COMPUTER APPLICATIONS ON PATTERN RECOGNITION FOR AGRICULTURAL PURPOSES

By
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تطبيقات حاسوبية للتعرف على الأنماط في أغراض زراعية

رسالة مقدمة من

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للحصول على

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1. Introduction

The performance of grading systems depends on the quality factors that are used in their design. For fruit grading there are many factors that farmers use for measuring the fruit quality. These factors can be classified into two groups: the external quality factors and the internal quality factors. The external quality factors can be defined and extracted from the visual appearance of the fruit. Commonly used factors are size, shape, color, and texture (fruit surface patterns). The internal quality factors can be defined by the fruit smell like aroma, taste, flavor, sweetness and sourness, and fruit nutritive value like vitamins, minerals, nutrients and carbohydrates, and other elements like dry matter content, total soluble solids content, sugar content, and acidity. There are some quality factors like firmness, crispness, and toughness that can be defined by touching the fruit and may be considered external or internal factors.

For marketing purposes, fruits are generally graded on the basis of their external quality features. The visual inspection, because of its practicability and simplicity, is the most frequent option in practice. Francis (1980) found that human perception could be easily fooled. Together with the high labor costs, inconsistency and variability associated with human inspection accentuates the need for objective measurements systems Therefore, intensive research is being conducted to automate visual inspection process. Automated grading of agricultural products has been getting special interest recently, as the demand for higher quality food products has increased. The potential of computer vision in the food industry has long been recognized (Tillett, 1990) and the food industry is now ranked among the top 10 industries using this technology (Gunasekaran, 1996). Continued advancements in image processing and pattern recognition fields are providing effective tools and techniques to build systems capable of grading and sorting almost every agricultural product. These systems differ from one another on the basis of image capturing processes, imaging equipment, image processing

techniques and *pattern recognition* (mainly feature extraction and classification) methods that they are employed.

In this study, the size, color and texture will be the main considerations for building a pattern recognition grading system mainly for fruits with a case study of (*Siwi* سيوي) date fruits in *"Tamr* stage" تمر . This computer vision application consists of a preprocessing application that helps in calculating the limits of features under this study i.e.: maximum size, minimum size of the training set of the fruit. This application may be replaced by manually input this limits. The main application purpose is to convert the visual aspects like size of the fruit to numbers which can be calculated. The classification method will be different for each kind of fruit, so this pattern recognition application will use a fuzzy logic classifier of (AlHomedey, 2011) which was designed to classify a semi-dry date fruit. This pattern recognition application can deal with any classifier techniques like artificial neural network (ANN), fuzzy logic (FL), K-nearest neighbor (KNN), or support vector machine (SVM).

Fuzzy rule-based inference models were used in this study. Fuzzy logic lies at the opposite pole of system modeling with respect to the NN and SVM methods. It is a white box approach - Structured knowledge (experience, expertise, or heuristics). No data required. IF-THEN rules are the most typical examples of structured knowledge. - In the sense that it is assumed that there is already human knowledge about a solution. Therefore, the modeled system is known (i.e., white). On the application level, FL can be considered an efficient tool for embedding structured human knowledge into useful algorithms. It is a precious engineering tool developed to do a good job of trading or precision and significance. In this respect, FL models do what human beings have been doing for a very long time. As in human reasoning and inference, the truth of any statement, measurement, or observation is a matter of degree. This degree is expressed through the membership functions that quantify (measure) a degree of belonging of some (crisp) input to given fuzzy subset.

Zadeh (1965; 1973) stated that the concept of fuzzy logic is used in many different senses. In a narrow sense, fuzzy logic (FL) is