

Project 1:

Data dimensionality reduction in a multi-scale computational model of the kidney:

Background:

This project is part of a larger project where we are using a systems approach to build a model of an entire mammalian kidney by modelling individual kidney units (nephrons) and their interactions.

Our current implementation is 64,000 nephrons, approximately the size of an entire rat renal system (two kidneys). We are looking to find patterns in the output data, so that key events in renal disease can be defined and explored. Disease events might be, for example, a change in function of a few nephrons at the onset of renal disease, or a pattern of progressive malfunction.

Because the system is so large, and there are so many time steps, the size of the output data makes it infeasible to store or analyse the data in reasonable time and space.

Goal:

The goal of this project is to understand and investigate at least two data dimensionality reduction techniques and to study their applicability to large data sets, in the context of the kidney model we have developed previously. Possible techniques include post-processing and on-the-fly summaries.

Scope and expected timelines:

Semester 1:

Literature review of dimensionality reduction, with a particular emphasis on the context of the kidney model. Literature review to be submitted.

Semester 2:

Implement writing out of the data from the current model. Demonstration of system to be given.

Semester 3:

Implement one or more dimensionality reduction method on the kidney data, and analyse improvements.

Student:

The project would suit a student with a strong computer science background.