

# **A Computer Vision System for the Classification of Moving Object**

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*"To my beloved Father, Mother and Sisters"*

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## **ABSTRACT**

The aim of this research is to produce a system that can detect the moving object and classify it into three classes: “Humans, Vehicle and Animals”. Using fixed video camera in outdoors environment, the system will capture the images and digitize them using (Piccolo Pro II) frame grabber at a rate of 25 frames per second. The Background Subtraction technique has been employed in the work as it is able to provide the most complete feature for data. However, it is extremely sensitive to dynamic changes like changing of illumination. Background Subtraction is done by taking the difference between any frame and the background in detecting the Moving Object. In order to reduce the effect of noise pixels resulting from the Background Subtraction operation, a number of pre-processing methods have been applied on the detected moving object. These preprocessing operations involve the use of median filter as well as morphological filters. Then the outline of the object will be extracted using border extraction technique. The classification makes use of both the shape and the dynamic features of the objects. In increasing the performance of the classification, all features are sequentially arranged so that the goal of this research is to be achieved. In this work, the performance achieved is 93% for class human, 93% for class vehicle and 64% for class animal.

## ABSTRAK

Tujuan utama kajian ini adalah untuk menghasilkan satu tujuan yang boleh mengenal pasti pergerakan sesuatu objek dan seterusnya mampu mengklarifikasinya kepada tiga kumpulan iaitu sama ada manusia, kenderaan atau haiwan. Dengan menggunakan sebuah kamera video untuk merakamkan keadaan persekitaran, yang kemudiannya merakamkan imej tersebut secara digital dengan menggunakan pencapai kerangka gambar (Picalo Pro II) pada kelajuan 25 kerangka per saat. Kaedah penolakan latar belakang digunakan dalam kajian ini kerana mampu memberikan ciri-ciri data yang paling menyeluruh. Namun begitu, ia adalah sangat sensitif kepada perubahan yang dinamik seperti cahaya dan persekitaran. Kaedah penolakan latar belakang dilakukan dengan mengenalpasti perbezaan di antara latar belakang dan kerangka gambar yang dikesan daripada objek yang bergerak. Operasi pra-pemprosesan dilakukan terhadap objek yang bergerak untuk mengurangkan kesan hingar piksel-piksel rawak daripada operasi penolak latar belakang. Ini dilakukan dengan menggunakan penapis median dan juga penapis morfologi. Kemudian, bentuk luaran objek akan diekstrak menggunakan teknik pengekstrakan sempadan. Pengklarifikasian ini akan melibatkan bentuk dan sifat dinamik yang terdapat pada objek tersebut. Bagi meningkatkan pencapaian klasifikasi, semua ciri-ciri disusun supaya objektif penyelidikan ini dapat dicapai. Hasil kajian menunjukkan pencapaian yang diperolehi ialah masing-masing sebanyak 93% bagi kumpulan manusia dan kumpulan kenderaan, manakala pencapaian bagi kumpulan haiwan pula ialah 64%.

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**LIST OF NOTATIONS**

$B(i,j)$	Initialize background.
$I1(i,j)$	First frame.
$M1(i,j)$	Mask created.
$g(x,y)$	Threshold version.
$T$	Fixed Value (32).
$f(x,y)$	Input.
$x_c$	Centre point for x coordinates.
$y_c$	Centre point for y coordinates.
$N_b$	The number of boundary pixels.
$x_i$	The pixel on the boundary of MO.
$y_{Top}$	The first pixel above $x_c$ ,
$y_{Bottom}$	The first pixel down $x_c$ .
$d_i$	The distance from the centroid $(x_c, y_c)$ to $(x_i, y_i)$ .

## LIST OF ABBREVIATIONS

MO	MOVING OBJECT.
BIA	Background initialization Algorithm.
BSA	Background Subtraction Algorithm.
FE	Feature Extraction.
WHR	Width to Height Ratio.
BAR	Base to Abdomen Ratio.
R	Red.
G	Green.
B	Blue.
HeadH	Head of Human.
PeakH	Peak of Human between 180-360.
HeadV	Head of Vehicle.
PeakV	Peak of Vehicle between 180-360.
HeadA	Head of Animal.
PeakA	Peak of Animal between 180-360.

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## **Chapter One**

### **Introduction**

#### **1.1 Preliminary**

Systems for detecting and classifying moving object have been a challenge for researchers due to the unpredictable behavior of the moving object (MO). The direction of the MO motion and its change over time plays a big roll in the classification. These problems have being solved for some cases but not all. Due to that, the proposed system is to classify certain cases for the MO after pre-processing.

#### **1.2 Limitation of other systems**

Researchers in the area of classifying of moving objects are dealing mostly with recognizing vehicles such as cars, buses and other not considering motor cycles, bicycles and humans in a certain situation due to the unpredictable behavior of human being. The worst is when analyzing animals with their unexpected movement. Due to the reasons illustrated before a few work has been done in this area.



### **1.3 Overall system stages**

Given a sequence of frames from a static camera, the proposed system is capable of detecting moving objects. The system extracts static and dynamic features of these moving objects and then classifies them into three categories i.e. “Human vehicles and animals”. In the following chapters methods used in the proposed system will be described. The methods introduced can be summarized as follows :

1. Background Initialization Algorithm (BIA).
2. MO Detection using Background subtraction Algorithm (BSA).
3. Object preprocessing.
4. Feature extraction (FE).
5. Classification.

### **1.4 Objective**

The main objective of this project is to design and develop a system that can detect and classify moving object into three classes: “walking and running human, vehicles or animals walking on four”. The object will be processed before classified using some image processing techniques to accommodate environmental changes during the acquiring process. This work can be an important part for intelligent security surveillance purposes.

## 1.5 Scope of work

In developing a system for automatic classification, the scope of the current research has been defined as follows:

1. Classification is limited to: “*Free walking and running isolated human, vehicles and sizable animals walking on four legs*”.
3. No automatic adaptation technique for the background involved.
4. Process does not include night vision.
5. Images with many fluttering objects such as trees and flags are not handled.
6. Only one moving object is allowed at any time.
7. The system will not deal with a MO that contains a shadow.
8. The algorithm has been developed using matlab in an offline mode.

## 1.6 Project Outline

The project is organized into five chapters. The outline is as follows;

### Chapter 1- Introduction

This chapter discusses the objectives and scope of the project and gives a general introduction on the environment and categories the moving objects that will be classified.

**Chapter2- Review of Literature studies**

This chapter reviews the previous work regarding the classification of MO.

**Chapter3- Overall System Process**

This chapter presents the overall system methodology and steps that must be taken into consideration for classification purposes.

**Chapter4- Algorithms & Implementation**

This chapter shows the final results for pre-processing, detecting and classifying the MO.

**Chapter5- Results**

This chapter consists of conclusion and recommended work for future improvement.

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