Generalidades de las aplicaciones de la IA para la microscopía y el análisis de imágenes

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Live-cell imaging in the deep learning era

Joanna W. Pylvänäinen [1], Estibaliz Gómez-de-Mariscal [2], Ricardo Henriques [2 3], Guillaume Jacquemet [1 4 5 6]

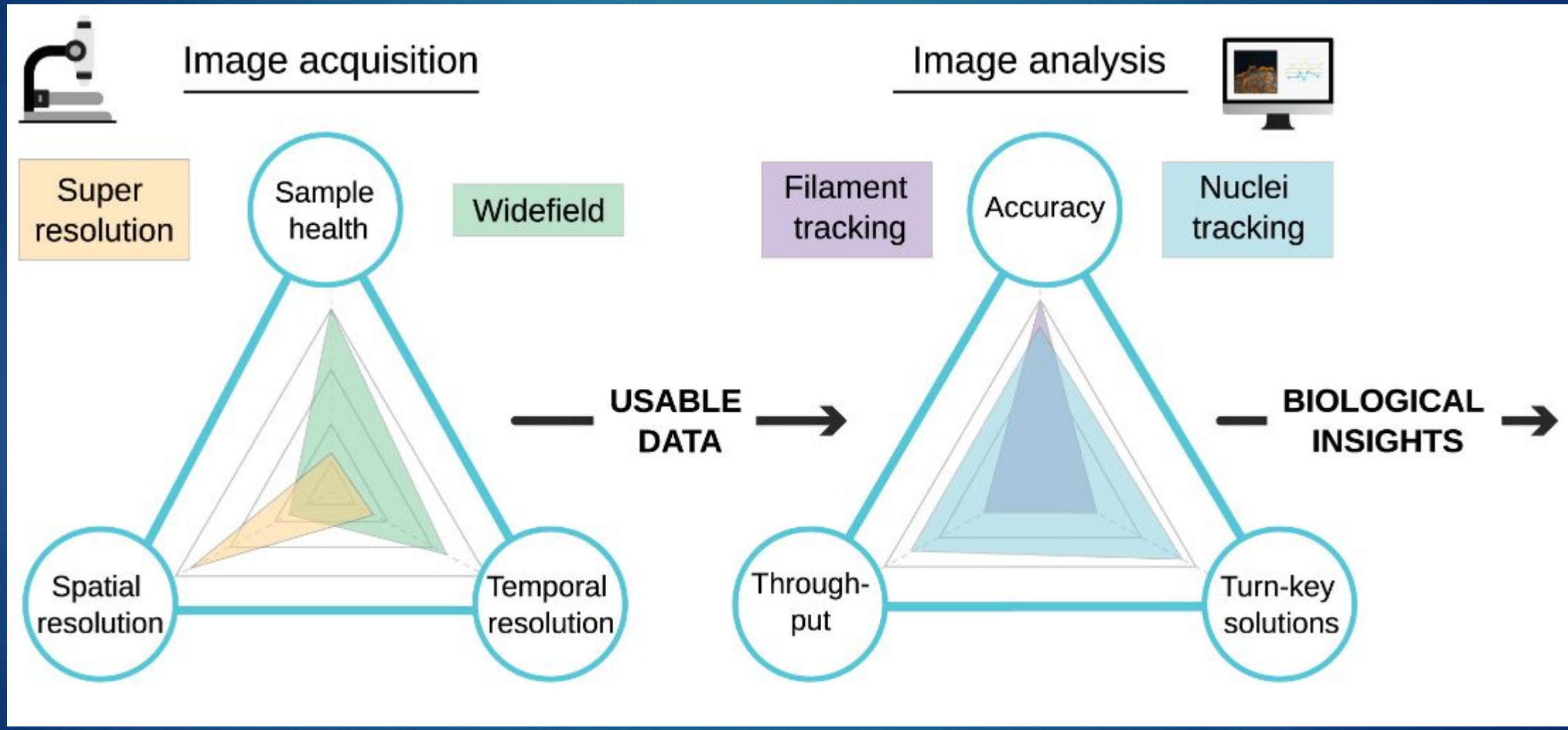
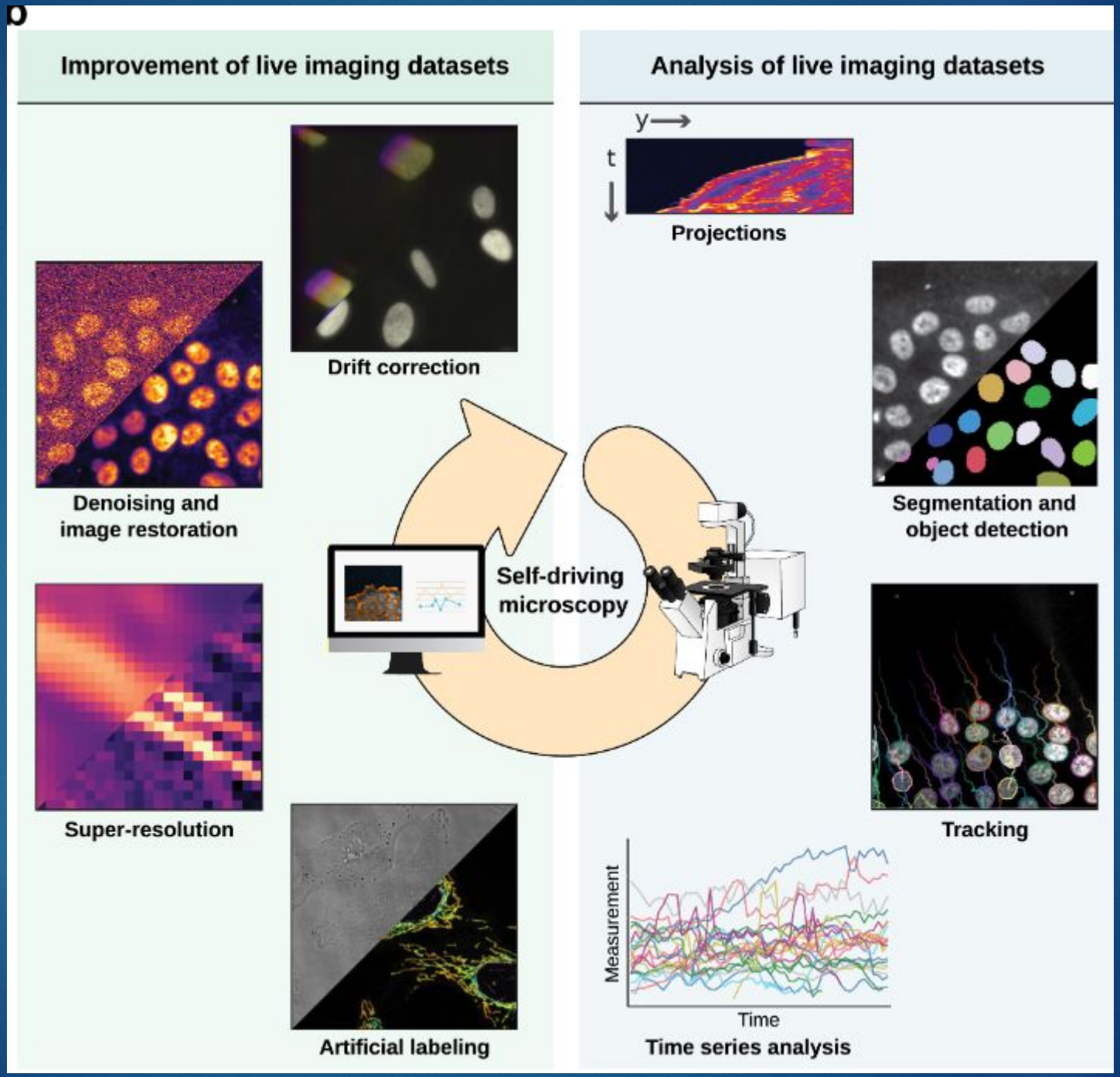
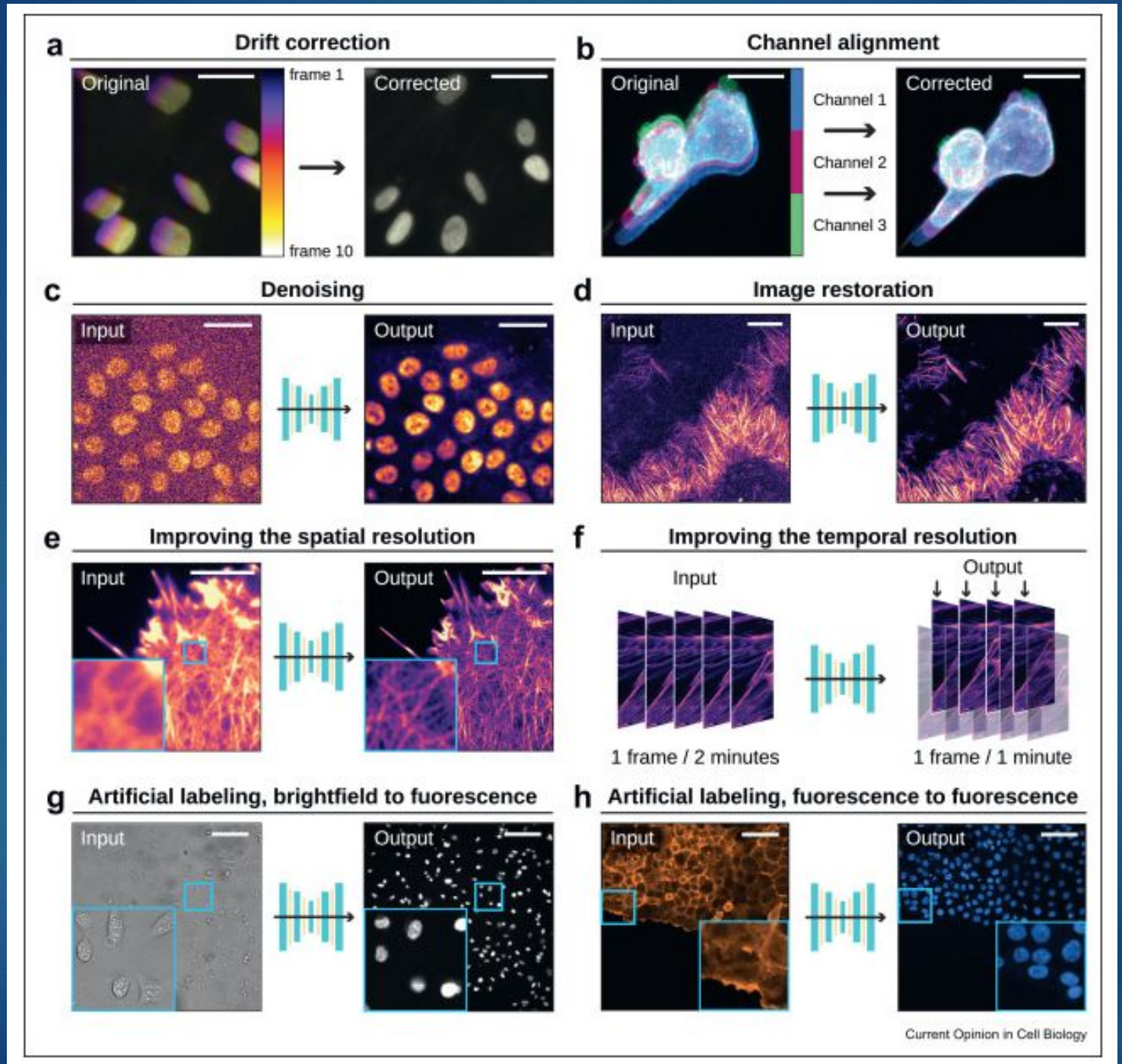
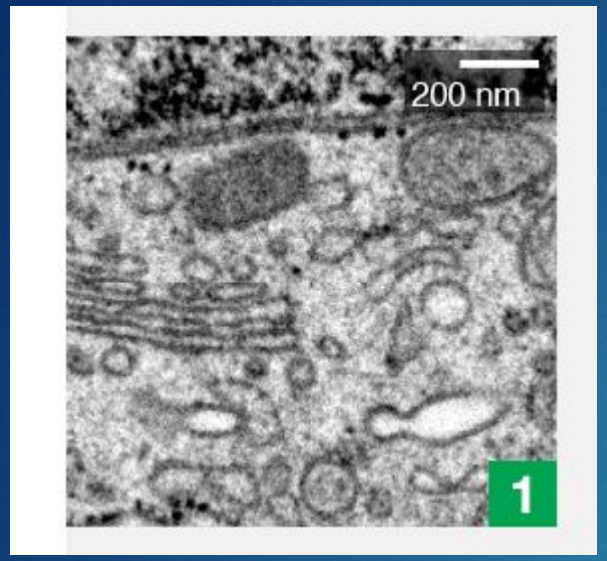
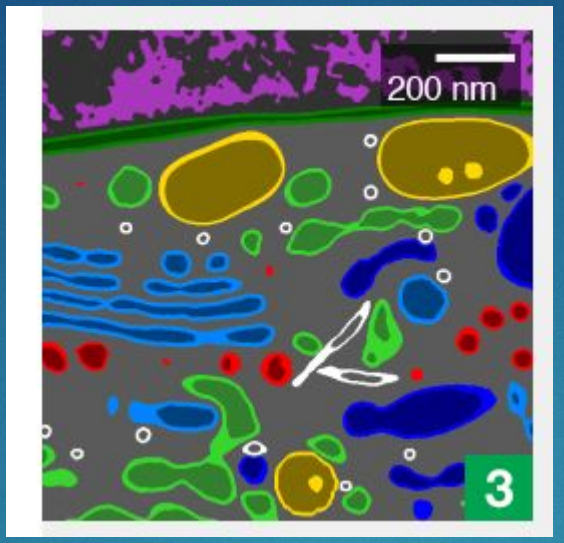


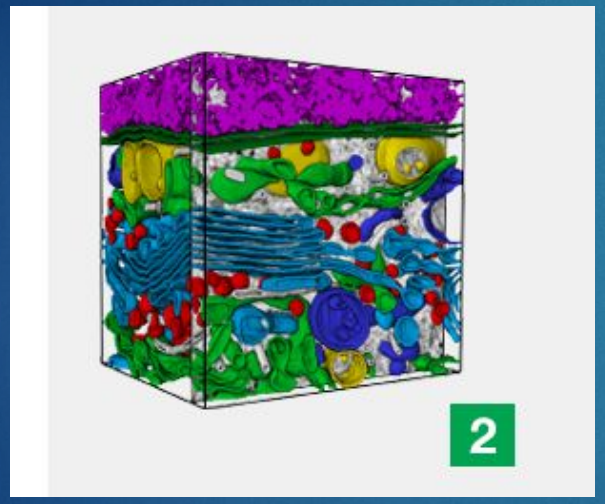
Image acquisition
Image analysis
Super resolution
Sample health
Widefield
Filament tracking
Accuracy
Nuclei tracking
USABLE DATA
BIOLOGICAL INSIGHTS
Spatial resolution
Temporal resolution
Through-put
Turn-key solutions

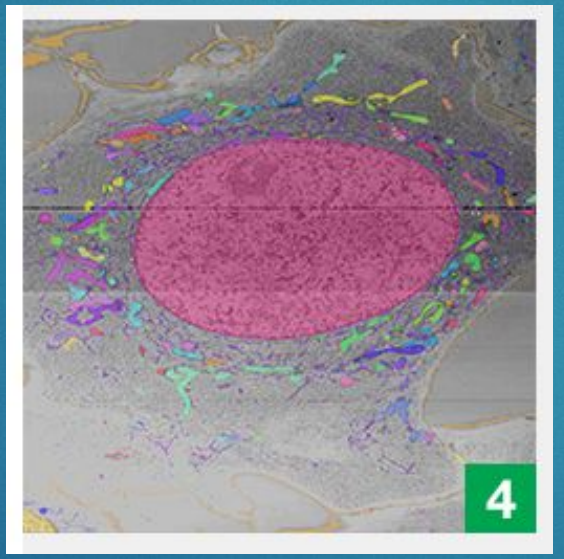

Improvement of live imaging datasets
Analysis of live imaging datasets
Drift correction
Denoising and
image restoration
Super-resolution
Artificial labeling
Self-driving
microscopy
y
t
Projections
Segmentation and
object detection
Tracking
Measurement
Time
Time series analysis


a
Drift correction
Original
frame 1
frame 10
Corrected
b
Channel alignment
Original
Channel 1
Channel 2
Channel 3
Corrected
c
Denoising
Input
Output
d
Image restoration
Input
Output
e
Improving the spatial resolution
Input
Output
f
Improving the temporal resolution
Input
Output
1 frame / 2 minutes
1 frame / 1 minute
g
Artificial labeling, brightfield to fuorescence
Input
Output
h
Artificial labeling, fuorescence to fuorescence
Input
Output
Current Opinion in Cell Biology


200 nm
1


200 nm
3


2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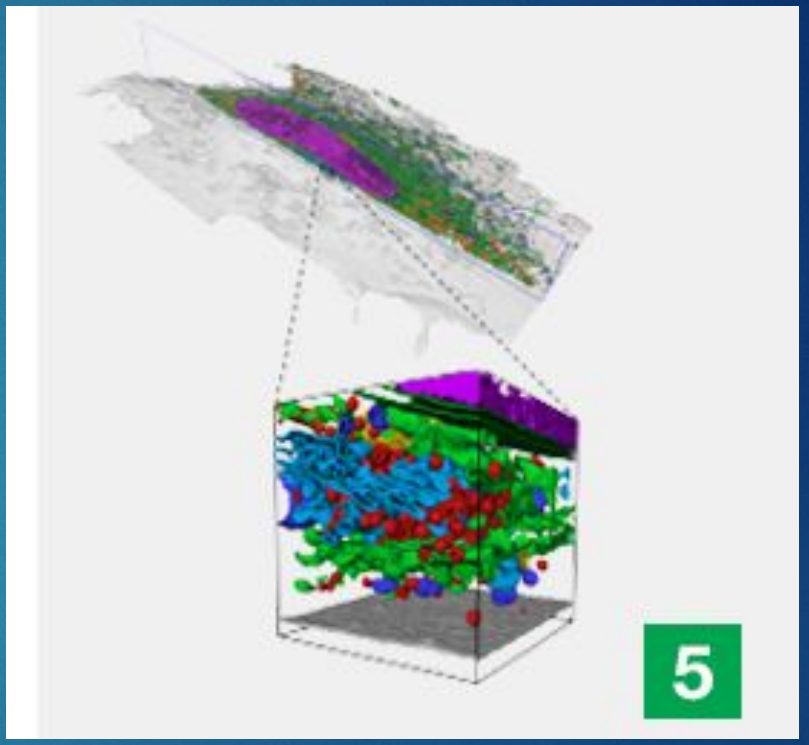
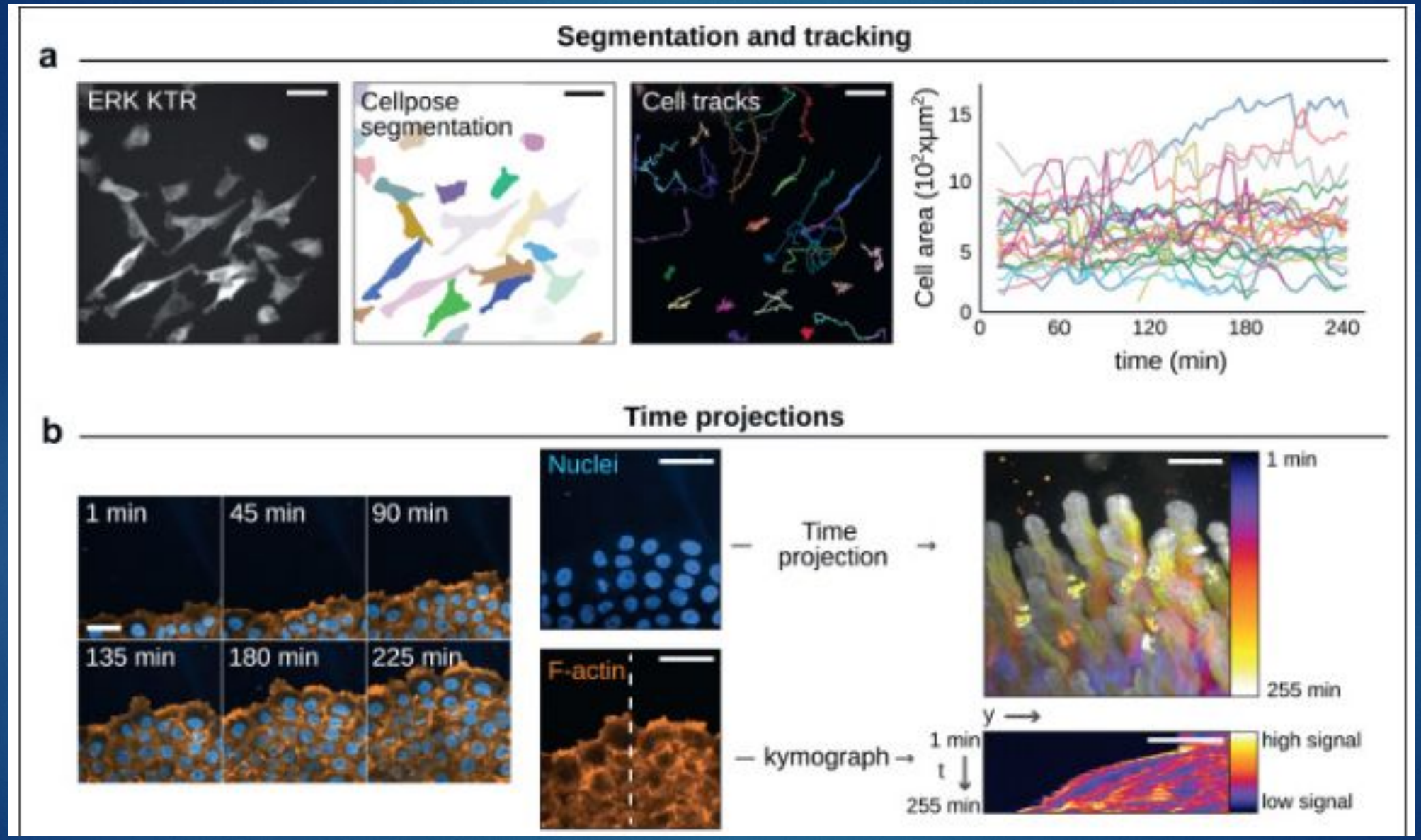
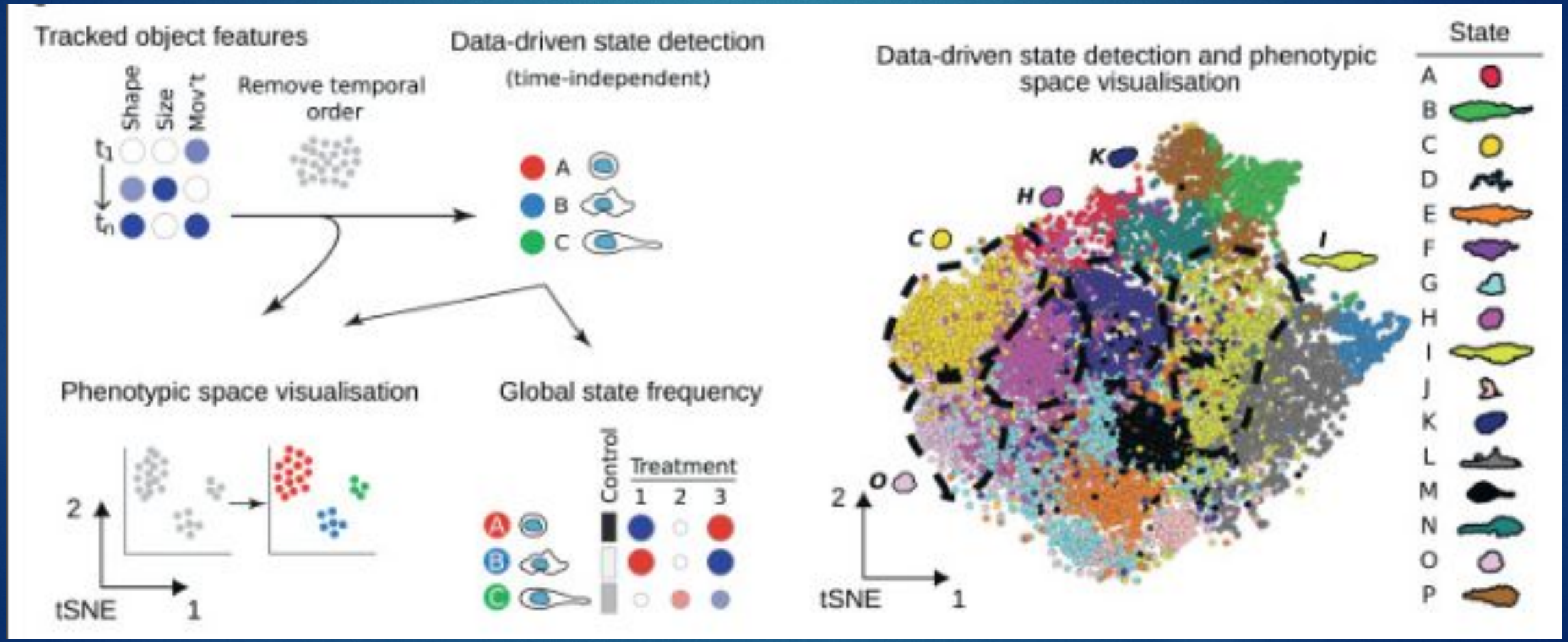

5


a
Segmentation and tracking
ERK KTR
Cellpose segmentation
Cell tracks
Cell area (10^2xμm^2)
15
10
5
0
0
60
120
180
240
time (min)
b
Time projections
1 min
45 min
90 min
135 min
180 min
225 min
Nuclei
F-actin
Time projection
1 min
255 min
y
1 min
t
255 min
kymograph
high signal
low signal


Tracked object features
Shape
Size
Mov't
Remove temporal order
Data-driven state detection
(time-independent)
A
B
C
Phenotypic space visualisation
2
tSNE
1
Global state frequency
Control
Treatment
1 2 3
Data-driven state detection and phenotypic space visualisation
K
H
C
I
O
2
tSNE
1
State
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P

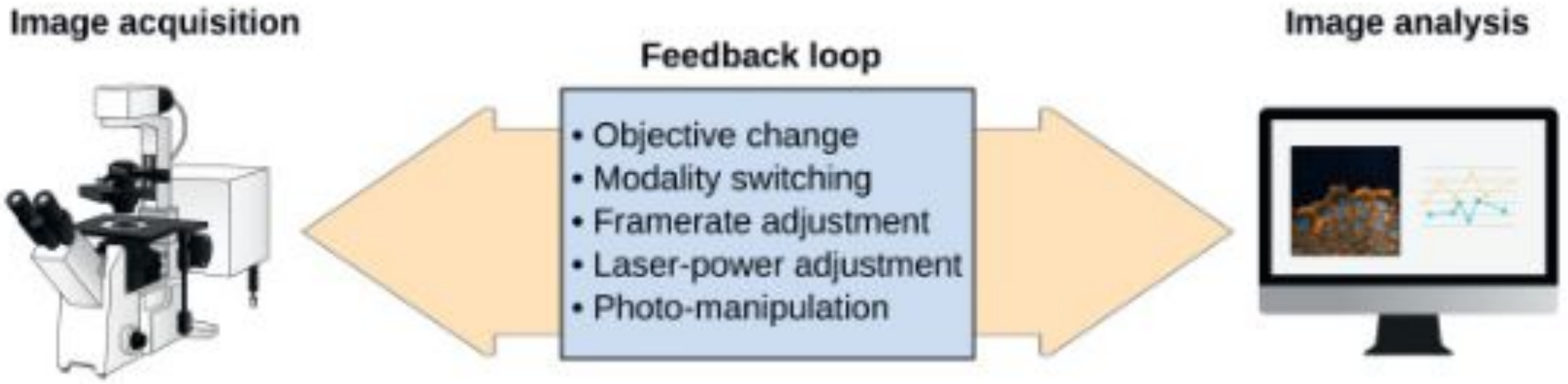


Image acquisition
Feedback loop
• Objective change
• Modality switching
• Framerate adjustment
• Laser-power adjustment
• Photo-manipulation
Image analysis
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