ROBERT GORDON UNIVERSITY ABERDEEN

SCHOOL OF COMPUTING SCIENCE AND DIGITAL MEDIA

MSc Big Data Analytics

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Project Title: Automated analysis of Visually Evoked Potential Response data from looming stimuli	
	Start Date: 15th September 2020
	Submission Date: 07th January 2021

CONSENT

I agree ✓
I do not agree ☐

That the University shall be entitled to use any results, materials or other outcomes arising from my project work for the purposes of non-commercial teaching and research, including collaboration.

DECLARATION

I confirm:

- **That the work contained in this document has been composed solely by myself and that I have not made use of any unauthorised assistance.**
- **That the work has not been accepted in any previous application for a degree.**
- **All sources of information have been specifically acknowledged and all verbatim extracts are distinguished by quotation marks.**

Student Signature: 	Date Signed: 07th January 2021

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Abstract

An organism's ability to move around in its environment depends on the capacity of its brain to process visual stimuli. To understand this important process better, neuroscientists use Visually Evoked Potentials, which are the responses a brain creates based on visual information. However, researchers face a major bottleneck since there are millions of data points extracted from their experiments, and only a relatively low number of those data points are Visually Evoked Potentials. Identifying these specific potentials manually is a time-consuming process which requires an expert in the domain. This project aims to partially automate the process so that research is performed more efficiently by analysing and implementing algorithms which can be used to smooth distorted, noisy data along with algorithms that do basic pattern matching. Several signal processing algorithms were reviewed and novel signal processing algorithms have been created to solve the problems faced. The key argument from this project showed that there was little possibility of identifying each VEP response accurately, and the best option providable was to point out all the possible VEP responses. The system has a minimum accuracy of 76.5% with the accuracy increasing depending on the number of VEPs, with a maximum accuracy of 88.2%. The final result is a system that takes in a directory of raw Electroencephalogram data and visually represents all possible VEPs to the researchers by analysing multiple data streams asynchronously and comparing them.

Keywords— Process management, Multithreading, Data structures design and analysis, Pattern matching, Visualization