Systems and Methods of Single-Cell Segmentation and Spatial Multiomics Analyses

Tech ID: 33784 / UC Case 2024-559-0

ABSTRACT

Researchers at the University of California, Davis have developed a novel cell segmentation technology for accurate analysis of non-spherical cells and that offers a comprehensive, high-throughput approach for analyzing the transcriptomic and metabolomic data to study complex biological processes at the single-cell level.

FULL DESCRIPTION

This technology presents a computer-implemented method for single-cell spatial omics analysis, combining advanced imaging and gene expression profiling to accurately analyze cells with complex shapes. It incorporates overlay images created from stained sample images to delineate cell boundaries, facilitating precise segmentation and analysis of individual cells. The cell segmentation method uniquely offers accurate analysis of cells with non-spherical geometry and providing a segmentation framework that recognizes and adapts to unique morphologies of brain cells such the star-shaped astrocytes, as well as the multipolar nature of neurons and glial cells.

Furthermore, this segmentation approach is also tailored for single-cell metabolomics by precisely overlaying cell segmentation map, derived from single-cell transcriptomics data, with a complementary image from imaging mass spectrometry (IMS) data. The fusion of these two sophisticated imaging techniques permits a previously unattainable examination of metabolites across varied cell types in both pathological and healthy tissue samples.

APPLICATIONS

- Drug efficacy evaluation and personalized medicine.
- Revolutionizing disease diagnosis, prognosis, and treatment planning.
- Discovery of new biomarkers for complex diseases.
- Enhanced understanding of cellular diversity within tissues, leading to novel therapeutic targets.

FEATURES/BENEFITS

- Enables comprehensive characterization and quantification of single-cell genomes, transcriptomes, proteomes, epigenomes, and metabolomes.
- Improves scalability, sensitivity, and specificity of single-cell analysis.
- Minimizes sample loss and artifacts, maximizing biological information recovery.
- Capable of analyzing cells with complex shapes and structures, including neuronal cells, fibroblasts, and stem cells.
- Supports a wide range of analysis types, including cell typing, cell-cell communication, protein-protein interaction networks, and more.

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OTHER INFORMATION

KEYWORDS

single cell spatial omics, single cell transcriptomics, single cell metabolomics, cell segmentation, gene expression profiling

CATEGORIZED AS

- **Biotechnology**
  - Bioinformatics
  - Genomics
  - Health
  - Other
  - Proteomics
- **Imaging**
  - Medical

- Addresses challenges in analyzing cells with complex and non-standard shapes.
- Addresses limited scalability, sensitivity, and specificity in existing single-cell omics methodologies.
- Overcomes difficulties in integrating multi-omic data for comprehensive single-cell analysis.

PATENT STATUS

Country	Type	Number	Dated	Case
Patent Cooperation Treaty	Published Application	2025/193958	09/18/2025	2024-559

Additional Patent Pending

RELATED MATERIALS

- TransMetaSegmentation (TMS): a transcriptome-based segmentation method for spatial metabolomic data - 06/13/2024

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Novel Solid Tumor Chemodrug LLS2
- Affinity Peptides for Diagnosis and Treatment of Severe Acute Respiratory Syndrome Coronavirus 2 and Zika Virus Infections
- Nanoparticles for Drug Delivery, Tissue Targeting and Imaging Analysis
- Conjugates That Combine HDAC Inhibitors and Retinoids into Disease Preventatives/Treatments
- A Novel RGD-Containing Cyclic Peptide for use in Cancer Imaging and as a Targeted-Therapy Ligand
- Site-Specific Ligation and Compound Conjugation to Existing Antibodies
- Exosome-Mimicking Nanovesicles
- Functional Illumination in Living Cells
- Multifunctional Porphyrin-Based Nanomedicine Platform
- A Two-step Drug Delivery System Based on Click Chemistry
- Transformable Smart Peptides as Cancer Therapeutics
- Engineered Biomaterial to Prevent Endothelial Inflammation
- Programmable Peptide Nucleic Acid-Based Nanoplatform for Customizable Drug Delivery
- Neuronal Injury Targeted Engineered Placental Mesenchymal Stem Cell Derived Extracellular Vesicles
- Hydrogelated Cells for Regenerative Medicine Applications
- Proteoglycan Mimetics For Enhanced Wound Healing Angiogenesis And Vascular Repair
- Nanoplatform for Cancer Therapy
- Ligands for Improved Angiogenesis and Endothelialization of Blood Contacting Devices

- Molecular
- Software
- **Medical**
  - Disease: Central Nervous System
  - Imaging
  - Other
  - Screening
  - Software
- **Research Tools**
  - Bioinformatics
  - Other
  - Screening Assays

RELATED CASES

2024-559-0

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