3D Object Recognition Using Affine Moment Invariants and Multiple Adaptive Network Based Fuzzy Inference System

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ABSTRACT

This paper addresses a performance analysis of Affine Moment Invariants for 3D object recognition. Affine Moment Invariants are commonly used as shape feature for 2D object or pattern recognition. However, this study proves that with some adaptation to multiple views technique, Affine Moment Invariants are sufficient to model 3D objects. In addition, the simplicity of moments calculation reduces the processing time for feature extraction, hence increases the system efficiency. In the recognition stage, this study used a neuro-fuzzy classifier called Multiple Adaptive Network based Fuzzy Inference System (MANFIS) for matching and classification. The proposed method was tested using two groups of object: polyhedral and free-form objects. The experimental
results show that Affine Moment Invariants combined with MANFIS network attain the best performance in both recognitions, polyhedral and free-form objects.

**Keywords:** 3D object recognition, multiple views technique, affine moment invariants, neuro-fuzzy system

### Introduction

In computer vision, the process of recognition typically involves some sorts of sensors, a model database which contains all the information about the objects representations and a decision making capability. Sensors, for instance, laser range finders, ultrasonic sensors, infrared sensors and charge-coupled device (CCD) cameras are used to gather images and information from a scene of interest. Then the digitized image is processed to represent it in the same way as the models are represented in the database. Finally, a recognition algorithm is applied to find the model to which the object best matches. The method is also known as model-based recognition system, and it is the most common system for shape or object recognition. Figure 1 depicts the interaction and information flow among different components of the system.

Human performs object recognition effortlessly and instantaneously, but an algorithmic description of this task for implementation on computers has been very difficult especially for 3D objects. Developing a 3D object recognition system is much harder compared to a flat 2D recognition system, since it allows additional degrees of freedom for the orientation of the object in space (Büker & Hartmann, 1996). In addition, objects may be partially occluded each other and only one side of the object can be seen from any given viewpoint, which is sometimes insufficient to distinguish similar objects.

![Figure 1: Block Diagram of a Typical Object Recognition System](image-url)