

The efficient cause of science

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Propositions accompanying the dissertation

THE EFFICIENT CAUSE OF SCIENCE:
COMPUTATIONAL METHODS FOR MAPPING THE VISUAL CORTEX

Salil Bhat

- I. Computationally efficient methods not only save researchers' valuable time, but also facilitate conducting research on more accessible and widely available hardware.
- II. Hashing frees us from the curse of dimensionality in the sense that memory requirements need not be exponential in the number of dimensions, but need merely match the real demands of the task. (*Sutton and Barto, 2018*)
- III. It is possible to efficiently model both population receptive fields and connective fields as a single linear dynamical system with stimulus being the control.
- IV. The Jaccard Index is an excellent similarity metric that is less susceptible to misleading values than correlation metrics.
- V. Dynamic Mode Decomposition, including its various flavors, is an efficient method for computing the dynamics of extremely large linear models.
- VI. Data-driven discovery, the fourth-paradigm of scientific discovery, will transform the computational methods used in neuroscience.
- VII. At times, it is better to invest in developing efficient software than in investing in powerful hardware.
- VIII. The real purpose of the scientific method is to make sure Nature hasn't misled you into thinking you know something you don't actually know. (*Robert M. Pirsig*)
- IX. One method cannot be more true than another; it can only be more convenient. (*adapted from Henri Poincaré*)
- X. The only principle that does not inhibit progress is: anything goes. (*Paul Feyerabend*)
- XI. The world is vastly non-linear, but with the right mindset and methods, we can achieve linear solutions and seek comfort in simplicity amidst chaos.