Neuromorphic computing is a promising computing paradigm that employs event-triggered computation and non-von Neumann hardware for an energy efficient system design. In my talk, I will present some of our neuromorphic computing work at the Oak Ridge National Laboratory on the different bio-inspired learning rules for training Spiking Neural Networks (SNNs) - spike timing dependent plasticity (STDP) and evolutionary optimization approaches. In addition, we also apply Bayesian optimization to fine-tune the hyperparameters of the network for the target application and the underlying hardware. These training and hyperparameter optimization approaches have been successfully applied to different classification and control tasks, including autonomous navigation and solar power plant control, which I will describe in detail during my presentation. In addition to these machine learning problems, neuromorphic computing has also been applied to non-cognitive tasks such as graph algorithms, signal processing, solving partial differential equations, etc., thereby projecting it as an application-specific customizable computing paradigm. In closing, I will present future research directions that can use the results from the above-mentioned studies in the areas of computational neuroscience and neuromorphic system co-design.