



Visual Exploration of Relationships and Structure in Low-Dimensional Embeddings

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Vaishali Dhanoa, Christina Humer, Moritz Heckmann, Christian A. Steinparz, Marc Streit

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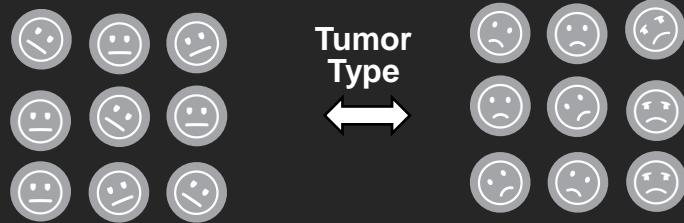
🐦 [@klaus_lml](https://twitter.com/klaus_lml)

<https://jku-vds-lab.at/biovis22-eckelt>



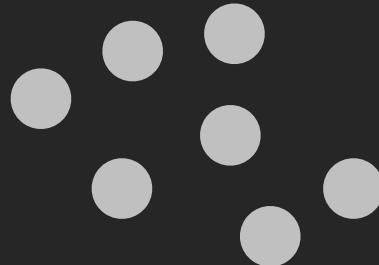
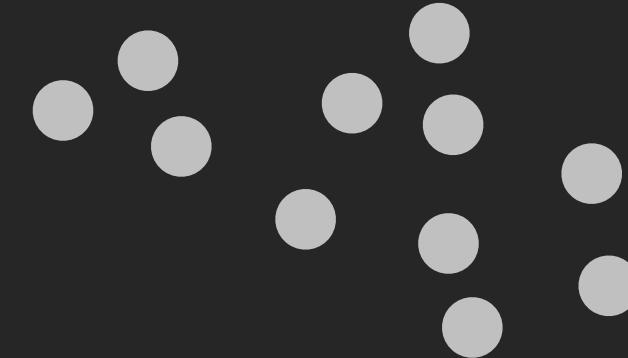
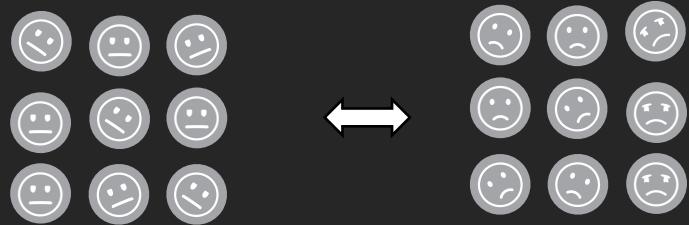
Motivation

Patients



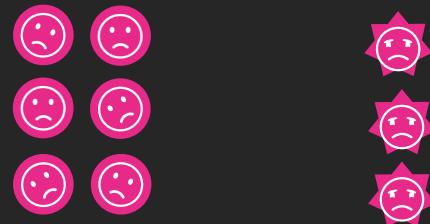
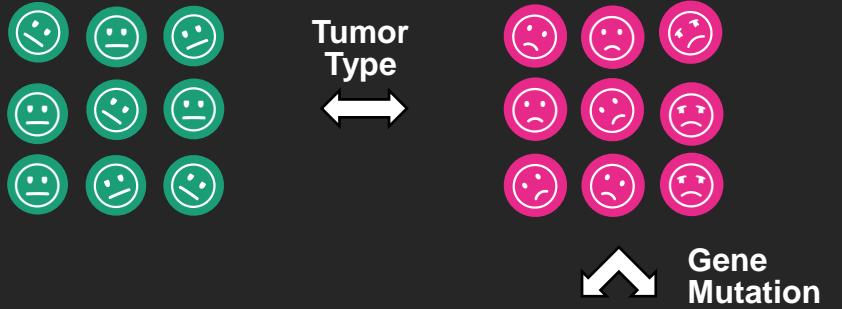
Motivation

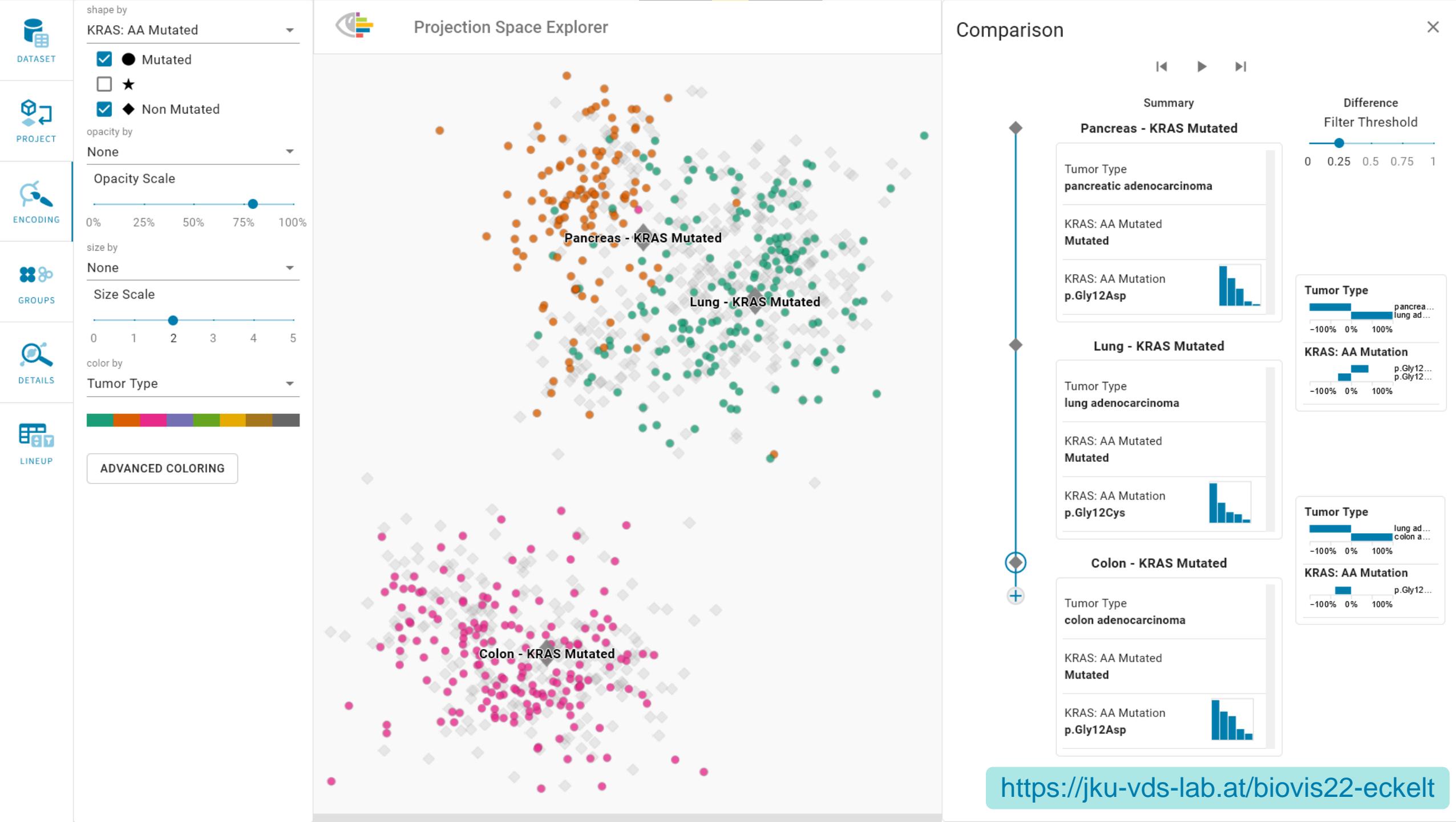
Patients



Motivation

Patients





Use Case

The screenshot shows a news article from The New York Times. The title is "How Scientists Shot Down Cancer's 'Death Star'". Below the title, it says "No drug could touch a quivering protein implicated in a variety of tumors. Then one chemist saw an opening." There are three small icons below the text: a gift icon, a share icon, and a bookmark icon. The main image is a colored scanning electron micrograph of a cancer cell, described as a "non-small cell cancer" cell. The cell has a central cluster of yellow and green, with many thin, red and orange projections extending outwards, resembling a star or a flower. Below the image is a caption: "A colored scanning electron micrograph of a cell of a common type of lung cancer, called non-small cell cancer. A new drug targets the mutated protein that leads to uncontrolled growth. Steve Gschmeissner/Science Source". At the bottom left is a small profile picture of the author, Gina Kolata, and the text "By Gina Kolata". At the very bottom is the date "Feb. 5, 2021".

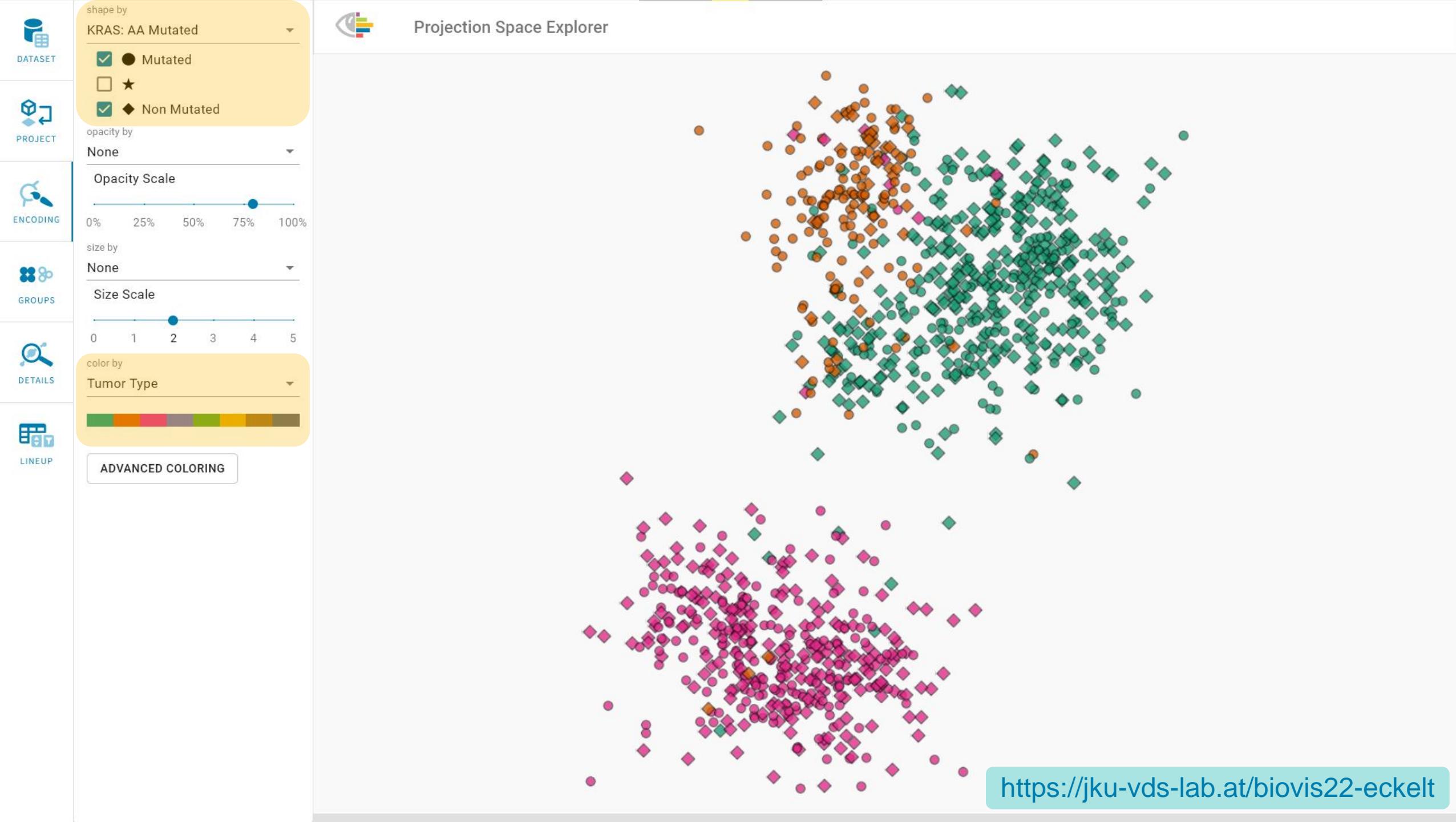
Treatment for cancer patients
with **KRAS G12C** mutations.

Data: TCGA

● Lung

● Colon

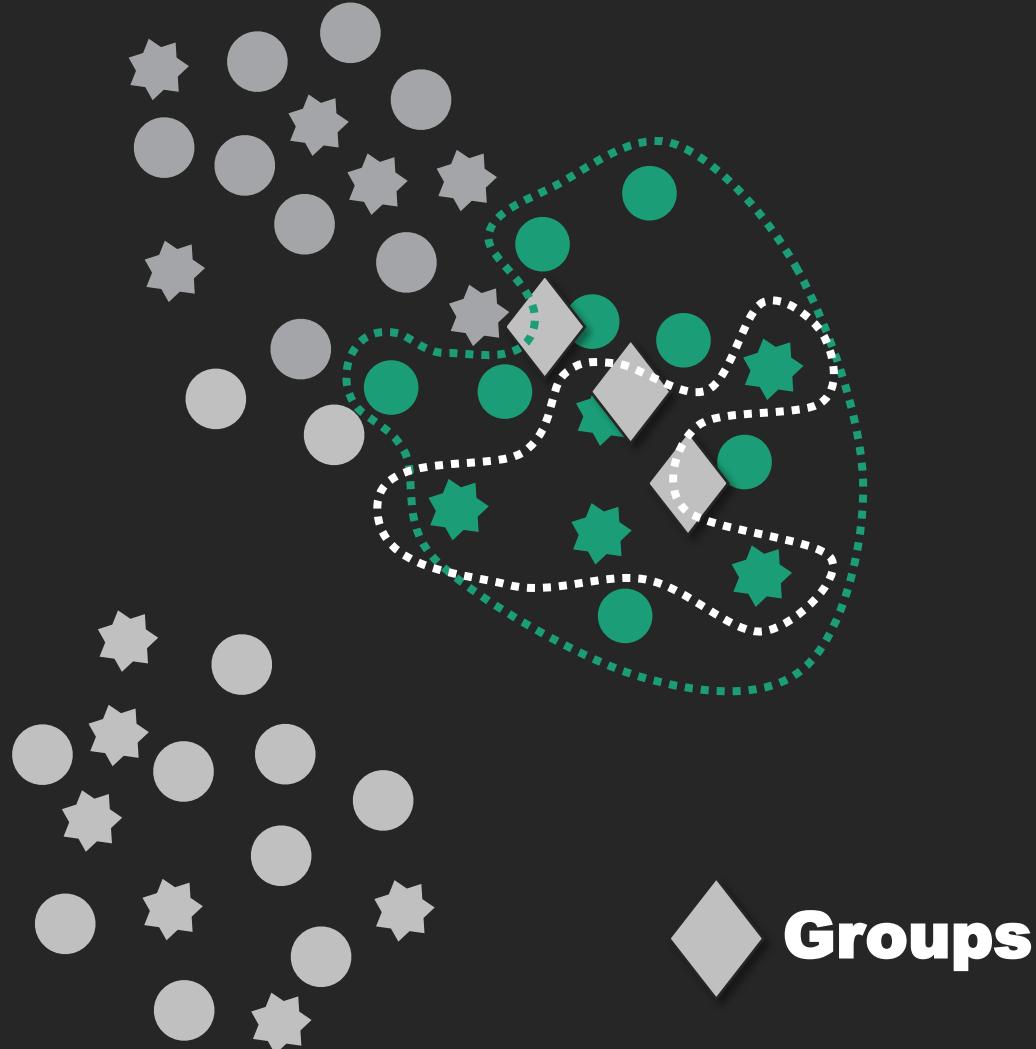
● Pancreatic



Representing Structure



Representing Structure

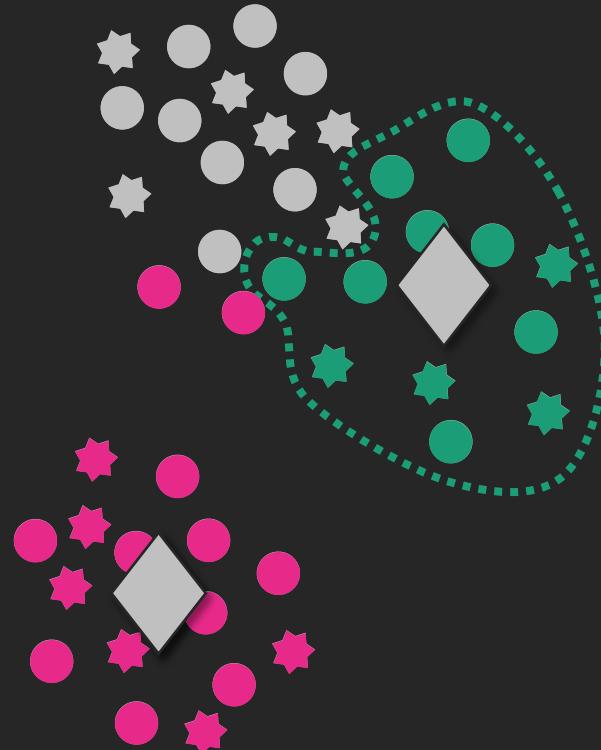


Representing Structure



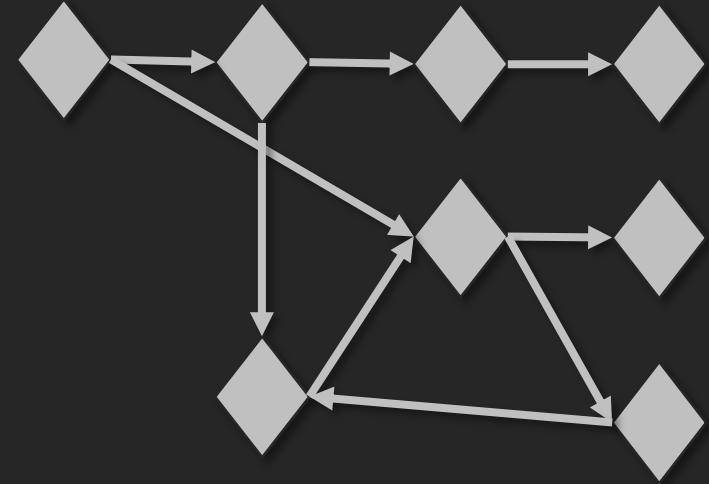
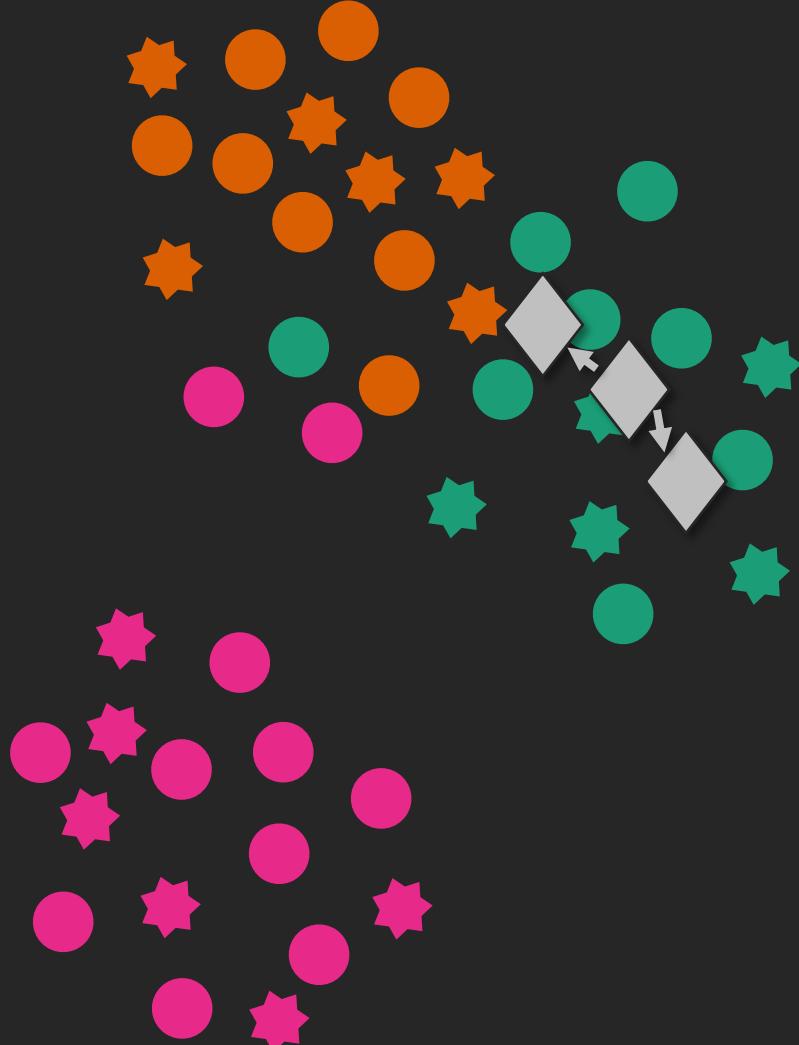
Defining Structure

- Single Items
- Groups
 - By User Selection
 - By Clustering
 - By (Meta-) Data



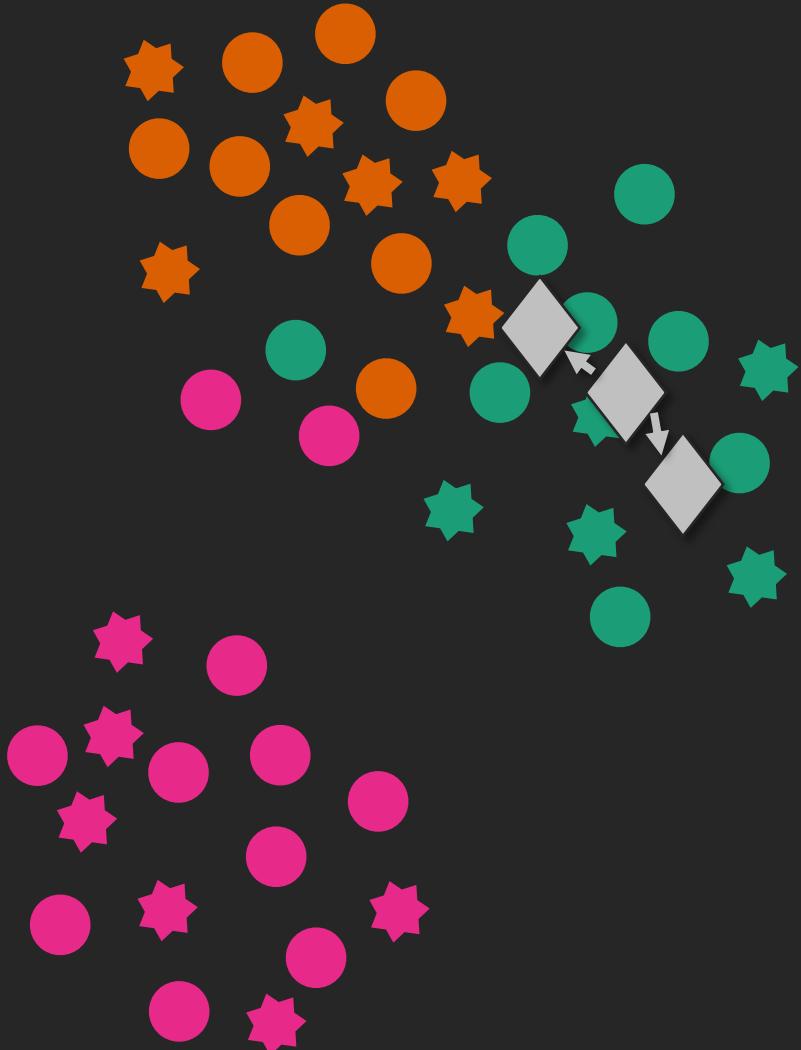
Tumor Type	Age	Expression	Mutation	...
Green	Grey	Grey	Blue	...
Green	Grey	Grey	Blue	...
Green	Grey	Grey	Orange	...
Pink	Grey	Grey	Orange	...
Pink	Grey	Grey	Blue	...
Pink	Grey	Grey	Orange	...

Representing Relationships: Group→Group



- Hierarchies
- Graphs

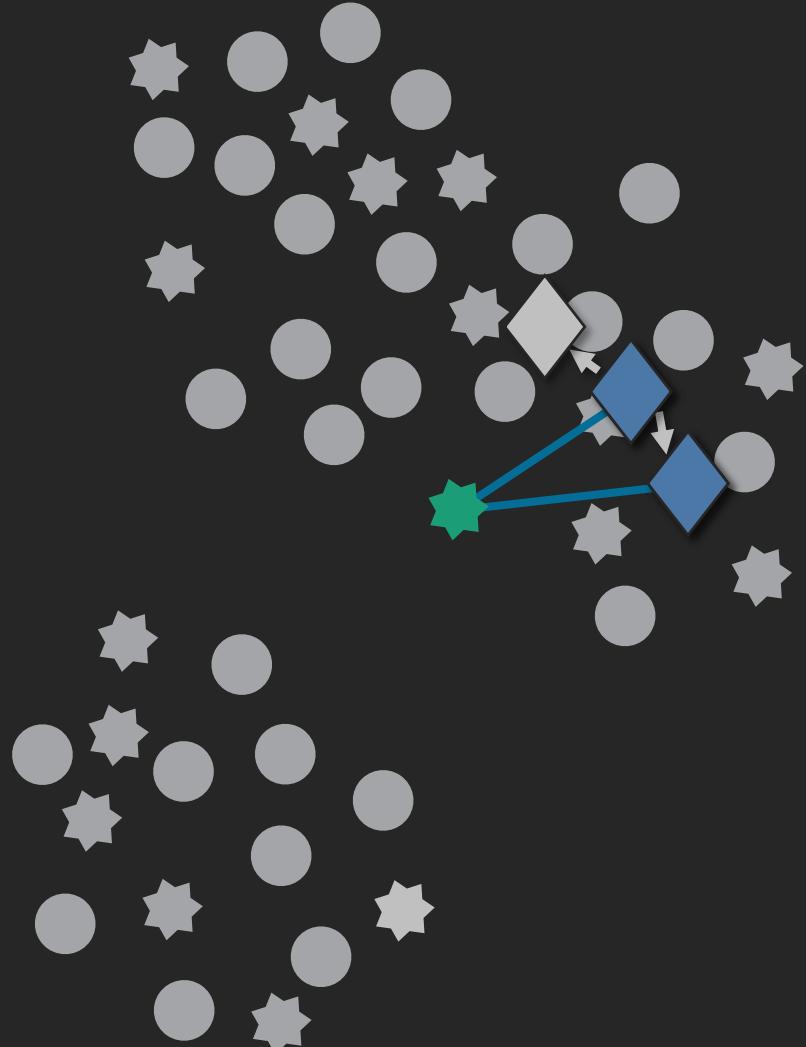
Representing Relationships: Item→Group



Representing Relationships: Item→Group



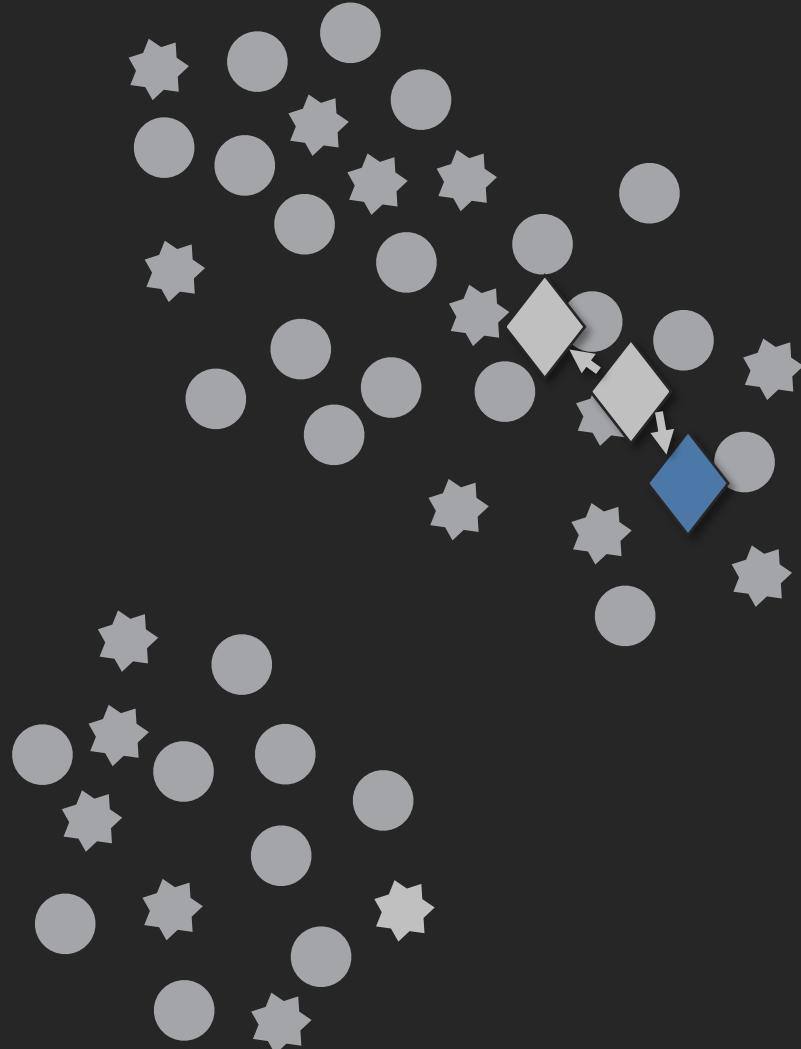
Representing Relationships: Item→Group



Selected points are connected with their groups' centroids.

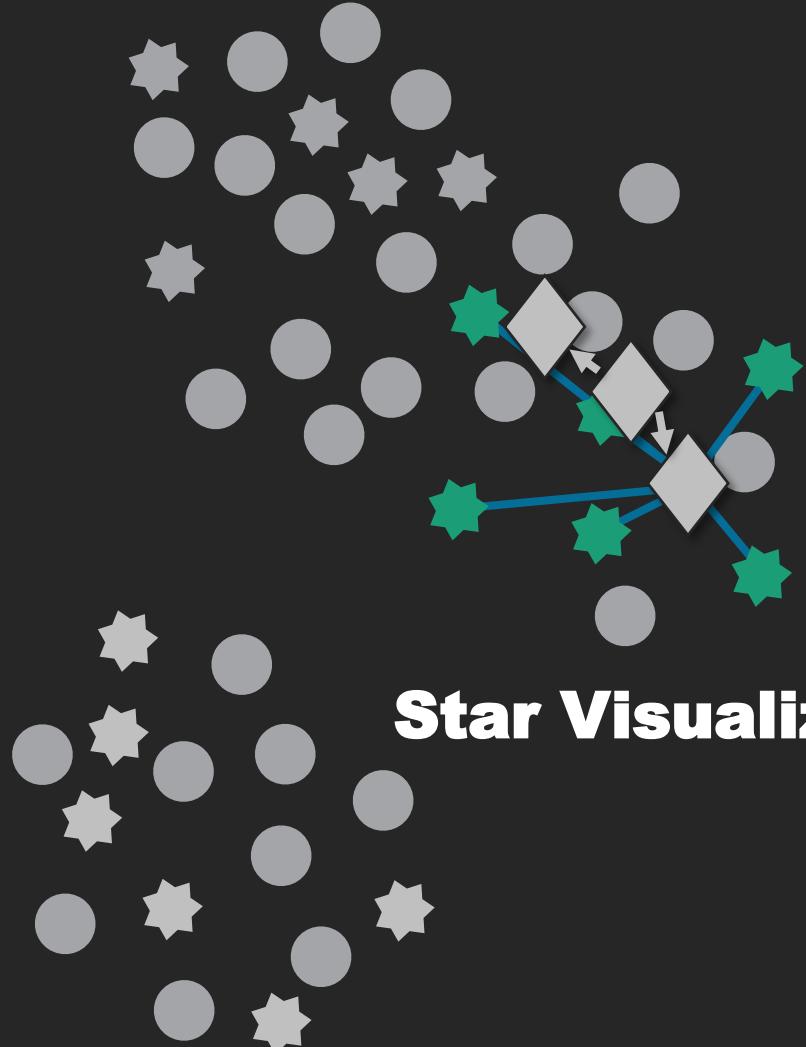
Representing Relationships:

Group→Item

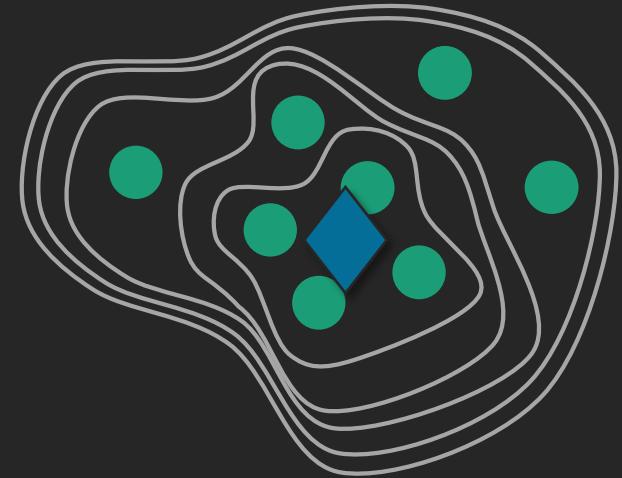


Representing Relationships:

Group→Item

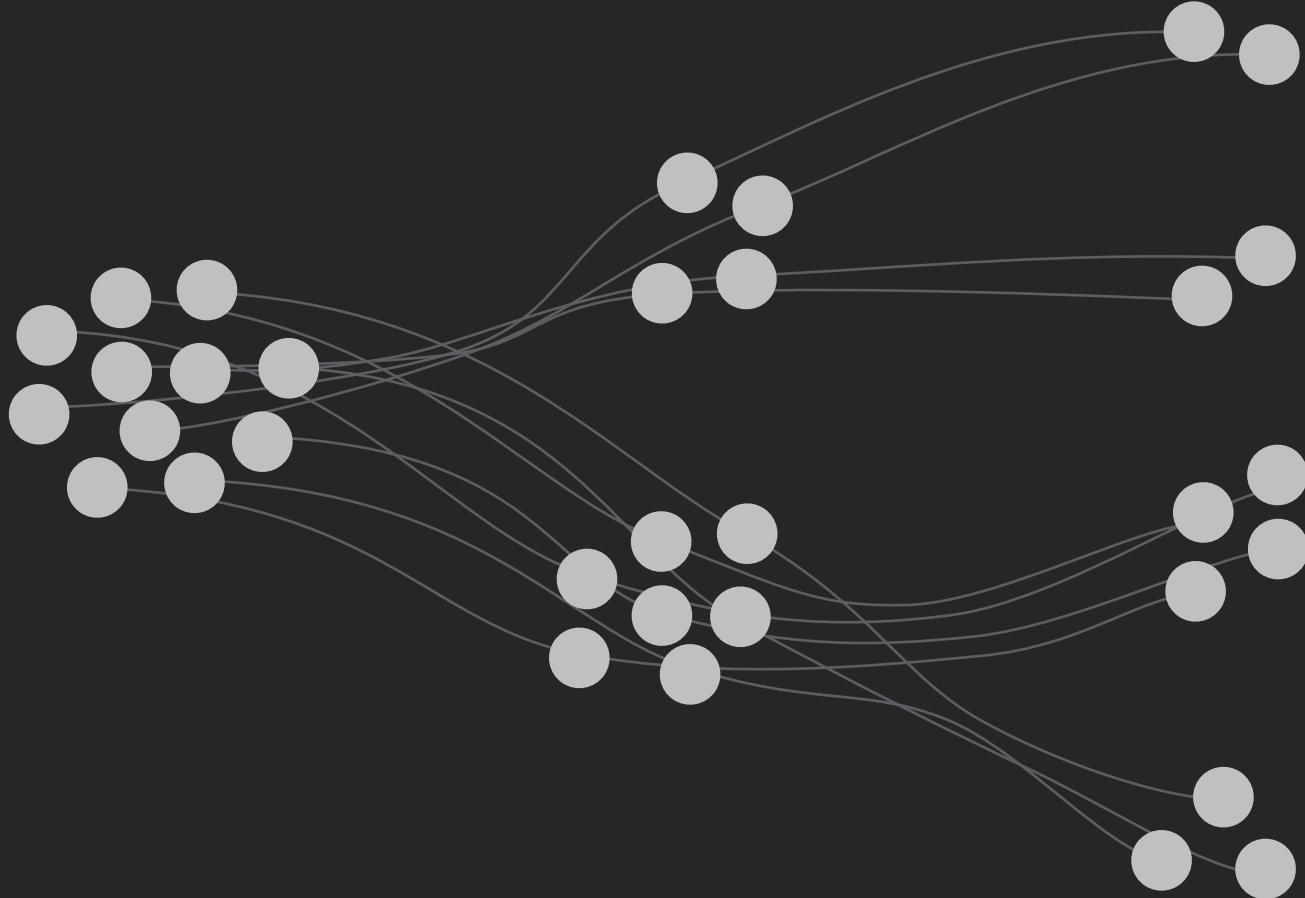


Star Visualization



Contour Plot

Representing Relationships: Item Sequences

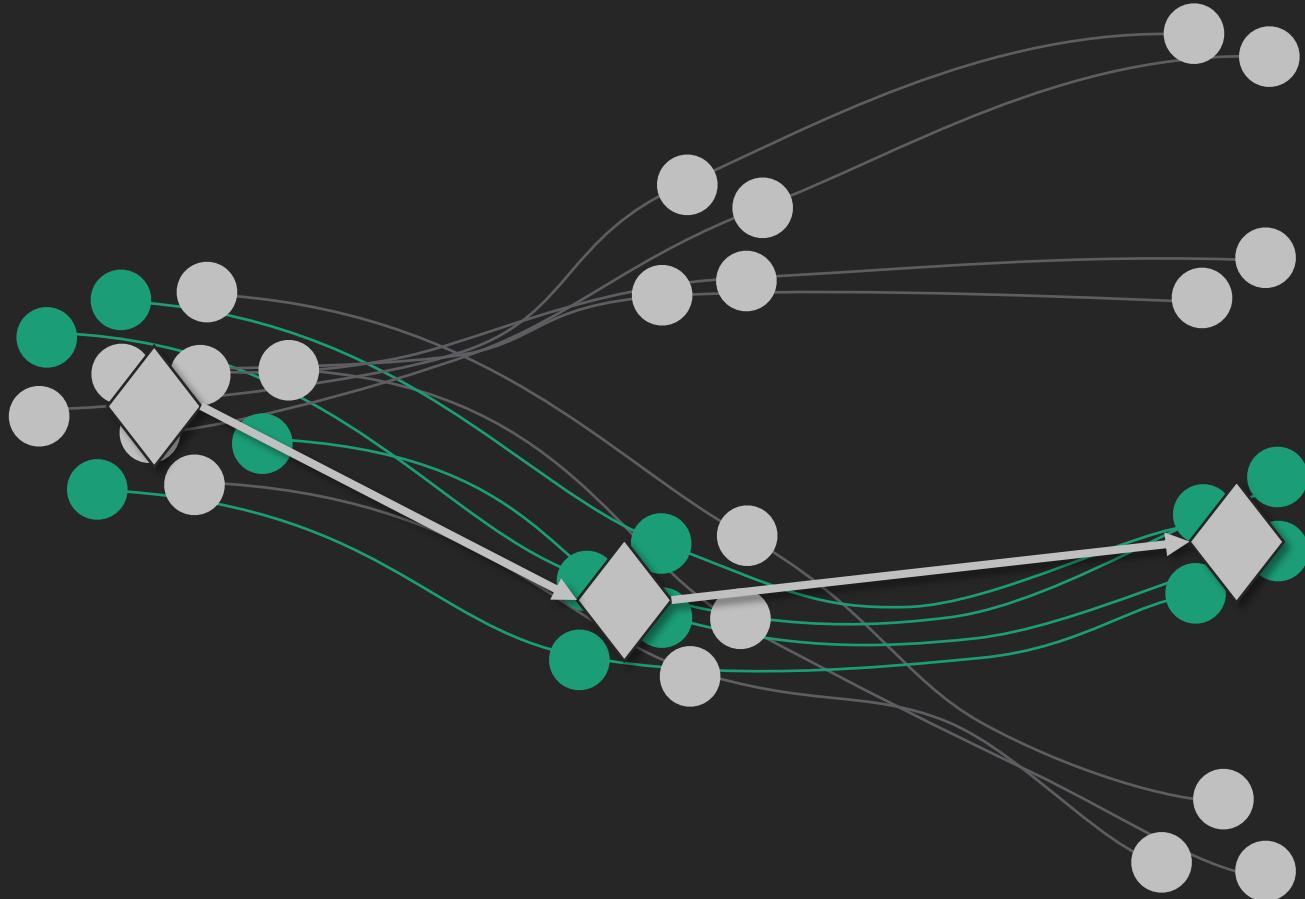


Regimen 1

Regimen 2

Regimen 3

Representing Relationships: Group Sequences

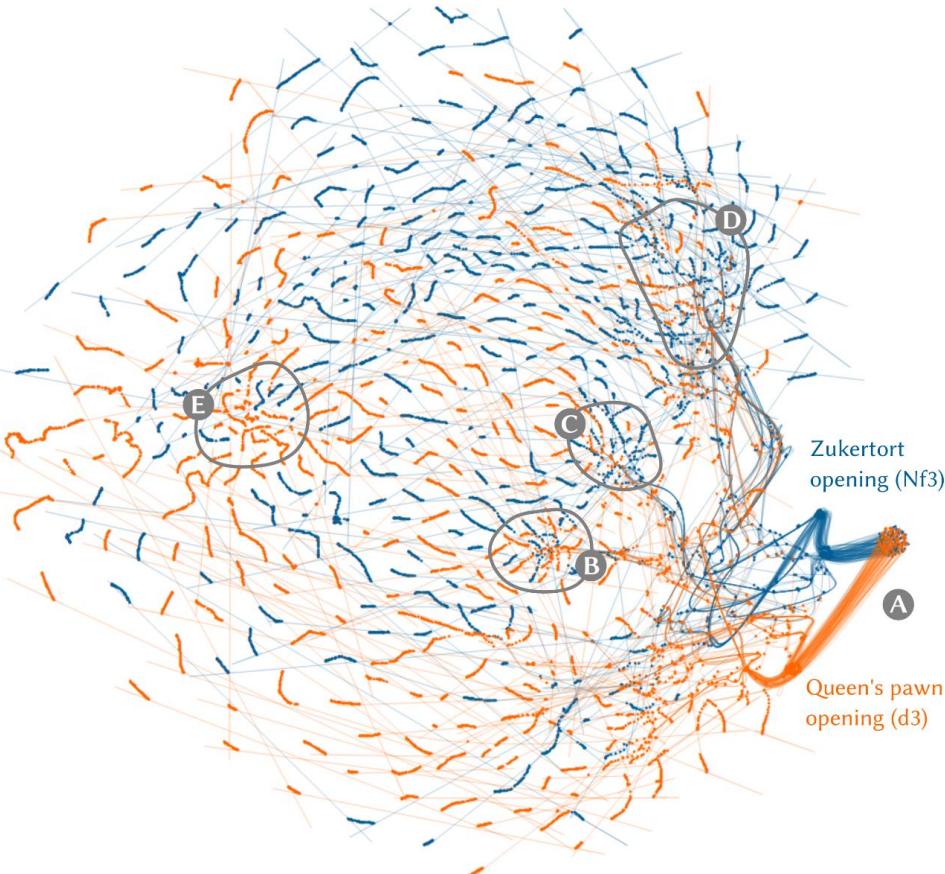


Regimen 1

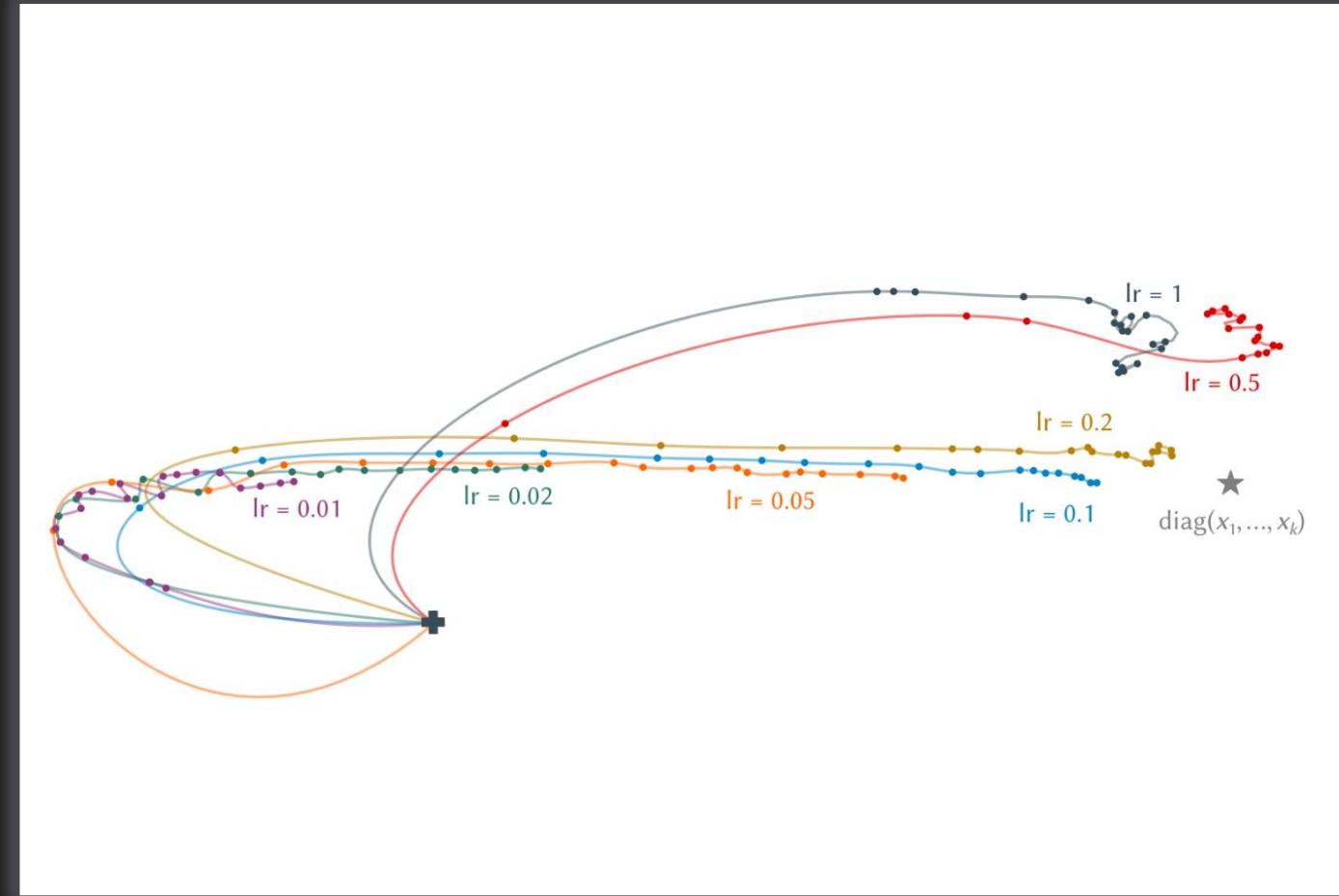
Regimen 2

Regimen 3

Sequential Data



Chess

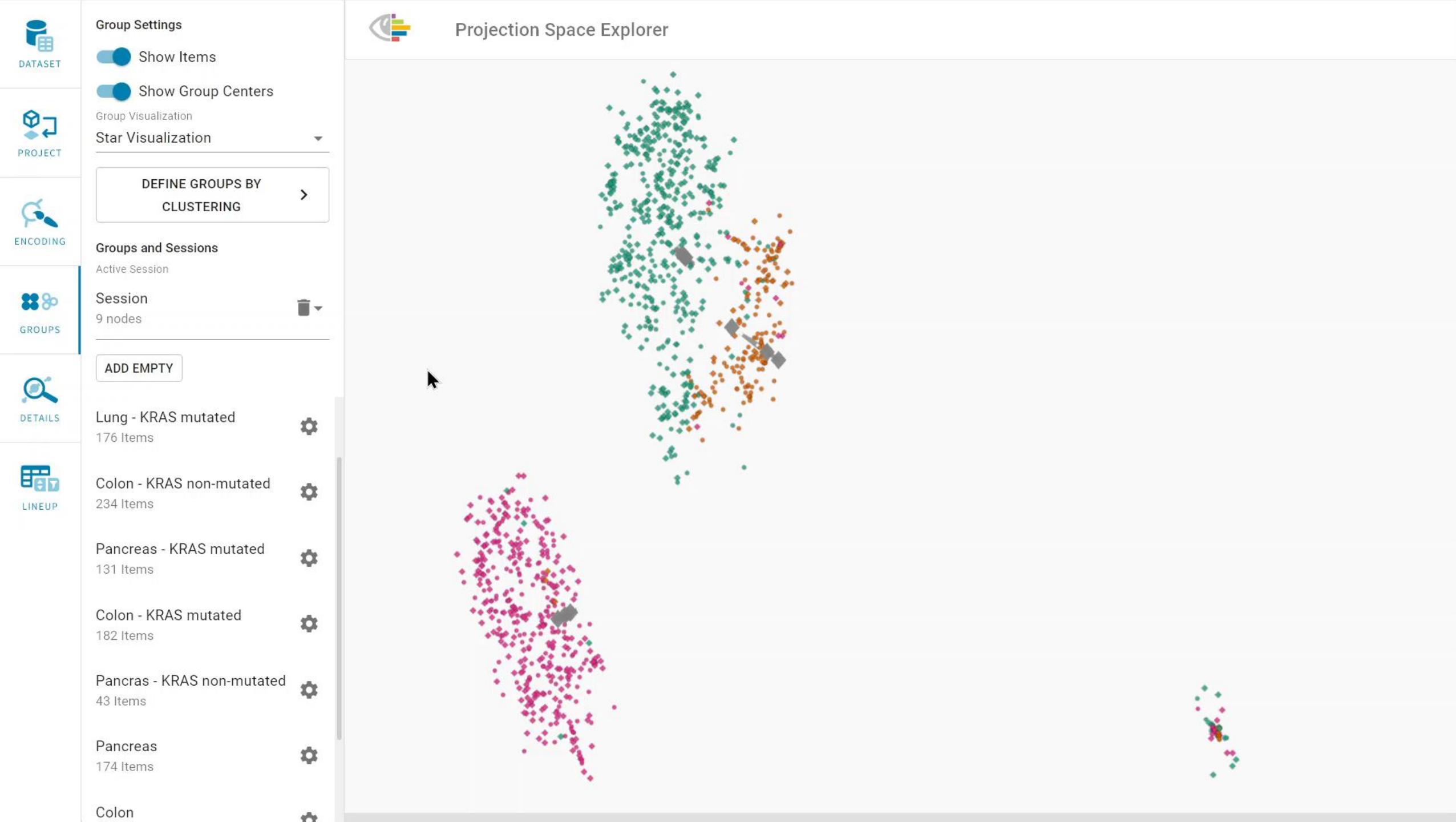


Neural Networks

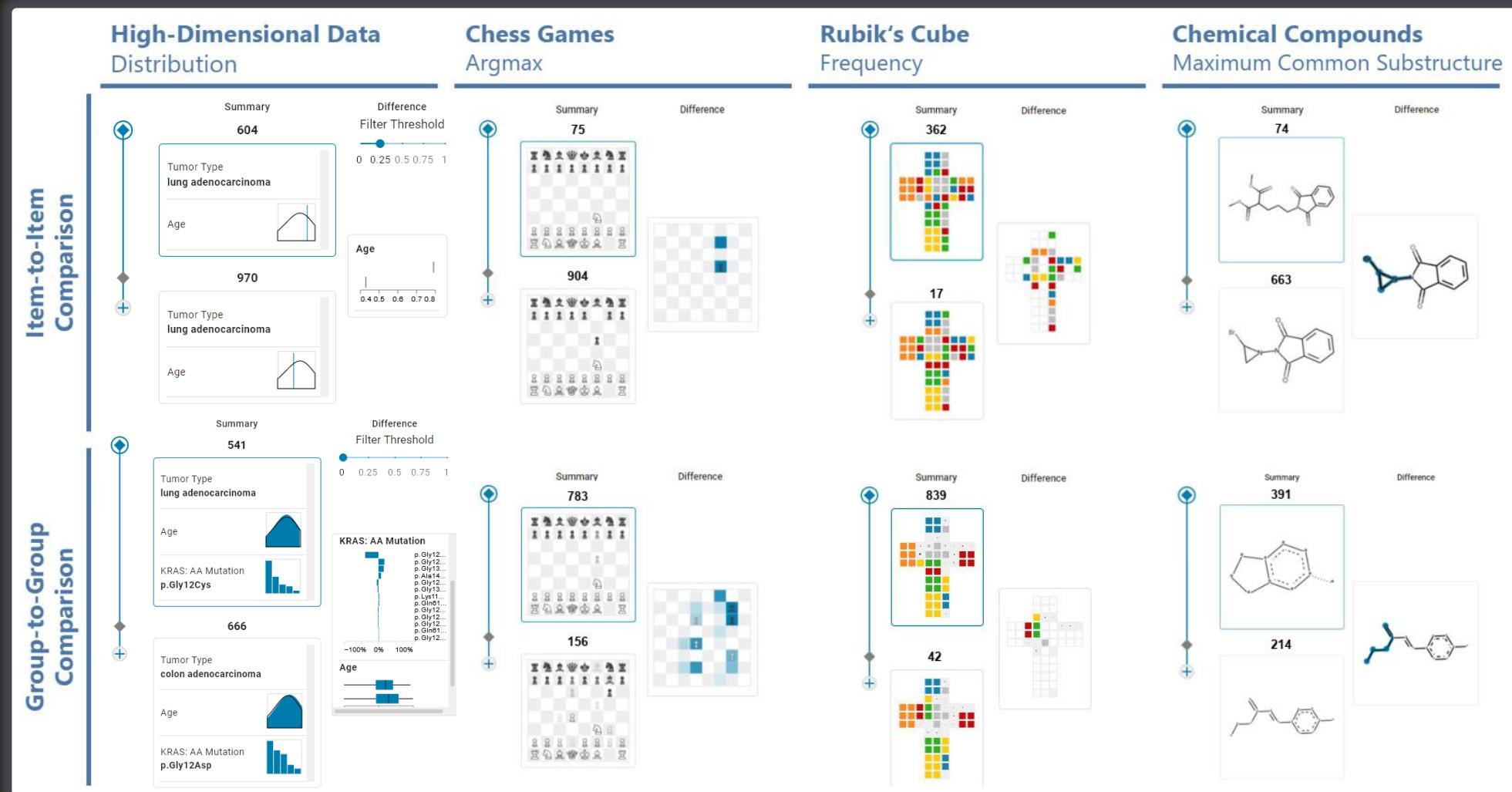
A. Hinterreiter, C. Steinparz, M. Schöfl, H. Stitz, and M. Streit, "Projection Path Explorer: Exploring Visual Patterns in Projected Decision-Making Paths," ACM Transactions on Interactive Intelligent Systems, vol. 11, no. 3–4, p. Article 22, 2021.

Visual Exploration of **Relationships** and **Structure** in Low-Dimensional Embeddings

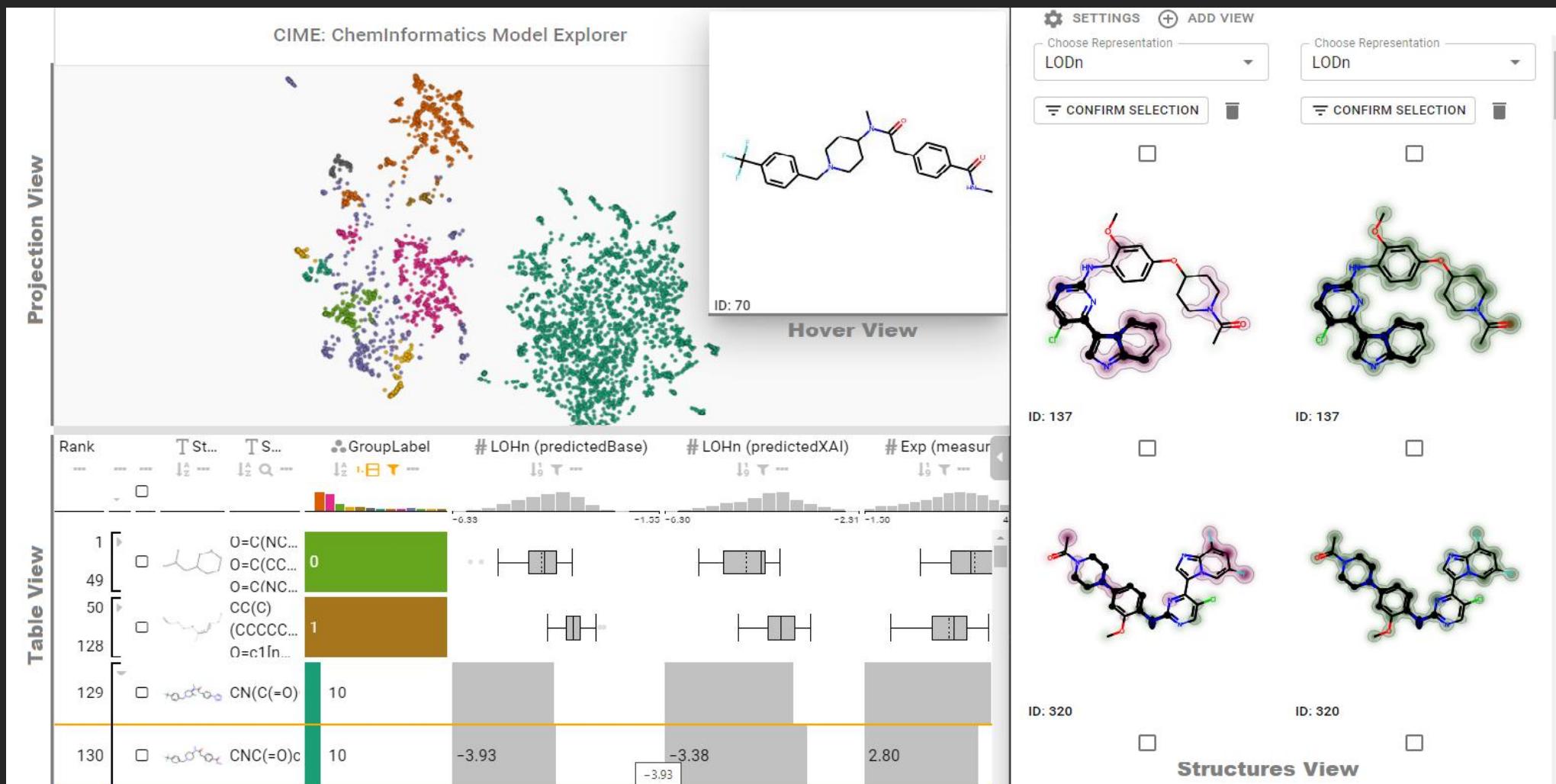




Summary and Difference Visualizations

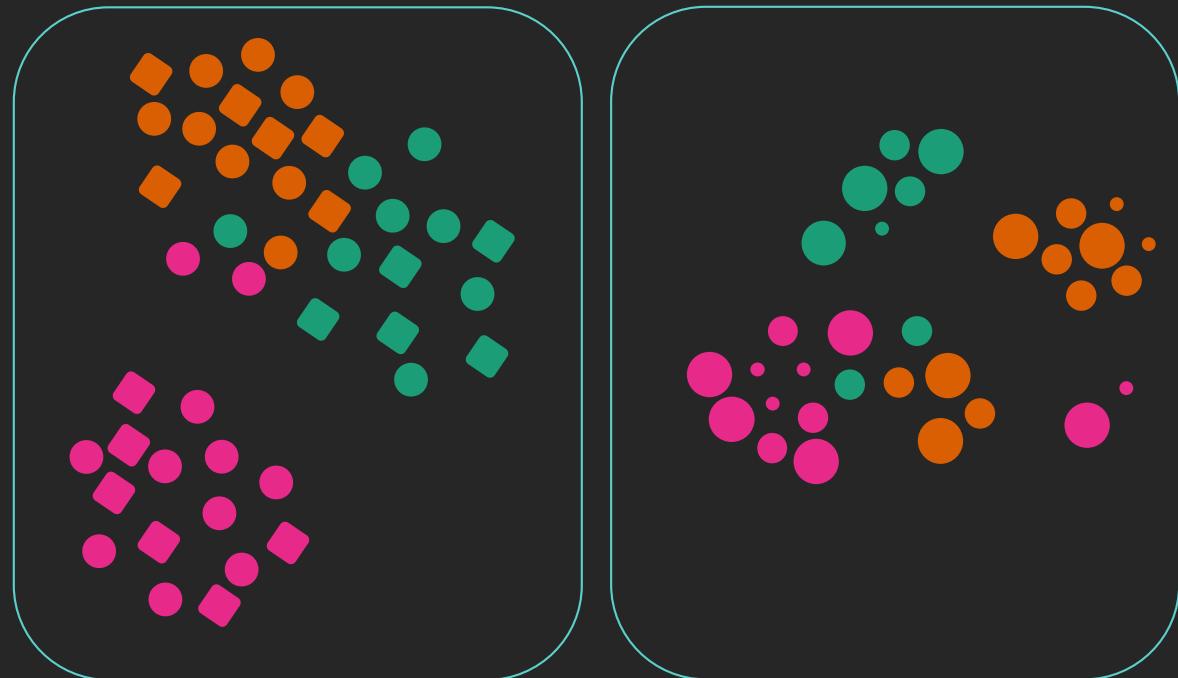


Chemical Data



Ongoing & Future Work

Comparing Embeddings



Comparison by Attribute Combinations

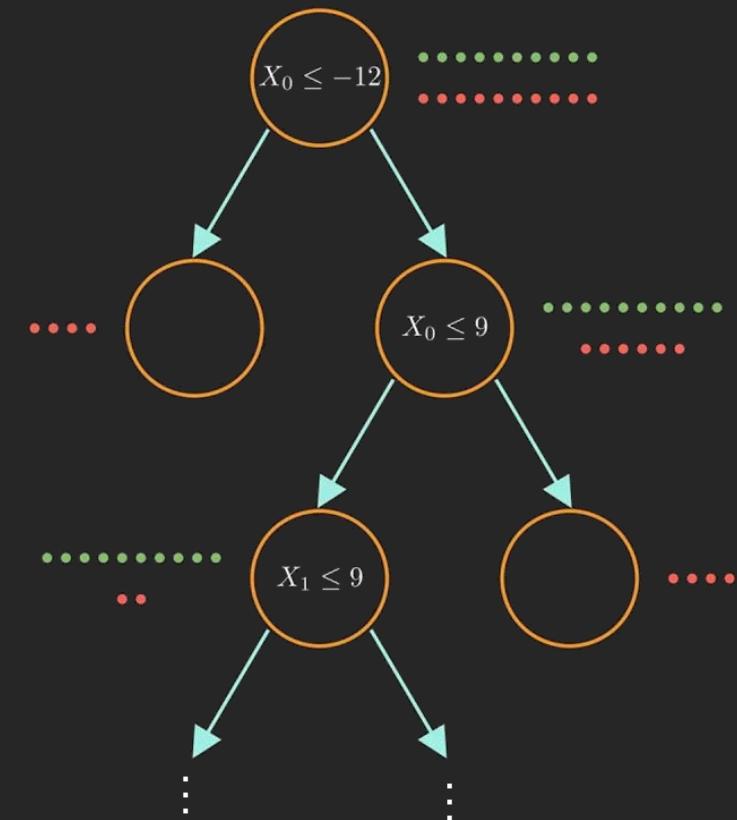
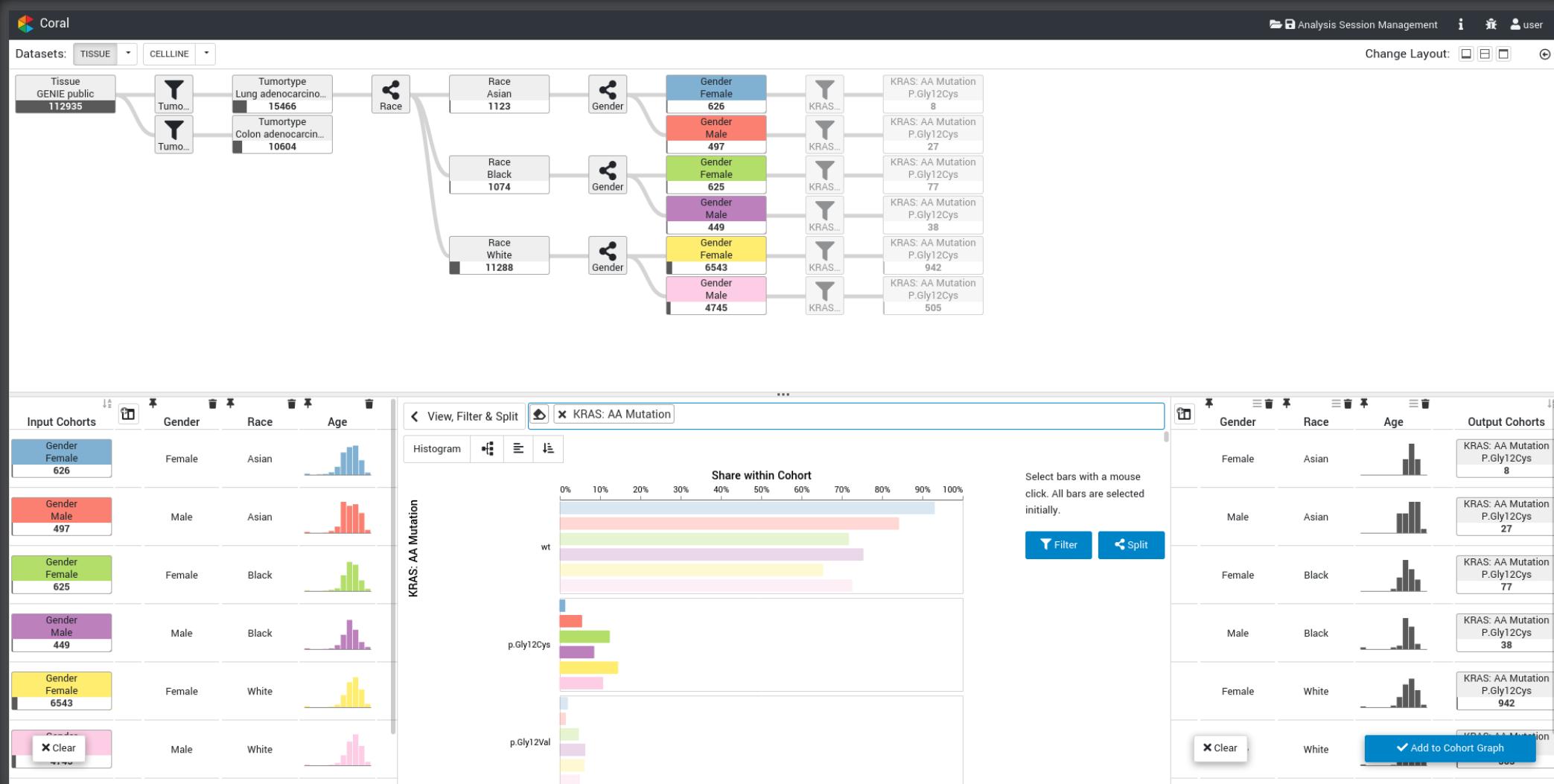


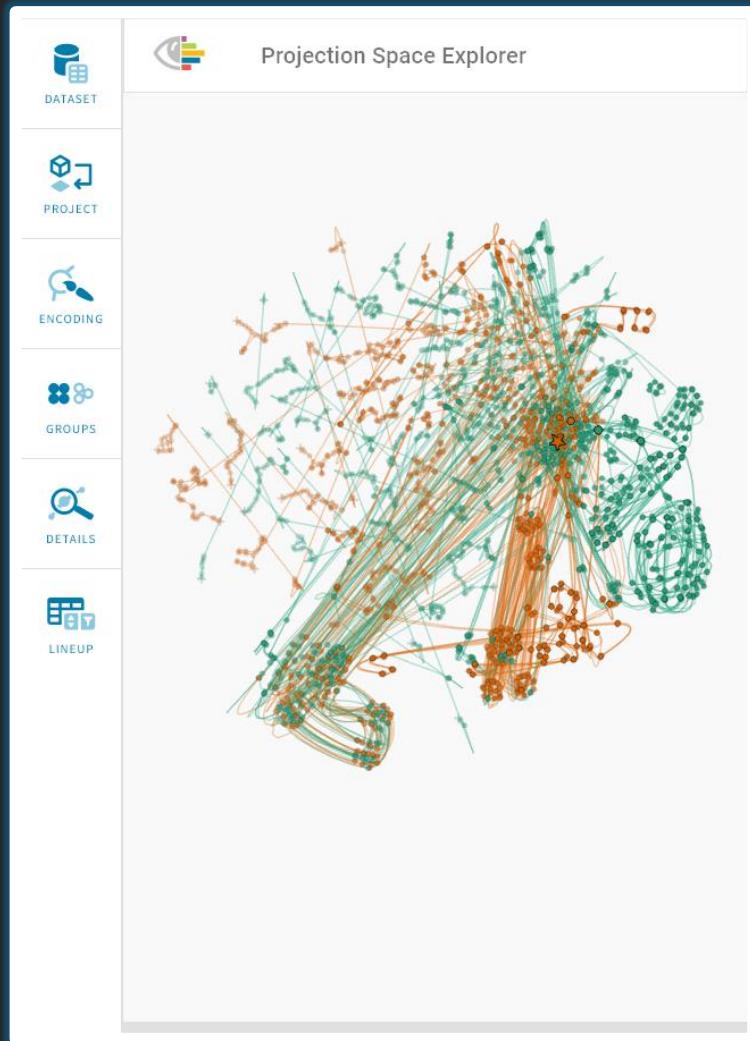
Image source: <https://www.youtube.com/watch?v=ZVR2Way4nwQ>

Ongoing & Future Work: Integration in Coral



P. Adelberger, K. Eckelt, M. J. Bauer, M. Streit, C. Haslinger, and T. Zichner, "Coral: a web-based visual analysis tool for creating and characterizing cohorts," Bioinformatics, vol. 37, no. 23, pp. 4559–4561, Dec. 2021

Online Tool



Overview

The landing page for the 'Projection Space Explorer'. It features the JKU Visual Data Science Lab logo at the top. Below it is a large heading 'Projection Space Explorer'. A descriptive paragraph explains the tool's purpose: 'The Projection Space Explorer visualization prototype is an interactive approach for the exploration and formation of structural relationships in embeddings of high-dimensional data.' Three buttons are present: 'Start Application' (blue), 'Datasets' (orange), and 'Video' (red). A preview image of the application interface shows a network graph. At the bottom, the text 'How it works' is displayed.

Library

A screenshot of a GitHub repository page for 'jkku-vds-lab / projection-space-explorer'. The repository is public, has 32 stars, and 0 forks. It includes sections for 'Code', 'Issues' (9), 'Pull requests' (8), 'Actions', 'Projects', and a 'develop' branch. A commit history shows a recent update by Moritz Heckmann. The README.md file is linked, and a section titled 'Controls' provides instructions for using the tool.

<https://jku-vds-lab.at/pse>

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JKU
Visual Data
Science Lab

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Boehringer
Ingelheim



Pro²Future



FWF

Der Wissenschaftsfonds.

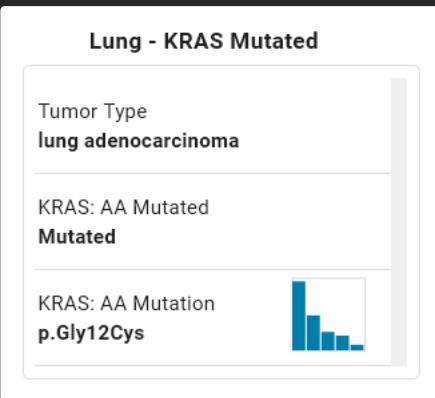
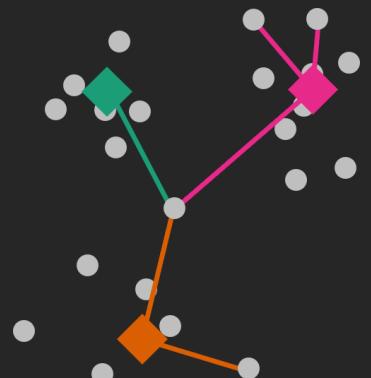
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10.1109/TVCG.2022.3156760

<https://jku-vds-lab.at/biovis22-eckelt>