Chase Christenson

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Summary

Data driven, quantitative researcher with 7+ years of experience in an academic setting, looking for opportunities to make a real-world impact through computational modeling. I'm excited about finding new challenges to address with applied mathematics. My research is focused on constructing mathematical models of cancer and developing new computational tools for data-driven science.

Professional Experience

Postdoctoral Researcher **Jan 2025 – Present**
Scientific Computing and Imaging Institute *– University of Utah*

- Developing multiscale models of melanoma growth combining principles from systems biology and cellular growth and response to therapy.
- Developing scientific machine learning algorithms for identification of non-linear systems from data.
- Utilizing differentiable programming techniques to improve methods for optimal of non-convex, constrained problems.
- Evaluation of unsupervised methodology for identification of protein-protein interactions from perturbation expression datasets.

Graduate Research Assistant **Aug 2020 – Dec 2024**
Center for Computational Oncology *– University of Texas at Austin*

- Developed imaging processing pipelines for 3D medical image datasets consisting of CT, SPECT, and/or MRI; used segmentation methods, rigid and non-rigid registration, data normalization and mathematical formulations to prepare images for visualization and analysis.
- Constructed frameworks in MATLAB and Python for analysis of longitudinal imaging data with mechanism based models. These works required writing finite difference code from scratch to implement variations on the Fisher-Kolmogorov equation. Parameters were estimated within the frameworks using either a least-squares minimization with custom gradient solvers, or Bayesian methods for introducing uncertainty.
- Developed a framework for building projection based reduced order model directly from processed imaging data. The custom, intrusive solver was implemented in both MATLAB and Python and is capable of simulating the 3D growth and response of breast cancer up to 3 orders of magnitude faster than the full model, with similar accuracy.
- Constructed digital twins capable of providing early predictions of response to therapy for glioblastoma and breast cancer patients. Constrained optimization problems based on clinical goals can be solved using a calibrated twin to provide patient specific feedback on therapeutic regimens with derivative free methods.

Undergraduate Research Assistant **May 2018 – May 2020**
Advanced Biophotonics and Nanomaterials Laboratory – *University of Texas at San Antonio*

- Worked in laboratory setting, evaluating protocols for chemical binding and detection abilities of a novel biosensor; custom engineered pneumatic system for delivering flow through microfluidic channels.
- Developed MATLAB programs for repeatable analysis of image outputs from the biosensor. Time dependent signals were determined from longitudinal images based on object recognition and used to estimate binding withing the biosensor.

Education

Ph.D. in Biomedical Engineering – 3.79 GPA **2020 - 2024**
University of Texas at Austin

- Advisor: Thomas Yankeelov, Ph.D.
- Concentration in computational biomedical engineering

M.S. in Biomedical Engineering – 3.79 GPA **2020 - 2022**
University of Texas at Austin

Bachelor of Science in Biomedical Engineering – 3.96 GPA **2017 - 2020**
University of Texas at San Antonio
- Concentration in Bio-imaging
- Minor in Computer Science

Peer Reviewed Publications

Viknesh, S, Tatari, Y, Christenson, C, Arzani, A. *ADAM-SINDy: An Efficient Optimization Framework for Parameterized Nonlinear Dynamical System Identification*, **arXiv**, (2025), https://arxiv.org/abs/2410.16528.

Christenson, C, Wu, C, Hormuth, DA, Ma, J, Yam, C, Rauch, GM, Yankeelov, TE. *Personalizing neoadjuvant chemotherapy regimens for triple-negative breast cancer using a biology-based digital twin*, npj Systems Biology and Applications, 11 (2025), 1-16. https://doi.org/10.1038/s41540-025-00531-z

Christenson, C, Wu, C, Hormuth, DA, Stowers, CE, LaMonica, M, Ma, J, Rauch, GM, Yankeelov, TE. *Fast model calibration for predicting the response of breast cancer to chemotherapy using proper orthogonal decomposition*, Journal of Computational Science, 82 (2024), https://doi.org/10.1016/j.jocs.2024.102400

Wu, C, Hormuth, DA, Christenson, C, Woodall, RT, Abdelmalik, MRA, Phillips, WT, Hughes, TJR, Brenner, AJ, Yankeelov, TE. *Image-guided patient-specific optimization of catheter placement for convection-enhanced nanoparticle delivery in recurrent glioblastoma*, Computers in Biology and Medicine, 179 (2024), 108889–. https://doi.org/10.1016/j.compbiomed.2024.108889

Christenson, C, Wu, C, Hormuth, DA, Huang, S, Bao, A, Brenner, A, Yankeelov, TE. *Predicting the spatio-temporal response of recurrent glioblastoma treated with rhenium-186 labelled nanoliposomes*, Brain Multiphysics, 5 (2023), 100084-. https://doi.org/10.1016/j.brain.2023.100084.

Hormuth, DA, Farhat, M, Christenson, C, Curl, B, Quarles, C, Chung, C, Yankeelov, TE. *Opportunities for improving brain cancer treatment outcomes through imaging-based mathematical modeling of the delivery of radiotherapy and immunotherapy*, Adv. Drug Deliv. Rev., 187 (2022), 114367. https://doi.org/10.1016/j.addr.2022.114367

Holland, MD, Morales, A, Simmons, S, Smith, B, Misko, SR, Jiang, X, Hormuth, DA, Christenson, C, Koomullil, RP, Morgan, DE, Li, Y, Xu, J, Yankeelov, TE, Kim, H., *Disposable point-of-care portable perfusion phantom for quantitative DCE-MRI*, Med Phys., 49(1) (2022), 271-81. https://doi.org/10.1002/mp.15372

Skills

Programming languages: MATLAB | Python | LaTeX
Computational: numerical simulations | parameter estimation | predictive modeling | image processing | optimal control | digital twins | Bayesian inference | statistical analysis | parallel computing | batch programming | GitHub | model selection | cluster analysis | decision trees | convolutional neural networks | reduced order modeling linear/log regression | PyTorch | system identification | differentiable programming
Biology: tumor biology | interpreting *in vivo* imaging data (MRI, SPECT/PET, CT) | quantitative systems biology
General: technical writing | presentations | project management | problem solving | mentoring

References

Thomas E. Yankeelov, Professor, Director of Center for Computational Oncology (Dissertation Advisor)
Department of Biomedical Engineering
University of Texas at Austin
thomas.yankeelov@utexas.edu

Amirhossein Arzani, Associate Professor (Postdoc Advisor)
Department of Mechanical Engineering & Scientific Computing and Imaging Institute
University of Utah
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Chengyue Wu, Assistant Professor
Department of Imaging Physics
MD Anderson Cancer Center
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