



Validating CancerSim2: A Comparative Study of Adaptive Therapy in Mice Experiments

Walker Mellon, Data Science, Analytics, and Engineering (Computational Models and Data)

Dr. Joshua Daymude, SCAI, BSS

QR CODE

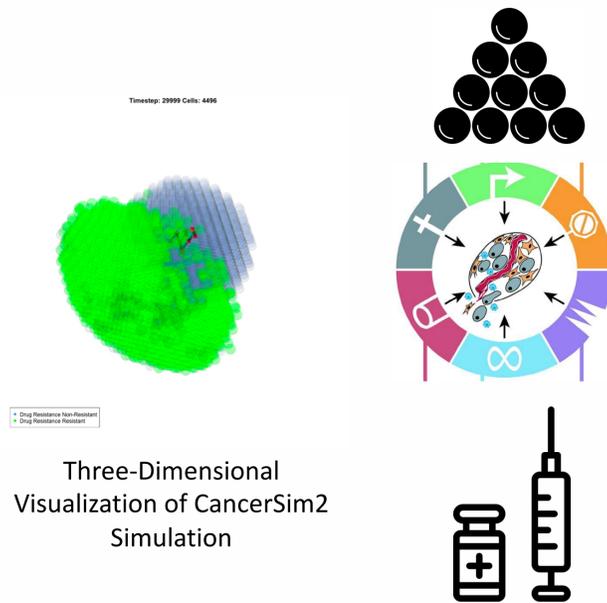
Abstract

This study focuses on validating **CancerSim2**, a three-dimensional, agent-based **simulation model** for cancer growth, through **comparison with clinical trials of adaptive therapies**. Unlike traditional methods that aim to eliminate cancer entirely, adaptive therapy seeks to control the disease. In her work, Dr. Sareh Seyedi conducted more than 50 experiments on mice, exploring various adaptive and non-adaptive therapy strategies for each individual subject. The next step involves enhancing CancerSim2 by incorporating features that allow researchers to mimic these real-world experiments more closely, which includes the introduction of functionalities to adjust drug dosages at specific times and to measure tumor burden. Subsequently, the outcomes of the simulation will be statistically analyzed and compared with the results from the experiments conducted on mice.

Impact Statement

Validating CancerSim2 against clinical trials of adaptive therapy to enhance and verify the accuracy of the model.

What is CancerSim2?



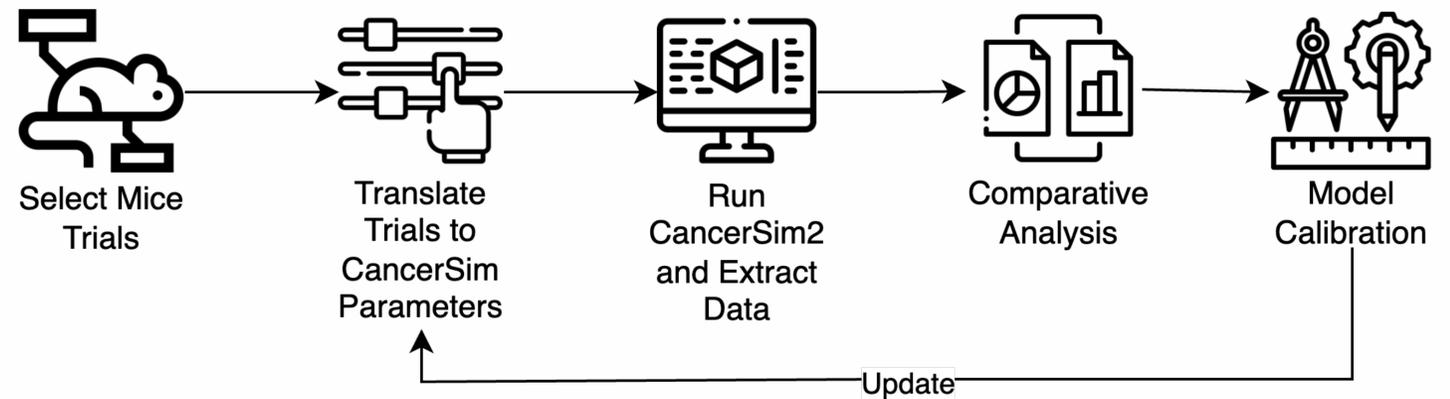
Three-Dimensional Visualization of CancerSim2 Simulation

- Three-Dimensional Agent-Based Model of tissue and tumor growth.
- Spatial Interactions within microenvironment
- Modeling of vasculature and resource distribution

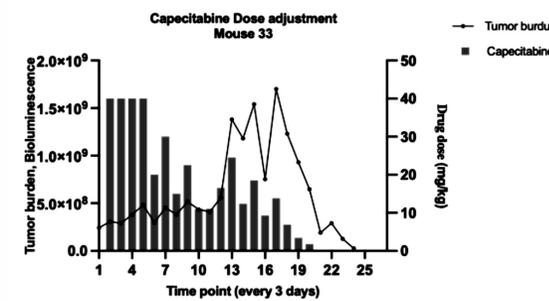
- Simulation of Hallmarks of cancer
- Includes:
 - Evading Growth Suppressors
 - Inducing Angiogenesis
 - Resisting Cell Death

- Implementation of Timed Drug Regimens
- Ability to test various Adaptive Therapy Protocols

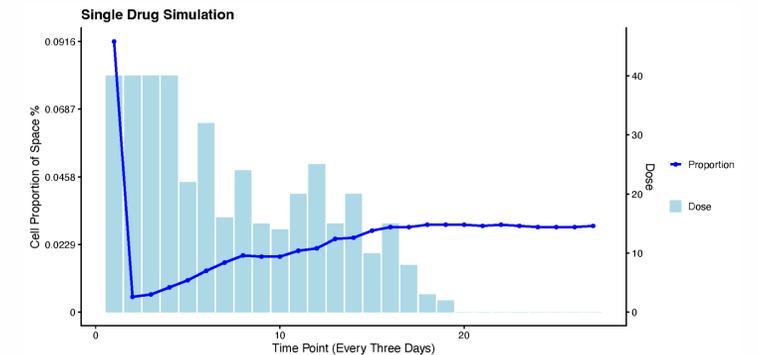
Experiment Overview



Preliminary Results

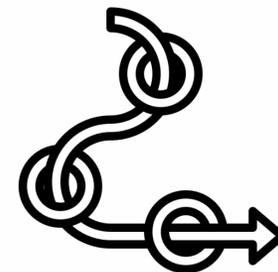


Mouse Experiment: Capecitabine Dose modulation (Seyedi, 2023)



1 drug CancerSim2 simulation with drug dosages mirroring Seyedi mice experiment. Dynamic Time Warp Distance: 472.49; R: -0.33

Future Development



- Continual development and implementation of CancerSim2 is still in progress. As new features are added to the model, this framework will be applied to ensure the model is accurate
- With new features and output generated from the model, new statistical and comparative analysis will most likely be implemented
- Additional studies will be gathered to compare CancerSim2 results
- Both 3d and data visualizations will be optimized for speed and readability

Acknowledgments

I would like to thank Dr. Daymude for the opportunity to collaborate with the Daymude Lab on this project. I have been able to learn so much about cancer, software development, and modeling through this collaborative effort. Many thanks to Dr. Carlo Maley for creating the opportunity for this collaboration and encouraging me to try something new. Sanjana Shah is the incredibly talented programmer and scientist who has handled most of the work for CancerSim2. I am very grateful to have the opportunity to examine her work. Ariadne Dimarogna has been an incredibly helpful teammate and colleague throughout the development of CancerSim2 and this project.