

Cell-Cell Interaction Analysis in Multi-volumetric Tissue Data

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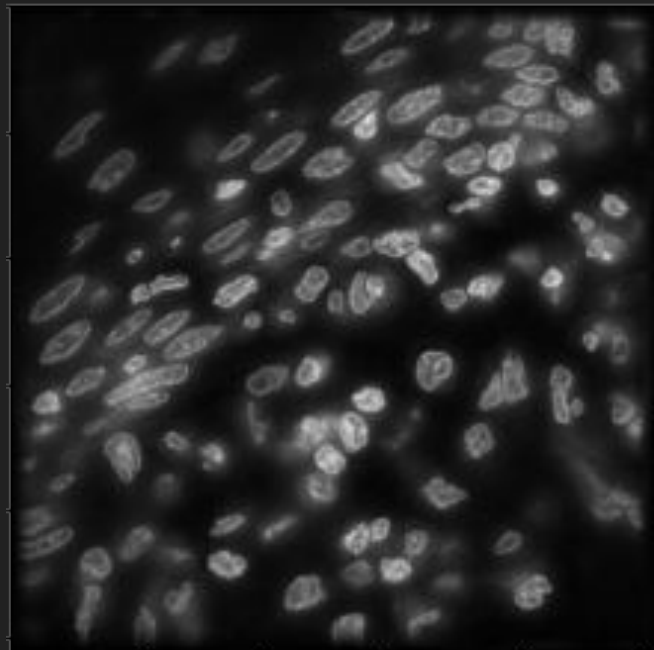


Laboratory of
Systems Pharmacology



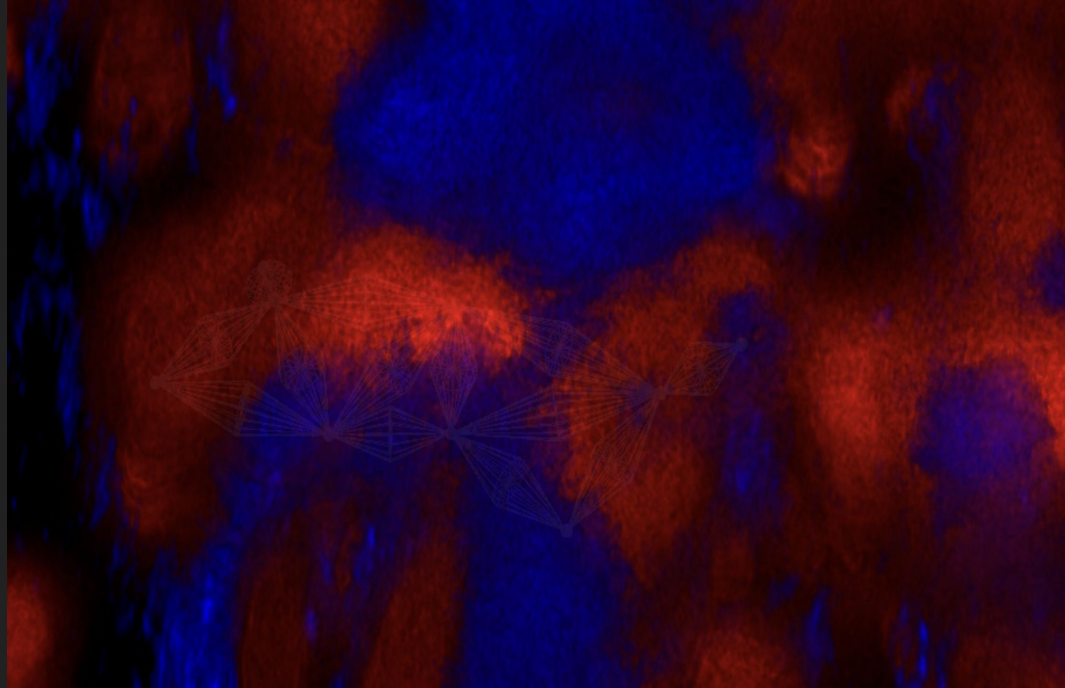
Data

- PCA-Dataset / Cutaneous melanoma
- 3D Cycif Data
- 42 cubes
- $110\text{ }\mu\text{m} \times 110\text{ }\mu\text{m} \times 5\text{ }\mu\text{m}$
- 21 markers



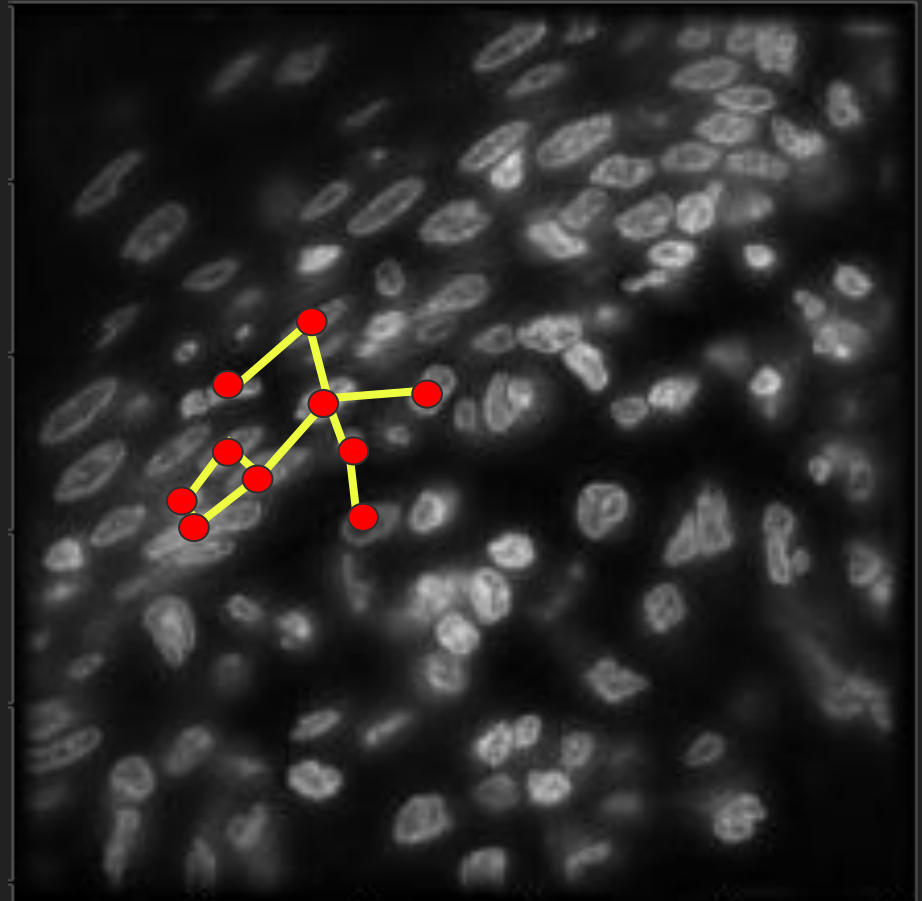
Volume Rendering

- Direct Volume Rendering
- Threejs + Typescript + Webgl
- Multichannel support
- Channel Customization



Cell Interactions

- What are cell interactions?
 - proteins between cells
- The interaction between cells can be represented as a graph where:
 - cells are vertices
 - interactions are edges



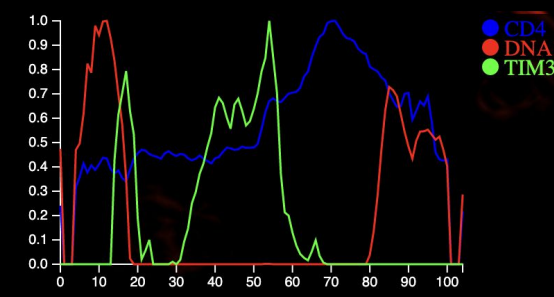
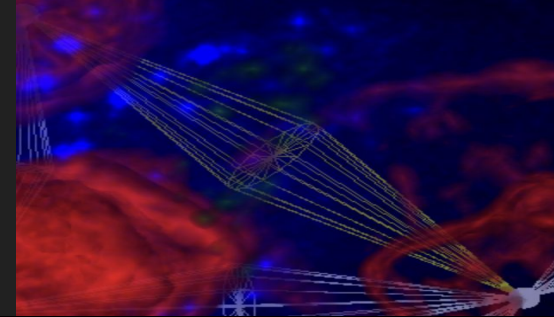
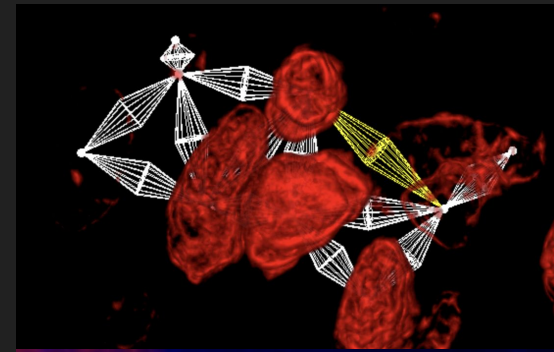
Understanding Cell-Cell Interactions

Traditionally cell-cell interactions are inspected manually

How can we quantify cell-cell interaction automatic without segmentation?

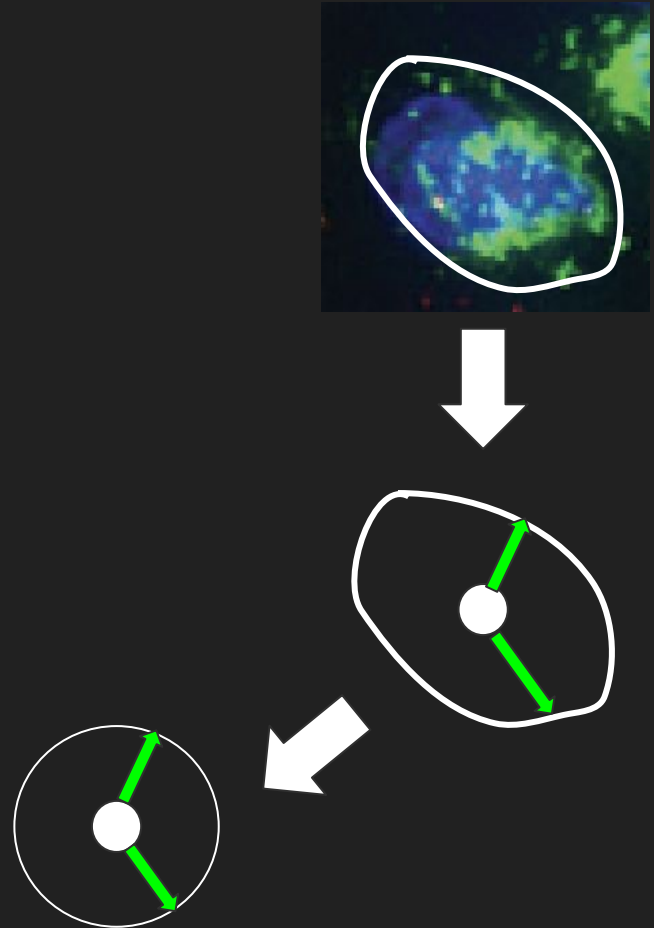
- using simple shapes like cylinders and cones as approximation
- projecting the measurements on to a line
- displaying the resulting histogram

After that we can also compare the interactions via different distribution metr



Polarizations of Markers

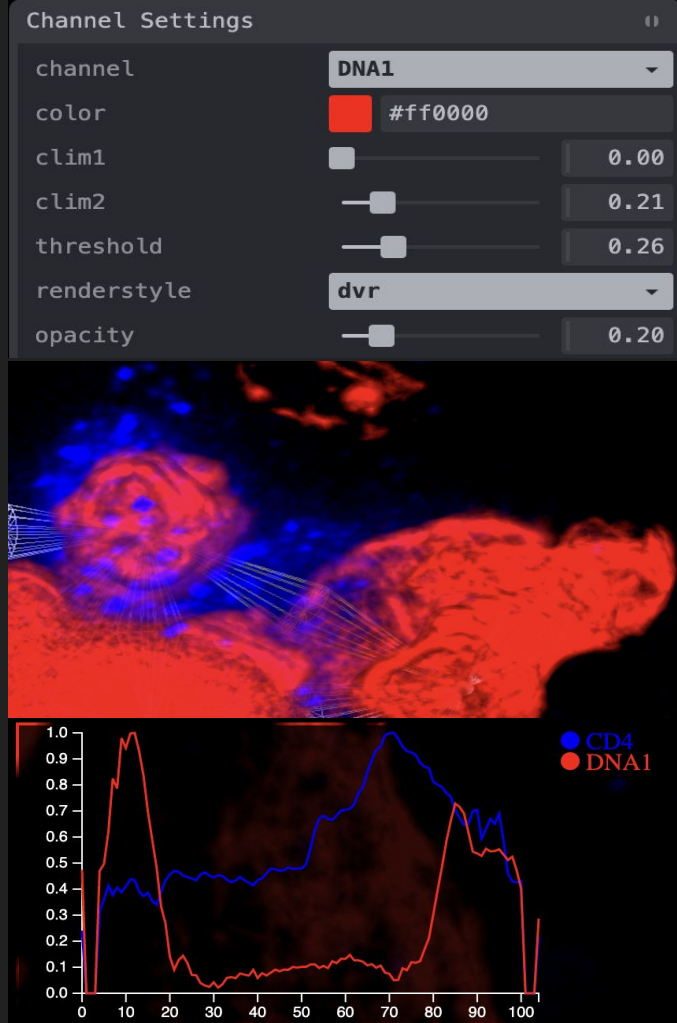
- analyze polarization for a single cell
 - abstract via a simple shape
 - with segmentation mask
- compare marker distributions
- analyze strength of polarity

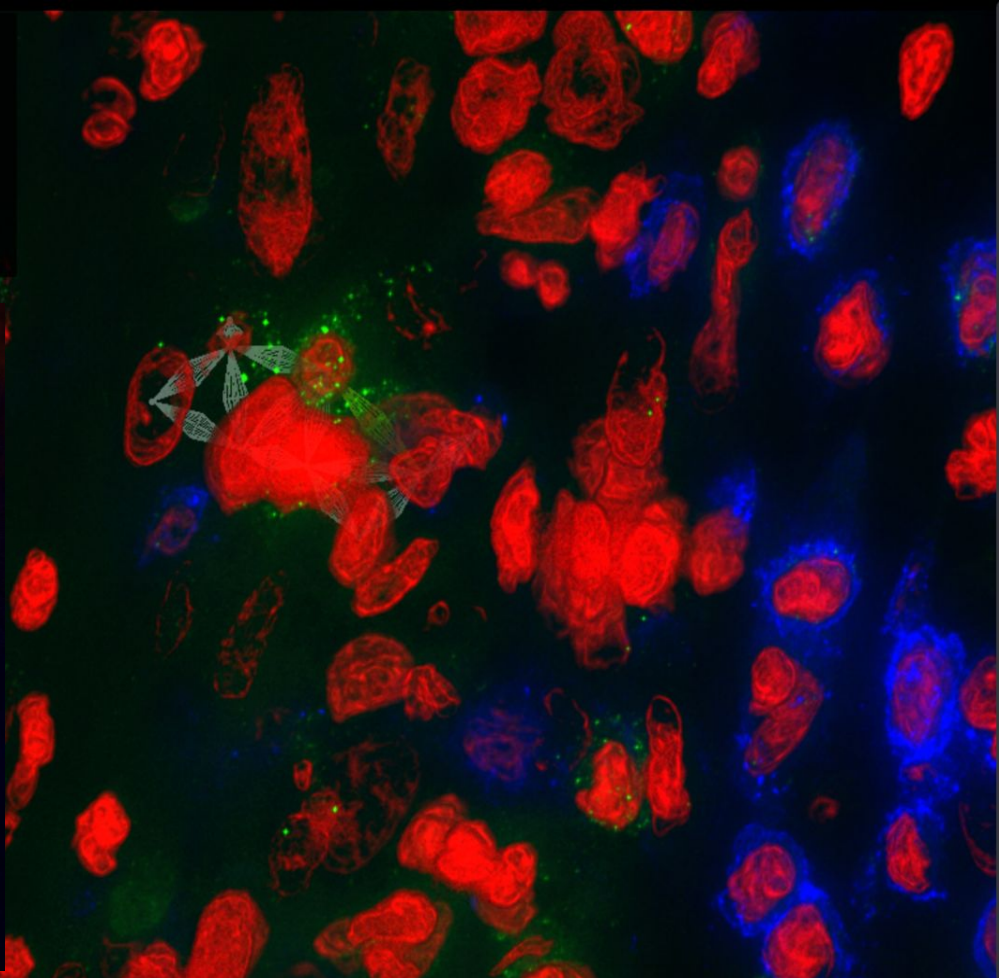
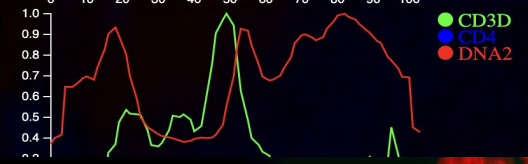
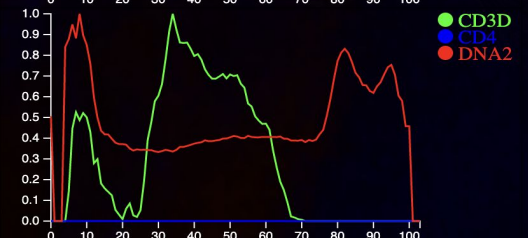
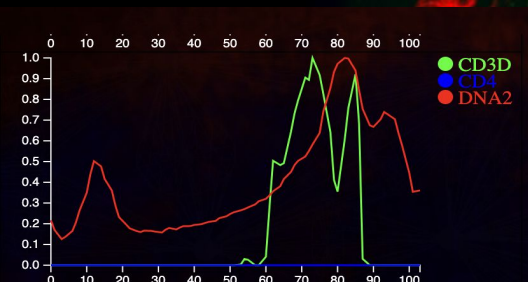
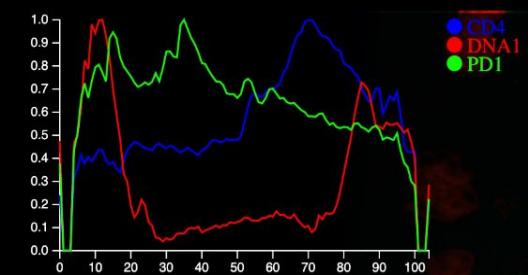


Tool

What can it do so far?

- display 3D multi-channel data
- customize channel visualization
- compute interaction in real time
- show interaction profiles of desired channels
- rank similar interactions





Channel Settings

channel: PD1
 color: #0fff00
 clim1: 0.00
 clim2: 0.08
 threshold: 0.01
 renderstyle: dvr
 opacity: 0.22

Analysis Settings

radius: 10

Visible	Interactions
CD163	
CD3D	
CD4	✓
CD40L	
CD68	
CD8A	
DNA1	✓
DNA2	
DNA3	
DNA4	
DNA5	
DNA6	
DNA7	
DNA_binary_masks	
DNA_masks	
GZMB	
HLAA	
HLAA_binary_masks	
HLAA_masks	
HLA-DPR1	

Demo

Future Work

- compare interactions
- group interactions
- measure marker polarizations
- compare marker polarizations

Acknowledgements

VCG



LSP



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Vienna

