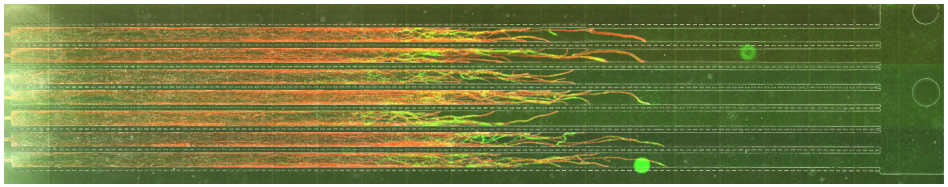
Bacteria-Hyphae interaction in microfluidic channels

Benedict Borer

ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

D-USYS
Soil and Terrestrial Environmental Physics



Data Acknowledgement

- Qualitative time series analysis of hyphae-bacterial interaction at cellular level in microfluidic channels
- Requested quantitativeinformation from the images:
  - Fungal growth in time
  - Spatial organization of bacterial cells


Integrative Biology

PAPER View Article Online

Probing bacterial–fungal interactions at the single cell level†

Claire E. Stanley,‡[a] Martina Stöckli,‡[b] Dirk van Swaay,[a] Jerica Sabotić,[c] Pauli T. Kallio,[b] Markus Künzler,[b] Andrew J. deMello*[a] and Markus Aebi*[b]

Experimental setup

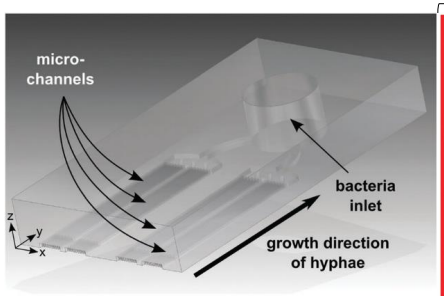


Image source: Stanley et al. 2014

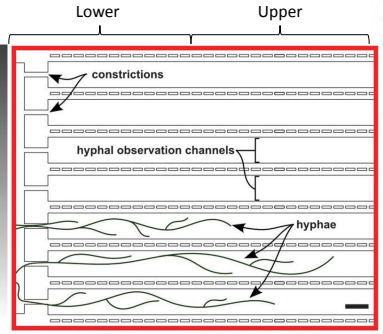
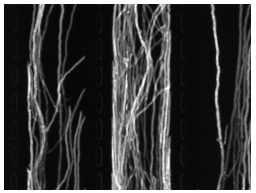
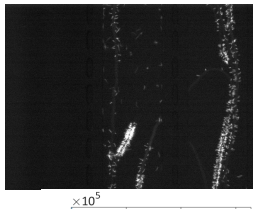


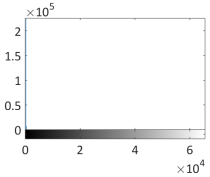
Image source: Stanley et al. 2014

Fluorescence microscopy images



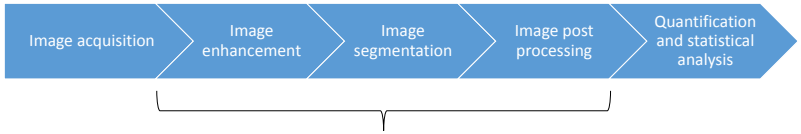


Camera: 12 bit (4096)
Saved as: 16 bit (65536)
Therefore: **only 6.25% of the intensity range is used**
Image dimension: 1392x1040 px



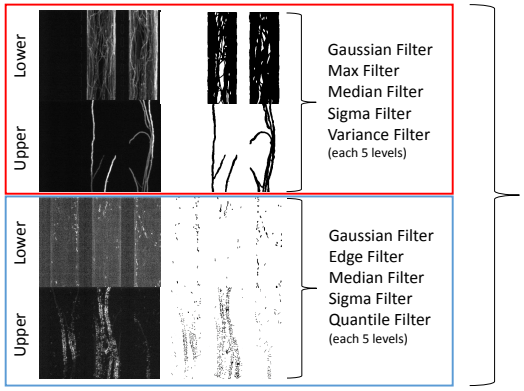
$3 * 21 * 11 * 2 = 1386/replication$

Image analysis protocol



Techniques?

Analysis triage



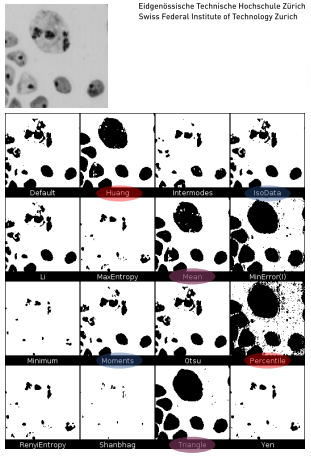
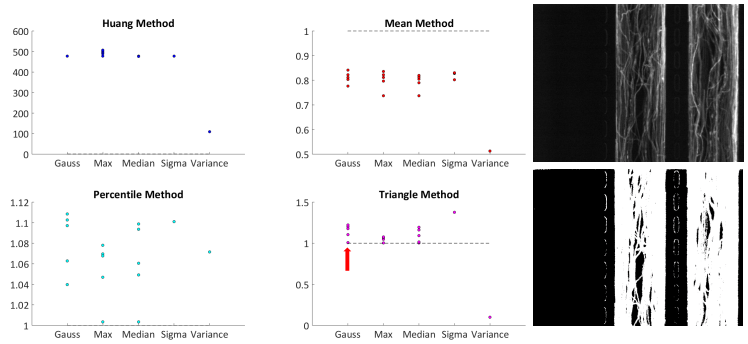
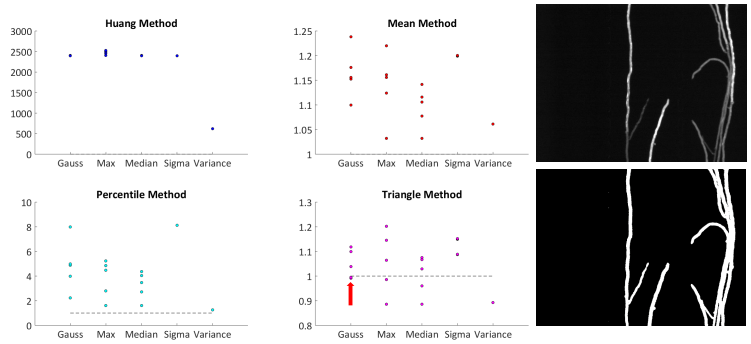


Image source: fiji.sc

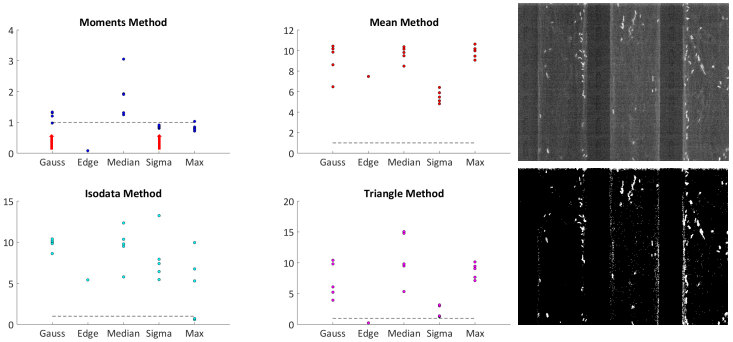
Hyphae segmentation lower



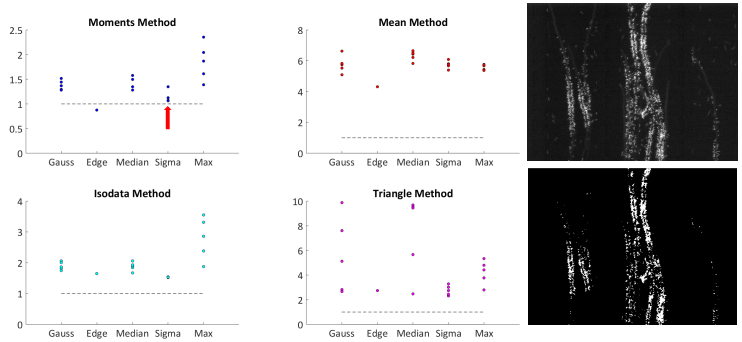
Hyphae segmentation upper



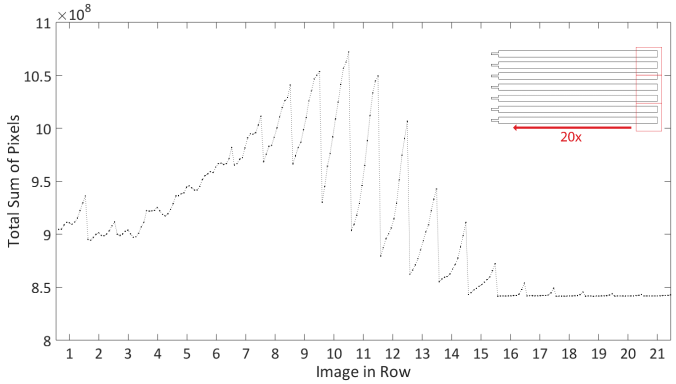
Bacteria segmentation lower



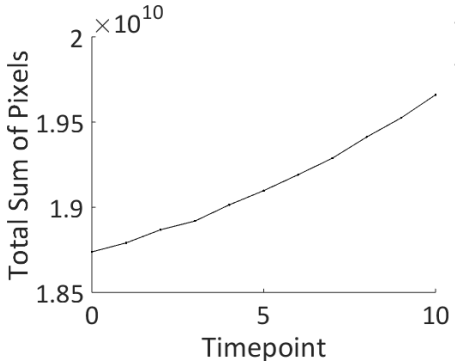
Bacteria segmentation upper



Results: Hyphal growth

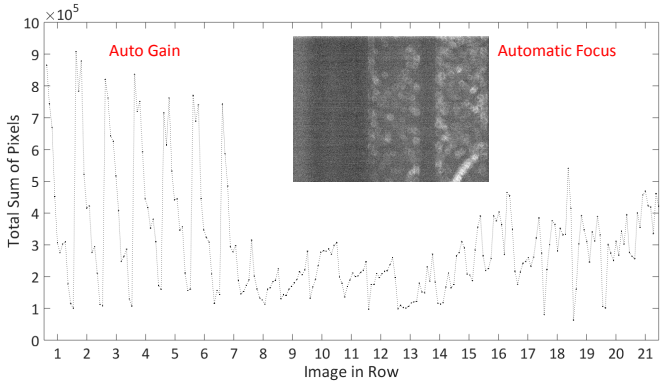


Results: Hyphal growth

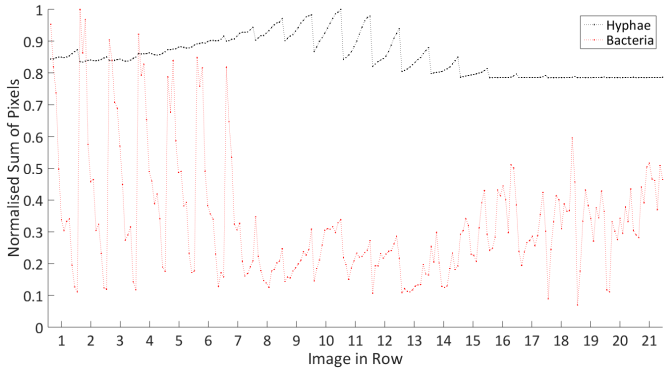


- Growth of hyphae is most likely well captured by the segmentation
- Area of pixels needs to be translated into biomass

Results: Bacteria segmentation



Results: Bacteria segmentation



Summary

- Able to calculate the growth of fungal hyphae from the dTomato images
- Pixel area needs to be translated into biomass
- Image acquisition of bacterial images needs to be improved
- Bacterial distribution can be determined (Component Analysis, Watershed algorithm)

Thanks to:

Dr. Claire Stanley (deMello Group)
Martina Stöckli (Aebi Lab)

All of you for listening!