Dr. Shengyu Li

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Personal Statement

I am a computational biologist with a Ph.D. in computer science. During my postdoc at Houston Methodist Research Institute, I developed cellDancer, a deep-learning model published in ***Nature Biotechnology*** that predicts RNA velocity and mRNA turnover strategy at single-cell resolution. My collaborative work includes studies on cardiovascular disease mechanisms, with co-authored publications in ***Nature Metabolism*** and ***Circulation Research***. Currently, I am collaborating with the Center for RNA Therapeutics to develop bioinformatics and computational methods for adding RNA-binding protein data, such as Ribo-STAMP-seq, into the RNA velocity framework. In the future, I aim to create advanced algorithms for codon optimization of designed RNA, 3D RNA structure prediction, and study RNA stability to promote RNA-based research and therapeutic strategies.

Education

Ph.D. in Computing **08/2017-05/2021**
School of Computing, University of South Alabama
Bachelor in Spatial Information and Digital Technology **09/2013-06/2017**
College of Information, Shanghai Ocean University

Publications

Journal Papers "*" *indicates equal contribution.* "†" *indicates corresponding author.* "‡" *indicates co-senior author.*

- **Li, S.***, Zhang, P.*, Chen, W., Ye, L., Brannan, K.W., Le, N.T., Abe, J.I., Cooke, J.P. and Wang, G.†, 2023. A relay velocity model infers cell-dependent RNA velocity. ***Nature biotechnology***, pp.1-10.
- Mao, H.*, Angelini, A.*, **Li, S.***, Wang, G., Li, L., Patterson, C., Pi, X. and Xie, L.†, 2023. CRAT links cholesterol metabolism to innate immune responses in the heart. ***Nature Metabolism***, pp.1-13.
- Abe, J.I.*†, Imanishi, M.*, **Li, S.***, Zhang, A., Ko, K.A., Samanthapudi, V.S.K., Lee, L.L., Bojorges, A.P., Gi, Y.J., Hobbs, B.P., Deswal, A., Herrmann, J., Lin, S.H., Chini, E.N., Shen, Y.H., Schadler, K.L., Nguyen, T.H.M., Gupte, A.A., Reyes-Gibby, C., Yeung, S.C.J., Abe, R.J., Olmsted-Davis, E.A., Krishnan, S., Dantzer, R., Palaskas, N.L., Cooke, J.P., Pownall, H.J., Yoshimoto, M., Fujiwara, K., Hamilton, D.J., Burks, J.K., Wang, G.‡, Le, N.T.‡, and Kotla, S.†‡, 2023. An ERK5-NRF2 Axis Mediates Senescence-Associated Stemness and Atherosclerosis. ***Circulation Research***.
- Chakraborty, A., Li, Y., Zhang, C., Li, Y., Rebello, K.R., **Li, S.**, Xu, S., Vasquez, H.G., Zhang, L., Luo, W., Wang, G., Chen, K., Coselli, J.S., LeMaire, S.A., and Shen, Y.H.†, 2023. Epigenetic Induction of Smooth Muscle Cell Phenotypic Alterations in Aortic Aneurysms and Dissections. ***Circulation***.
- Nguyen, M.T.*, Imanishi, M.*, **Li, S.***, Chau, K., Banerjee, P., Velatooru, L.R., Ko, K.A., Samanthapudi, V.S.K., Gi, Y.J., Lee, L.L., Abe, R.J., McBeath, E., Deswal, A., Lin, S.H., Palaskas, N.L., Dantzer, R., Fujiwara, K., Borchrdt, M.K., Berrios Turcios, E., Olmsted-Davis, E.A., Kotla, S., Cooke, J.P., Wang, G.‡, Abe, J.†‡, and Le, N.T.†‡, 2023. Endothelial activation and fibrotic changes are impeded by laminar flow-induced CHK1-SENP2 activity through mechanisms distinct from endothelial-to-mesenchymal cell transition. Frontiers in Cardiovascular Medicine, 10.
- Coley, A.B., Stahly, A.N., Kasukurthi, M.V., Barchie, A.A., Hutcheson, S.B., Houserova, D., Huang, Y., Watters, B.C., King, V.M., Dean, M.A., Roberts, J.T., DeMeis, J.D, Amin, K.V., McInnis, C.H., Godang, N.L., Wright, R.M., Haider, D.F., Piracha, N.B., Brown, C.L., Ijaz, Z.M., **Li, S.**, Xi, Y., McDonald, O.G., Huang, J., and Borchert, G.M.† (2022). MicroRNA-like snoRNA-Derived RNAs (sdRNAs) Promote Castration-Resistant Prostate Cancer. Cells, 11(8), p.1302.
- Renner, R.*, **Li, S.***, Huang, Y., van der Zijp-Tan, A., Tan, S., Li, D., Kasukurthi, M., Benton, R., Borchert, G., Huang, J.† and Jiang, G.† (2019). Using an artificial neural network to map cancer common data elements to the biomedical research integrated domain group model in a semi-automated manner. BMC medical informatics and decision making, 19(7), 1-13.
- Ma, B., Wu, Z., **Li, S.**, Benton, R., Li, D., Huang, Y., Kasukurthi, M., Lin, J., Borchert, G., Tan, S., Li, G., Yang, M.† and Huang, J.† (2020). Development of a support vector machine learning and smart phone Internet of Things-based architecture for real-time sleep apnea diagnosis. BMC Medical Informatics and Decision Making, 20(14), 1-13.

- Li, J., Zhang, Z., **Li, S.**, Benton, R., Huang, Y., Kasukurthi, M., Li, D., Lin, J., Borchert, G., Tan, S., Li, G., Ma, B.†, Yang, M.† and Huang, J.† (2020). A partial encryption algorithm for medical images based on quick response code and reversible data hiding technology. BMC Medical Informatics and Decision Making, 20(14), 1-16.
- Chen, H., Zhang, D., Zhang, G., Li, X., Liang, Y., Kasukurthi, M. V., **Li, S.**, Borchert, G., and Huang, J.† (2018). A semantics-oriented computational approach to investigate microRNA regulation on glucocorticoid resistance in pediatric acute lymphoblastic leukemia. BMC medical informatics and decision making, 18(2), 149-157.

Conference and Workshop Papers

- **Li, S.**, Huang, Y., Kasukurthi, M.V., Yang, J., Li, D., Yang, G., Lin, J., Tan, S., Bourrie, D., Ma, B.†, Borchert, G.M.†, and Huang, J.† (2021, December). A New Classification Algorithm and a New Oversampling Method of Mapping Common Data Elements to the BRIDG Model. In 2021 IEEE International Conference on Bioinformatics and Biomedicine (BIBM) (pp. 2788-2795). IEEE.
- Kasukurthi, M.V., Houserova, D., Huang, Y., **Li, S.**, Li, D., Lin, J., Yang, G., Tan, S., Bourrie, D., Ma, B., Borchert, G.M.†, and Huang, J.† (2021, December). SURFR: A Real-Time Platform for Non-Coding RNA Fragmentation Analysis Using Wavelets. In 2021 IEEE International Conference on Bioinformatics and Biomedicine (BIBM) (pp. 2720-2727). IEEE.
- Renner, R.*, **Li, S.***, Huang, Y., Tan, S., Li, D., Van Der Zijp-Tan, A. C., Benton, R., Borchert, G., Huang, J.†, and Jiang, G.† (2018, December). Mapping common data elements to a domain model using an artificial neural network. In 2018 IEEE International Conference on Bioinformatics and Biomedicine (BIBM) (pp. 1532-1535). IEEE.
- Li, J., Zhang, Z., **Li, S.**, Benton, R., Huang, Y., Kasukurthi, M., Li, D., Lin, J., Borchert, G., Tan, S., Ma, B.†, Yang, M.† and Huang, J.† (2019, November). Reversible data hiding based key region protection method in medical images. In 2019 IEEE International Conference on Bioinformatics and Biomedicine (BIBM) (pp. 1526-1530). IEEE.
- Ma, B., Wu, Z., **Li, S.**, Benton, R., Li, D., Huang, Y., Kasukurthi, M., Lin, J., Borchert, G., Tan, S.†, and Huang, J.† (2019, November). A SVM-based algorithm to diagnose sleep apnea. In 2019 IEEE International Conference on Bioinformatics and Biomedicine (BIBM) (pp. 1556-1560). IEEE.
- Kasukurthi, M. V., Zhang, D., Housevera, M., Huang, Y., Tan, S., Ma, B., Li, D., Benton, R., Lin, J., **Li, S.**, Borchert, G.†, and Huang, J.† (2019, November). SURFr: Algorithm for identification and analysis of ncRNA-derived RNAs. In 2019 IEEE International Conference on Bioinformatics and Biomedicine (BIBM) (pp. 1504-1507). IEEE.

Posters/Abstracts

- **Li, S.***, Kotla, S., Imanishi, M., Ko, K.A., Samanthapudi, V., Savage, H., Schadler, K., Deswal, A., Lin, S., Reyes-Gibby, C., Yeung, S.C., Pownall, H.J., Fujiwara, K., Le, N.T., Wang, G., and Abe, J., 2022. Differentially Expressed Genes Mediated By Erk5 S496 Phosphorylation In Hypercholesterolemia-induced Macrophage Reprogramming. Arteriosclerosis, Thrombosis, and Vascular Biology, 42(Suppl_1), pp.A244-A244.
- Nguyen, M.T., **Li, S.***, Masaki, I., Velatoorua, L.R., Banerjeea, P., Abe, R., Ko, K.A., Kotla, S., Gi, Y.J., Cooke, J.J., Fujiwara, K., Borchrdt, M.K., Wang, G., Abe, J., and Le, N.T., 2022. Novel Atheroprotective Role of Chk1-induced Senp2 S344 Phosphorylation under Laminar Flow. JVS-Vascular Science, 3, p.420.
- Kotla, S., Imanishi, M., **Li, S.***, Zhang, A., Ko, K.A., Samanthapudi, V.S.K., Lee, L.L., Herrmann, J., Lin, S., Shoykhet, M.N., Shen, Y.H., Schadler, K., Nguyen, M.T., Gupte, A.A., Reyes-Gibby, C., Yeung, S.C., Palaskas, N.L., Cooke, J.P., Pownall, H.J., Yoshimoto, M., Fujiwara, K., Hamilton, D., Burks, J.K., Wang, G., Le, N.T.T., and Abe, J., 2022. Erk5 S496 Phosphorylation, but Not Erk5 Kinase Activation, Promotes Senescence-Associated Cell Growth (sacg) and Inflammation of Myeloid Cells and Atherosclerosis via Upregulating Sumoylation at a Novel Site (k518) on Nrf2 and Aryl Hydrocarbon Receptor. Circulation, 146(Suppl_1), pp.A14719-A14719.
- Nguyen, M.T., Imanishi, M., **Li, S.***, Ko, K.A., Banerjee, P., Velatooru, L.R., McBeath, E., Fujiwara, K., Kotla, S., Chau, K., Abe, R., Borchardt, M.K., Yeh, E.T., Cooke, J.P., Wang, G., Abe, J., and Le, N.T.T., 2022. Checkpoint Kinase 1-Associated Senp2 S344 Phosphorylation Under Laminar Flow Attenuates Endothelial-Mesenchymal Transition and Atherogenesis. Circulation, 146(Suppl_1), pp.A15362-A15362.
- Kotla, S., Imanishi, M., **Li, S.***, Ko, K.A., Samanthapudi, V.K., Savage, H., Schadler, K., Shen, Y.H., Deswal, A.M., Lin, S., Reyes-Gibby, C., Yeung, S.C., Pownall, H.J., Fujiwara, K., Burks, J.K., Le, N.T., Wang, G., Abe, J., 2022. Qualitative Single-cell Assessment By Imaging Mass Cytometry (imc) Analysis Reveals Senescence-associated Stemness (sas) Induced By Erk5 S496 Phosphorylation In Atherosclerotic Plaque. Arteriosclerosis, Thrombosis, and Vascular Biology, 42(Suppl_1), pp.A232-A232.

Presentations

DeBakey Heart and Vascular Center Research Day

Poster Presentation: "Deep Learning Reveals Cell State Transition"

Houston, 03/2024

4th Annual Gulf Coast Vascular Research Consortium

Poster Presentation: "Differentially Expressed Genes Mediated By ERK5 S496 Phosphorylation in Hypercholesterolemia-Induced Macrophage Reprogramming"

Shreveport, 03/2022

Awards

03/2016 Second Prize, The Seventh National Professional Software Engineering "Blue Bridge Cup" Design Contest in Shanghai Division

12/2016 and 11/2015 Excellent Student Award

06/2015 Advanced Individual in Scientific Innovation Activities

11/2016 Prize, Certificate for Excellence

11/2016 and 05/2015 First Scholarship, Shanghai Ocean University

11/2015 Second Scholarship, Shanghai Ocean University

04/2016, 11/2014, and 05/2014 Third Scholarship, Shanghai Ocean University

Work Experience

Postdoctoral Fellow, **Houston Methodist Research Institute, Houston, TX, United States** **08/2021-present**

- Designing AI algorithms to address complex biomedical questions.
- Developed a scalable deep learning model for profiling dynamic cell state transitions based on RNA velocity.
- Conducting data mining and data analysis for next-generation sequencing data. Collaborated on two significant research projects:
    - Utilized single-cell RNA-Seq data for investigating the link between carnitine acetyltransferase (CRAT) depletion, cholesterol catabolism, and cardiac inflammation, leading to dilated cardiomyopathy. Revealed a novel connection between cardiac energy metabolism, cholesterol regulation, and the immune system in heart failure.
    - Leveraged bulk RNA-Seq data to explore the role of extracellular signal-regulated kinase 5 (ERK5) in reprogramming myeloid cells towards a proinflammatory senescent phenotype, contributing to atherosclerosis.
- Assisting in preliminary data searching and analysis for grant proposal writing.

Graduate Assistant, **University of South Alabama, Mobile, AL, United States** **08/2017-05/2021**

- Conducting research under my Ph.D. mentor's supervision.
- Developed advanced algorithms: Designed and implemented artificial neural network algorithms for mapping Common Data Elements (CDEs) to the Cancer Data Standards Registry and Repository (caDSR) and for classifying CDEs using neural networks.
- Engaged in interdisciplinary research, contributing to projects involving snoRNA retrieval and analysis, real-time sleep apnea diagnosis, and the development of the semantic search system OmniSearch for microRNA-target gene interactions.
- Assisting with grading in numerous courses, including Performance Evaluation of Algorithms and Advance Data Structures and Algorithms.

Professional Activities

Editorial Board Member

2022 - Journal of Mathematical Techniques and Computational Mathematics (JMTCM)

Program Committee

2022 - International Workshop on Data Mining in Bioinformatics (BIOKDD)

Technical Program Committee

2021 - IEEE International Conference on Machine Learning and Applications (ICMLA)

2021 - International Conference on Advanced Bioinformatics and Biomedical Engineering (ICABB)

2021 - International Workshop on Data Mining in Bioinformatics (BIOKDD)

2020 - International Conference on Advanced Bioinformatics and Biomedical Engineering (ICABB)

Reviewer

2023 - International Conference on Information Technology and Computer Communications (ITCC)

2022 - Expert Systems with Applications (ESWA)

2022 - IEEE/ACM Transactions on Computational Biology and Bioinformatics (TCBB)

2022 - International Conference on Bioinformatics and Biomedical Technology (ICBBT)

2022 - International Conference on Bioinformatics and Biomedicine (BIBM)

2022 - International Work-Conference on Bioinformatics and Biomedical Engineering (IWBBIO)

2021 - IEEE/ACM Transactions on Computational Biology and Bioinformatics (TCBB)

2021 - Expert Systems with Applications (ESWA)

2021 - Gene Reports

2021 - Expert Systems with Applications (ESWA)

2021 - PLOS Computational Biology

2021 - PLOS ONE

2021 - Cancer Biomarkers

2021 - IEEE International Conference on Bioinformatics and Biomedicine (BIBM)

2021 - BMC Supplements

2020 - International Workshop on Biomedical and Health Informatics (BHI)

2020 - Computational and Structural Biotechnology Journal (CSBJ)

2020 - IEEE International Conference on Bioinformatics and Biomedicine (BIBM)

2020 - Computational Biology and Chemistry (CBAC)

2020 - Mini-Reviews in Medicinal Chemistry

2020 - Institute of Electrical and Electronics Engineers Access

2020 - International Workshop on Biomedical and Health Informatics (BHI)

2019 - BioMed Central Special Issue

2019 - IEEE International Conference on Bioinformatics and Biomedicine (BIBM)

2019 - International Workshop on Biomedical and Health Informatics (BHI)