A System Based Approach to Efficiently Implement Color Differentiation Mechanism with Respect to Automobiles.

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Abstract— Artificial Intelligence is the intelligence of machines focusing on creating machines that can engage on behaviors that human considers Intelligent Expert Systems are the programs based on their theory and methods of AI. Expert Systems have a wide variety of applications especially when coming to object recognition. This paper explains the applications of expert systems in object recognition and proposes a sample model of an expert system that would recognize an automobile by differentiating its color.

Keywords— Artificial Intelligence, Color Differentiation, Automobiles, Expert Systems.

I. INTRODUCTION

Artificial Intelligence is the intelligence of machines focusing on creating machines that can engage on behaviors that human considers intelligent [Bean Lands, 1994]. It is also called machine intelligence. It focuses on problem solving techniques and functions of the human brain. Expert Systems are the programs based on their theory and methods of AI.

The scientific goal of AI understands the intelligence by building the computer programs that shows the intelligent behavior. They are related with the concepts and the methods of a computer program and how the knowledge is used to make those changes will be represented inside the machine. The intelligence covers many skills which include their ability to solve the problems, learn them, and understand the language AI has all those factors [Waterman D A, 1986]. AI is applied in the area of problem solving concepts and methods for building the programs rather than calculating a solution.

AI programs that have an expert level competence in solving the problems by bringing the body of the knowledge about some specific tasks are known as the knowledge base or ES. ES is used for those programs whose knowledge base contains the knowledge used are gained by the human experts, similar to the knowledge gathered from the non-experts or textbooks. The two terms, expert systems (ES) and knowledge based systems (KBS), are used at a time. They represent the widest AI application. The human intellectual endeavor that is to be captured in an expert system is known as the task

domain. Task refers to some goal-oriented problems or problem-solving those tasks. Domain refers the task which is to be performed. Typical tasks to be performed are diagnose the problem, planning the task, scheduling them, configure them and designing the task. An example of a task domain is aircraft scheduling.

The process of building an expert system is known as knowledge engineering and the people practicing the above engineering are called the knowledge engineers [O'Leary D E, 1995]. The knowledge engineers must be sure that the computer has all the knowledge that is required to solve a problem. The knowledge engineers must select one or more forms to represent the required knowledge as patterns in the memory of the computer program that is they may select a task known as knowledge representation task, to represent knowledge. They must also be sure that the computer can use the knowledge efficiently by choosing a handful of reasoning methods. The practice of knowledge engineering describes the components of expert systems.

II. BENEFITS OF EXPERT SYSTEMS

Expert systems will be more effective than other computer based applications, because they [Geraghty,

1993]:

- May combine the knowledge of many experts in a specific field.
- Can store an unlimited amount of information and works that are much faster, than a human.
- Are available for 24 hours a day, and can be used at a distance over the network.
- Are able to explain their information requests and their suggestions.
- Can process their client's uncertain responses by combining several pieces of useless information to make strong recommendations.
- Can accumulate the knowledge of high level employees for any company, which is useful when the company needs to fire the employees due to their worse market conditions.

III. EXPERT SYSTEM IN OBJECT RECOGNITION

Vision enables us to recognize people, animals, and inanimate objects reliably. In AI or computer vision, it is currently to use the term object recognition to refer to all of these abilities. This includes determining the class of particular objects that have been imaged-e.g, a face-as well as recognizing specific objects-e.g., Bill Clinton's face. Motivating applications include the following:

A. Biometric Identification

Criminal investigations and access control for restricted facilities require the ability to identify unique individuals. Fingerprints, iris scans, and facial photographs result in images that must be matched to specific individuals [Hollnagel E, 1989].

B. Content Based Image Retrieval

It is easy to find a location in a document, if one exists, for the string "cat"-any text editor provides this capability. Now consider the problem of finding the subset of pixels in an image which correspond to the image of a cat. If one had this capacity, one could answer image queries such as "Bill Clinton and Nelson Mandela together"," a skater in mid-air", "the Eiffel Tower at night", and so on, without having had to type in caption keywords for each photograph in a collection. As image and video collections grow, manual annotation cannot scale [Stachowitz R A, 1988].

C. Handwriting Recognition

Vision is used to recognize not only objects, but also activities. We can identify gaits, expressions, gestures, actions and so on. Research on activity recognition is still in its infancy, so in this section we will concentrate on object recognition [Webs P J, 1990].

The problem of visual object recognition is generally easy for people, but has proved to be very difficult for computers. One wants to be able to identify a person's face in spite of variations in illumination, pose with respect to the camera, and facial expression. Any of these changes causes widespread differences in pixel brightness values, so a straightforward comparison of pixels is unlikely to work. When one wants to recognize examples of a category such as "car", one must cope with the within category variation. Even the very restricted problem of recognition of handwritten digits in postal zip codes proved to be quite a challenge [Bundy A, 1987].

D. Multiple views of Three-Dimensional Object

The challenge is image segmentation. Any image will typically contain multiple objects, so we need first to partition it into subsets of pixels that correspond to single objects. Once the image has been partitioned into regions, one can then input these regions or assemblies of regions into a classifier to determine object labels. Unfortunately, bottom up segmentation is an error prone process, so alternatively one might seek to find object groups top down. That is, search for a subset of pixels that you can classify as a face, and if you succeed, you have found a group! Purely top down approaches have high computational complexity, because one needs to examine image windows of different sizes, and at a different locations, as well as compare them to all the different object hypotheses. At present, most practical object recognition systems use such a top down strategy, though this might change as bottom-up techniques improve [Finlay P N, 1988].

The second challenge is to ensure that the recognition process is robust against variations in illumination and pose. Humans can recognize objects in spite of considerable variation in precise appearance as measured by pixel brightness values. For examples, we can recognize a friend's face under different illumination conditions,

or at different angles of view. As an even simple example, consider recognizing the hand written digit 6. One should be able to do this at different sizes and at different positions in the image, and in spite of small rotations of the view [Harbridge R M, 1986].

The key point to note here is that geometrical transformations such as translation, scaling and rotation, or transformations of image brightness caused by moving light sources physically, have a different character than the intra-category variation such as exists between different human faces, or the different ways of writing the digit 4. On the other hand, the effects of geometric and physical transformations are systematic and one should be able to factor them out to by a proper design of the features used represent the training instances [Pau L F, 1987].

To provide invariance under geometric transformations, one technique that has proved quite effective is to preprocess the image region into a standard position, scale, and orientation. Alternately, we can merrily ignore the cause nature of the geometrical and physical transformations and think of them as just other sources of variability for the classifier. In the training set, example need to be provided corresponding to all these variations, and the hope is that the classifier will include an appropriate set of transformations of the input so that the variations are factored out [Drucker P, 1993].

The use of shape for object recognition has proved to be much more difficult. Broadly speaking, there are two main approaches: brightness based recognition, in which pixel brightness values are used directly, and brightness based recognition, which involves the use of spatial arrangements of extracted features such as edges or key points [Edwards G, 1993]. The following figure shows how multiple view is obtained for a three dimensional object.

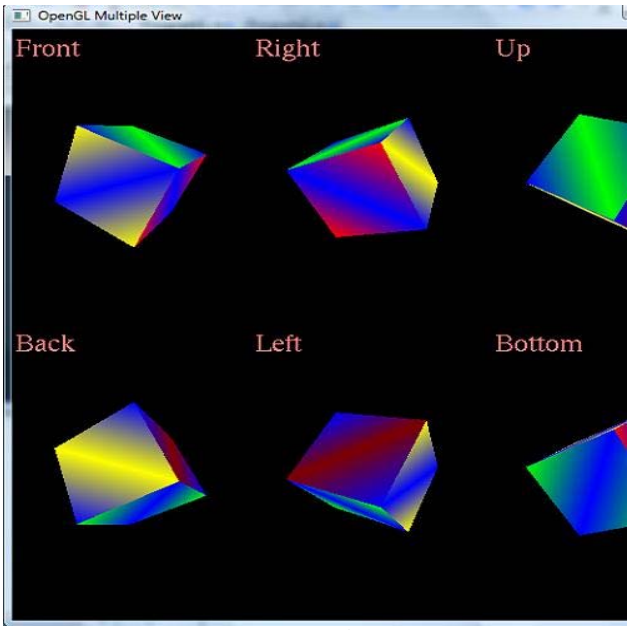

Figure 1: Multiple views of a three dimensional object
Source: Website, vis.lbl.gov

E. Brightness Based Recognition

A variety of statistical methods have been used to develop face detectors from image databases, including neural networks with raw pixel inputs, decision trees with features defined by various bar and edge filters, and naïve Bays models with wavelet features.

One negative aspect of using raw pixels as feature vectors is the great redundancy inherent in this representation. Consider two nearby pixels on the cheek of a face; they are likely to be very highly correlated because of similar geometry, illumination, etc. Data reduction techniques, such as principal component analysis, can be used successfully to reduce the dimensionality of the feature vector, enabling recognition of such things as faces with greater speed than one would get in a higher-dimensional space [Mann C K, 1992].

F. Features Based Recognition

Many different definitions have been proposed for distances between images. One of the more interesting approaches is based on the idea of deformable matching. In his classic work on growth and form, D'Arcy

Thompson observed that related but not identical shapes can often be deformed into alignment using simple coordinate transformations. We operationalize a notion of shape similarity as a three stage of process:

- Solve the correspondence problem between the two shapes,
- Use the correspondence to estimate an aligning transform, and
- Compute the distance between the two shapes as a sum of matching errors between corresponding points, together with a term measuring the magnitude of the aligning transformation.

The distance between two shapes can be defined as a weighted sum of the shape context distances between corresponding points and the bending energy associated with he thin plate spline. Given this distance measure, one can use a simple nearest-neighbor classifier to solve the recognition problem [Compton P, 1992].

IV. POSE ESTIMATION

In addition to determining what an object is, we are also interested in determining its pose, i.e., its position and orientation with respect to the viewer. For instance, in an industrial manipulation task, the robot arm cannot pick up an object until the pose is known. In the case of rigid objects, whether three dimensional or two dimensional, this problem has a simple and well defined solution based on the alignment [Jafar M, 1990].

V. DEVELOPMENT OF AN AUTOMATIC COLOR DIFFERENTIATION SYSTEM

Expert Systems are developed with the help of a collection of software packages and tools which are used to develop the expert systems [Keller R, 1987]. Expert System provides a high potential payoff for reducing the downside risk. It can capture and preserve for irreplaceable human expertise. Automobile color differentiation is an important stage in the systems of intelligent traffic. Nowadays the cars play a very big role in the transportation. The use of cars is increased because of the needs of human and growth of population in present years. Therefore, the control of cars is becoming a big problem and it is much more difficult to solve it [Kim H S, 1991]. The automobile color differentiation system is used for the purpose of effective control. The license plate recognition is a form of automobile color differentiation. It is a technology of image processing used to identify the cars by their license plate. The real time License Plate Recognition plays a main role in the automobile monitoring of rules of traffic and maintains the enforcement of law on public roads. Though every car carries a different license plate, no tags, transmitters or external cards need to be recognized by the license plate [Bailey D G, 2002].

VI. EXISTING SYSTEMS

There are many researches for the identification of car that have been approached by the license plate of car to recognize and extract some of the related work. The normal human eyes have3 types of sensor and the signal of the 3 sensors determines the response of color of the observer. The response of the system produces the 3 dimensional phenomena of 3 dimensional spaces. When a human being visualizes something, light enters into the eye. Light hits the light detector which is in the retina of the eye. The behavior is related to a digital camera which records a reading when the light hits the light detector on the back of camera. In electronics the graphical system Red Green Blue color model is relatively applied to provide such coordinate system of 3 dimensional spaces. In electronics the graphical system, of the Red Green Blue color model is used for the output and input devices such as digital cameras, video recorder, color TV, LCD and computer screen. The computer monitors the use of Red Green Blue color and the images of computer are stored in the color system of Red Green Blue [Kim S K, 1990]. The Red Green Blue color system is based on 3 basic color components such as red, green and blue in pixels. In a true image color, for each color component, there is a range of intensity, from 0 to 200 and when the 3 combination of different intensities are superimposed, a colorized hue is obtained. The model of color recognition has been applied in the commercial fields, industrial sectors and also in social responsibilities. For instance, it is used as a reliable and powerful parameter in the machines of robotics that aid for the blind and the color of blind people, quality control for the manufacture colored paper, diamond color sorting and in characterizing the thermal paints [Johnson A S, 1990].

A research has been proposed by the author Johnson that automatic color differentiation uses the techniques of optical character differentiation. Author Johnson proposed that the boundary of knowledge-guide follows the template that match the automatic color differentiation. According to author Morgan the neural networks of bidirectional associative memories are used for reading the number plate [Morgan D A, 1990]. It is appropriate for small number of pattern. According to the proposition of Westerberg neural networks and fuzzy logic for car is the License Plate Recognition. This method is used for discrete-time cellular neural networks and fuzzy logic segmentation for feature extraction [Westerberg M, 1994]. According to the author Choy the method is based

on the vertical edge using the Hough transform for extracting the license plate [Choy H J, 1987]. According to the author John neural networks are used for color extraction and the template matching is used to recognize the characters. The author also uses the genetic algorithm based on the segmentation to extract the plate region [John M A, 1995]. According to the author Staci the approach to form the orientation map as recognition features using a Gabor filter for recognizing the characters [Staci E, 2000]. According to the author Yoshimura the Gabor jets the projection to form a feature vector for recognizing the low resolution character of gray-scale [Yoshimura H, 2000]. According to Hontani this method is used for extracting the characters without the prior knowledge of their size and position in the image [Hontani H, 2001]. According to the author Park the method used to extract the license plate depends on the color of the plate [Park M, 1994].

VII. EXPERT SYSTEM ARCHITECTURE

The method used of extracting the plate region is based on the segmentation of color image by genetic. In this research the proposed algorithm is based on the segmentation of plate characters, recognition of characters and extraction of plate region. The images of Red Green Blue of car are captured using a Web Digital Camera. The captured images have the resolution of 1080*400 pixels. In the research work, many environments have to be considered such as the lighting sensitivity, position of the camera and background conditions. The elements have the probabilities to affect the collection of data. The camera is positioned 40 centimeter above the sample. The car is parked on an empty parking space. The device is provided with 2 bulbs with same power. Sufficient lighting is provided to the car throughout the capturing process. It is necessary to have constant and similar light sources and camera as different light sources and different cameras create different intensities of pixel.

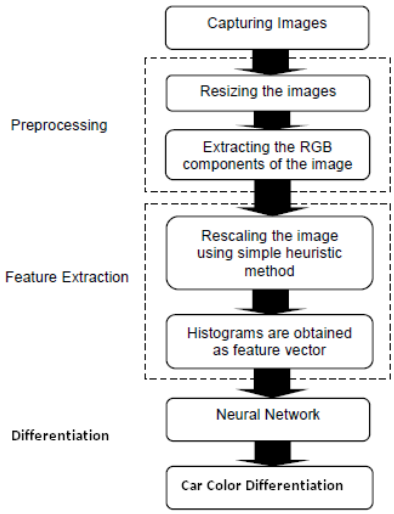

Figure 2: Expert System for performing Automatic Automobile Color Differentation
Source: Website, Abouterpsystem.com

The system has 3 processes. They are:

- Preprocessing,
- Feature Extraction and
- Differentiation

A. Preprocessing

In the stage of preprocessing the captured images are resized to reduce the index of color of the image. Each image of the car will be extracted by the pixel into its color of red, green and blue. The color components of red, green and blue can be displayed in gray-scale index

B. Feature Extraction

In comparison with the mechanism of the normal eyes of human being the car color differentiation is determined by the simple glance of eye that dominate the car. In the observation of micro scale the color of the car is not yellow as there will some black dot colors or still any yellow-green color skin. Therefore, from the principles, each pixel of the color component of the image is rescaled and analyzed into 3 groups. In future the

color extraction of histograms is used as a future vector. For example, the original idea of using the histograms is used to index the large database image. A binary histogram is proposed to utilize the image of the gray scale level. The color histogram is used as a feature in the color recognition. The intensity of the color component lies between 0- 95, and the image will be rescaled to 0. The color component lies between 96-150, it will be rescaled to 120 and for 180-250, and the color component will be rescaled to 265. Therefore the color histograms are obtained for each color component by counting the number of pixels that have the same color scales in the image. These histograms are used to determine the color differentiation of car by using a simple heuristic method

C. Differentiation

The Artificial Neural Network is a new form of AI of brain to analyze and compute the data. Training the Neural Network system, has 2 methods used, they are the unsupervised and supervised methods. The unsupervised method means the system learn by its own to determine the process. However in this research, only the supervised method is used to develop the model of Neural Network using the model of error back propagation. The supervised method means that the needs of the system should be trained by an instructor and if it is compared to the brain, it means that the neurons acts differently compared to the rest in guiding the process.

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