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Research Topic

Computational Biology

Research Problem

How can biological phenomena be predicted using computer models?

Problem Statement

Given the gene maps of many fruit fly embryos, construct a Bayesian network to predict embryonic development.

Operational Definitions

Gene Map: A representation of the components of the genes of an organism.

Bayesian network: A digraph where each node represents an event and is assigned a probability value, and which can be used to predict the occurrence of specific events given certain prior events

Problem Description

While computer models can be used to accurately predict many phenomena, Developing models for statistical inference remains a difficult problem, three-pronged problem. One must determine how such models should be represented, what can be inferred from analysis of the model, and how a computer can learn to automatically improve its inference model for the future.

These problems are practically addressed by modeling the development of fruit fly embryos. Digital analysis of fruit fly embryos can help determine the presence of specific genes, the further development of which can be predicted by representing the known quantities as nodes in a Bayesian network. By working on improving this model, it is possible to improve our knowledge of modeling systems in general

Computer Science Perspective

Predictive modeling is a key portion of computer science, closely tied to graph theory and artificial intelligence, as well as to other emerging fields like automated visualization.

Disciplines Actively Involved

Biology

Computer Science

Operational Definition

Actively Involved Disciplines: A Discipline from which a member would be acknowledged in the research paper or any discipline involved for which there is a professional association that fosters more knowledge of it through the scientific method.

Description of Disciplines Involved

Biology: This research will advance the study of embryonic development, and draws on the study of genetics.

Computer Science: Bayesian Networks are one of the most important concepts of AI, and this research actively studies how they can be used to improve our understanding of Biology.

References

Eric Xing's website:

<http://www.cs.cmu.edu/~epxing/>

Lecture Slides:

<http://www.cs.cmu.edu/~epxing/CSic-final1.pdf>

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