# Probabilistic Machine Learning and Small Data

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In this presentation I want to give an introductory overview of machine learning for three major learning domains, that of supervised learning, unsupervised learning, and reinforcement learning. The focus of the discussions is thereby the understanding of the relations between these three learning domains, as well as the understanding of the relations of different models within each learning domain. With this goal in mind I want to outline models of supervised learning such as maximum likelihood regression, graphical (Bayesian) networks, and general learning machines such as neural networks and support vector machines, some models in unsupervised learning such as (sparse) Boltzmann machines and expectation maximization, and reinforcement learning such as temporal difference and Q-learning. I want also to show how these three domains in learning theory map onto the brain, and how the probabilistic framework is not only convenient to describe learning theories but might capture essential brain processes. Finally I want to discuss some more recent thought on `small data' when low complexity models are drowned in high-dimensional feature spaces with few noisy data. While `big data' are currently a domain where existing learning models have proven themselves, it seems that humans are rather faced with relatively small data sets compared to the size of the state space in a real world environment.