reset detection model > From file > select your trained model
2. Assign prediction parameters
3. Predict (remember to scroll to the last time point on the BDV before running the prediction)



# Prediction hyperparameters

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	file/dir on the server
dataset dir (relative path from /workspace/datasets/)	CC_i2n_treatment2000_pos5_nucmem_unp
detection model file (relative path from /workspace/models/)	_i2n_treatment2000_pos5_nucmem_unp_detection.pth
flow model file (relative path from /workspace/models/)	CC_i2n_treatment2000_pos5_nucmem_unp_flow.pth
detection Tensorboard log dir (relative path from /workspace/logs/)	_i2n_treatment2000_pos5_nucmem_unp_detection_log
flow Tensorboard log dir (relative path from /workspace/logs/)	CC_i2n_treatment2000_pos5_nucmem_unp_flow_log

Full  
time  
range

Be less  
strict in  
prediction



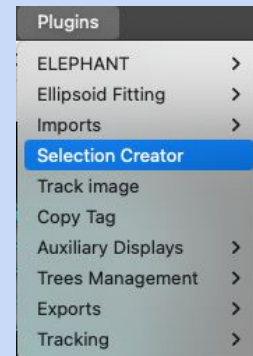
## Steps (Page 3) - Prediction (segmentation) and tracking

1. Download the trained model (\_elephant\_server/workspace/models)
2. Open new nucmem file on Mastodon (that you wanna have the spots predicted)
3. Predict!
4. Track!
5. Selection creator (specific region of interest)

# Selector - create boxes around the ROI

## 1. Example script

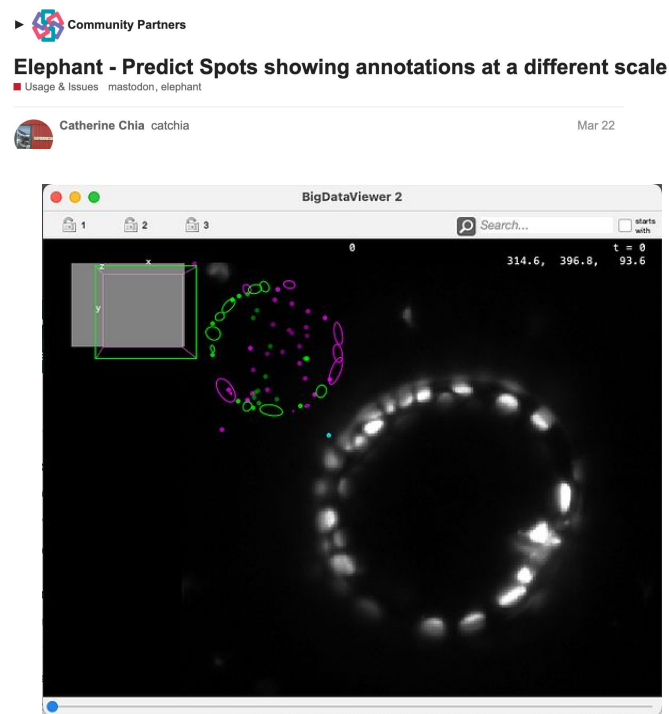
```
(vertexFeature('Spot position', 'X') > 58 & vertexFeature('Spot position', 'X') < 150  
& vertexFeature('Spot position', 'Y') > 20 & vertexFeature('Spot position', 'Y') < 85  
& vertexFeature('Spot position', 'Z') > 25 & vertexFeature('Spot position', 'Z') <  
100.) | (vertexFeature('Spot position', 'X') > 10 & vertexFeature('Spot position',  
'X') < 70 & vertexFeature('Spot position', 'Y') > 90 & vertexFeature('Spot position',  
'Y') < 140 & vertexFeature('Spot position', 'Z') > 50 & vertexFeature('Spot position',  
'Z') < 110.) | (vertexFeature('Spot position', 'X') > 75 & vertexFeature('Spot  
position', 'X') < 150 & vertexFeature('Spot position', 'Y') > 75 & vertexFeature('Spot  
position', 'Y') < 130 & vertexFeature('Spot position', 'Z') > 125 &  
vertexFeature('Spot position', 'Z') < 185.)
```



## 2. Assign tag

# Encountered issues

1. Timeout (use GNU screen)
2. Wrong scale on BDV (fix the XML, use fixXMLBug.py)



<https://forum.image.sc/t/elephant-predict-spots-showing-annotations-at-a-different-scale/78919>

# Reference

1. 20230309\_UserGuide\_ElephantClient\_GNUScreen.pdf
2. utilsZoo.txt
3. fixXMLBug.py