

# Machine Learning for Time-Domain Discovery and Classification

*Joseph Richards*  
*Lawrence Berkeley National Laboratory*

## Abstract

To maximize the scientific returns from modern time-domain projects, sophisticated machine-learning tools must be used. Our group has been on the cutting edge of the methodological and algorithmic development for time-domain astronomical data analysis. I will describe several problems in which we have made great strides, including real-time discovery and classification of transient events, photometric supernova typing, and probabilistic classification of variable stars from long-baseline time series. I will describe our use of manifold learning for feature extraction in multi-band supernova light curves, active learning to overcome sample-selection biases, and semi-supervised learning to maximally leverage existing sets of labeled and unlabeled data. These algorithmic advances have already reaped benefits for discovery and classification in real-time surveys and hold a tremendous amount of promise moving forward.