Vitessce

Modular Visualization of Spatial Single-Cell Omics Data

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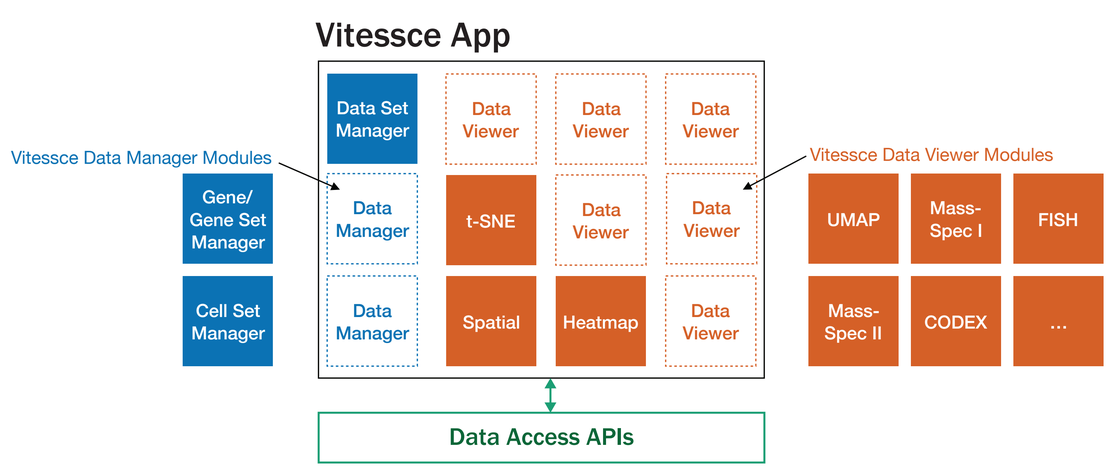
Motivation

Technologies to measure single-cell data in human and other tissues are on the rise, creating complex datasets which integrate sequencing, mass spectrometry, and high-resolution microscopy.

Can we improve access and enable the visual exploration of these integrated data?

Modularity

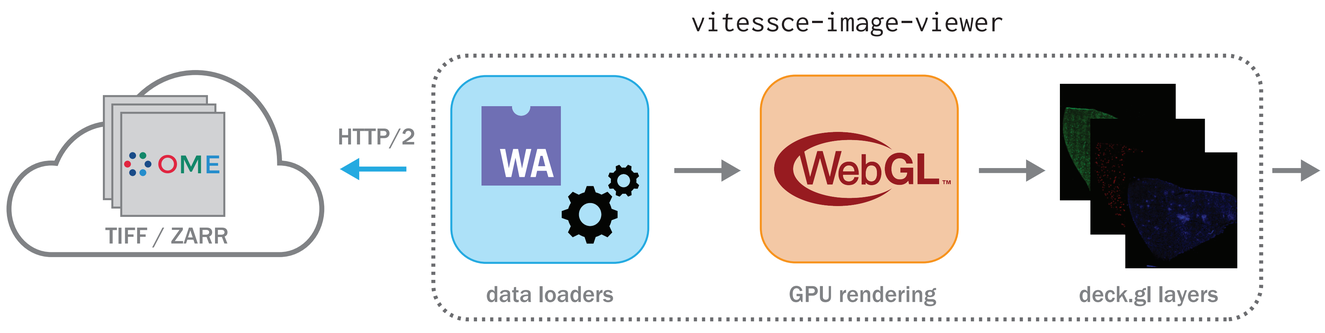
Vitessce uses React with a modular event-bus architecture. It can be configured as a standalone application, or individual data manager and data viewer modules can be extracted into other applications.



Multimodal and Multiscale Imaging with Viv

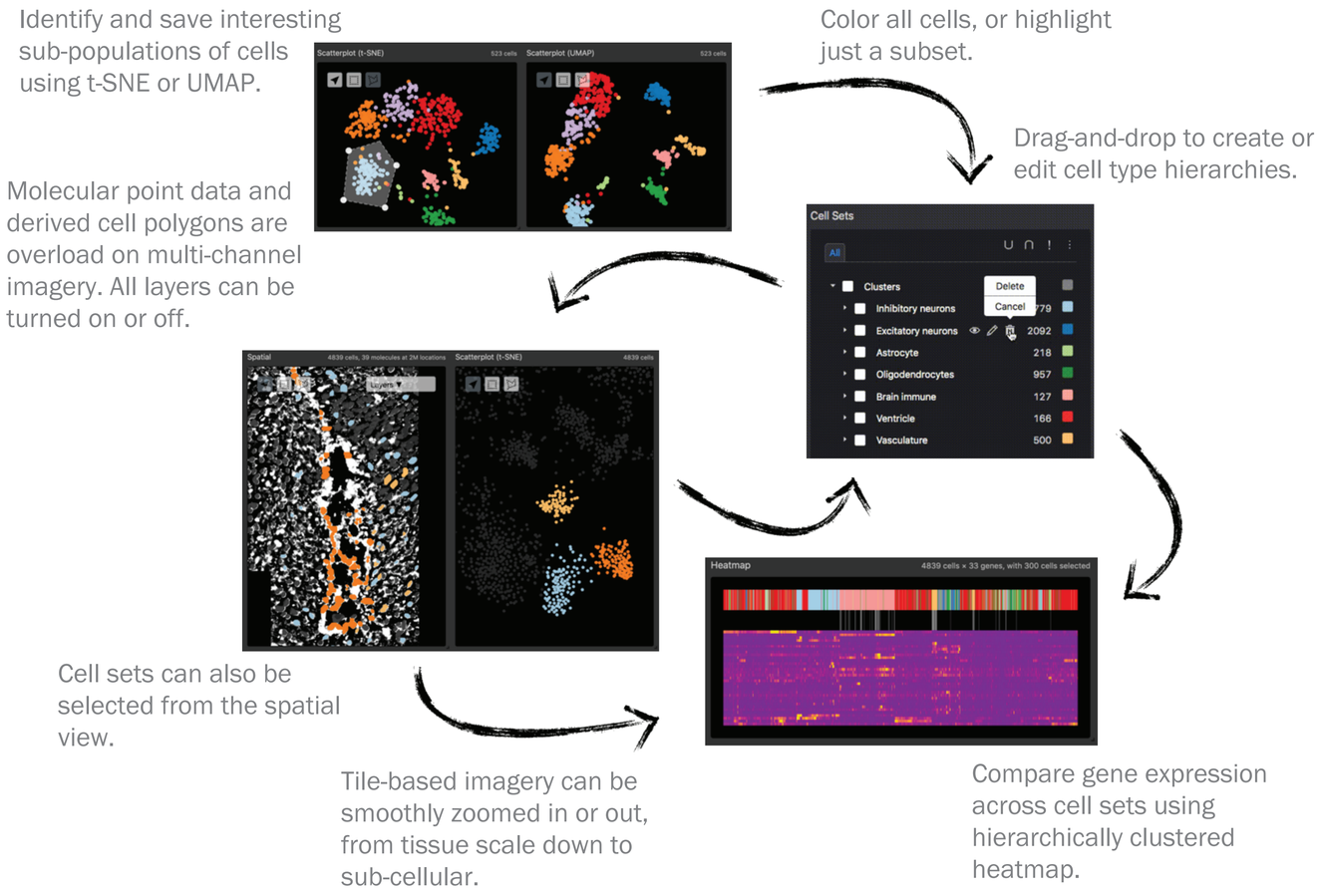
Vitessce image viewer (Viv) is a flexible, open-source library for visualizing large, high bit-depth images on the web. The two major components of the library are:

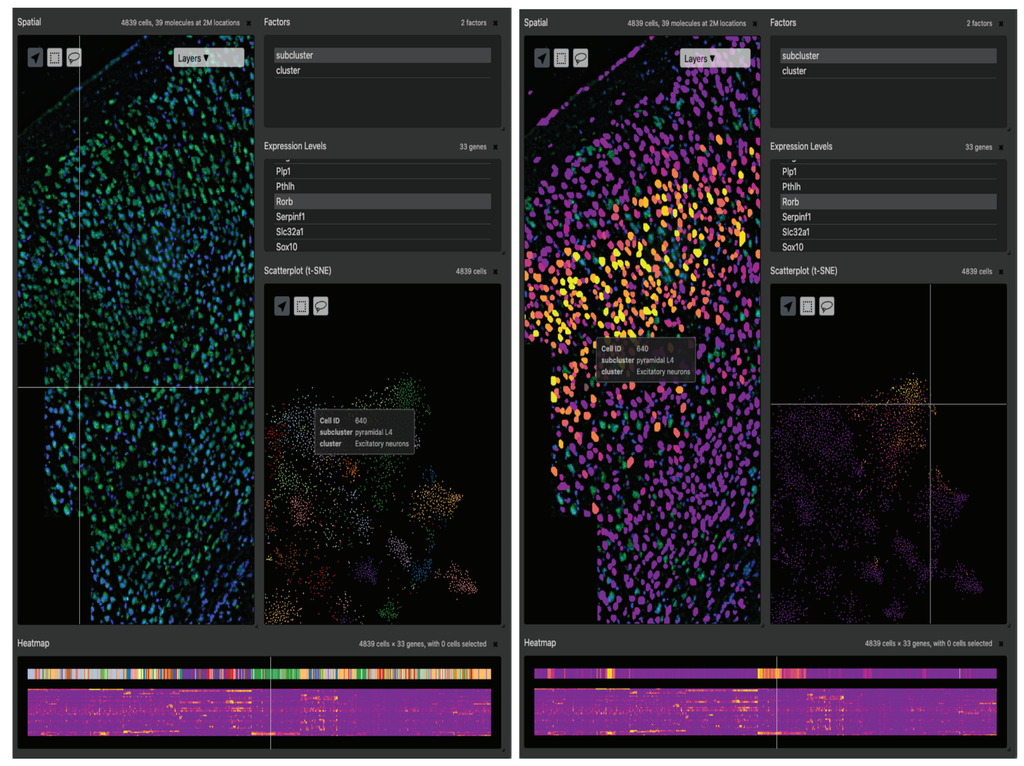
1) low-level utilities to access & decode RAW 2D arrays from standard image formats
2) GPU code to render decoded arrays in generic coordinate space



Interaction

This is an example of how the visualization components can be used together.



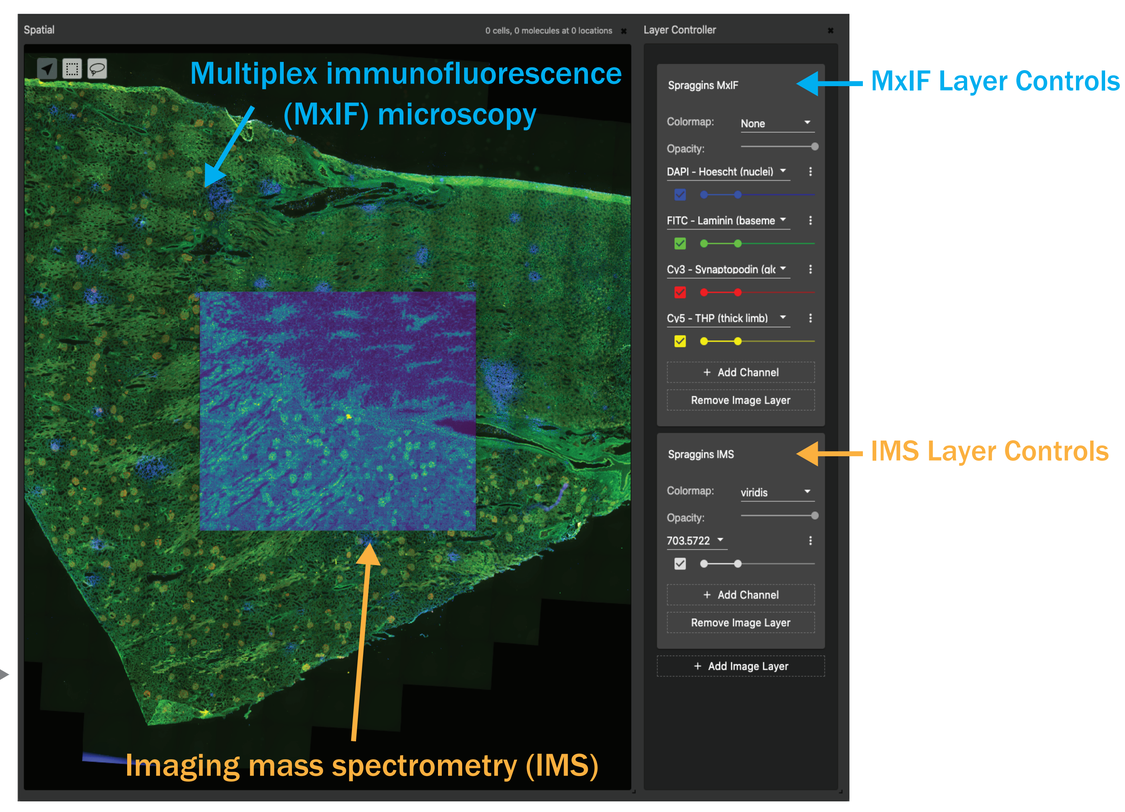


2D cell nuclei imagery + gene expression t-SNE projection

2D cell nuclei imagery + 2D cell segmentation + gene expression t-SNE projection

Coordinated selections (Codeluppi *et al.*, 2018)

Views are linked via biological entities (e.g. cells & genes) and can display relationships in both 2D/3D space as well as high-dimensional space (e.g. gene expression).



Viv in Vitessce (HubMAP Vanderbilt TMC, Spraggins *et al.*)

Images captured with different technologies at different resolutions can be transformed and combined as **layers** in a **Spatial component**.

The **Layer Controller component** controls ***which*** channels to render for a particular image source as well as ***how*** to render each channel (e.g. blending, colormap, contrast limits).

Future work

Most work has focused on supporting static, remote datasets. However, since Vitessce is so modular, we plan to embed our visualizations within common interactive analysis environments (e.g. Jupyter notebooks, R shiny, etc)

Demos:
http://vitessce.io
http://viv.vitessce.io

Github:
https://github.com/hubmapconsortium/vitessce
https://github.com/hubmapconsortium/vitessce-image-viewer
https://github.com/hms-dbmi/vitessce-data

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