

VISION-BASED CUSTOMER COUNTING FOR SHOPPING LOTS

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To my beloved parents, wife, son and relatives

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ABSTRACT

Market research is vital for businesses to prosper in this modern world, and customer traffic data forms a very important part of the market research studies in order for business owners to gauge the attractiveness of the products available at their business premises and hence allow them to strategize their business or marketing plan accordingly. However, the problem arises when customer traffic data is collected manually, which is tedious, time-consuming and prone to error. The purpose of this project is to develop a simple, user-friendly software based on MATLAB to count the number of people at a premise. The input to the software is a pre-recorded video sequence captured by an overhead camera hung from the ceiling. This video sequence involves top view scenes of people walking at a designated area in the business premises within the sight of an overhead camera. In order to perform the task of counting the number of people in a video, multiple digital image processing techniques are implemented, starting with frame grabber to extract still images from a video sequence, followed by image pre-processing steps including RGB image conversion to grayscale, background subtraction, threshold-based object segmentation and morphology operations. The last step involves tracing the boundary of the region of interest and then label and count it based on blob measurement. The project integrates these steps into a flow within a Graphical User Interface (GUI), and the final implementation is a working GUI with the capability to accept user interaction. The completed software is able to count the number of people, with accuracy at about 81% depending on the image conditions.

ABSTRAK

Penyelidikan pasaran adalah penting untuk perniagaan supaya ia boleh berjaya dalam dunia moden ini, dan data trafik pelanggan membentuk informasi yang sangat penting dalam kajian penyelidikan pasaran bagi membolehkan pemilik perniagaan untuk mengetahui daya tarikan produk yang terdapat di perimis perniagaan mereka, dan dengan itu membolehkan mereka untuk menyusun strategi pelan perniagaan atau pemasaran mereka dengan sewajarnya. Walau bagaimanapun, masalah timbul apabila kutipan data trafik pelanggan dilakukan secara manual yang memakan masa dan terdedah kepada kesilapan. Tujuan projek ini adalah untuk membina satu perisian yang mudah dan senang diguna berdasarkan MATLAB untuk mengira bilangan orang di satu kawasan premis. Input kepada perisian ini ialah satu video rakaman yang telah direkod oleh kamera overhead yang digantung dari siling. Rentetan video akan memaparkan adegan pandangan atas orang-orang berjalan di satu kawasan yang ditetapkan di dalam premis perniagaan di sisi kamera overhead. Untuk melaksanakan tugas pengiraan bilangan orang di dalam video rakaman, pelbagai teknik pemprosesan imej digital dilaksanakan, bermula dengan bingkai bakhil untuk mengeluarkan imei dari urutan video, diikuti dengan langkah-langkah pra-pemprosesan imej termasuk penukaran RGB gambar kepada grayscale, penolakan latar belakang, segmentasi objek berdasarkan ambang dan operasi morfologi. Langkah terakhir melibatkan pengesanan sempadan and pelabelan objek yang dikehendaki. Projek ini mengintegrasikan langkah-langkah ke dalam aliran dalam Antara Muka Pengguna grafik (GUI), dan pelaksanaan akhir adalah satu GUI dengan keupayaan untuk menerima interaksi pengguna. Perisian yang siap berupaya untuk mengira bilangan orang, dengan ketepatan pada kira-kira 81% bergantung kepada keadaan imej.

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LIST OF ABBREVIATIONS

RGB	-	Red, Green, Blue
GUI	-	Graphical User Interface
IEEE	-	Institute of Electrical and Electronics Engineers
HOG	-	Histogram of Oriented Gradients
NCC	-	Normalized Color Coordinates
PNG	-	Portable Network Graphics
CPU	-	Central Processing Unit

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CHAPTER 1

INTRODUCTION

1.1 Background

One of the key indicators for a business to prospect in the modern days is the number of potential customers entering into the business premises, for example shopping lots. Even though these customers may not be buying the products on display, their mere presence can be a useful indicator in terms of the attractiveness of the products available in the premises.

Due to this reason, statistics of the number of potential customers entering the shopping lots constitutes a very important piece of information for the business owners in analyzing the customer traffic and hence strategizing their business or marketing plan accordingly in order to attract more customers into their business premises.

The most common way of monitoring the number of people entering a business premise without any technology involved is by manually counting them. This can be very tedious and time-consuming, let alone prone to error for the person assigned to perform this task.

Therefore, an automated way of customer counting by means of vision-based software is a very attractive proposition. However, such an approach does have its own technical challenges to be overcome in its implementation. For example, one must consider the most suitable image processing techniques to be used in order to

achieve a good level of accuracy and oftentimes that means complex image processing algorithms are required.

1.2 Objective

The aim of this project is to develop a simple, user-friendly vision-based software to count the number of people entering or leaving a premise.

1.3 Scope of Work

This is a software-based project and MATLAB is used for implementation. The input to the software is a pre-recorded video sequence captured by an overhead camera hung from the ceiling. This video sequence shall involve top view scenes of people walking at a designated area in the business premises within the sight of an overhead camera. Video capturing is not covered as part of this project.

1.4 Project Report Overview

This project report consists of five chapters. Chapter 1 describes the background, objective, scope of the project and also an overview of the project report. Chapter 2 discusses the literature review of similar works that had been done and the methods that were used. Chapter 3 describes the methodologies used in this project as well as giving an overview description of the final software that is the result of this project. Chapter 4 discusses the test results, limitations of this project and the future works proposed. Finally Chapter 5 covers the conclusion.

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