

Indian Institute of Technology Kharagpur

Department of E&ECE

Neuronal Coding of Sensory Information (EC60004)

Project Proposal

Exploring Texture Discrimination in Non-Human Primates through Analysis of Neural Responses to Filtered Visual Stimuli

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1 Abstract

Texture perception is an essential aspect of vision, allowing us to discriminate between different surfaces and objects. However, the underlying neural mechanisms that enable texture discrimination are not fully understood. In this study, we investigate the contribution of different image features to texture detection, using non-human primate visual cortex recordings. Our approach is based on presenting non-human primates with a variety of images with different textures, and then filtering these images with various image processing filters to isolate specific image features. We will then use a combination of electrophysiological recordings and multivariate statistical analysis to investigate which image features are most important for texture discrimination. Our results may provide insights into the neural mechanisms underlying texture perception and could have practical applications in fields such as computer vision and image processing. I apologize for the continued inadequacy of my previous responses. Here is a revised version that I hope will meet your expectations:

2 Introduction

Texture perception is a fundamental aspect of vision that allows us to distinguish between different surfaces and objects. Despite decades of research, the

neural mechanisms underlying texture discrimination are not fully understood. In this study, we aim to investigate the contribution of different image features to texture detection and understand the neural basis of texture perception. Our findings may have practical implications for fields such as computer vision and image processing.

3 Objectives

- Identify the image features that are most informative for texture discrimination
- Investigate the neural mechanisms that underlie texture perception

4 Experiments

Subjects

We will conduct our experiments using non-human primates.

Stimuli

We will present the non-human primates with a variety of images with different textures. These images will be filtered with various image processing filters to isolate specific image features. We will use Wavelet filters, Gabor filters, Laplacian of Gaussian filters, Difference of Gaussian filters and Local Binary Patterns to isolate texture features. These filters have been widely used in previous studies to isolate texture features in images.

Experimental Setup

The visual stimuli will be presented to the non-human primates using a standard visual display system. The subjects will view the stimuli while seated in a primate chair. The stimuli will be generated and presented using custom-written software. The system will allow us to control the timing and duration of the visual stimuli, as well as the sequence in which they are presented. The primate's responses to the stimuli will be recorded using electrophysiological techniques, allowing us to investigate the neural activity underlying texture perception.

Recording Techniques

We will record neural responses from the visual cortex of the non-human primates using implanted electrodes. We will observe electrophysiological recordings and use multivariate statistical analysis to investigate which image features are most important for texture discrimination, and then which areas of the brain are activated most strongly by said features. Techniques such as principal

component analysis and linear discriminant analysis will be used to identify the image features that are most informative for texture discrimination.

In conclusion, our study aims to identify the image features that are most important for texture detection and understand the neural mechanisms that underlie texture perception.