

Motivic analysis of neuronal responses to visual stimuli

A Project Report

submitted by

ATHUL VIJAYAN

*in partial fulfilment of the requirements
for the award of the degree of*

MASTER OF TECHNOLOGY

**DEPARTMENT OF ENGINEERING DESIGN
INDIAN INSTITUTE OF TECHNOLOGY, MADRAS.**

April 2016

THESIS CERTIFICATE

This is to certify that the thesis entitled **Motivic analysis of neuronal responses to visual stimuli**, submitted by **Athul Vijayan**, to the Indian Institute of Technology, Madras, for the award of the degree of **Master of Technology**, is a bona fide record of the research work carried out by him under my supervision. The contents of this thesis, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

Dr. Hema A. Murthy
Research Guide
Assistant Professor
Dept. of Computer Science and Engineering
IIT-Madras, 600 036

Place: Chennai

Date:

ACKNOWLEDGEMENTS

****I would like to thank everyone who helped me.**

ABSTRACT

KEYWORDS: Markov Decision Processes, Symmetries, Abstraction

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	i
ABSTRACT	ii
LIST OF TABLES	v
LIST OF FIGURES	vi
ABBREVIATIONS	vii
NOTATION	viii
1 Overview of Thesis	1
1.1 Introduction	1
2 Background and Previous work	2
2.1 Experiment setup	2
2.1.1 Sinusoidal grating visual stimuli	2
2.1.2 Natural videos visual stimuli	2
2.2 Orientation and Directional selectivity of neurons in V1	2
3 Analyzing neuronal properties	3
3.1 Quantifying Orientation and Directional selectivity	3
3.2 Modeling neuronal response to sinusoidal gratings stimuli	3
3.3 Classification of neurons based on selectivity	3
4 Searching for Motifs	4
5 Rough Longest Common Subsequence	5

6 Inferences and Future work	6
A Neural visual pathway	7

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

RLCS	Rough Longest Common Subsequence
LCSS	Longest Common Segment Set

NOTATION

$\rho(a, b)$	Pearson correlation between a and b
V1	Primary Visual Cortex

CHAPTER 1

Overview of Thesis

1.1 Introduction

CHAPTER 2

Background and Previous work

2.1 Experiment setup

2.1.1 Sinusoidal grating visual stimuli

2.1.2 Natural videos visual stimuli

2.2 Orientation and Directional selectivity of neurons in V1

CHAPTER 3

Analyzing neuronal properties

Characteristics of neurons in the V1 are discussed in the background section. In this chapter, we use experimental data to demonstrate the claimed properties of neurons in V1.

3.1 Quantifying Orientation and Directional selectivity

3.2 Modeling neuronal response to sinusoidal gratings stimuli

3.3 Classification of neurons based on selectivity

CHAPTER 4

Searching for Motifs

CHAPTER 5

Rough Longest Common Subsequence

CHAPTER 6

Inferences and Future work

APPENDIX A

Neural visual pathway

REFERENCES