

Report: Neuroscience Spike Detection Project

Introduction

The Neuroscience Spike Detection Project focuses on detecting and analyzing neural spikes from extracellular recordings. Neural spikes, or action potentials, are essential signals for understanding brain activity and neural network dynamics. This project implements a comprehensive pipeline for processing neural signals, identifying significant spikes using False Discovery Rate (FDR)-based thresholding, and enforcing physiological constraints through refractory period analysis. The signal processing includes band-pass filtering (300 Hz - 10,000 Hz) for noise removal and optimal spike detection.

Results and Discussion

The project successfully implemented a robust spike detection framework, effectively distinguishing between positive and negative spikes while minimizing false positives through refractory period enforcement. The pipeline demonstrated strong performance in noise reduction and spike characterization, with clear visualization of detected spikes across 30,000 sample ranges. Future improvements could include threshold optimization for diverse signal types and integration of machine learning methods for enhanced spike classification.

Figure 1

