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REVIEW ARTICLE

A Simplified Review on REAL TIMEOBJECT DETECTION AND 3D MODELING

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ABSTRACT

In view of some shortcomings about frequently used currently shape recognition algorithms a fast geometry figure recognition algorithm **Real time Object Detection and 3D modeling system (OD3DM)**based on segmentation method is presented in this paper. We will use segment method over convention method. Segmented method includes analysis of objects in segment i.e. in small parts. The Real time Object Detection and 3D modeling system (OD3DM) focuses to integrate detection of Complex geometric structure and 3D modeling techniques through artificial intelligence and Fuzzy logic. The proposed system OD3DM will be using Artificial Intelligence and fuzzy logic to propose a basic model that can detect and Model the extracted images into 3D. The OD3DM system has been among the widest research areas in the field of computer vision, since over a decade. In this article, we present a brief review on OD3DM system. Although, there are number of systems available for detection and 3D modeling but there is hardly any system available that can detect and model the images of objects into 3D. Here we will be proposing a system that can detect, extract and model the images in 3D. The experimental results on collected image dataset will show that the proposed approach is more accurate and efficient than traditional methods. This paper can be treated as a reference for getting in depth knowledge of the OD3DM system and its future in computer science engineering.

Keywords–Object Detection and 3D modeling (OD3DM)**,** Artificial Intelligence (AI), Synthetic aperture radar imagery (SAR), Region of Interest (ROI), Computer aided design (CAD)

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1. INTRODUCTION

ODDM system is one of the most important research aspects in pattern recognition field and has been deeply pervasive in image analysis, machine vision, object recognition and other application fields. At present, the frequently-used shape recognition algorithms for the closed geometry figure such as ellipse, circle, and polygon and so on, are based on Hough transform, Radon transform, and neural network, shape matching, clustering and other algorithms. The algorithm based on Hough transform is popular and have advantages when dealing with beeline, curve, circle or ellipse, but it really has difficulties in the detection of other shapes and has large amount of calculation. Although the algorithm based on neural network is able to recognize more shapes, it requires pre-setting similar shape templates and training them and has large amount of calculation and higher time complexity. The algorithm based on shape matching requires the shape description and representation which are used for the comparison between the image to detect and the template. [1].In view of some shortcomings about the algorithms above, a new algorithm is presented in this paper, which can recognize the closed geometry figures such as polygon, circle and ellipse and has some advantages such as lower complexity, higher speed and precision and easy realization.OD3DM system focuses to detect Complex geometric structure and 3D modeling of images taken from various angle. Complex geometric structure will be selected and will be modeled using 3D modeling. Modeling it will be done after object detection.3D modeling is based on AI and we have to prepare the basic model which detect the images, extract and model the images into 3D modeling.

1.1. Real Time Object Detection and 3D Modeling – Definition

Object recognition by computer has been an active area of research for nearly five decades. For much of that time, the approach has been dominated by the discovery of analytic representations (models) of objects that can be used to predict the appearance of an object under any viewpoint and under any conditions of illumination and partial occlusion. The Object detection ultimately discovers the appearance of broad object categories and in accordance with the human conceptual framework so that the computer can "tell" what it is seeing. [2]

3D modeling is the process of developing a mathematical representation of any three-dimensional surface of object (either inanimate or living) via specialized software. 3D models represent a 3D object using a collection of points in 3D space, connected by various geometric entities such as triangles, lines, curved surfaces, etc. Being a collection of data (points and other information), 3D models can be created by hand, algorithmically (procedural modeling), or scanned. 3D modeling will be done using AI and Fuzzy logic.AI is the intelligence exhibited by machines or software, and the branch of computer science that develops machines and software with human-like intelligence. Fuzzy form is a form of many-valued logic; it deals with reasoning that is approximate rather than fixed and exact. Compared to traditional binary sets (where variables may take on true or false values) fuzzy logic variables may have a truth value that ranges in degree between 0 and 1.

1.2 Geometric Structures - Geometry study as a practical science concerned with surveys, measurements, areas, and volumes. It has various approach to understand and implementation. Euclidean geometry has become closely connected with computational geometry, computer graphics, convex geometry, incidence geometry, finite geometry, discrete geometry. Geometry study as a practical science concerned with surveys, measurements, areas, and volumes.

It has various approach to understand and implementation:-

Euclidean Geometry Euclidean has become closely connected with computational geometry, computer graphics, convex geometry, incidence geometry, finite geometry, discrete geometry, and some areas of combinatorics.

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Differential Geometry Differential has been of increasing importance to mathematical physics due to Einstein's general relativity postulation that the universe is curved

Algebraic Geometry The field of algebraic geometry is the modern incarnation of the Cartesian geometry of co-ordinates.

Some Geometric Structures

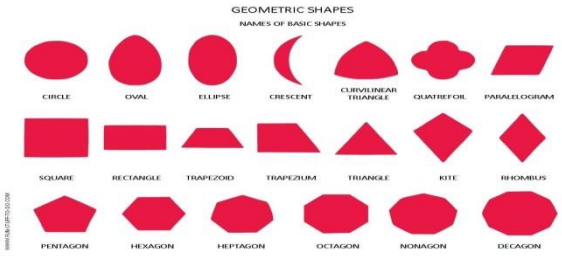

Figure1A highly detailed 3-D geometric model for a tank.

Figure 1 has thousands of polygonal surface facets and is used to recognize this specific tank in synthetic aperture radar imagery (SAR). The rationale here is that there are only a finite number of military weapons and vehicles so that a concerted effort could "model the world" in this limited domain. [2]

1.3Technology Used For Modeling Process

1. Polygonal Modeling - Points in 3D space, called vertices, are connected by line segments to form a polygonal mesh. The vast majority of 3D models today are built as textured polygonal models, because they are flexible and because computers can render them quickly.

2. Curve Modeling - Surfaces are defined by curves, which are influenced by weighted control points. The curve follows (but does not necessarily interpolate) the points. Increasing the weight for a point will pull the curve closer to that point. Curve types include non-uniform rational B-spline (NURBS), splines, patches and geometric primitives.

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3. **Digital sculpting** - Still a fairly new method of modeling, 3D sculpting has become very popular in the few years it has been around. There are currently 3 types of digital sculpting: *Displacement*, which is the most widely used among applications at this moment, *volumetric* and *dynamic tessellation*.

2. Background

A fast geometry figure recognition algorithm based on edge pixel point eigen values had been presented earlier in which polygon apexes and its rank orders are quickly recognized. Firstly based on the different variation laws of the eigen values of polygon apexes and other pixel point and the exact shape recognition of the polygon is finished.

The simulation result shows the algorithm merits such as recognizing rich kinds of figure, lower computational complexity, higher processing speed, no pre-setting template. [1]

Recent advances in object recognition have emphasized the integration of intensity-derived features such as affine patches with associated geometric constraints leading to impressive performance in complex scenes. General 3-d relations among patches are enforced by the epipolar constraint and local planarity relations can be tested by affine invariant relations among patches.

This combinatorial problem can be solved by re-introducing the classic role of generic shape models such as polyhedral and generalized cylinders. [2]

If we might want to recognize whether someone is nodding their head to mean "yes" or shaking their head to mean "no" when interacting with a computer. Two accelerometers can be used to obtain the data on head movement.

If the forward facing accelerometer's output is high and the side facing accelerometer's output is low, then the individual is nodding. The opposite sensor outputs would indicate a shake. [3]

The primary problem solved by the invention involves determining the string or sequence that is most similar to a sequence presented to the system. The search could be initiated by presenting, to the system, a noisy or inexact version of a string contained in memory -for example, at a web-site or in the library or database.

The invention will yield the closest string/sequence by searching the dictionary of possible words using a newly invented AI-based strategy called the Clustered Beam Search. [4]

Object-based information is represented via polygons corresponding to the boundaries of object regions. Polygon approximation is basically motivated with the difficulties faced in processing polygons with large number of vertices. The user may set the number of vertices to be in the approximated polygon, and may hierarchically simplify the output.

The vertices of polygons are simplified according to the velocities and accelerations of the vertices with respect to the centroid of the polygon. [5]

A curve matching framework for planar open curves under similarity transform is based on a new scale invariant signature in which the signature is derived from the concept of integral of unsigned curvatures. If one input curve as a whole can be aligned with some part in the second curve then the algorithm find the requisite starting and end positions.

The paper extends frame work to a more general case where some part of the first input curve can be aligned with some part of the second input curve. [6]

The main idea behind the method is to work with a range image, whose depth interval size is compressed in a feature preserving way. The algorithm relies on the achievements of High-Dynamic-Range Compression. These derivatives are compressed by applying an attenuation function which leads to a relative convergence of the entries.

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The approach is intuitive, fast and works very well for high compression ratios. [7].

Most people visualize a point as a tiny dot. Lines are thought of as long, seamless concatenations of points, and planes are thought of as finely interwoven lines: smooth, endless and flat. These objects may be visualized but they cannot be defined.

The conventions of the Cartesian plane are well suited to assisting in visualizing Euclidean geometry. [8].

The primary intention of pattern recognition is to automatically assist humans in analyzing the vast amount of available data and extracting useful knowledge from it. Fuzzy approach can be applied to deal with this data stochastic in nature.

It deals with fuzzy models and algorithms for unsupervised learning, when we deal with non-crisp data. [9]

Triangle meshes for the representation of highly complex geometric objects are preferred due to their algorithmic simplicity, numerical robustness, and efficient display. The advantage of switching to this representation is that algorithms for polygonal meshes usually work for shapes with arbitrary topology and do not suffer from the severe restrictions.

This accelerates the overall processing time and reduces the potential for round–off errors. [10]

Human recognize a multitude of objects and images with little effort. The more often a person sees an object the more he gets familiar with it. The system utilizes three major steps in object recognition namely image processing, ANN processing and interpretation.

Study proved that the optimum lighting condition opted for the system is at 674 lumens with an accuracy of 99.99996072%.[11]

The classification on the watermelon's leaf diseases is based on color feature extraction from RGB color model where the RGB pixel color indices have been extracted from the identified Regions of Interest (ROI). Some of the popular watermelon leaf diseases in Malaysia are *Anthracnose, Powdery Mildew* and Downey *Mildew*

The proposed automated classification model involved the process of diseases classification using Statistical Package for the Social Sciences (SPSS) and Neural Network Pattern Recognition Toolbox in MATLAB. [12]]

The strategy proposed aims to recognition of analog digit numbers on electrical meters applying Neural Networks. The process starts with extraction of the region containing the numbers, continues with segmentation in order to extract and binarize each character.

Feature extraction methods are applied to the processed digits to be classified by a neural network. [13]

A novel solution for a monocular camera is formulated by tightly coupling various computational modules including geometric analysis, segmentation, scale estimation, and object detection. The objects of interest are embedded in perspective geometry induced by buildings, along with distorted appearance.

The results are used to eliminate the projective image distortion and generate multiple hypothetical rectified planes for accurate object detection. [14]

Extracting complex geometric primitives from 2-D imagery is a long-standing problem that researchers have had to deal with. Parallelization capability of GPUs with inherent parallelism on genetic algorithms has been merged to cope with the problem of detecting complex geometric primitives on high resolution imagery.

The idea of classical Hough transform was to perform a mapping from image space to parameter space in order to obtain a function. [15]

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3. Core Concept

Object Detection

Detecting complex geometric structure and its 3D modeling concept has gained a lot of interest and widely accepted by the world especially the geospatial-related discipline. The Object detection ultimately discovers the appearance of broad object categories and in accordance with the human conceptual framework so that the computer can "tell" what it is seeing.[2]

Complex geometric Object Detection and will be done using Artificial Intelligence (AI) and Fuzzy logic. Object will be captured using real time camera. Images taken from the camera would be stored in a folder. Collection of images stored in image folder is our data source and a training set of images that contains complex geometric structures will be taken for object matching and modeling purpose.

3D Modeling

3D modeling is the process of developing a mathematical representation of any three-dimensional surface of object (either inanimate or living) via specialized software. 3D models represent a 3D object using a collection of points in 3D space, connected by various geometric entities such as triangles, lines, curved surfaces, etc. Being a collection of data (points and other information), 3D models can be created by hand, algorithmically (procedural modeling), or scanned.

Philosophy of Geometric Object Detection: The problem of sorting events and situations into useful categories arises in so many ways that it is tempting to regard it as the central problem of artificial intelligence. The enormity of the usual underlying search process requires that each trial result be used to remove (on the average) a relatively large class of trial possibilities. Each method will be fruitful only when applied to some particular class of problems, and efficient operation requires that these be recognized. The sorting operation involved may be called "pattern—recognition" or "characterization". We will detect complex geometric pattern.

Geometric constraints associated with different views of the same patches under affine projection are combined with a normalized representation of their appearance to guide the matching process involved in object modeling and recognition tasks. The proposed approach is applied in two do- mains: (1) **Photographs** — models of rigid objects are constructed from small sets of images and recognized in highly cluttered shots taken from arbitrary viewpoints. (2) **Video** — dynamic scenes containing multiple moving objects are segmented into rigid components, and the resulting 3D models are directly matched to each other, giving a novel approach to video indexing and retrieval.

4. Advantages of Geometric Description

From the earliest attempts at recognition, geometric representations have dominated the development of the theoryand resulting algorithms and systems. There are a number of reasons why geometry has played such a central role.

1. Invariance to viewpoint -Geometric object descriptions allow the projected shape of an object to be accurately predicted under perspective projection.

2. Invariance to illumination - Recognizing geometric descriptions from image scan be achieved using edge detection and geometric boundary segmentation. Such descriptions are reasonably invariant to illumination variations.

3. Well developed theory - Geometry has been under active investigation by mathematicians for thousands of years. The geometric framework has achieved a high degree of maturity and effective algorithms exist for analyzing and manipulating geometric structures.

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4. Man-made objects -A large fraction of manufactured objects are designed using computer-aided design (CAD) models and therefore are naturally described by primitive geometric elements, such as planes and spheres, triangular mesh or polynomial patches.

Technique used for Pattern Detection: Simple method, based on fuzzy logic, to recognize multi-stroke sketches of geometric shapes and uni-stroke gestural commands. It uses temporal adjacency and global geometric properties of figures to recognize a simple vocabulary of geometric shapes drawn in different line styles. The geometric features used (convex hull, largest-area inscribed and smallest-area enclosing polygons, perimeter and area ratios) are invariant with rotation and scale of figures.

Algorithms to be used:

1. Combinatorial algorithm
2. Flood fill algorithm
3. Shoelace algorithm
4. Marching triangles algorithm

CONCLUSION

Although, there are number of systems available for detection and 3D modeling but there is hardly any system available that can detect and model the images of objects into 3D. Here we will be proposing a system that can detect, extract and model the images in 3D.The experimental results on collected image dataset will show that the proposed approach is more accurate and efficient than traditional methods. We will prepare the model which will accurately detect the complex geometric structures and will model it into 3D.Artificial intelligence and fuzzy logic will be used to implement this work. All the implementation will be done in Matlab using AI and fuzzy Logic methods which will provide better and accurate results as compare to the traditional approaches.

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