Seminar Talk

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Tuesday, September 12, 2017
3:00 p.m. KH 224

Title: Statistical Laws That Govern Learning Machine Architectures and Generalization Performance

Abstract:
In this talk, I will introduce new ways of thinking about learning machines: in terms of fundamental statistical laws that unknown, discriminant functions of data are subject to. Thinking about learning machines in terms of statistical laws will lead to the discovery of equations of statistical equilibrium along with equations of minimization of eigenenergy and Bayes' risk that learning machine architectures are subject to. I will devise a system of fundamental equations of binary classification for a classification system in statistical equilibrium. I will use this system of equations to formulate the problem of learning unknown, linear and quadratic discriminant functions from data as a locus problem, thereby formulating geometric locus methods within a statistical framework. Solving locus problems involves finding the equation of a curve or surface defined by a given property and finding the graph or locus of a given equation. I will devise fundamental, data-driven, locus equations of binary classification for linear and quadratic classification systems in statistical equilibrium, where the opposing forces and influences of a system are balanced with each other, and the eigenenergy and the corresponding Bayes' risk of a classification system are minimized. Thereby, I will formulate two classes of learning machines that are scalable modules for optimal, statistical pattern recognition systems, where the generalization error of each class of learning machines is Bayes' error: which is the lowest error rate that can be achieved by a discriminant function and the best generalization error that can be achieved by a learning machine.

Bio:
Denise M. Reeves is an electrical engineer and computational mathematician whose research in machine learning bridges Bayes' decision theory, geometric locus methods, Hilbert space methods, and statistical methods. Dr. Reeves' research interests include feature engineering for biochemical and biological data, applications in computational medicine, and feature engineering for applications where "black box" classification methods are too risky, e.g., homeland security, medical, and military applications. Dr. Reeves received her B.S. and M.S. degrees in electrical engineering from Old Dominion University, and a Ph.D. degree in information technology from George Mason University. She currently lives and works in Northern Virginia.