A Classifier for Predicting Depth of Anesthesia Using Multimodal Cortical Recordings

Team 1: **Vian Ambar Agustono, Elisa Cordeiro Lopes**
Technical Advisors: **John A. White, Daniel Carbonero, Jad Noueihed**

Anesthetics are widely used in modern medicine to induce loss of consciousness and henceforth allow painless performance of medical procedures that would be otherwise unbearable. Therefore, anesthetics have proven useful for surgeries and invasive clinical procedures in all populations. Because anesthetic response is not uniform across patients, it’s crucial to have an objective measure of depth, other than behavioral response Empirical measurements of anesthetic depth are difficult to take and are sometimes unavailable altogether. Hence, we propose a machine learning classifier to discern the level of anesthesia in mice using local field potential (LFP) and two-photon calcium imaging recordings. The voltage recordings are automatically preprocessed to extract burst suppression activity, as well as filter and identify artifacts. Recurrence rate and burst suppression rate are features chosen to characterize the nonlinear nature of burst suppression events which occur only in the anesthetized state. When a subject is anesthetized, neuronal signals shift in power from high to low frequencies, which is quantified as a feature by spectral edge frequency. These features were used in two classification models: random forest and support vector machine. The former is robust, flexible and offers greater accuracy due to its collection of prediction trees, while the latter is versatile and matches with the brain because the brain is highly nonlinear. We cross validate both models, to demonstrate both classification models are effective at predicting the depth of anesthesia in mice.