

Knowledge-based Systems for Logo Recognition

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Abstract: We describe a flexible system for recognising complex images of Logo comprises of texts and graphics. Logo is a unique trade mark of any legal company registered under the Ministry of Home Trade. The proposed system uses a "blackbox" to act as a rule-based system or an expert system to which all the knowledge sources have access. The main idea is to reduce a long matching process between targetted Logo and the data based models before one-to-one matching is carried out to finally give the correct answer of recognition.

1. Introduction

With the rapid growth of economic expansions nowadays, has demanded the computer's algorithmics to do more intelligent works to keep pace with the current challenging needs. The needs of more dynamic programming and intelligent processing strategy is increased more and more in different walk of applications. The mode of computer applications nowadays has gone far ahead as to imitate human vision functions. Progress in computer vision has generally been slow compared to other branches of computer science. While the vision task is very easy for us humans, it has proven to be very difficult to teach a computer even the rudiments of a vision system. Not until in the late 70's, it came to a reality. Many algorithms have been devised for computer vision are actually derived from low level process in Image Processing and Pattern Recognition. Application of Image Processing and Pattern Recognition is now mature for certain areas like biomedical analysis, industrial automation tasks, traffic automation, document processing robot vision and etc.

In this proposal, a flexible system for recognising complex images of Logo is described. Logo is a unique trade mark of any legal company registered under the Ministry of Home Trade. If any new company were to register to start its business; he

or she has to submit an application form issued by the Ministry. One of the items checked is the proposed Logo. In order to make it acceptable, the applied Logo should not match to any existing Logo. The similarity to any Logo will cause the application to be rejected. Under the current process, the matching is done manually. The applied Logo is running over probably thousands of Logos to check its validity. To add to the matter, the number of Logos in hand does not stop but increases day by day with the growth of successful registrations.

Under the proposed automation system, an expert rule is introduced to optimize the number of matchings taken place to finally give the answer of recognition. The rules will give the closest information of the proposed Logo to the data-based Logo of that characteristics before one-to-one matching is made.

2. The Proposed System

We describe a flexible system for recognising complex images of Logo comprising of texts and graphics. The proposed system involves partially occluded objects using planning and strategy. The system uses a "blackbox" to act as a short-term memory and a means to share knowledge between different processes giving rise to data processing via a multiple instruction streams multiple data streams system. Amongst the different techniques being involved in the object segmentation are Hough transform to extract lines, arcs and circles. Other important generic features to be extracted are corners and extended salient features. A simplified blackbox system for these processes is shown below.

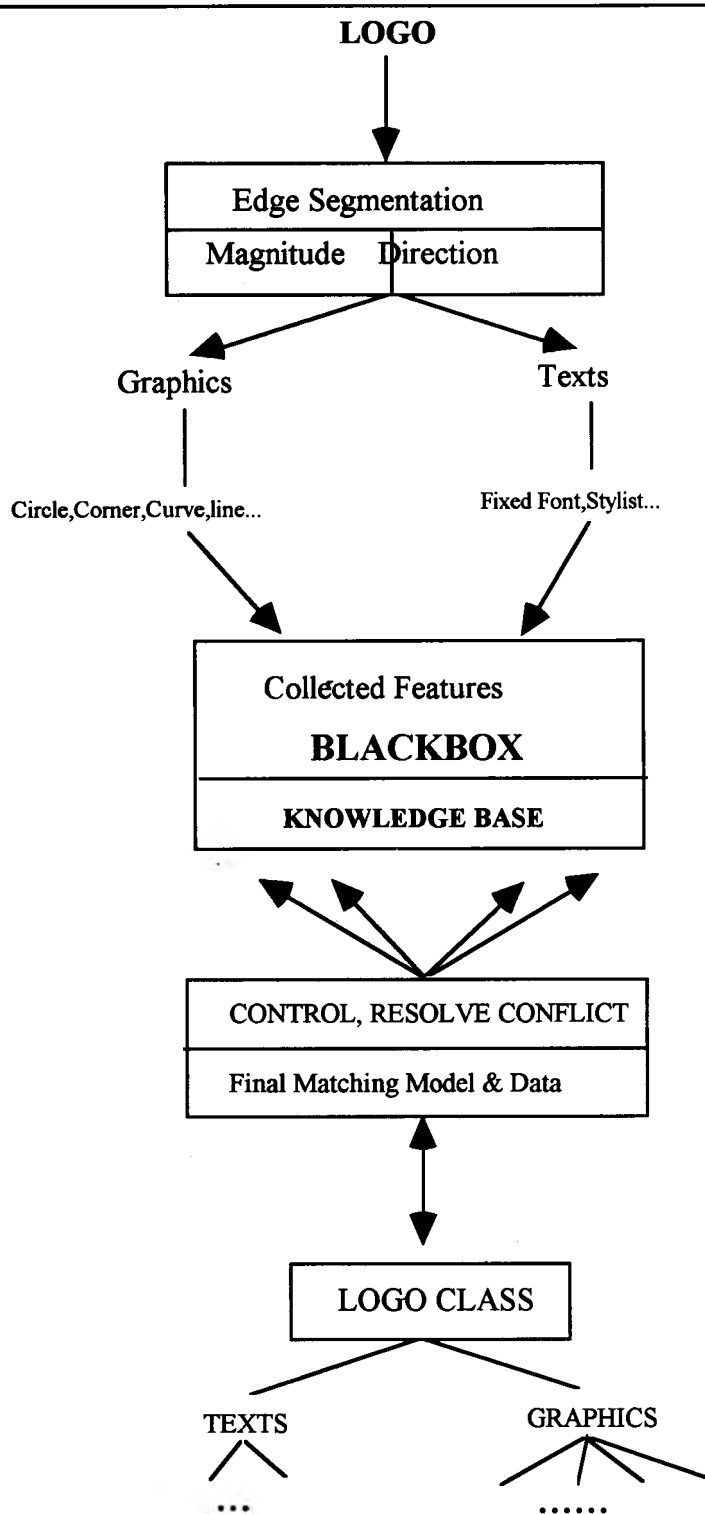


Fig. 1. A Schematic diagram of the proposed blackbox processing system

There are two major processes are going to take place in the proposed system: (1). Segmentation and (2). Recognition/interpretation. The segmentation is an iconic process which is best carried out procedurally and the image interpretation is a symbolic process which is probably best carried out declaratively.

Furthermore, from the iconic process we extract object primitives such as corner, circle, curve, line and other extended features such as texts, which we can store as a list of items on a table for subsequent symbolic processing. The symbols can be manipulated through predicate logic. This constraint affects the choice of our corner detector [Dzulkifli 93]. The line and circle detection are via the use of Hough transformation. These three features can be considered as being generic. Other extended features often termed salient, are detected using $s(y)$ graph.

The great and challenging task is to extract texts from the iconic process. Text is always considered as a part of image under scanning process of data acquisition. Though there are several choices of OCR softwares around us, yet text in Logo could be in different forms (fancied letter, flourish, etc) and probably far beyond their capabilities to recognize it.

The table described above is referred to as the 'blackbox'. The blackbox is a shared memory structure to which all the knowledge sources have access. In another words, the blackbox is a rule-based system or a knowledge based system or an expert system (Figure 2.). The main idea behind an expert system is that human knowledge (which is often in a procedural form) should be explicit in the form of rules which are then used by inference engines, a collection of which then forms an expert system shell. When a knowledge source is activated it uses the knowledge residing on the blackbox to create a new hypothesis and write the result back on the blackbox or it modifies existing knowledge.

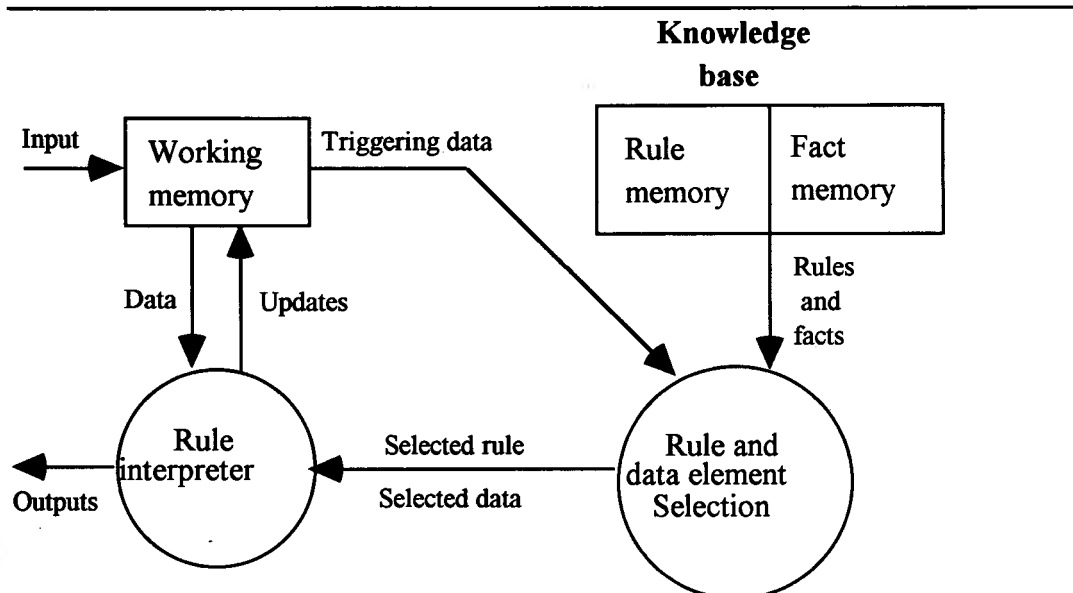


Fig. 2. Architecture of a proposed rule based system

Object recognition tasks consist fundamentally of searching and matching features; this task requires a priori knowledge about such entities as arcs, circle, etc (as prescribed above). This knowledge can be represented either in procedural or declarative form. In our blackbox, a rule has the form of;

if <condition> then <action>

where the condition is referred to the antecedent and the action is the consequent. The interpretation of the rule is, if the antecedent can be satisfied then the consequent too. In such as case, if the consequent defines an action then the system executes the specified action; if the consequent defines a conclusion, then the system infers a conclusion. In our system, a condition is referred to the following example. If the models consists of either circular objects, regular polygons (either with or without holes) and other more complex shapes, then the action will be a geometrical reasoning about the object class. The object classes are then matched to the same typed class of Logo's data base to get a closest matching. Finally, the one-to-one matching procedure is carried out to give a correct interpretation/recognition.

The main idea of the above explained concepts is to reduce a long matching process between targetted Logo/image and the data based models.

3. Conclusions

A proposed knowledge-based system for Logo recognition could give a solution to the problem of automation process in Logo recognition at the Ministry of Home Trade. A quick decision could be on a finger tip in determining whether or not an applied Logo is already patented.

A mixture of the traditional image processing program and rule based system solution proposed in this proposal could be an interesting point to look at. A traditional image processing solution differs from a rule based system in that it lacks a rule and selection sub-system. However, it often has a knowledge database containing model information (not rules). Instead of a rule interpreter, there is a user defined program consisting of one or more algorithms with control and dataflow designed into the system. However, they often have a common workspace which is used and updated by the algorithms. A program lacks the flexibility of a rule-based system. For a modification in its task execution, a new program may need to be written because the control and data flow may be changed by the addition of the new code. In a rule-based system, only the new rules need to be added to the knowledge base. To summarize the advantages of a rule-based system, a list of which is shown below.

1. It presents problem-solving method in a way which is suitable for computers.
2. It is modular.
3. It is incremental.
4. It is explainable.
5. It provides a framework for conceptualising computation.
6. It provides parallel method for problem solving, and
7. It makes distinction between analytic and imperative know-how.

4. References

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