

# Comparison of canonical immune cells in tumour microenvironment

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# Overview

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1. Problem to solve

2. Methods

3. Results

4. Diskussion

# Problem to solve<sup>1</sup>

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Cancer Type		Cases in 2022 in the US (NIH)		Estimated death Rate 2022
Breast	1	290,560	4	43,780
Prostate	2	268,490	5	34,500
...	...	...	...	...
Pancreas	10	62,210	3	49,830
...		...	..	...
Liver	14	41,260	6	30,520

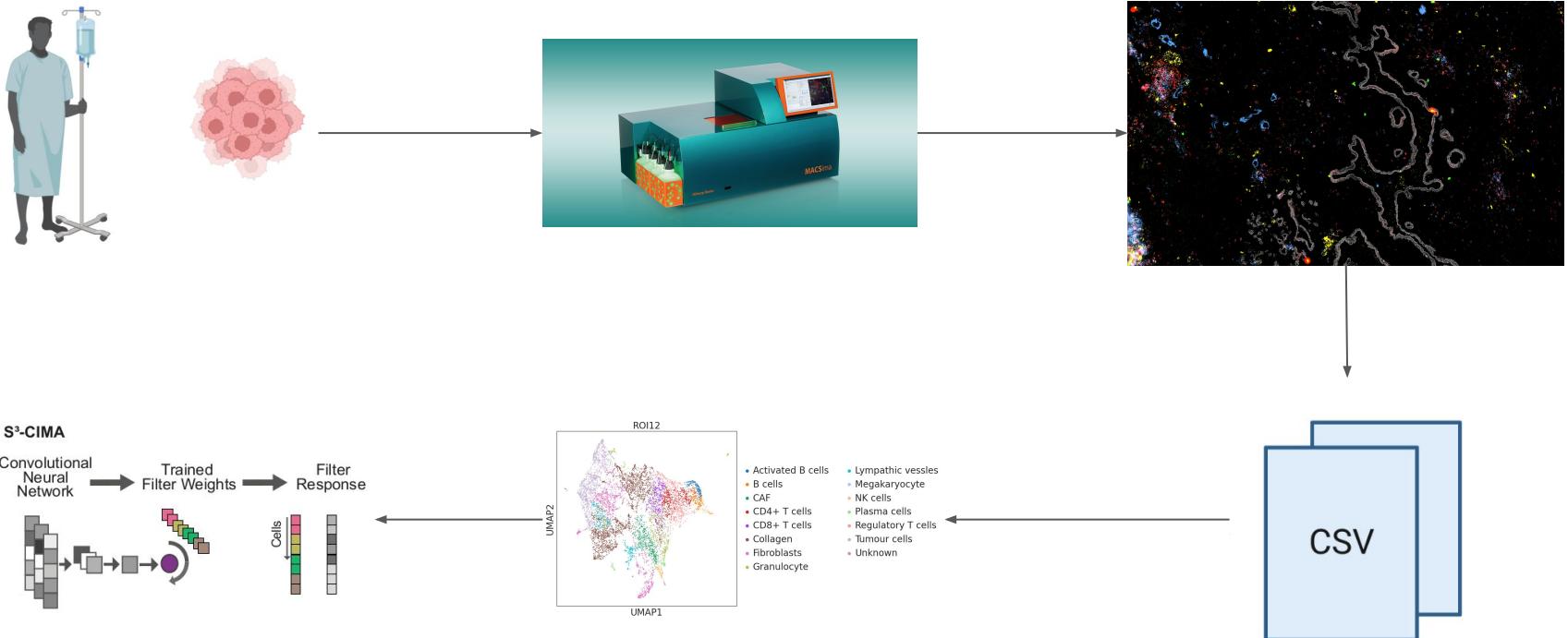
# Data

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	<b>PDAC</b>	<b>HCC</b>
<b>Samples</b>	8	15
<b>Imaging Technology</b>	MACsima	Codex
<b>Annotation</b>	annotate every single sample	annotation was provided
<b>S3-CIMA</b>	no	yes

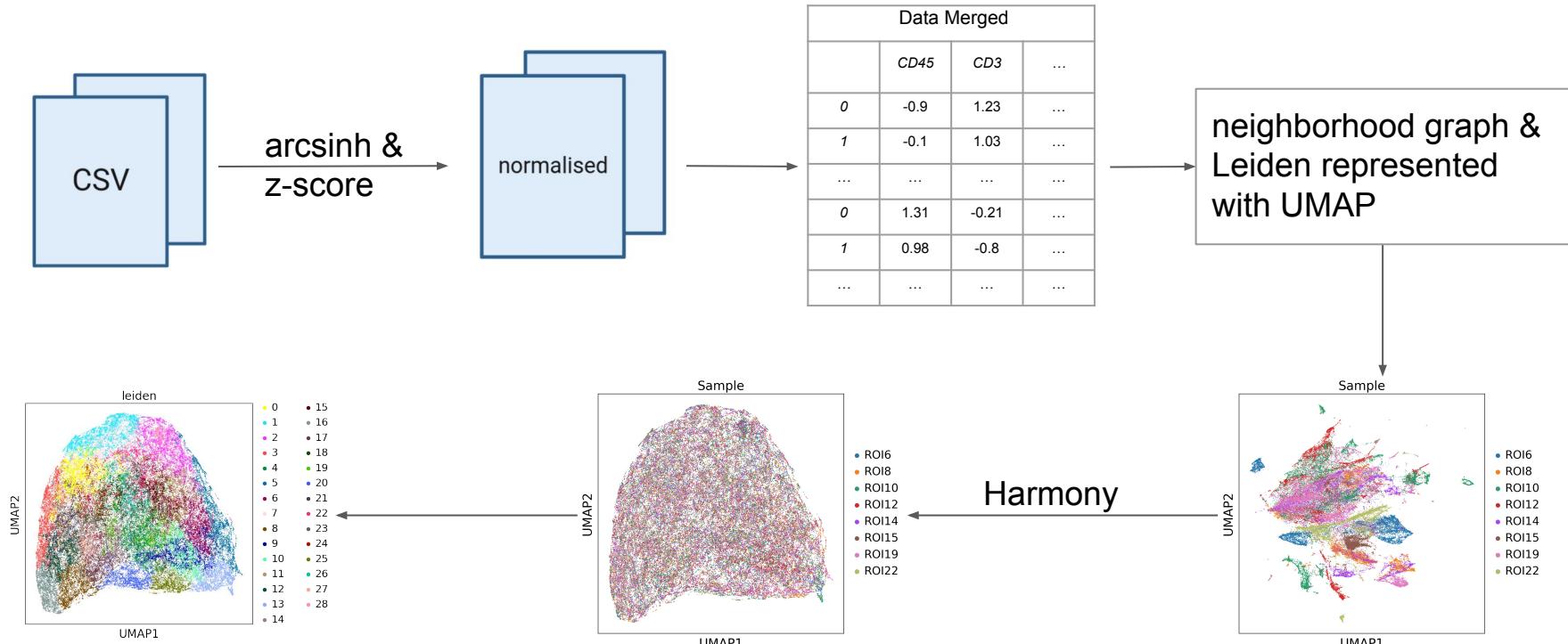
# Methods<sup>2</sup>

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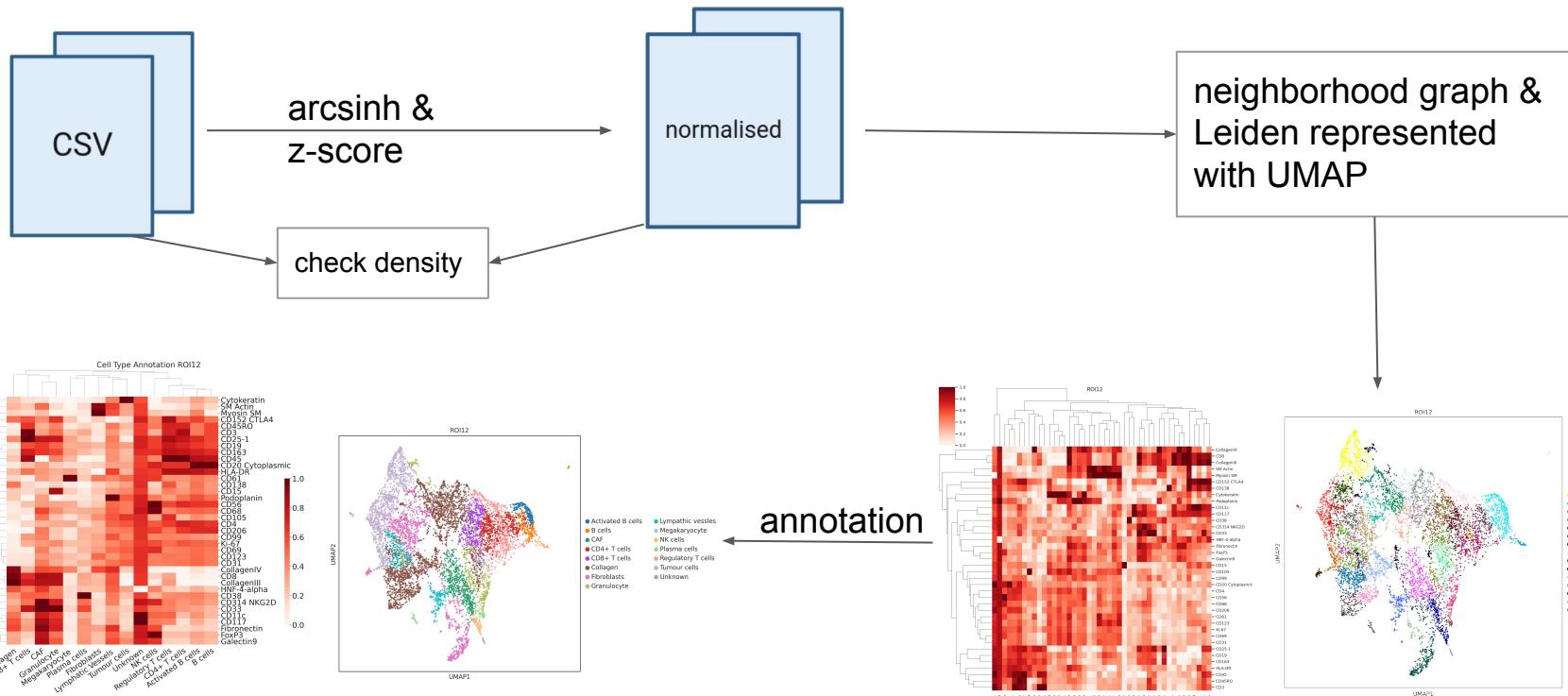
Comparison of canonical immune cells in tumour microenvironment

# Methods - Annotation for merge Data



Comparison of canonical immune cells in tumour microenvironment

# Methods - Annotation for every single Datafile

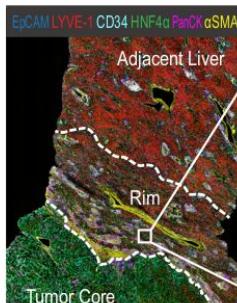


Comparison of canonical immune cells in tumour microenvironment

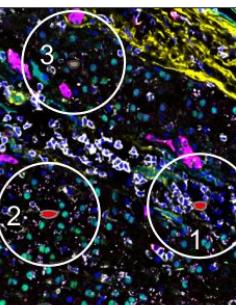
# Methods - S<sup>3</sup>-CIMA<sup>3</sup>

## I Spatial Input

CODEX  
tissue image



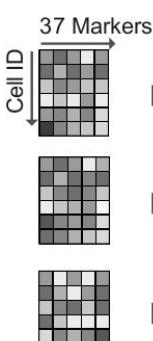
MAIT neighborhood  
in different  
tissue regions



k nearest  
MAIT cell  
neighbors



Multi-cell  
input



Label

Label

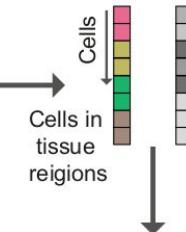
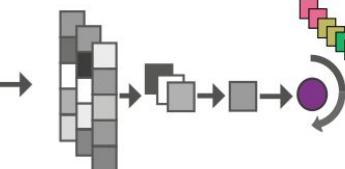
- Adjacent liver
- Rim
- Tumor core

- MAITs (anchor cell)
- Random anchor cell (background)

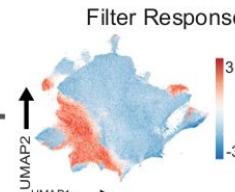
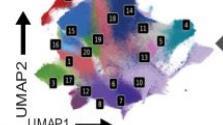
## II S<sup>3</sup>-CIMA

Convolutional  
Neural  
Network

→ Trained  
Filter Weights → Filter  
Response



Map to annotated  
cell types

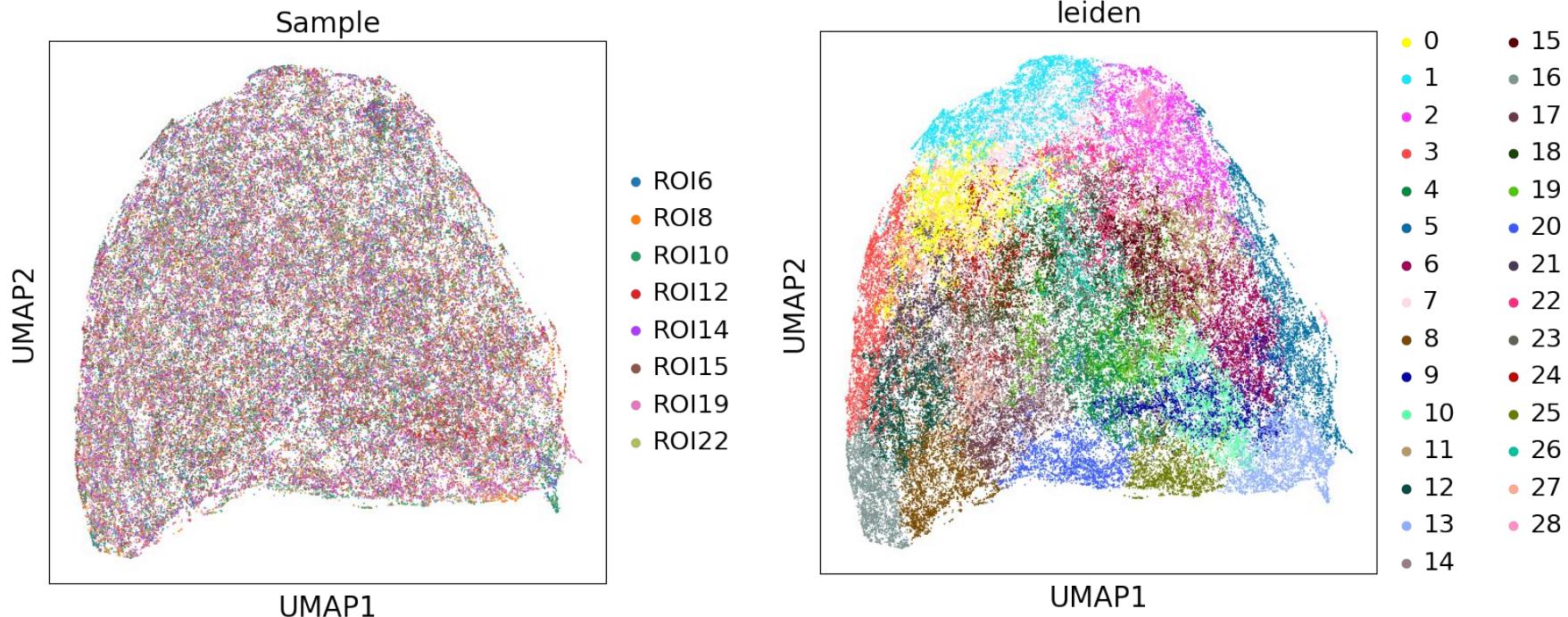


Filter Response

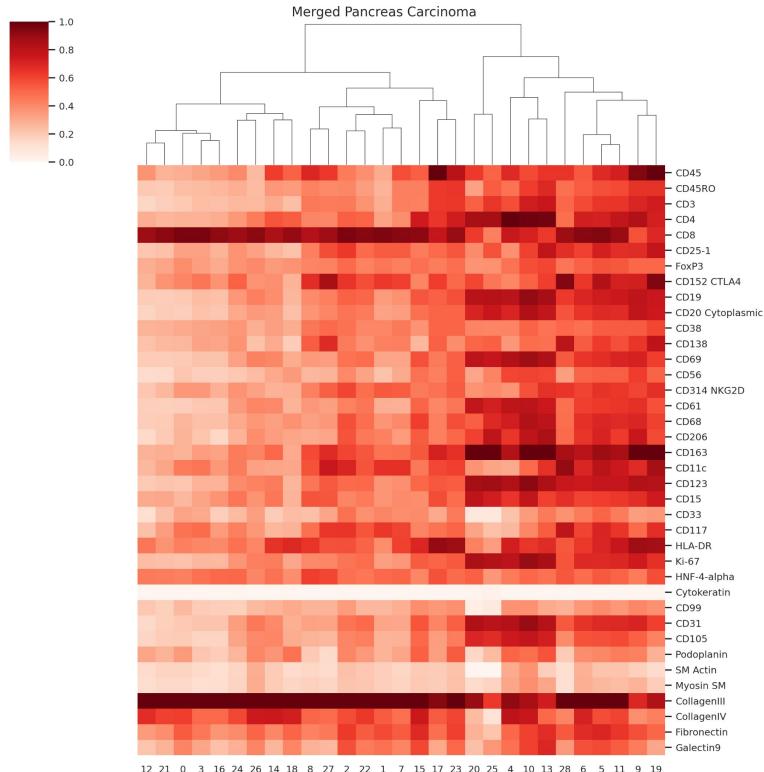
High  
Select cells  
with high  
filter  
response

Low

# Results - Merge and batch corrected Data



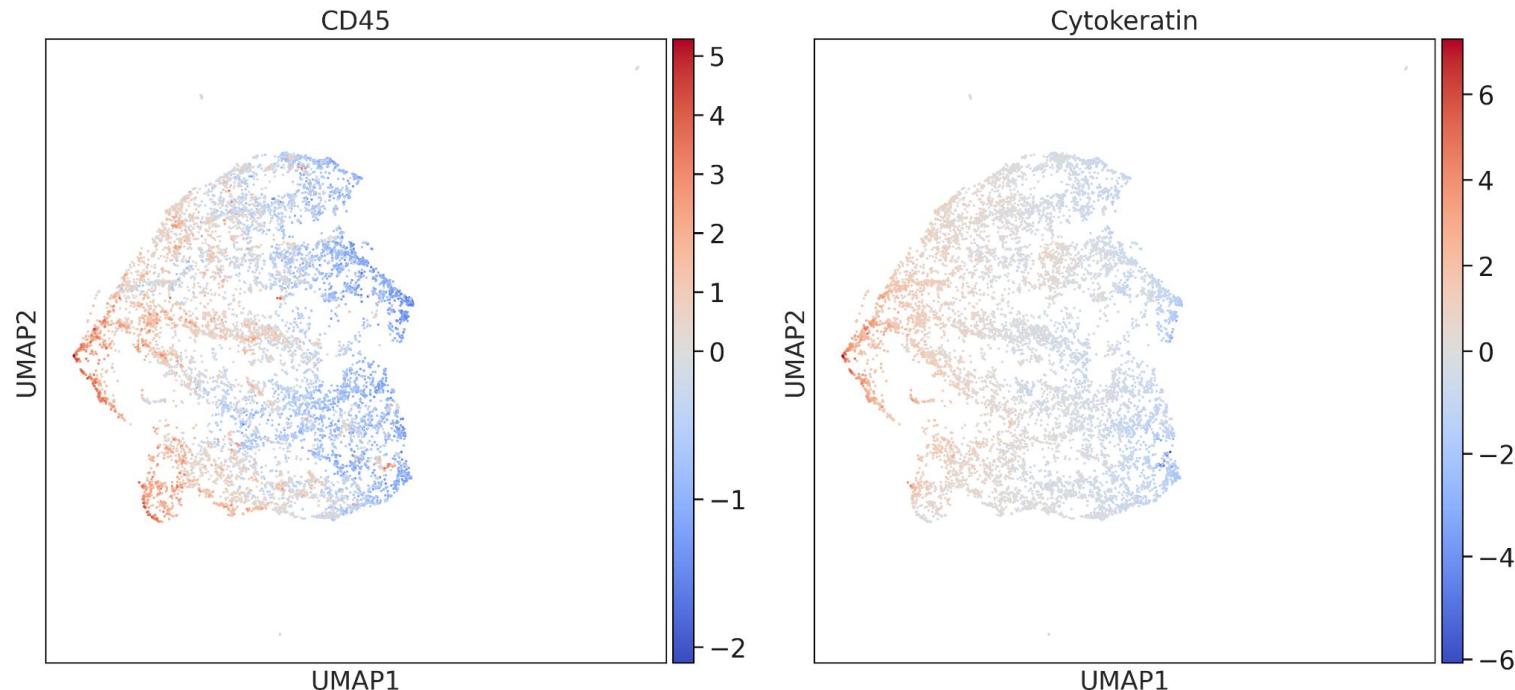
# Results - Merge and batch corrected Data



Comparison of canonical immune cells in tumour microenvironment

# Results - ROI6

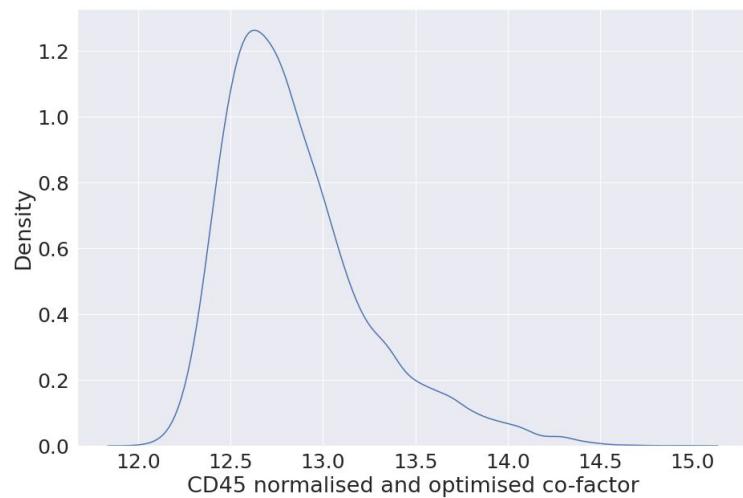
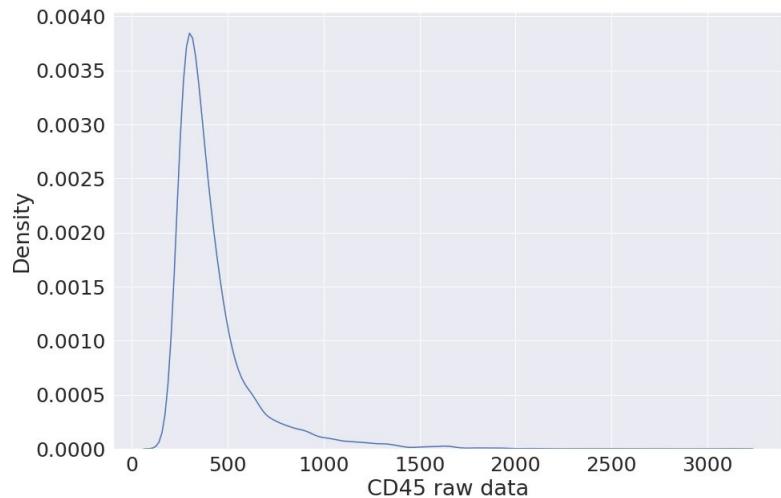
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Comparison of canonical immune cells in tumour microenvironment

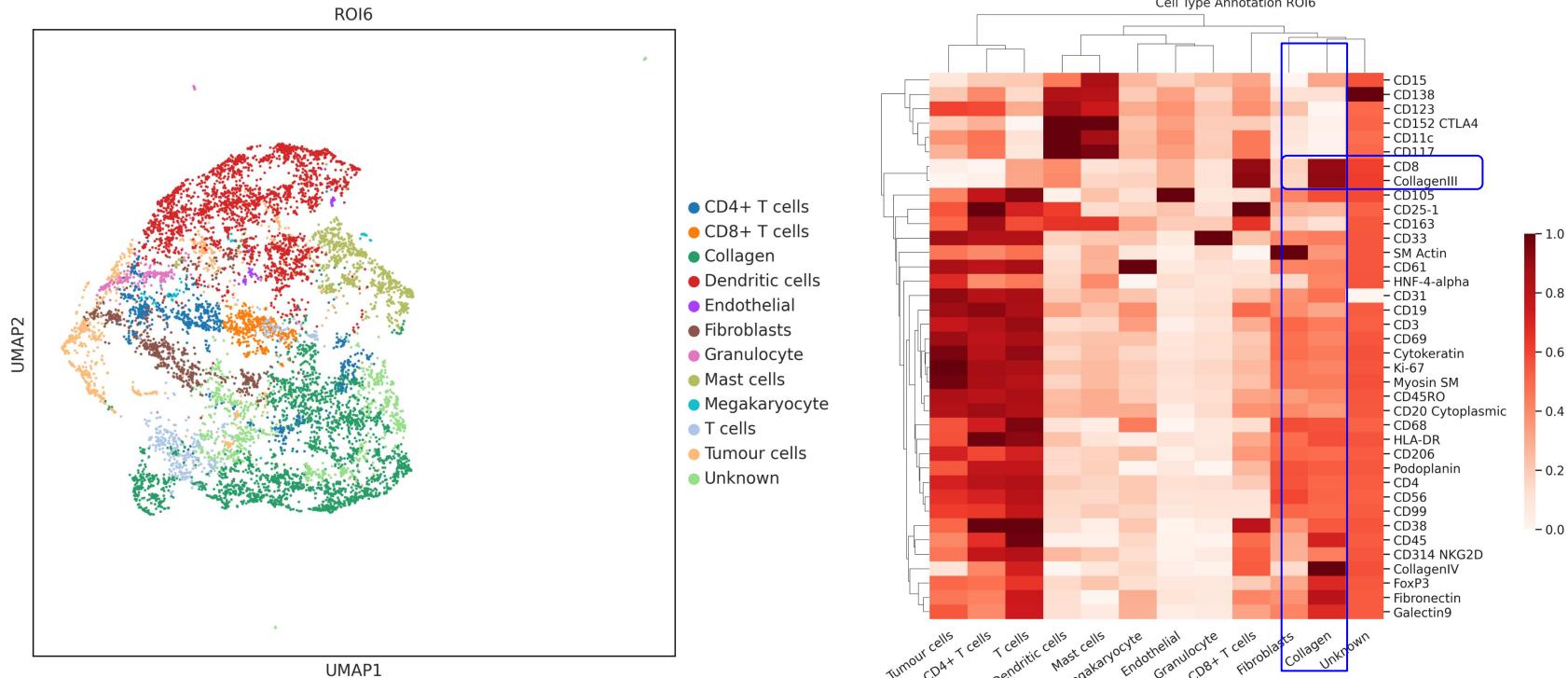
# Results - ROI6

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Comparison of canonical immune cells in tumour microenvironment

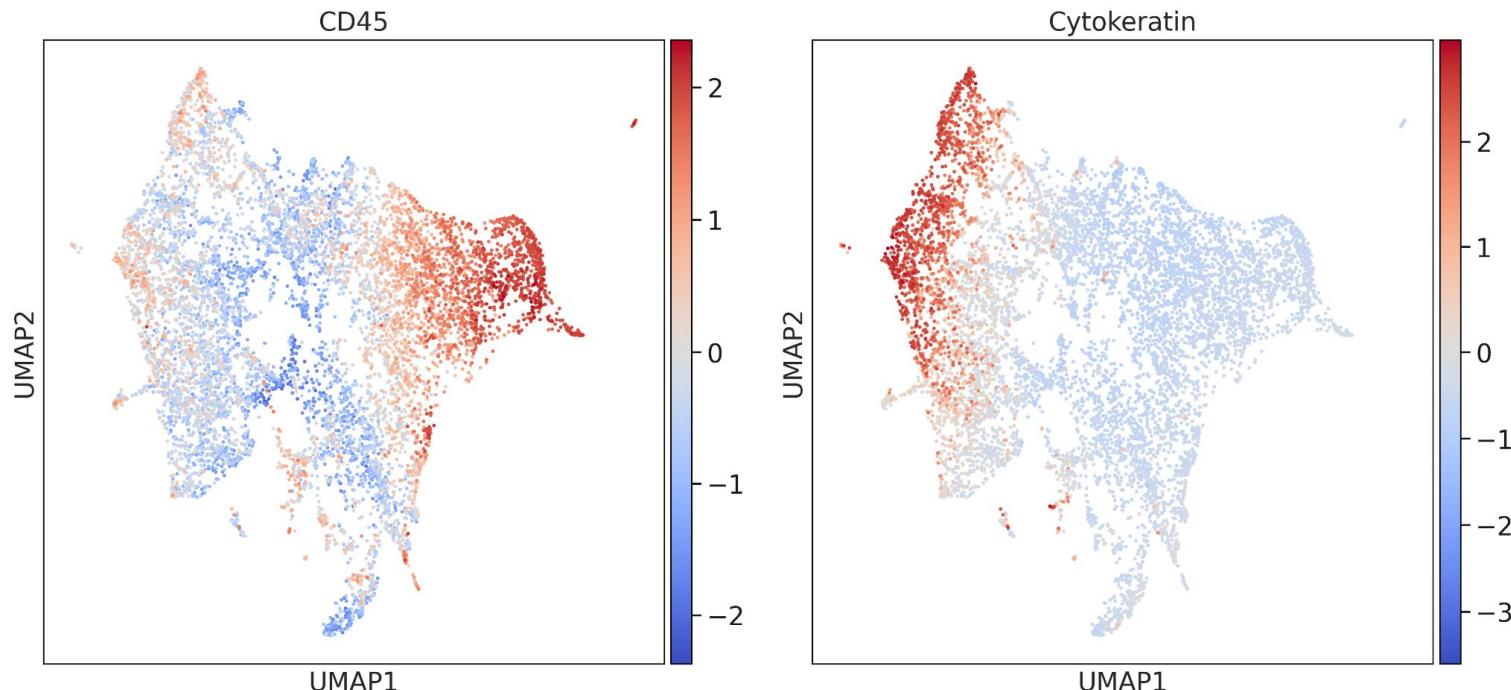
# Results - ROI6



Comparison of canonical immune cells in tumour microenvironment

# Results - ROI12

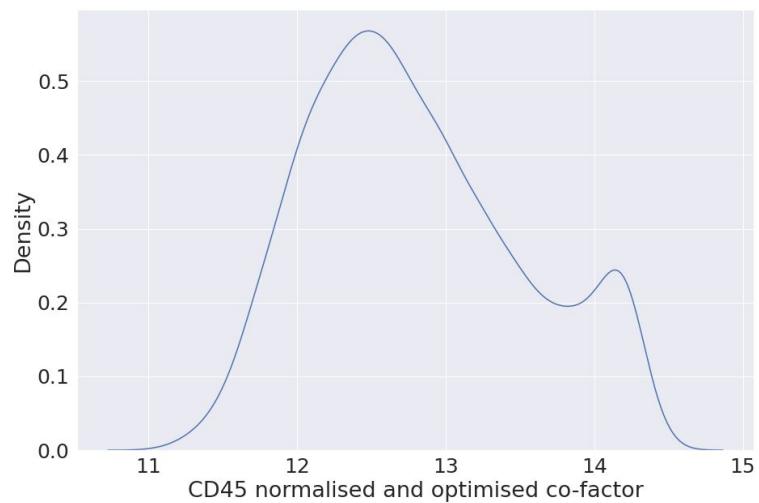
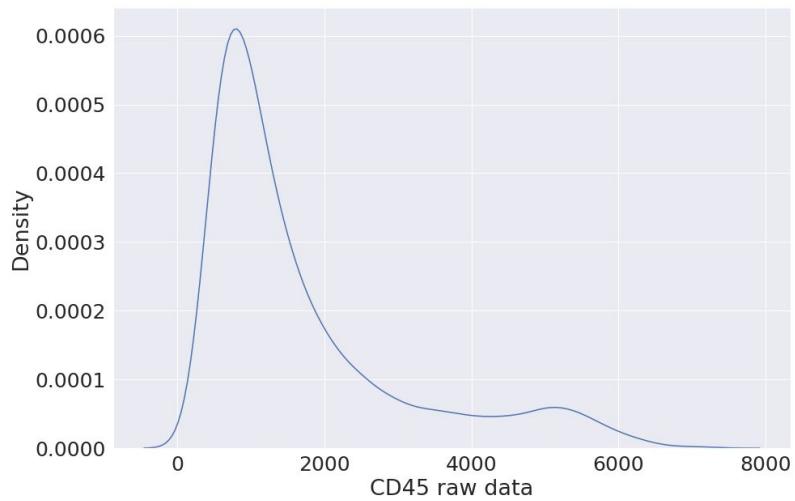
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Comparison of canonical immune cells in tumour microenvironment

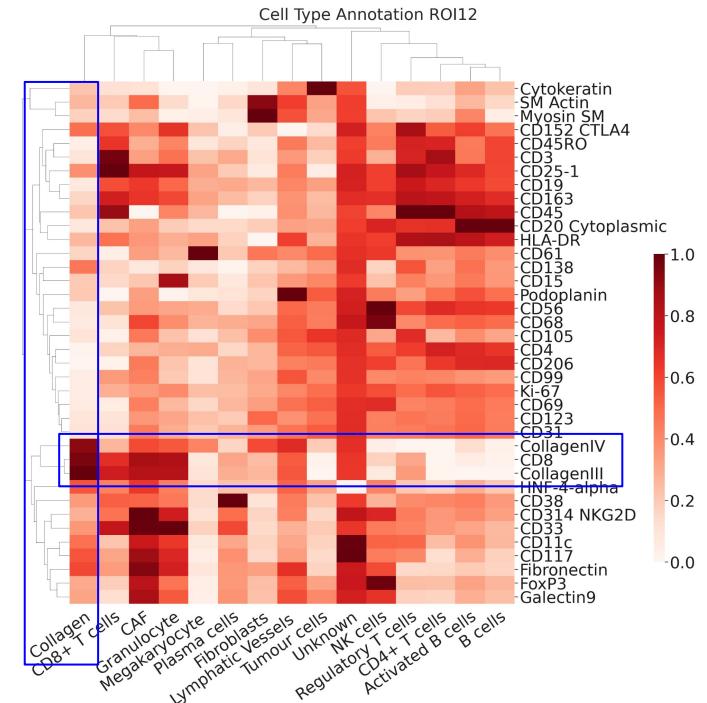
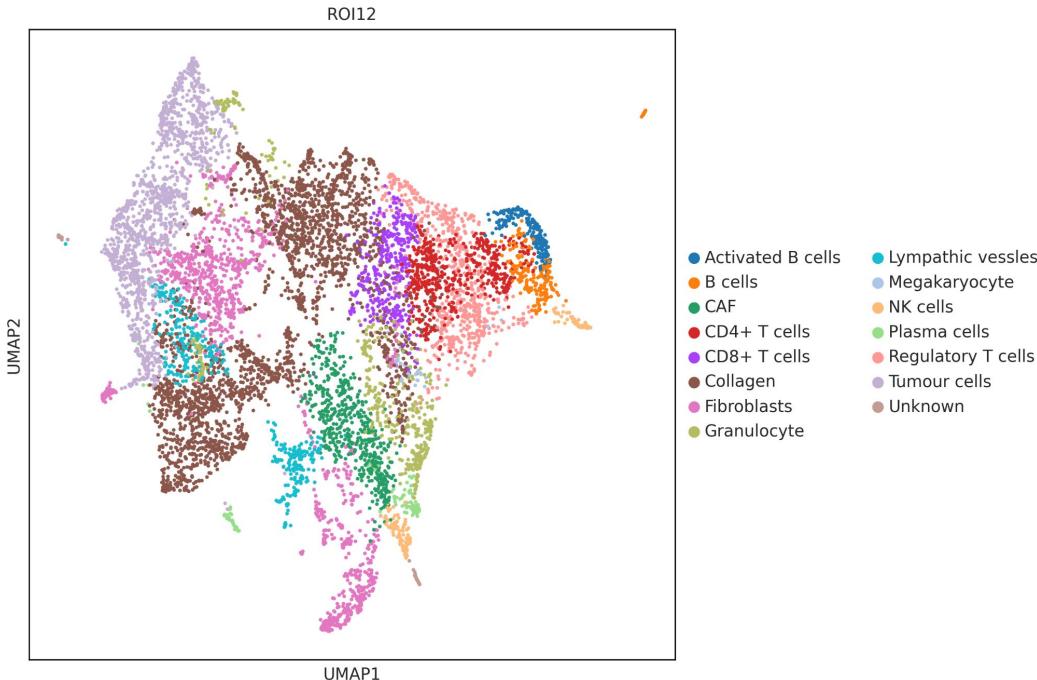
# Results - ROI12

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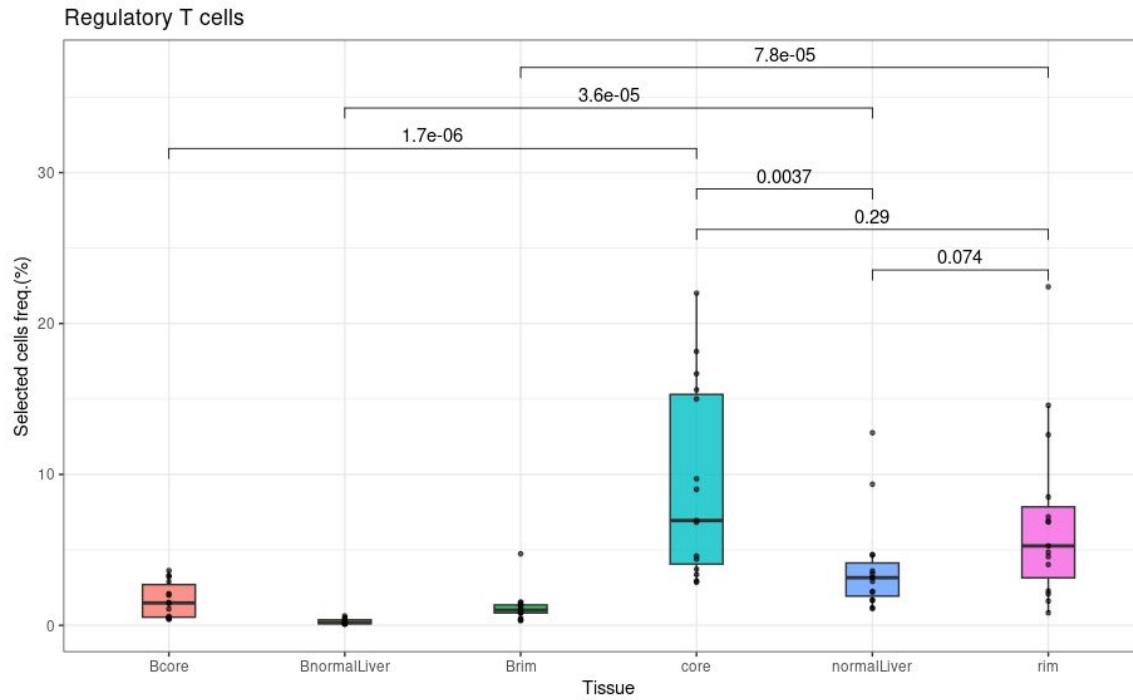
Comparison of canonical immune cells in tumour microenvironment

# Results - ROI12

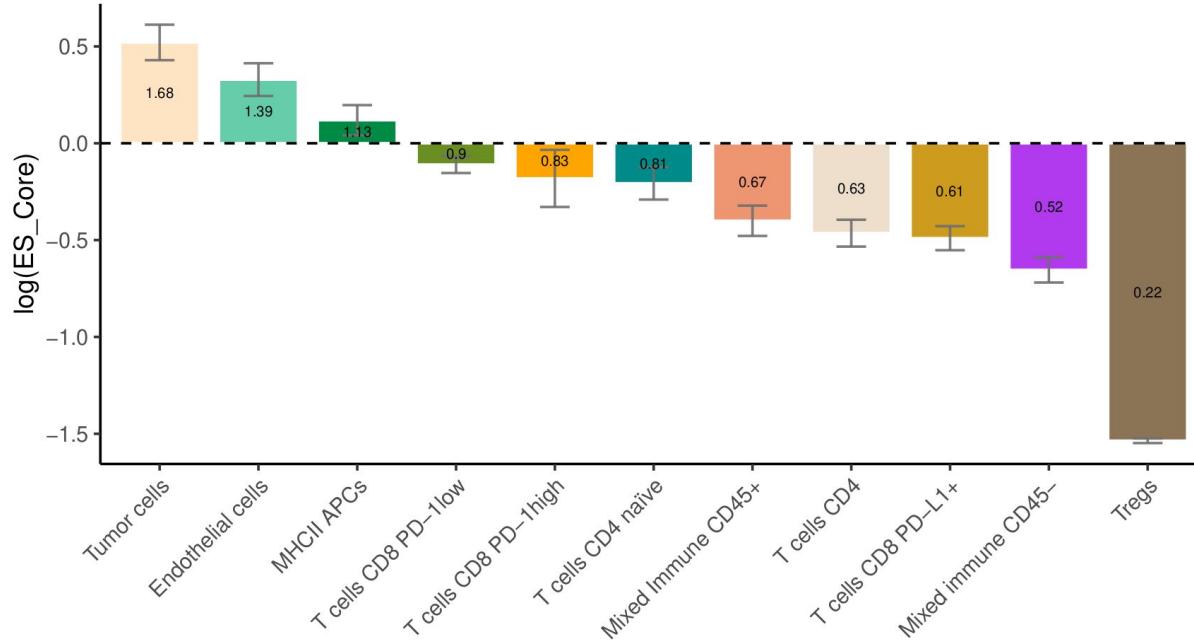


Comparison of canonical immune cells in tumour microenvironment

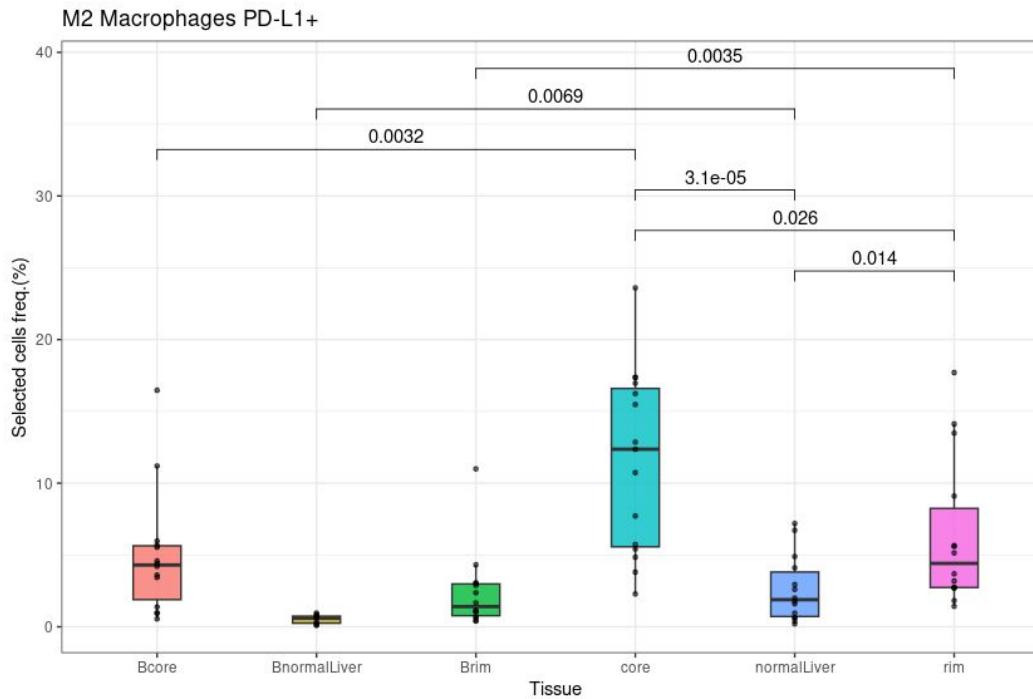
# Results - Regulatory T cells



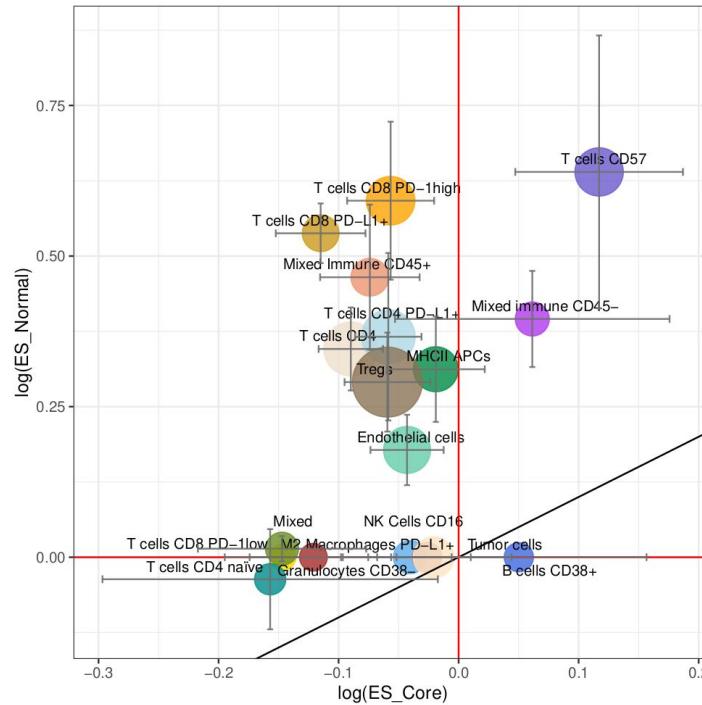
# Results - Regulatory T cells



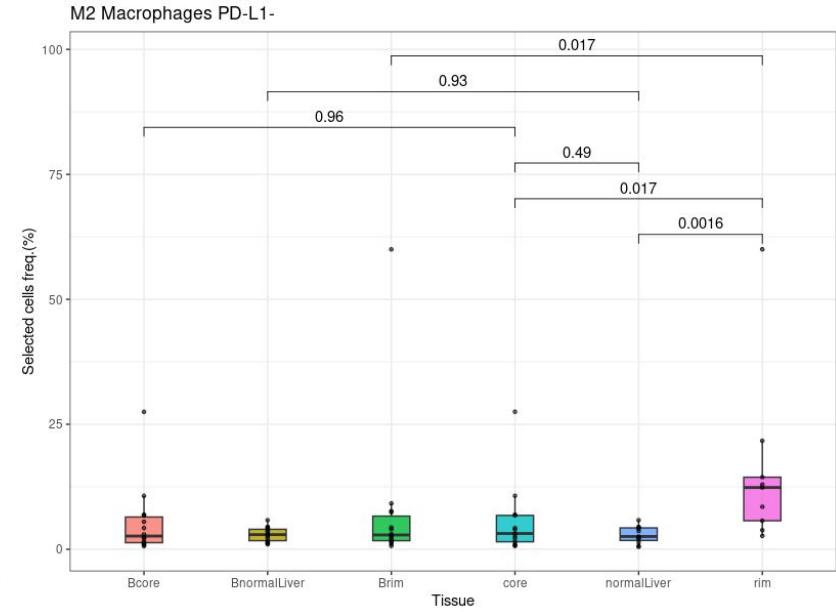
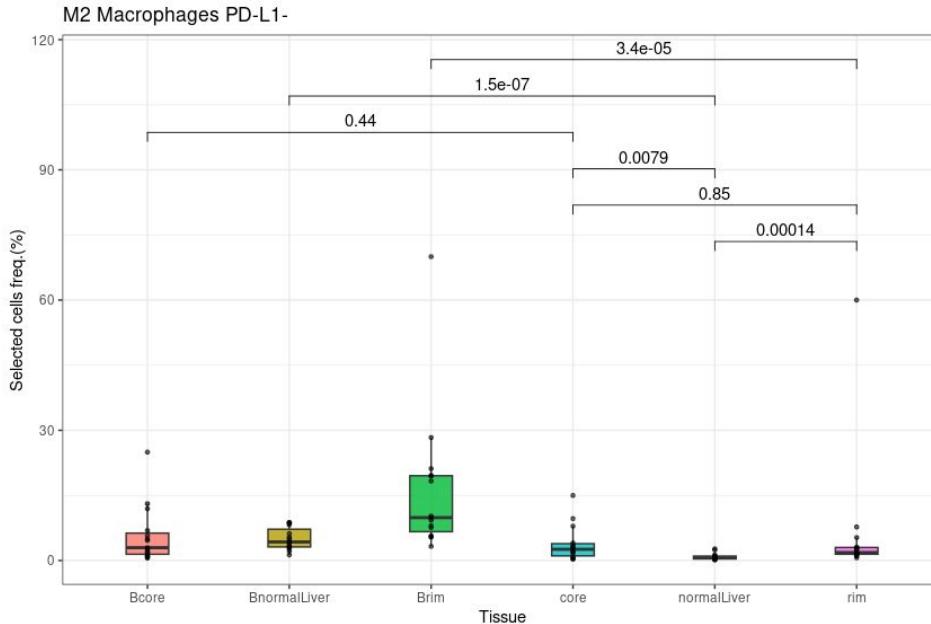
# Results - M2 Macrophages PD-L1+



# Results - M2 Macrophages PD-L1+



# Results - M2 Macrophages PD-L1-



# Summary & Outlook

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## Summary:

- PDAC samples were annotated
- Quality of images can not be corrected
- S<sup>3</sup>-CIMA: Detection of enriched cells
- Regularly T cells immunosuppressive around the tumour cells

## Outlook:

- Refined methods in the lab are needed
- Detection of enriched cells for larger cohort

# Source

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- 1) <https://seer.cancer.gov/statfacts/html/common.html>
- 2) MACSima image: <https://www.miltenyibiotec.com/DE-en/products/macsim-a-imaging-system.html>
- 3) Ruf, B., Bruhns, M., Babaei, S., et. al. (2023), 'Csf1r+pd-l1+ tumor-associated macrophages trigger mait cell dysfunction at the hcc invasive margin', Submitted to Cell .  
Babaei, S., Christ, J., Makky, A., Zidane, M., Schürch, C. and Claassen, M. (2023), 'S3-cima: Supervised spatial single-cell image analysis for the identification of disease- associated cell type compositions in tissue', Submitted to Cell Patterns .