

Mathematics Saves Lives: Models and Signals enabling Medicine and Biology

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A good decision is based on knowledge and not on numbers – Plato

Plato's quote is taken out of context, but describes well the relative places of data and analytics in the scientific process. The point is that more data is not always better - with the increased data volume and complexity, the challenge becomes how to extract information relevant to the population or to a particular person at a particular time. Real-time data sources are abundant and doubling every two years, with many based on biosensors relevant to biology and healthcare. Systems biology uses mathematical models and computation to make data useful and to provide a dedicated structure that must be in place for proper analysis, interpretation, and translation of the results. In my talk, I illustrate this concept by examples using signaling networks to understand pathophysiology, stochastic methods to assess the effect of radiation, entropy to detect critical subacute illness, or modeling and control algorithms to treat diabetes.