1153-92-260 **Brad Theilman*** (btheilma@ucsd.edu), **Krista Perks** and **Timothy Q Gentner** (tgentner@ucsd.edu). *Exploring invariant structure in neural activity with applied topology and category theory.*

Animals rely on the structure of the natural world to guide their behaviors. How this structure is carried in the spatiotemporal patterns of activity among the neurons that make up the brain is not well understood. Importantly, activity patterns tied to the same events in the natural world can vary significantly between animals and within animals across time, implying deep invariances that remain unexplored. Current mathematical tools available to neuroscientists for quantifying the invariant structure in neural activity patterns are limited. Here, we combine recent advances in applied algebraic topology and spectral graph theory to build tools to quantify invariant structures in neural activity. We show that these tools capture the structures of interest using both computer models and in-vivo electrophysiology from the brain of a songbird. Finally, we describe how category theory applied to this problem generalizes these constructions and provides an alternative point of view that mitigates several conceptual difficulties with current neural data analysis approaches. (Received August 29, 2019)