

A STUDY ON COMPUTATIONAL GEOMETRY

K.Abirami,

II BSc. Mathematics,
Department of Mathematics,
Sri Krishna Adithya College of Arts and Science,
Coimbatore-641042,Tamil Nadu,India.

M.Harini,

II BSc. Mathematics,
Department of Mathematics,
Sri Krishna Adithya College of Arts and Science,
Coimbatore-641042,Tamil Nadu,India.

N.Selva Nandhini,

II BSc. Mathematics,
Department of Mathematics,
Sri Krishna Adithya College of Arts and Science,
Coimbatore-641042,Tamil Nadu,India.

Abstract: Now-a-days dealing with mathematics has become a great challenge in many fields such as administration, manufacturing, production, marketing, etc,. The development and advancement in the field of computer science has paved way to solve many mathematical related problems. Let us imagine a situation, you are walking on the campus of a university and suddenly you realize you have to make an urgent phone call. There are many public phones on campus and of course you want to go to the nearest one. The map would show a subdivision of the campus into regions to reach the nearest phone call. What would these regions look like? And how could we compute them? So one such way to compute them is Computational Geometry.

Keywords: 2-dimensional graphics, Computer graphics, Geometric algorithms, Pattern recognition.

I.INTRODUCTION

Computational geometry is a branch of computer science concerned with the design and analysis of algorithms for solving geometric problems. In a deeper sense it is the study of the inherent computational complexity of geometric problems under varying models of computation and it pre-supposes the determination of which geometric properties are computable in the first place. Some purely geometrical problems arise out of the study of computational geometric algorithms, and such problems are also considered to be part of computational geometry. While modern computational geometry is a recent development, it is one of the oldest fields of computing with history stretching back to antiquity. Today there are rich collections of geometric algorithms that are efficient, and relatively easy to understand and implement.

The main branches of computational geometry are:

- ✓ **Combinatorial Computational Geometry**
- ✓ **Numerical Computational Geometry**

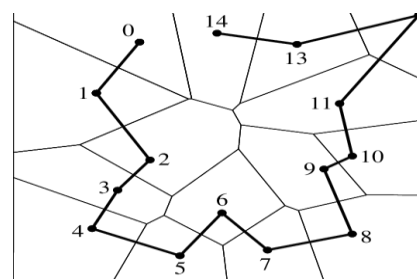
Combinatorial Computational Geometry: The primary goal is to develop efficient algorithms and data structures for solving problems of basic geometrical objects such as points, line segments, polygons, etc.

Numerical Computational Geometry: This primarily deals with representing real-world objects in forms suitable for computer computations. The application areas include shipbuilding, aircraft and automotive industries.

II.APPLICATION DOMAINS

The important applications of computational geometry include robotics(motion planning and visibility problems), geographic information systems(GIS) (geometrical location and search, route planning), computer-aided engineering(CAE) (mesh generation), computer vision (3D reconstruction).

Robotics: The field of robotics studies the design and use of robots. As robots are geometric objects that operate in a 3-dimensional space.

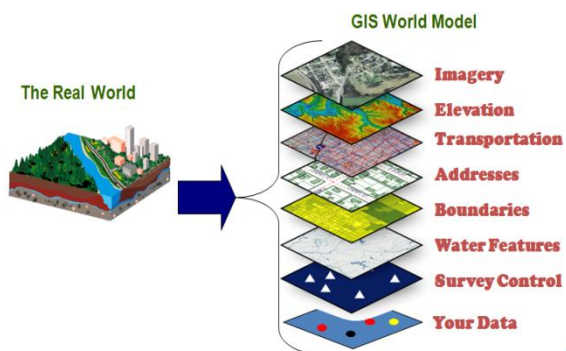


(Fig-1 Voronoi Diagram)

These technologies are used to develop machines that can substitute for humans and replicate human actions. Some geometric problems occur in the design of robots and work cells in which the robot has to operate. These geometric problems sometimes occur with a kinematic component. Path planning is an important issue in the field of robot motion planning as it allows a robot to get from source

point to target point, and the application of Voronoi diagram helps in this case.

Graphic Information System (GIS): A system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data. It stores geographical data like the shape of countries, the height of mountains, the course of rivers, the type of vegetation at different locations, population density, or rainfall. Efficient data structures are needed for these operations.



(Fig-2 Graphic Information System (GIS))

Computer Graphics: A computer-generated image data created with help from specialized graphical hardware and software. The scenes vary from simple two-dimensional drawings to realistic-looking 3-dimensional scenes. When dealing with moving objects and in virtual reality applications, it is important to detect collisions between objects. All these situations involve geometric problems. The other applications include molecular modeling, pattern recognition, integrated circuit design and CAD and CAM.

III.CONCLUSION

In 19th century, when the electronic digital computers were first introduced, it was used as a “number cruncher” imitating the purpose of its mechanical calculating predecessors built by mathematicians. However, it was relatively difficult for human beings to communicate with machines through numbers. Thus the development of programming languages helped considerably to smooth the human-machine interface. Computing became visual and the foundation of visual computing is computational geometry.

IV.REFERENCES

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Laboratory- School of Computer Science McGill University.