CHAPTER 1

INTRODUCTION

1.1 Motivation of the research

Photography is a kind of graphic design that expounds the consciousness and esthetic sensibilities of the photographer. The photographic composition is one of the important components in the photo. The aim of the composition is to make the total balance and tension by properly arranging subjects in the photo. The eyes of the viewer will be guided to the designed main subject [1]. Hence, a good photo by the professional photographer always follows the rules of the photographic composition. However, a “blind” photo processing that assumes each photo with the same “composition” is applied in a lot of real image applications. For digital photo processing, i.e., photo enhancement [2], segmentation [3], output [2], and synthesis [4], we need to match up the photographic composition to do accurate processing rather than “blind” processing.

For applications of image processing and pattern recognition (IPPR), there are three factors carried some fuzziness in nature [5]: (1) information loss when mapping 3D objects into a 2D image; (2) ambiguity and vagueness in some definitions as examples of edges, regions, and sharps etc.; (3) ambiguity and paradox in explaining low-level image processing results, such as types of region in uniform, high contrast, and texture. Besides, if the specific problem is complex, which the types are too many and the features of the pattern are so mixed in numerical values, the classifiers in traditional pattern recognition are not so helpful [6]. In many cases, the measurements of the features extracted from the objects are quite different, so the problem of how to calculate the difference between the patterns is becoming more complicated. The majority of pattern recognition problems do not have separable classes, in which case

the location of discrimination hyper-surfaces in the feature space can never separate the classes correctly and some objects will always be misclassified [7]. Therefore, a different methodology in contrast to traditional methods is likely to be the key to solving all of these ambiguous problems.

Soft computing is a set of computing methodologies that are mainly fuzzy logic, neural networks, and evolutionary computing. From the viewpoint of systems, techniques using fuzzy logic may have certain advantages over conventional means, due to the simplicity of the algorithms to be achieved and because noise and imprecision's can be manipulated more easily than precise system models [8]. Although current methods based on fuzzy logic are not perfect, they offer us some new ideas and new ways to solve the problem of simulating the intelligence of human while the traditional method uses logic symbol to do so.

In this thesis, we adopt the concept of fuzzy logic for recognizing the photographic composition of the real images. The advantage is that it only needs a few of rules and image features that can provide adequate information to recognize 8 kinds of photographic composition. After the photographic composition is measured, the proposed recognizing system will give the confidences for 8 kinds of photographic compositions.

1.2 Survey of related researches

The ability of recognizing and classifying patterns is one of the most primary characteristics of human intelligence [9]. From a general point of view, pattern recognition may be defined as a process by which we search for structures in data and classify these structures into categories such that the degree of association is high among structures of the same category and low between structures of different categories.

As a filed of study, pattern recognition has been developing since the early 1950s.

Computer-based automatic pattern recognition systems have vast applicability. As the tide of using neural network and fuzzy logic grows up, a lot of experts who work in AI field are coming to use and analysis these new methods. While doing research work, they have found out some questions [10] such as: although neural network is powerful in machine learning, associative memory and parallel processing, it fails to do well in some symbol processing and indefinite reasoning. On the contrary, the fuzzy logic is vice versa.

Fuzzy logics are logics with fuzzy sets. In a narrow sense, fuzzy logic refers to a logical system that generalizes classical two-valued logic for reasoning under uncertainty. In a broad sense, fuzzy logic refers to all of the theories and technologies that employ fuzzy sets, which are classes with unsharp boundaries.

The utility of fuzzy logics in pattern recognition and cluster analysis was already recognized in the mid-1960s, and the literature dealing with fuzzy pattern recognition and fuzzy clustering is now quite extensive [9]. These interesting problems have been successfully investigated a lot by many researchers [11]. It is believed that fuzzy logic is a useful tool for handling the uncertainty associated with vagueness and/or imprecision.

The output of the recognizing system is generated by a fuzzy inference system. Conventional fuzzy inference system (FIS) models are proposed by Mamdani [12] and Takagi [13, 14]. The Mamdani model is the most simple and efficient model. A Mamdani FIS tests each input value against each membership function associated with that input [15]. The outputs from all membership functions in a rule are combined, usually using the fuzzy AND function, often the minimum of the membership function output values, to give the overall firing strength of the rule. The firing strength of the rule then determines the maximum level of the consequent membership function. All the qualified consequents are then aggregated together using, for instance, the max

function, to produce the final consequent shape, which is then defuzzified using one of the defuzzification operators.

1.3 Sketch of the research work

In this thesis, we develop an automatic recognizing method using image features from some specific regions is described. The method combines outputs of multiple rules and feature extraction algorithms to obtain confidences that can recognize the correct photographic composition. The recognizing system is Mamdani systems that were designed with the associated membership functions and rules guided by analyzes of photographic compositions. Experimental results show that the proposed method is robust and effective for photographic composition recognition.

1.4 Thesis organization

This thesis is organized as follows: in Section 2, we introduce the principal types of photographic compositions and describe feature analysis. In Section 3, some feature extractions are illustrated. In Section 4, the rationale of fuzzy logic fusion is discussed. Empirical examples are studied in Section 5. Section 6 is the conclusion and suggestions.