Neural Signal Analysis for Implantable Electrode Arrays

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Problem

- How can we demonstrate that new neural recording devices will function properly in vivo?
- Goal: Monitoring seizure activity in the brain.
- Seizures are inherently chaotic and hard to replicate.
- How can we determine the reliability of these neural recording devices?

Approach

- Implanting arrays onto the surface of the brain
- Stimulating various limbs on the body
- Monitoring the response from the stimulus to create heatmaps

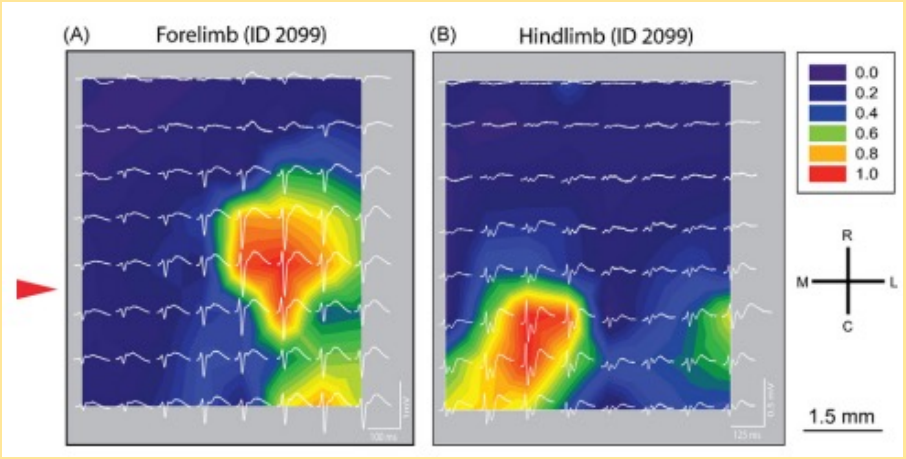

Fig. 1: An example somatosensory (stimulus) heatmap of the forelimb and hindlimb. From Journal of Neuroscience Methods (Jonas H., Volume 172, Issue 2, 30 July 2008, Pages 255-262)

Lesson Application

- Finding peak area of stimulation and creating a quadratic that fits the peak and its surrounding points using $f(x) = ax^2 + bx + c$
- Identifying key features to determine the resolution of the image
- **Hands-on Activity:**

Using non-invasive sensors to monitor stimulus

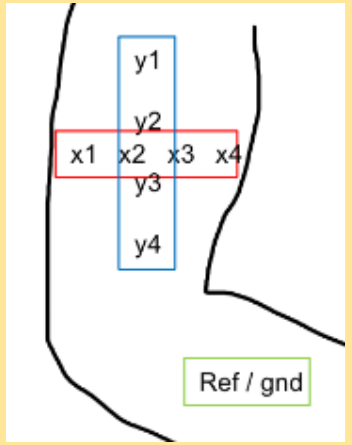

Fig. 3 (Above): An example of a parabola created from the peak found in a matrix.

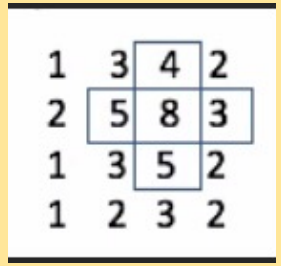

Fig. 4 (Above): An example of how we turn a heatmap into a matrix and determine where the peak is located.

Fig. 2 (Above): A rough diagram of a possible experiment to monitor stimulus in real-time. Credit: Daniel Gulick

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