

LIE DETECTION SYSTEM ON EYE ACTIVITIES ALGORITHM
USING IMAGE PROCESSING TECHNIQUE

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**LIE DETECTION SYSTEM ON EYE ACTIVITIES
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APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Bachelor of Electronic Engineering with Honours.

Signature :

Supervisor Name : Dr Masrullizam bin Mat Ibrahim

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DEDICATION

Specially dedicated to My beloved family and friends for the help and encouragement. Thanks to my supervisor, Dr Masrullizam bin Mat Ibrahim and all the lecturers who gave me guidance and advice throughout the process of finish my final year project

ABSTRACT

Lie detection has been invented from 1900s and still evolving from polygraph to brain imaging. Although the lie detection machine has evolved greatly, the cost and complexity of the system is still high thus inspired this project which are cost effective, simple, and easy to use. The aim of this project is to develop an improvement of the existing lie detection algorithm based on eye activity. The project is developed a system with integration of algorithms and camera. The camera is used to examine the activity of eye in real time application using Matlab software platform. Based on the experimental results, this system have shown promising detection rate as discussed detail in chapter 4.

ABSTRAK

Pengesanan kebohongan telah dicipta dari tahun 1900-an dan masih berkembang dari polygraph ke pencitraan otak. Walaupun mesin pengesan kebohongan telah berkembang dengan pesat, kos dan kerumitan sistem masih tinggi dan ini memberi inspirasi kepada projek ini yang kos efektif, mudah, dan mudah digunakan. Tujuan projek ini adalah untuk membangunkan algoritma pengesanan kesilapan yang sedia ada berdasarkan aktiviti mata. Projek ini dibangunkan dengan sistem integrasi algoritma dan kamera. Kamera ini digunakan untuk memeriksa aktiviti mata dalam aplikasi masa sebenar menggunakan platform perisian Matlab. Berdasarkan keputusan percubaan, sistem ini telah menunjukkan kadar pengesanan yang menjanjikan seperti butiran terperinci dalam bab 4.

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LIST OF SYMBOLS AND ABBREVIATIONS

NLP	:	Neuro Linguistic Programming
GUI	:	Graphic User Interface
fMRI	:	Functional Magnetic Resonance Imaging
fNIRS	:	Functional Near-Infrared Spectroscopy
PC	:	Personal Computer
EEG	:	Electroencephalography
ERP	:	Event Related Potentials
BOLD	:	Blood Oxygen Level Dependent
PET	:	Positron Emission Tomography
SPECT	:	Single-photon Emission Computed Tomography
HbO ₂	:	Haemoglobin
d-Hb	:	Deoxygenated Haemoglobin
EAC	:	Eye Accessing Cues
PRS	:	Primary Representational System
BF	:	Blink Frequency
CHT	:	Circular Hough Transform

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CHAPTER 1

INTRODUCTION

1.1 Project Overview

The aim of this project is to make an improvement on lie detection algorithm based on eye activities. From eye activity, lie can be detected even in a smallest change. There are many existing techniques to detect lie in which ranged from polygraph technique to facial characteristics technique. Image processing is the method specifically used in this project. This project also developed based on real-time application. In the software part, MATLAB is used as platform to develop and evaluate the algorithm. The algorithm begins with the capturing image of the eye and focusing on the iris activities, and then the data are processed to determine whether the subject is lying or not. First, the algorithm detects the face of the subject and focus on it. Then, the system focus on eyes of the subject as to identify the iris activities

which is iris gaze direction. This system integrates with Neuro Linguistic Programming (NLP) principle, in which iris gaze direction is recognized in order to detect the subject is lying or not. The next procedure is to integrate GUI (Graphic User Interface), algorithm and camera. The performance of developed algorithm is validated from extensive experiment. For the hardware part, camera is needed integrated with computer and software. This project will cover to improved only the eye activities algorithm.

1.2 Objectives

To accomplish this project, there are several objectives to achieve as follows:

1. To improve the existing lie detection algorithm based on eye activity.
2. To develop an integrated lie detection system based on eye activity.
3. To validate the performance of the developed system.

1.3 Problem Statement

Lie detection system has evolved from using polygraph to new modern brain imaging technology such as Functional Magnetic Resonance Imaging (fMRI) and Functional Near-Infrared Spectroscopy (fNIRS). Both polygraph and brain imaging technique is high cost and complex. This project proposes an improvement to the existing algorithm, which focuses on eye activities. Eye activities such as eye movement and eye blink are directly connected to cognitive brain, that means the activities are spontaneously happen. Therefore, the character of lie can be captured from the eye activities. The method on detecting lie are also made simple as it only

focuses on eye activity only. This system is also cost-effective compared to other technique of lie detection.

1.4 Scope of Work

This project basically is a lie detection system on facial analysis algorithm using image processing technique based on eye activity. Matlab software is used in order to complete this project. Limitation of this project is this lie detection focuses only on eye activity, not overall face.

This system use integration of Graphical User Interface (GUI), algorithm and camera. The integration is shown as Figure 1.1.

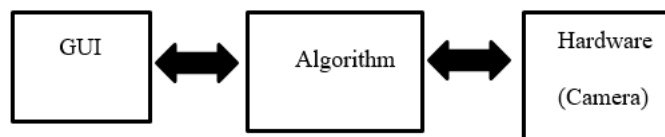


Figure 1.1: System integration

1.5 Project Significance

Lie happens whenever you deliberately endeavor to misdirect somebody. A few lies are huge while others are little; some are totally false proclamations and others are facts with a couple of fundamental subtle elements made up or left out. A few lies are self-evident, and some are exceptionally inconspicuous. When lying, there are natural reaction that can be detected. Detecting lie is a crucial factor in certain sector especially in law enforcement. Truthfulness is important for that sector so this is where lie detection is being applied. Lie detection will help the court or the police to know whether the suspect is telling the truth or not and help lessen the time for an investigation. This project also is useful for NLP practitioner in psychology work

related. Those NLP practitioners can use this algorithm in order to practice NLP in lie detection based on eye movement.

Lie detection has evolved exponentially and many technique has been discovered throughout the year. Many studies are being made as to know what method are the best in detecting lies. For this project, image processing focused on iris movement alongside Neuro Linguistic Programming (NLP) approach in adapting the proposed lie detection. Another lie detection based on eyes is by using eye blink rate. So this project is different than any other eye related in lie detection.

Other than that, this project has its own value in sustainability and environmental factor. This project uses a PC based system so there is no material that can harm environment. Harmful substances are also not being used in making this project. This is because this project only use computer to run the system and camera for detecting lie. There are no substances waste in the making of this project.

1.6 Chapter Review

In chapter 1, a short description of introduction which is about general overview of lie detection system. Problem statement is clearly stated to introduce the importance of this project. Then this chapter is oriented to the significance of the study and the research questions, hypotheses, or assumptions to follow. This is to explain what problem are being solve or what improvement are being made compared to previous research. The objectives of this project are also being stated to guide researchers of what expected result that need to be achieved at the end of this project. Next, the scope of work is being explained in detail to set the limitation of this project. Project

significance are also being discussed to show the impact on the stated problem statement.

Chapter 2 is literature review. A lot of journal and article had been reviewed as a reference for this study. Related topic is being gathered and discussed in this chapter so that the aims of this project can be achieve to solve the problem. The reviewed are includes history of lie detection, several different techniques of lie detection, Neuro Linguistic Programming (NLP), and the method to detect lie. The related papers have been summarized in this section.

Chapter 3 is methodology of the project. Implementation to achieve the aims of this project is presented in this chapter. Software, hardware and flowchart had been explained in detail. Besides, every phase of the flowchart is discussed carefully. Technique or algorithm that had been used in every phase will be stated clearly.

Chapter 4 is all the experimental result that has been done out to assess the performance of the developed system. Developed integrated system are being shown and discussed thoroughly one by one. Procedure about how to obtain result also are shown. Results of this experimental are explained and discussed thoroughly.

Chapter 5 concludes the results and discussion that are being obtained from the experimental process. A short recommendation toward future development is also have been discusses in this chapter.

CHAPTER 2

BACKGROUND STUDY

This chapter discusses the literature of the several related journals and article. The evolvement of lie detection technology also is discussed in this chapter.

2.1 Nature of Lie

Deception is a common nature behavior that normal human performs consistently. Lying is a ubiquitous social phenomenon common to daily life. Lying is the deliberate telling of something not true that is usually done when a man understands that honesty does not meet someone else's desires. There are plenty reasons to lie including a longing to look extraordinary, control social collaboration, keep away from issue, protect relational connections, or accomplish relational power [1].

Everyone must have experienced lying whether accidentally or not. There are several type of lies. According to [1], there are three categories of lies which are gray lie, real lie and white lie. Real lies are unacceptable lies that have genuine outcomes that totally cover the truth. They were seen similar to the most genuine and unsuitable type of lies since they deliberately deceive people which can cause significant issues. White lies were depicted as being small lies that are paltry, half evident, have nice intention and for the most part adequate. They are generally little and trifling, does not hurt anyone and are usually utilized by many people, thus making them saw similar to the slightest serious sort of lie. Generally, people had exceptionally constructive audit of white lies, as it is innocuous, insignificant, little, and even helpftal as indicated by individuals. Middle region in the space of real and white lies were described as gray lies. Two types of gray lies include ambiguous gray lies and justifiable gray lies. Lies that can without much of a stretch be translated in various ways by various individual is known as ambiguous gray lies since they do not neatly fall into either classification while legitimate gray lies are those lies that are told in many ways, yet the vast majority consider to be reasonable in specific conditions.

There are many signs that can be indication of when human is lying. Based on research paper [2], they found that there is common belief about liars. Liars usually shift their posture, touch and scratch themselves, seems nervous, and had flawed in their speech. Besides, the phrase “other people cannot see you in the eyes” is the most common stereotype about liars. The researchers uncovered a pan-cultural stereotype in two worldwide investigations which is: liars avoid eye contact. So, it is safe to say that in order to detect lie, observing eye movement is one of the way.