

Spatial Neighborhood Analysis and Comparison for Nanoscale Brain Structures

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Motivation

- Neurobiologists acquire vast amounts of high-resolution **image data of the mammalian brain**
- This data lets experts tackle questions regarding brain physiology, diseases, and the emergence of consciousness
- Experts need visualization tools** enabling them to analyze imaging data efficiently to **translate data into knowledge**
- Most existing visualization tools focus on nerve cell connectivity analysis, whereas experts are also interested in **analyzing spatial neighborhoods in brain tissue**

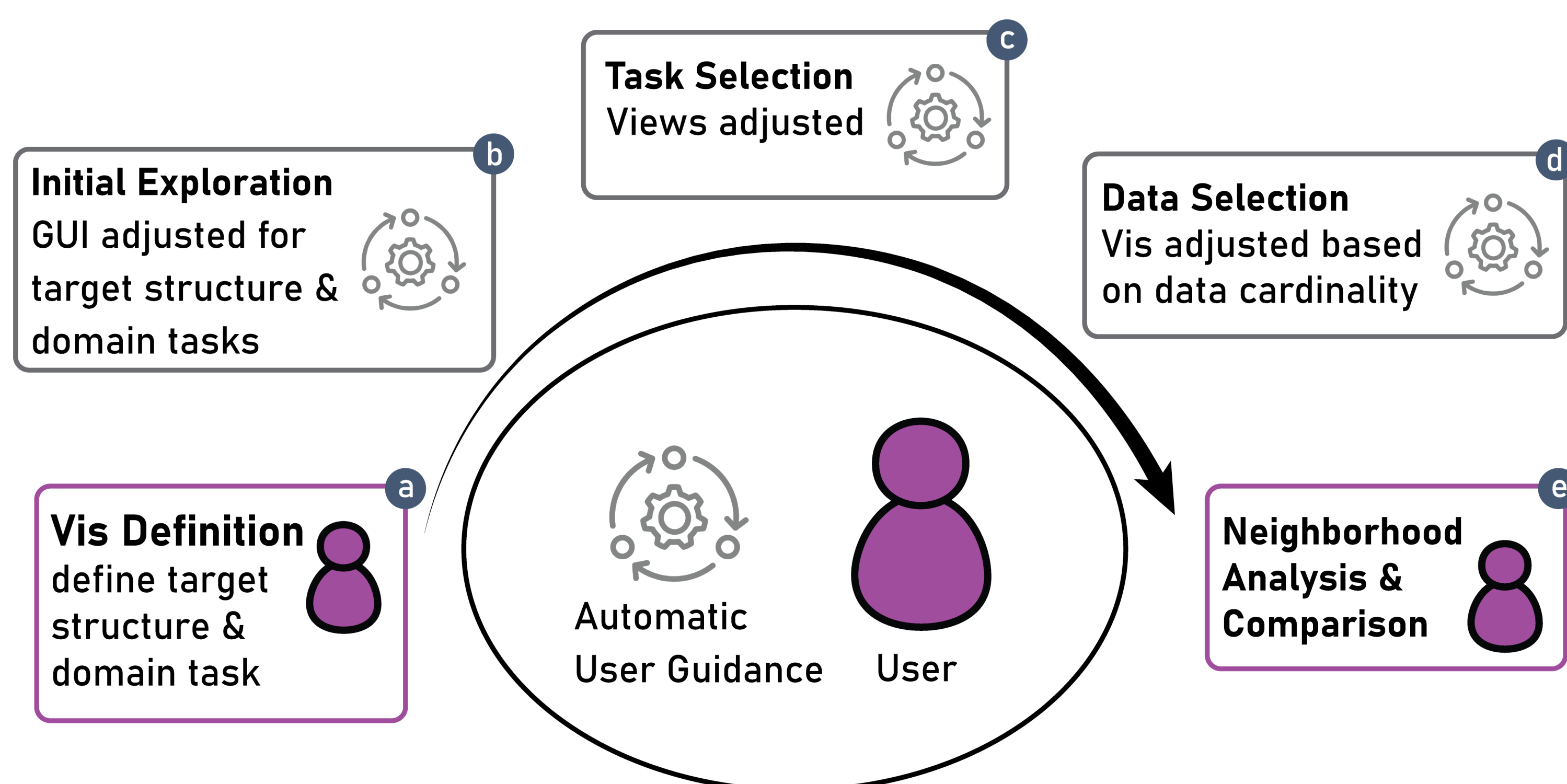
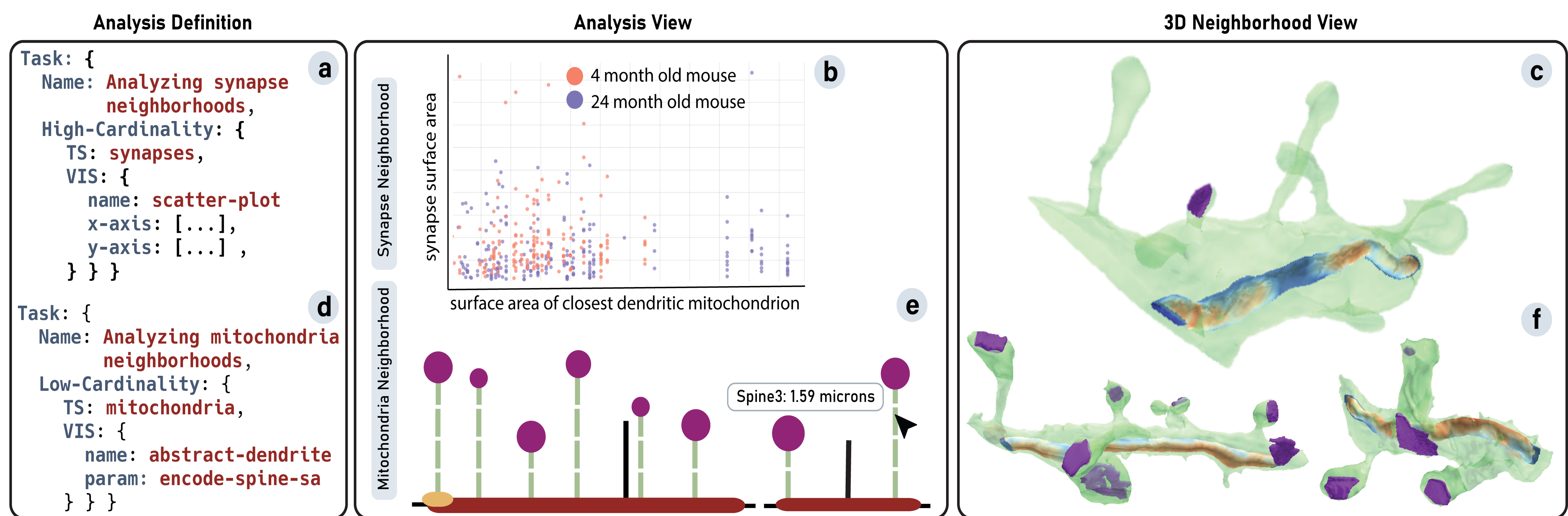
Contribution

We propose **NeuroKit**, a **toolkit for analyzing and comparing spatial neighborhoods of brain tissue**. Our approach focuses on three contributions:

- We propose a **customizable framework for spatial neighborhood analysis** of 3DEM data
- NeuroKit supports a **scalable visual comparison** approach for spatial neighborhoods allowing the comparison of a wide range of element cardinalities
- We present a **custom analysis scenario** studying mitochondria in neuronal tissue

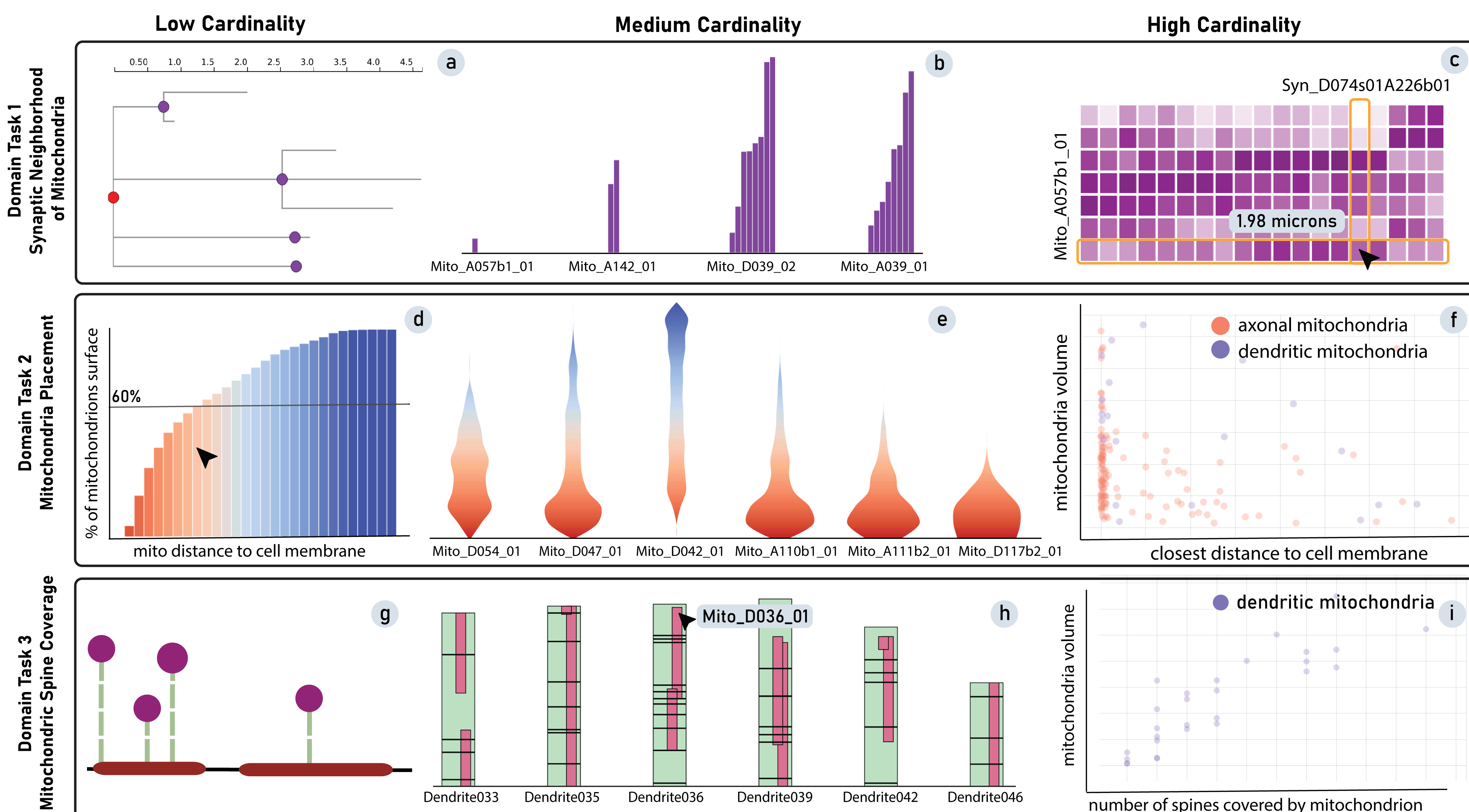
Approach

- Specify an **analysis definition** (a, b) in the JSON file format
- Analyze neighborhoods in the **quantitative analysis views** (b, e)
- Gain detailed insight into the **3D neighborhood views** (c, f)



Workflow

- First, the user **specifies a comparison target** structure and a **domain task** (a)
- Based on this input, NeuroKit automatically guides the user during the exploration by adjusting the UI (b), adapting the visualization to the domain task, and the data cardinality (c, d)
- Thereby, **NeuroKit facilitates the analysis and comparison of spatial neighborhoods** by providing a highly flexible and easy to use framework (e)



Mitochondria Analysis Scenario

- Mitochondria are responsible for **providing energy to the nerve cell**
- We used NeuroKit to **specify three domain tasks** to analyze their spatial neighborhood (see rows)
- Each domain task supports **visual comparison at three cardinalities** (see columns)
- NeuroKit **automatically adjusts the cardinality level** based on the number of spatial neighborhoods that are being compared