Face Detection Robot

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Abstract

Face detection is a process that occurs very quickly in humans, unless the object is located only a short distance away. In this paper, we present a computer-based control system for human detection and security in such challenging environments. Human detection is an important task in artificial intelligent robotic systems, which typically require a robust target detector to function in a variety of circumstances. A system of this kind can be used for security monitoring, data collection, and experiments. The uses a Microsoft kinetic RGD Camera as a visual sensing device. design for human detection. Additionally, we implemented a robot operating system (ROS)-based computer control system on a four-wheel mobile platform. The results of the experiments confirm that the proposed face detection system works.

1. Introduction

In places like a multi-specialty hospital with tens of doctors and hundreds of patients, a face-based user verification robot has many uses. Because the diseases are contagious, it is difficult and risky for a human to direct patients to the appropriate doctor in such settings. As a result, a face-based user verification robot checks for the patient's scheduled appointment with the relevant doctor and directs them to the appropriate chamber without human intervention.

This robot can be used in a variety of settings, including offices, larger businesses, and other settings where authentication and security are of the utmost importance. In this project, we will simulate a robot application and use ROS and Open-CV to carry out face-based user verification tasks.

The entire application that we create is a robot application that exists in a simulation world and is equipped with vision and face detection capabilities. It will sense and detect faces of people in the simulation environment and carry out particular actions based on our specifications. In order to develop this simulation, we will make use of the ROS Melodic version, Python Open-CV, and Visual Studio code as the IDE. Simple heuristic and anthropometric methods have been used in face detection since the 1970s. These methods are mostly rigid because they assume things like a plain background and a frontal face, like in a typical passport picture. Any change in image conditions would necessitate, if not a complete redesign, for these systems. Despite these issues, research interest did not increase until the 1990s, when face recognition and video coding systems started to be implemented in practice. There has been a significant amount of interest in face detection research over the past ten years. Schemes for segmentation that are more robust have been presented, particularly those that make use of generalized information, motion, and color. Statistics and neural networks have also made it possible to identify faces in a variety of scenes that are cluttered from a distance from the camera. In addition, face detection techniques can be effectively divided into two broad categories that are distinguished by their distinct approaches to utilizing face knowledge. Face detection techniques require a priori information of the face, so numerous advancements in the design of feature extractors, such as deformable templates and active contours, that are capable of accurately locating and tracking facial features. The first group of techniques make explicit use of face knowledge and employ the traditional detection method, which involves obtaining low-level features prior to knowledge-based analysis.

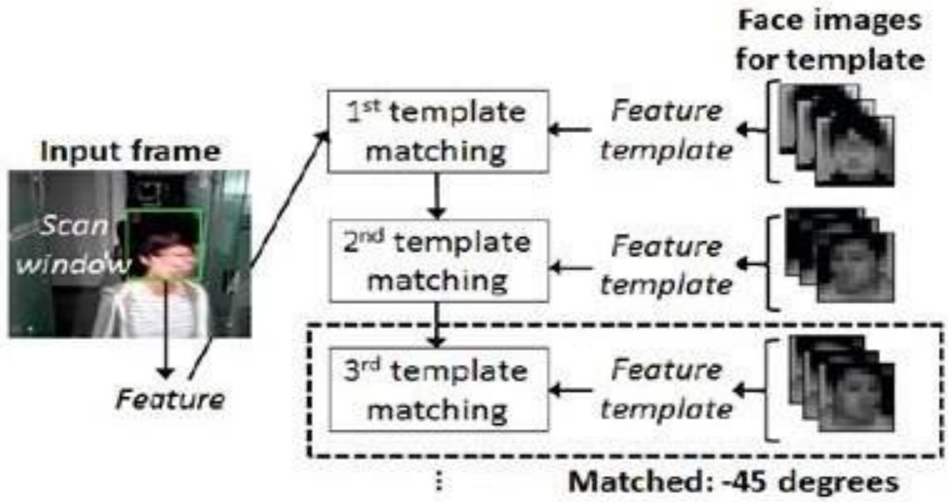

Fig.1 Template Matching

2. Literature Review

Face detection is a computer technology that finds the size and location of a person's face in any digital image. The facial features are identified, and any other objects in the digital image, such as bodies, trees, and buildings, are omitted. It is possible to think of it as a special case of object-class detection, where the goal is to locate and determine the sizes and locations of all objects in an image that belong to a particular class. Face detection is one example of face localization in a broader sense. The goal of face localization is to determine the locations and sizes of a predetermined number of faces, typically one. The two main methods for identifying facial features in an image are the feature base approach and the image base approach. The Feature Base Approach tries to match known face features to image features by extracting them. The image base approach, on the other hand, tries to match the training and testing images to perfection.

These methods are referred to as the feature-based approach because features are the primary components. Since the 1970s, these methods have sparked the majority of interest in face detection research, as evidenced by the majority of the reviewed literature. The methods in the second group address face detection as a general recognition problem by making use of the most recent developments in pattern recognition theory. Without the need for feature derivation or analysis, image-based representations of faces, such as 2D intensity arrays, are directly classified into a face group using training algorithms. These relatively new methods use a mapping and training scheme to implicitly incorporate face knowledge into the system, in contrast to the feature-based approach.

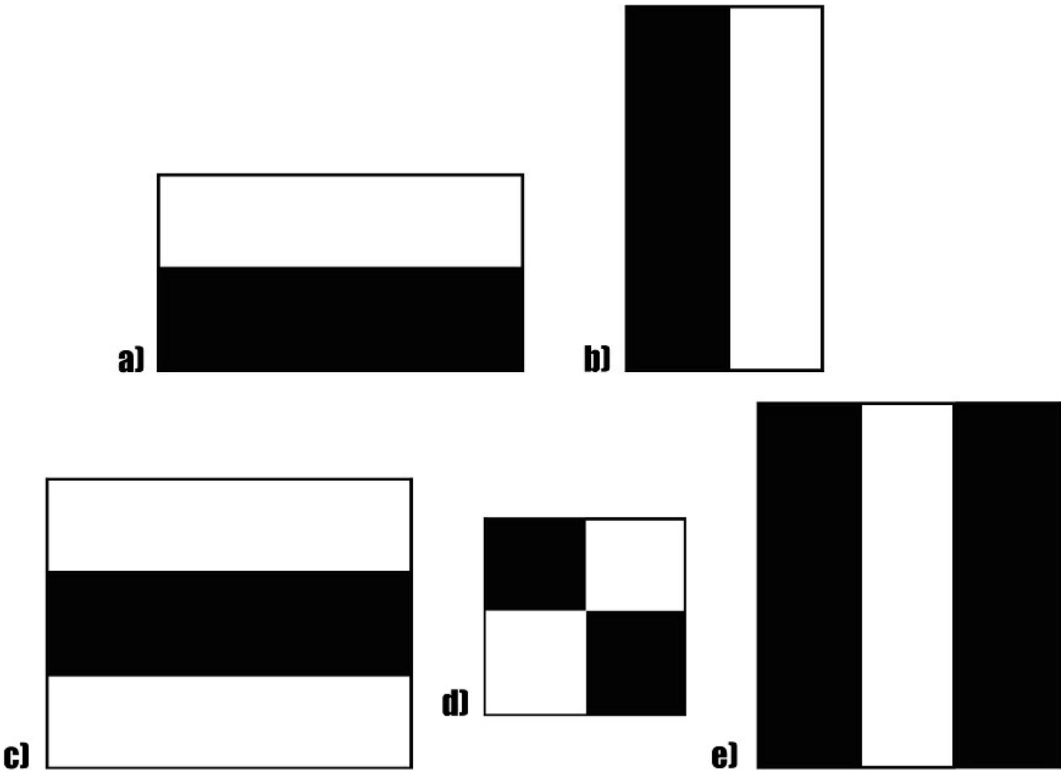

Fig.1 HAAR Features

3. Proposed System

The haar include persistently crosses from the upper left of the picture to the base right to look for the specific element. The whole idea of the haar feature traversal can be seen in this simple illustration. The haar feature would actually move through the image pixel by pixel. Additionally, the haar features will be utilized in their entirety. These fall broadly into three categories, each of which is determined by the feature that each person is looking for.

As can be seen above, the first set of two rectangle features is responsible for determining whether the edges are in a horizontal or vertical direction. The second set of three rectangle features is responsible for determining whether a lighter region is surrounded by darker regions on either side or the other way around. The change in pixel intensities across diagonals is determined by the third set of four rectangle features.

Now, the haar features traversal on an image would necessitate a lot of math. It requires 18 pixel value additions (for a rectangle enclosing 18 pixels), as we can see for a single rectangle on either side. Consider doing this for the entire image with haar features of all sizes. Even for a machine with high performance, this would be a busy operation.

Fig 3: Feature Detection on an Image containing a face

The Robot Operating System (ROS) is a flexible framework for writing robot software. It is a collection of tools, libraries, and conventions that aim to simplify the task of creating complex and robust robot behavior across a wide variety of robotic platforms. Why? Because creating truly robust, general-purpose robot software is hard. From the robot's perspective, problems that seem trivial to humans often vary wildly between instances of tasks and environments. Dealing with these variations is so hard that no single individual, laboratory, or institution can hope to do it on their own.

As a result, ROS was built from the ground up to encourage collaborative robotics software development. For example, one laboratory might have experts in mapping indoor environments, and could contribute a world-class system for producing maps. Another group might have experts at using maps to navigate, and yet another group might have discovered a computer vision approach that works well for recognizing small objects in clutter. ROS was designed specifically for groups like these to collaborate and build upon each other's work, as is described throughout this site

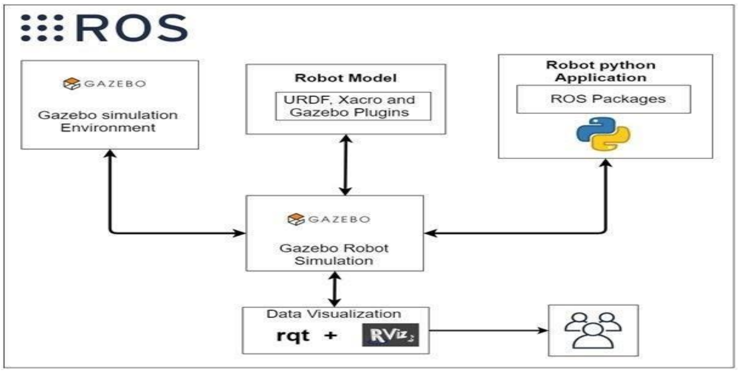

Fig 4: Technical Architecture

4. Conclusion

A model for using robots to identify human faces is shown to us in this. To accomplish this, we will develop the simulation using the Visual studio code as an IDE and the ROS Melodic version of Python Open-CV to identify faces. We can develop the code by importing the URDF packages and incorporating the Hokuyo distance laser sensor into the robot to detect it within human range..

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