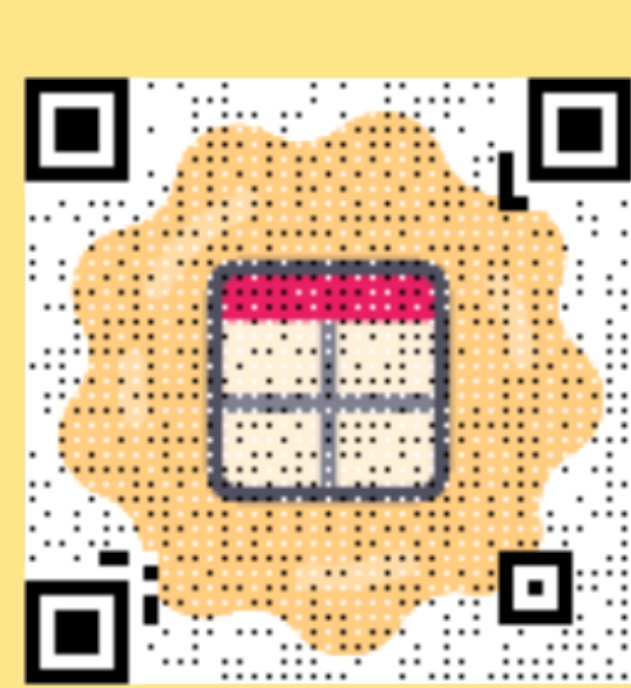


CytoTable: High Performance and Scalable Single-cell Morphology Feature Engineering

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Introduction

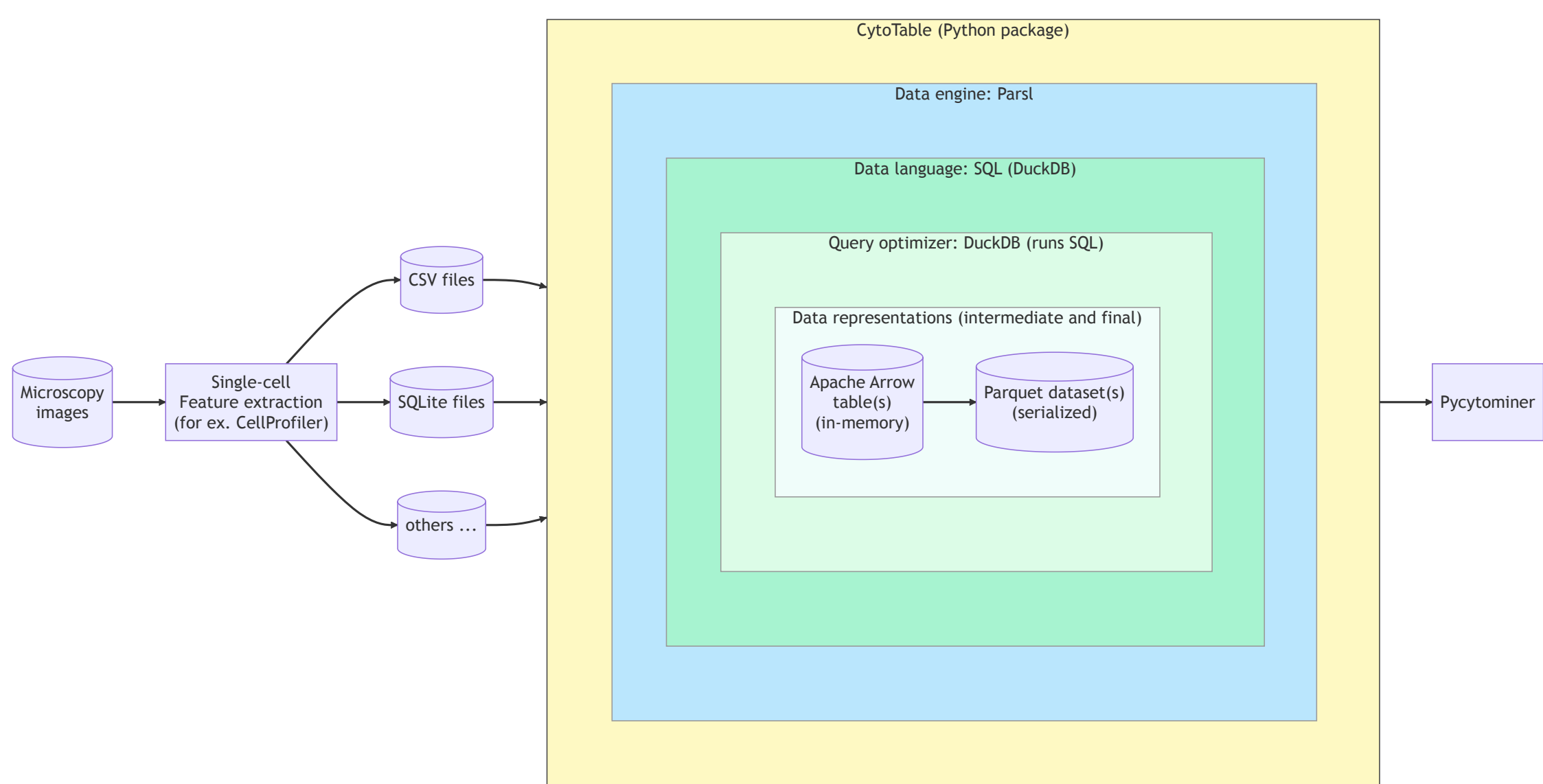


Figure 1. Diagram showing high-dimensional single-cell morphology data flow with relationship to CytoTable modular data stack components.

We are solving significant scalability and replicability challenges with high-dimensional single-cell morphology data (such as those extracted from CellProfiler[1]) by implementing novel and effective capabilities as a modular, portable, and cross-language single-cell data stack[2]: (a) language frontend: SQL (DuckDB[3]), (b) intermediate representation: Apache Arrow[4] and Apache Parquet[5], (c) query optimizer: DuckDB[3], (d) execution engine: Parsl[6] with Pythonic MapReduce design patterns[7], (e) execution runtime, Python package (PyPI, source)(Figure 1).

Morphology Feature Data Scalability

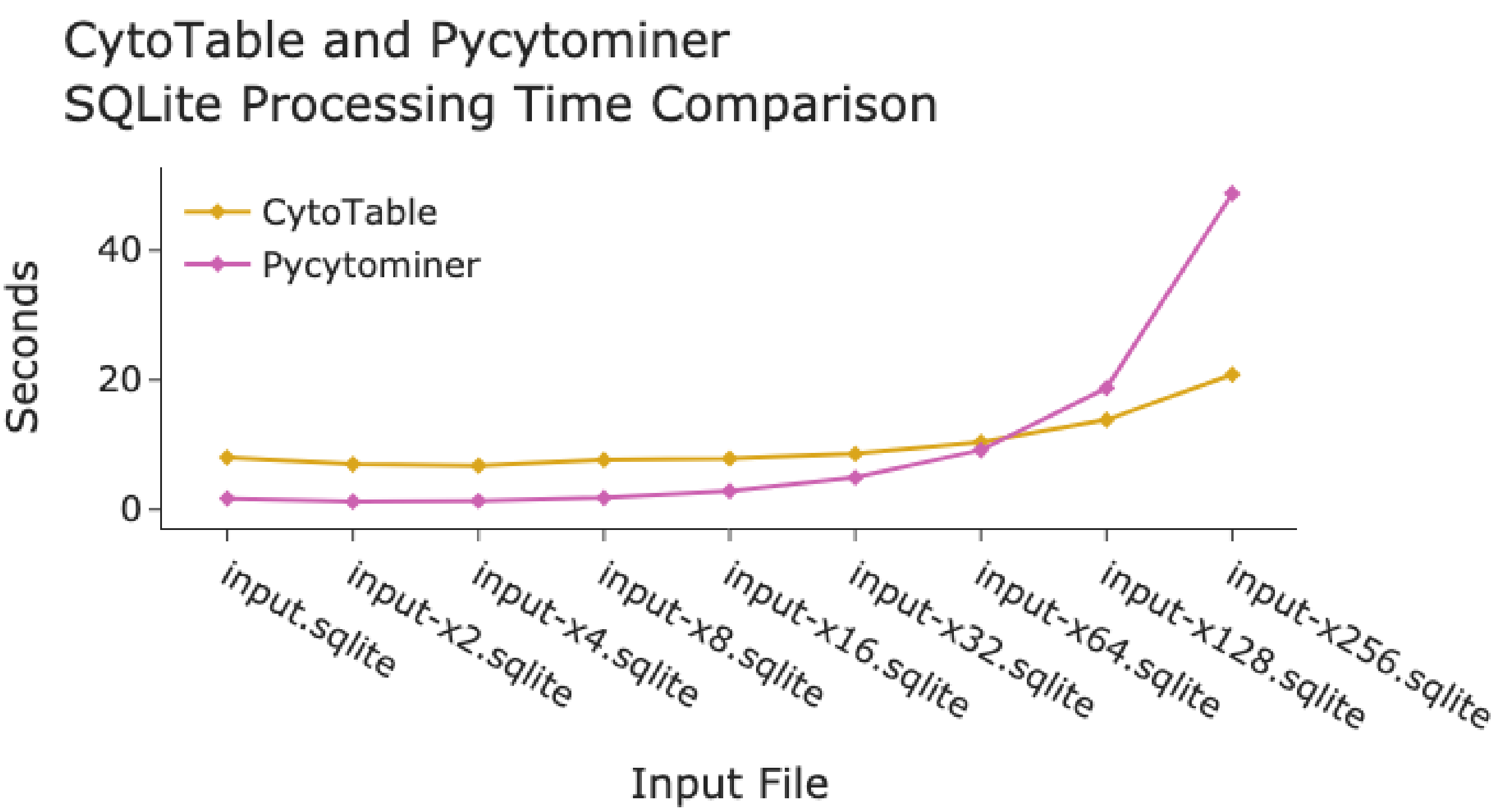


Figure 2. Plot showing processing time duration for CytoTable and Pycytominer for various datasets.

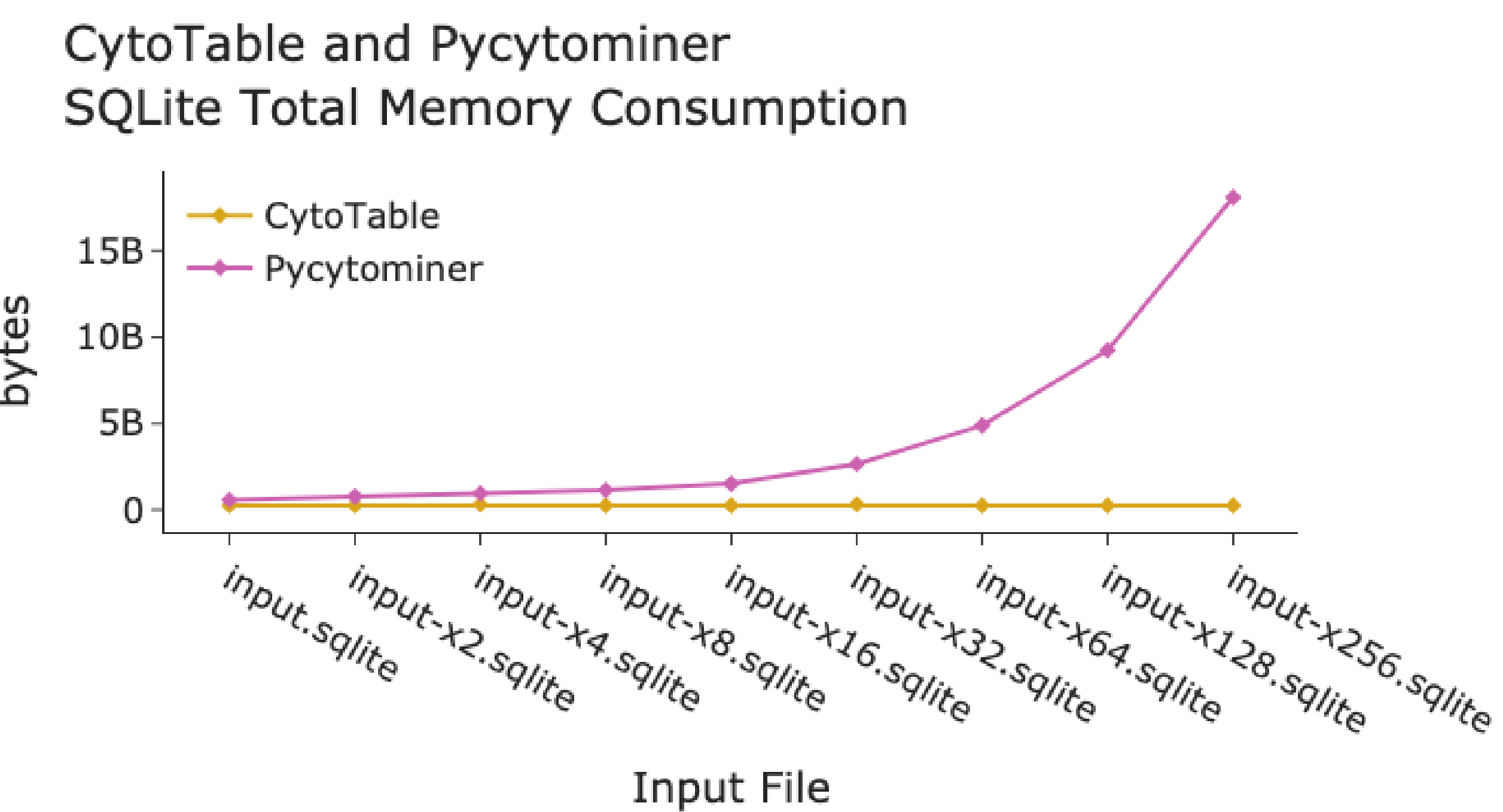


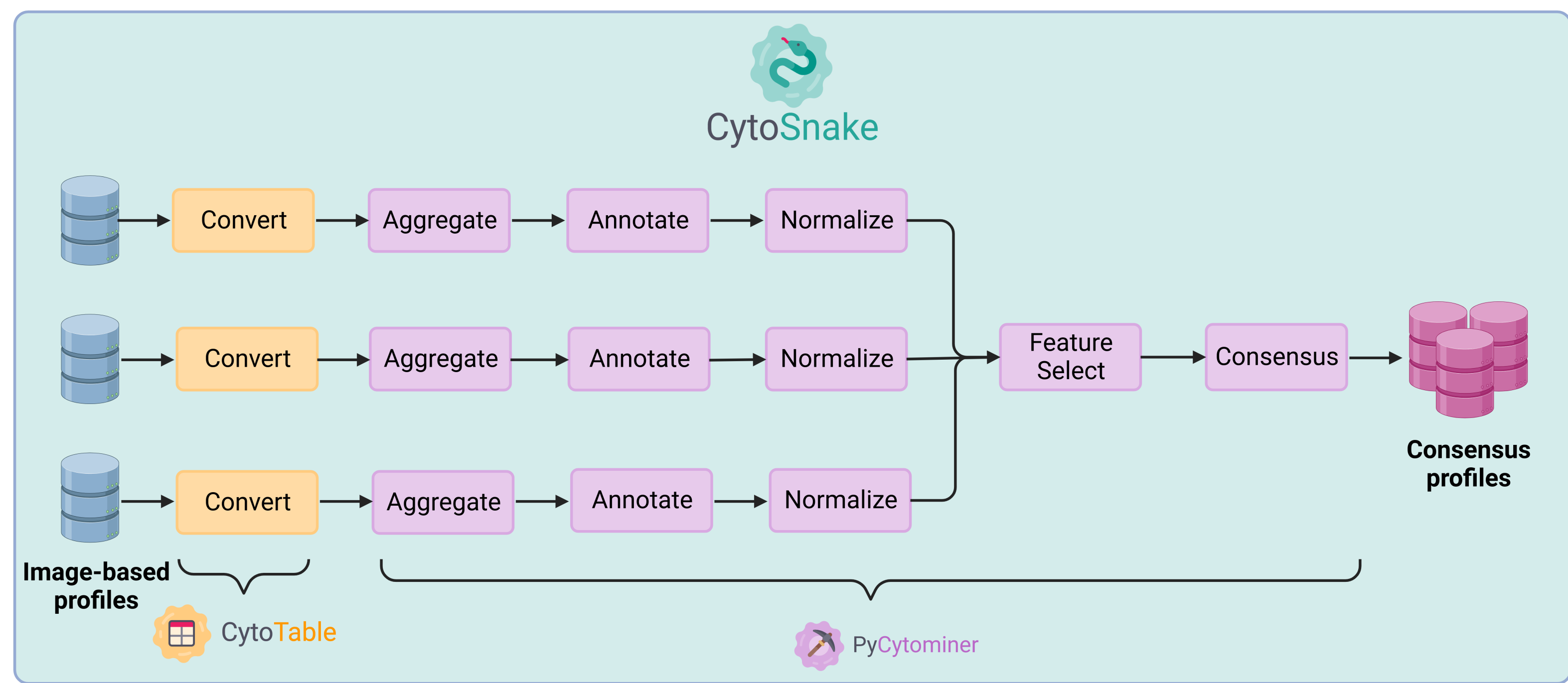
Figure 3. Plot showing total memory consumption for CytoTable and Pycytominer for various datasets.

CytoTable builds upon the shoulders of Pycytominer, helping to streamline the `SingleCells.merge_single_cells(...)` method. We decrease overall processing completion time and memory consumption for large amounts of data by leveraging composable data stack elements.

Empowering the Cytomining Ecosystem

Orchestration: CytoSnake

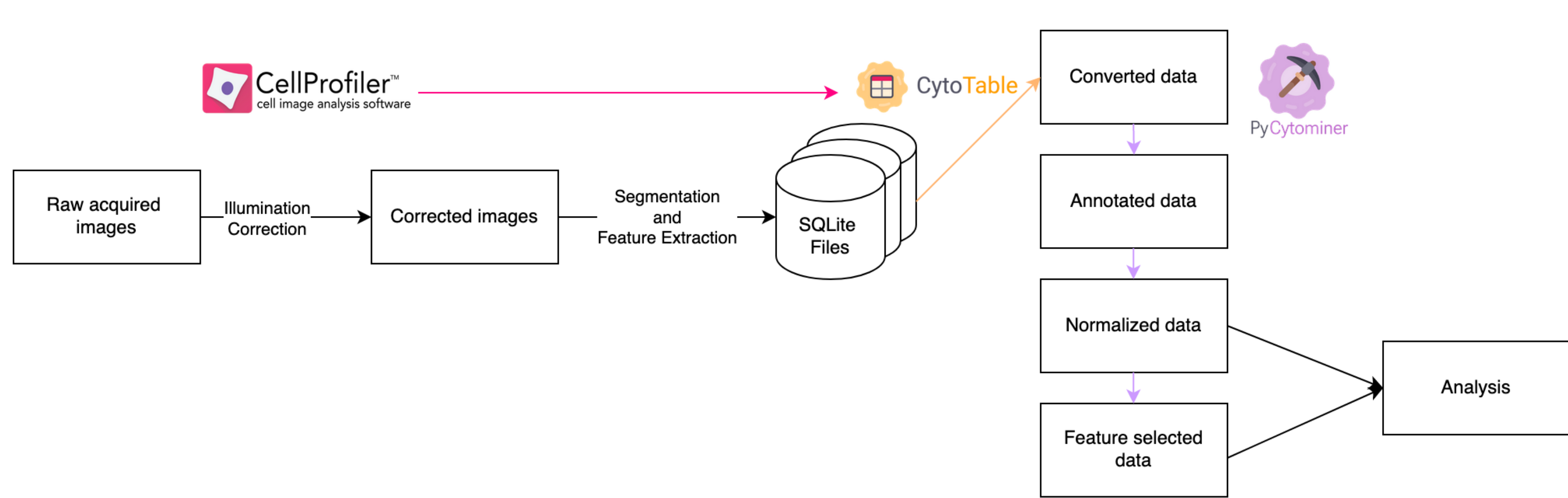
Authors: Erik Serrano, Jenna Tomkinson, Roshan Kern, Vince Rubinetti, Dave Bunten, Gregory P. Way



CytoSnake is an innovative tool for orchestrating high-dimensional cell morphology data processing pipelines, including those which leverage CytoTable and other applied usecases.

Applied research: NF1 Schwann cell analysis

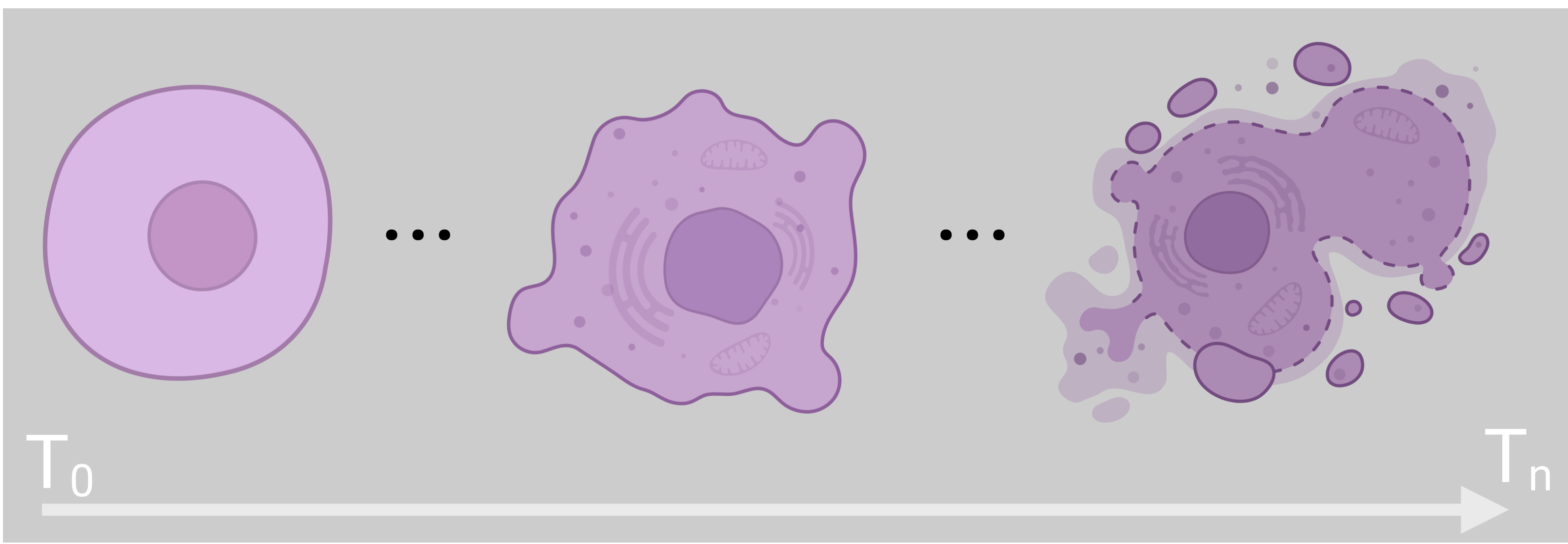
Authors: Jenna Tomkinson, Cameron Mattson, Erik Serrano, Gregory P. Way



Comprehensive dataset analyses for cell painting assays, enabling the further understanding of cellular morphology NF1 Schwann cells and rare disease treatment.

Applied research: Pyroptosis signature project

Authors: Michael J. Lippincott, Jenna Tomkinson, Gregory P. Way



Identifying and characterizing pyroptosis signatures in cellular systems, aiding in the study of inflammatory cell death pathways as part of the Interstellar collaboration.



Applied research: CFReT project

Authors: Jenna Tomkinson, Erik Serrano, Gregory P. Way

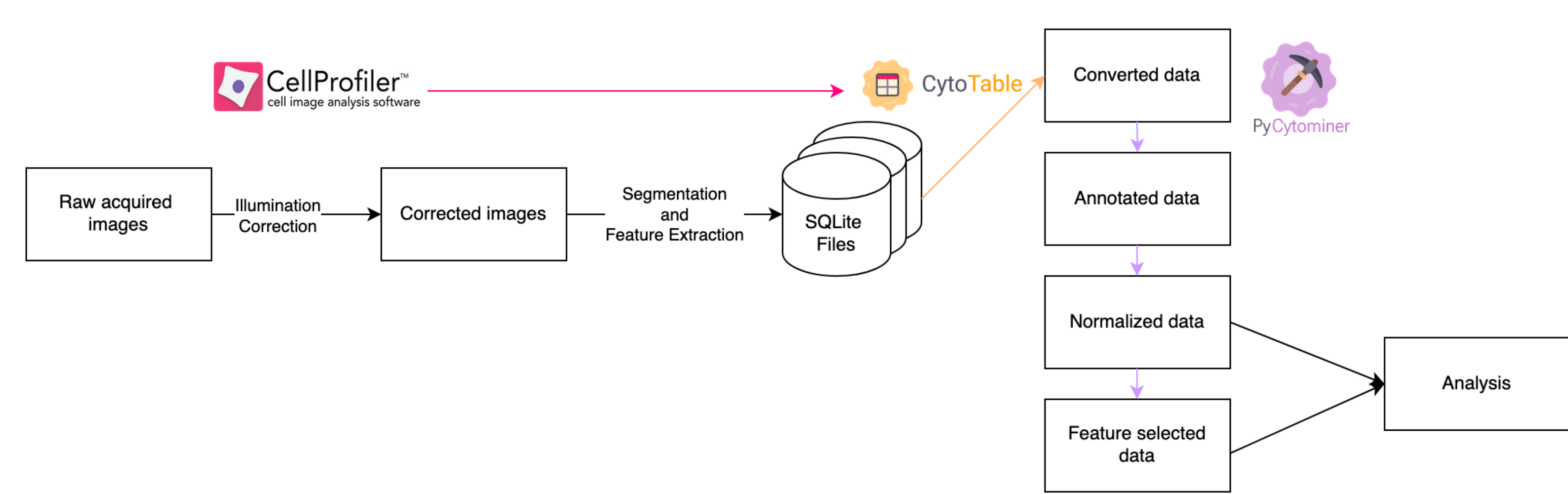
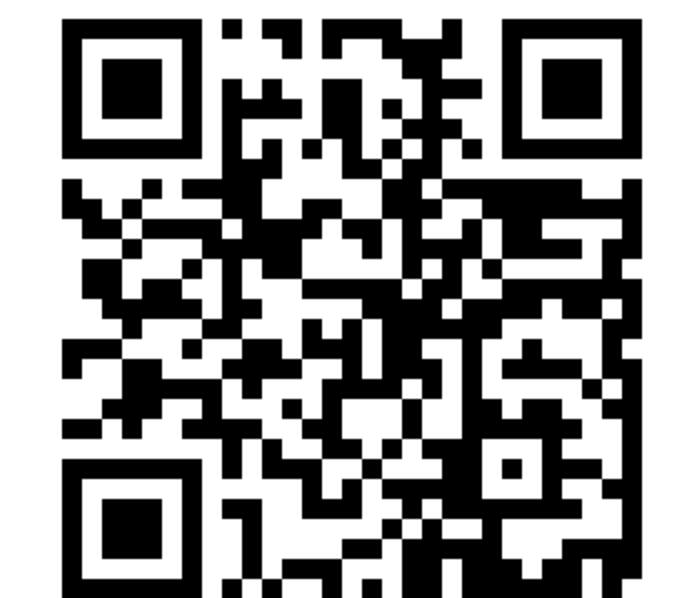


Image-based analysis of cardiac fibroblast datasets to uncover proprietary drug impact on reversing fibrosis.



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