MASTER'S THESIS

Connectome eigenmodes underlies functional connectivity patterns in conscious awake and anesthetic mice

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Abstract

Consciousness and loss of consciousness is something we encounter in our everyday lives. Despite its commonplace in everyday life, scientist are still trying to understand and find reliable markers for it. In this work we use a data-driven K-means clustering approach to uncover the different functional patterns associated with different consciousness levels.We pursue this study using a high resolution optogenetic voltage image of the mouse brain waking up from anesthesia.The main questions we addressed in this study are: Can we identify signatures of conscious and unconsciousness from functional connectivity patterns? What is the nature of the different patterns that correspond to wakefulness and anesthesia? What is the nature of dynamics between these functional patterns in wakfulness and anesthesia? How does the anatomical connectivy support the observed functional patterns in wakefulness and anesthesia? Our results show that during anesthesia, the brain is characterized by a single dominant brain pattern with short range connections. Furthermore, we observed from our results that during anaesthesia the brain is characterized by minimal temporal exploration of the different brain configurations. Conversely, in awake state we observed the opposite. The brain pattern with long range connections are frequent in wakefulness. In addition, wakefulness is characterized by somewhat frequent temporal exploration of brain states. Our results show that analysis of functional connectivity patterns can be a useful tool for identifying specific and generalizable fingerprints of wakefulness and anaesthesia.

Table of Contents