Consider map $F: U \rightarrow V$. Given data pairs $\{u_j, F(u_j)\}$ the goal of supervised learning is to approximate $F$. Neural networks have shown considerable success in addressing this problem in settings where $X$ is a finite dimensional Euclidean space and where $Y$ is either a finite dimensional Euclidean space (regression) or a set of finite cardinality (classification). Motivated by the need for surrogate modeling and for scientific discovery, we focus on the design and analysis of algorithms which address supervised learning for settings where $U$ and $V$ comprise spaces of functions; thus $F$ is an operator.

The talk describes emerging methodology in this area, emerging theory which underpins the methodology and numerical experiments which elucidate the efficiency of different approaches. Various applications from continuum mechanics are described, including the Navier-Stokes equation, the Helmholtz equation, nonlinear elasticity and the advection equation.