Mesial temporal lobe epilepsy is the most common drug resistant epilepsy syndrome. Many patients with this disorder suffer from memory dysfunction as hippocampal seizures can impact memory. Surgical resections, although they can cure seizures, often worsen memory.[1] Sharp wave ripples are the most synchronous patterns in the mammalian brain, detected in the hippocampal CA1 layer. They are transient fast oscillatory events (100-250 Hz) and biomarkers for memory consolidation.[2] However, spike ripples, a pathological biomarker for seizures in an epileptic hippocampus, share similar properties with sharp wave ripples. These events are not well understood and can not be reliably classified using current detectors.[3] Machine learning (ML) approaches provide new opportunities to classify subtle differences in rhythms. Recently several ML approaches were proposed and found to be successful in detecting SWR in rodents and non-human primates.[4] For this project, the RipplAI toolbox was used, which was shown to be successful in detecting SWRs in mice and macaque hippocampus. The goal of this project was to evaluate the accuracy of ML approaches used in RipplAI to detect SWR in human recordings and in the setting of epileptic activity. While these models were able to detect some SWRs in humans, they were much less effective and would require further retraining to be useful.

[1] (Mathon et al., 2017)
[2] (Joo & Frank, 2018)
[3] (Kramer et al., 2019)
[4] (Navas-Olive et al., 2024)