Synopsis of Original Research Paper

Neural representation of tactile sensation through limbs coated with moisturizer

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Sensory information, particularly somatosensation, plays a crucial role in defining the boundary between the body and the external environment. Through somatosensation, animals perceive features such as roughness and temperature from the external world. Brain processing of this information is dynamically modulated by skin conditions and past experiences, a phenomenon realized through somatosensory neuroplasticity. While somatosensory input from peripheral receptors is transmitted to the primary somatosensory cortex (S1), the specific neural representation of tactile features like roughness and how this representation varies with skin conditions remain unclear. This study aims to investigate neural representation of tactile sensation through limbs coated with moisturizer. Traditional methods of neural activity analysis often involve extracting features based on frequency intensities or firing rates, which may overlook important information for decoding somatosensation. S1, representing the body surface, likely encodes tactile features across the entire cortex. To decode somatosensation accurately, it is essential to record neural activity from a broad area of S1 and employ methods to extract bias-free features. This study focuses on deep learning, which can automatically extract relevant features from vast amounts of data without human intervention. We established an experimental system where rats repeatedly experienced smooth and rough surfaces. Based on this system, an algorithm was developed to accurately detect the timing of foot-strikes on the surfaces. We then analyzed a gait of rats, whose limbs were coated with vaseline. Furthermore, we recorded local field potentials in S1 with and without vaseline. We established a deep learning algorithm to predict whether the surface was rough or smooth. We will further analyze the neural representation in S1 when the paw soles were coated with vaseline and explore the relationship between neural representation and neuroplasticity.