CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

31851

Project Title

Computing Cancer: Can Markov Decision Processes Computationally Model Cancer?

Abstract

Objectives/Goals

Cancer is a growing problem in the US and the world. Despite advances in treating cancer, growing cancer rates prove the need for additional research. Computational models for studying cancer are being studied more as they may prove more efficient in studying the impacts of drug delivery on cells, as opposed to testing on lab animals. This study is among the first to use Markov Decision Processes (MDPs) to model cancer.

MDPs model agents attempting to maximize their expected utility by taking actions that move them between states. This study used an MDP to model cells that could move, stay, or reproduce. The program was executed in twenty environments by changing five values for a reward if the cells reproduced and four values for a cost if the cells moved.

The goal was to establish whether or not MDPs are a viable alternative to current computational models of cancer by determining whether MDPs can respond to changing environments. The hypothesis is that MDPs can model cancer since the cells would act differently under different environments.

The results validated the hypothesis. Cells in the environment with the highest reward and cost were ten times more likely to clone, one-fourth as likely to stay, and never moved, compared to cells in the environment with no rewards or costs. The study concluded that MDPs are an alternative to current models of cancer. This study is intended as the first step towards an MDP comparable to real cells. Refinement is left for further research.

Summary Statement

Computational model of cancer cells using Markov Decision Processes

Help Received

Dad helped with the project idea and research material. Mother and brother helped with the board design.