Editor'sPicks

BY DAVID PAIK, PhD, EXECUTIVE EDITOR

One of our goals at *Biomedical Computation Review* is to create a sense of kinship among members of this very diverse community of researchers. This column provides reviews of some of the latest and most significant research in various sub-specialty areas as well as reviews of articles that examine the relationships among the various fields that touch on biomedical computation and issues that affect us all.

Philosophy of Science

Epistemological Perpetual Motion?

While many researchers are extremely optimistic about the future of computational biology, not all share this zeal and it is worthwhile to examine the counter-arguments. Referring to the path from observation to understanding, John F. Allen predicts in a 2001 commentary in *BioEssays* that "the formidable combination of computing power and access to data cannot produce a qualitative shift in the way that we do science." He describes the centuries-old philosophical debate about the validity of logical induction (vs. deduction). His stance on the debate is clear with his description of the threat of "a new dark age" where data miners who would dare to abandon hypothesis-driven research are "asking for the epistemological equivalent of a perpetual motion machine." He takes this argument to the extreme by asking the reader to consider the intellectual property implications of automated understanding from data (if it were possible) saying that one might then "corner the market" on knowledge. In summary, he states that "discovery cannot occur *in silico*. There is no induction machine." While I do not completely agree with Allen, this commentary and its associated responses are well worth reading and pondering by all who are interested in biomedical computation.

DETAILS

John F. Allen
Bioinformatics and discovery: induction beckons again.

***BioEssays* 23:104-107.**

Allen's stance is that data miners are "asking for the epistemological equivalent of a perpetual motion machine."

Biology and Engineering

Seeing the Forest through the Trees

To anyone who has studied either discipline, it is self-evident that biologists and engineers generally approach their problems from opposite perspectives (i.e., reverse- vs. forward-engineering). Yuri Lazebnik writes very eloquently about this topic in this 2002 paper in *Cancer Cell*, describing his experiences as a new assistant professor studying apoptosis and his interactions with his mentors.

Lazebnik whimsically describes how a biologist might attempt to fix a broken radio, drawing an analogy between electronic circuits and signal transduction pathways. The biologist would find a large number of functioning radios, shoot them with metal particles, identify malfunctioning "phenotypes," and then determine the culprit components and their interdependencies. However, this bottom-up empirically-dominated view of the radio would be a far cry from the top-down engineer's design-dominated view of the radio's circuit diagram. The graphic language of circuit diagrams is quantitative, unambiguous and universal, in contrast with traditional representations of complex biological networks that use ad hoc arrows and symbols. However, important work, some of which predates this paper, has been done in formalizing and standardizing the semantics of the graphical representations of complex biological systems, allowing for more of a systems approach to biology. This paper provides an interesting comparison of how biologists and engineers approach problems, and is well worth a read for those coming from either field.

Lazebnik describes how a biologist might attempt to fix a broken radio.

DETAILS

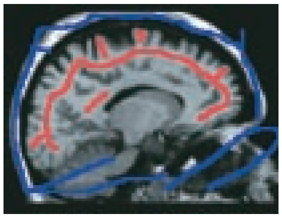
Yuri Lazebnik
Can a biologist fix a radio?—Or, what I learned while studying apoptosis

Cancer Cell, Sept. 2002 Vol. 2

Visualization and Machine Learning

Painting by Numbers

Visualizing complex three-dimensional datasets just got easier. Fan-Yin Tzeng and her colleagues at UC Davis have come up with a way to interactively edit and refine volume rendered images by "painting" with smart paintbrushes.



Volume rendering is a common method for visualizing volumetric data such as a stack of MRI slices. Each voxel (3-D pixel) is assigned an opacity value in order to visualize the desired structures (e.g., air is assigned zero opacity and solid tissue is assigned full opacity). However, manually defining an opacity function becomes nearly impossible when the opacity of each voxel depends on more than one or two features of each voxel (e.g., intensity and gradient magnitude). Tzeng and her fellow researchers describe a novel method for defining opacity functions by a painting interface. Different paintbrushes, one for each class, are used on the original source images to provide examples to a machine learning classifier, which learns the classification function from this training data and then defines the opacity of every voxel for the volume rendering algorithm.

Their approach eases the burden on the user by having them interact with the images directly, instead of with abstract high-dimensional mathematical features, letting intelligent algorithms do the hard work. For users of visualization software, this method has the potential to make volume rendering easier to use by making the interactions extremely simple and intuitive. For researchers in image-related areas, this work nicely ties together the inverse problems in computer graphics (producing images from models) and in computer vision (producing models from images). □

DETAILS

Fan-Yin Tzeng, Eric B. Lum, and Kwan-Liu Ma
An Intellegent System Approach to Higher-Dimensional Classification of Volume Data

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