



QUADTREE VISUALIZER

Major Project

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REVIEW - II PRESENTATION

Group ID: PHI – CS 73

Group Members:

Under the Guidance of :
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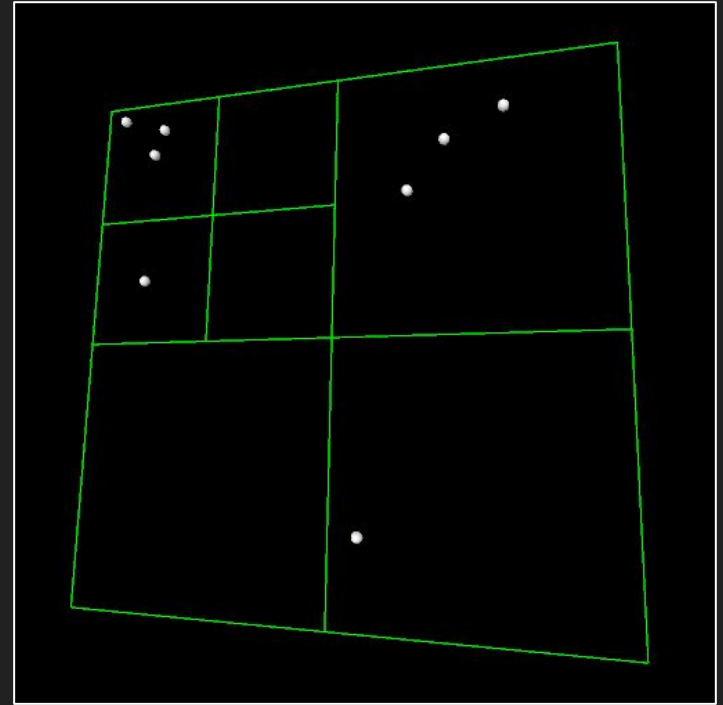
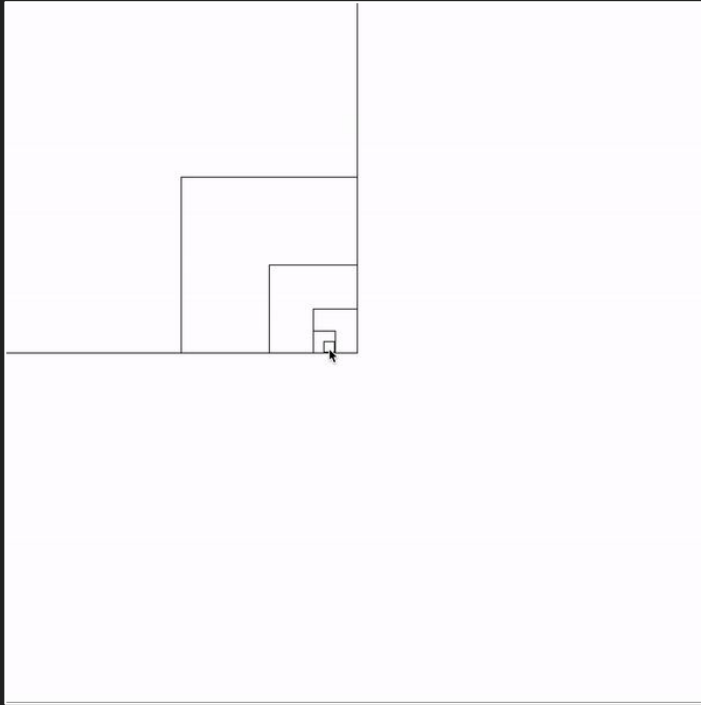
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QUADTREE VISUALIZER

Major Project

Project by:

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An application capable of presenting a view of the QuadTree.

Design and development of QuadTree view and data model.

ABSTRACT

- Develop a program that can show a QuadTree view and data model architecture using a single global library.
- Many digital map applications have the need to present large quantities of precise point data on the map. Such data can be weather information, the population in towns, etc. With the development of Internet of Things, we expect such data will grow at a rapid pace. How to visualize such magnitude of data on mobile devices and web browsers becomes a problem.
- This project aims to build an efficient library for interactively visualizing such data, using a combination of grid-based clustering and hierarchical clustering, along with quadtree spatial indexing.

OBJECTIVES

This project's objective is to provide a single global library that can be shared, reused, and readily accessed.

Quadtree aims to be:

- Versatile (can be used in dynamic and static contexts)
- Simple
- Lightweight
- Easy to use
- Fast
- Header only
- Implemented with modern C/C++ features

LITERATURE SURVEY

QuadTree is dead!!



I'm Dead, Now What?

TYPES – Point Quadtree, Edge Quadtree, Polygonal Map QuadTree.

All forms of quadtrees share some common features:

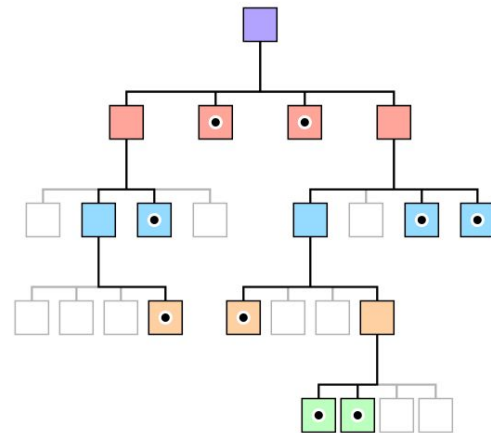
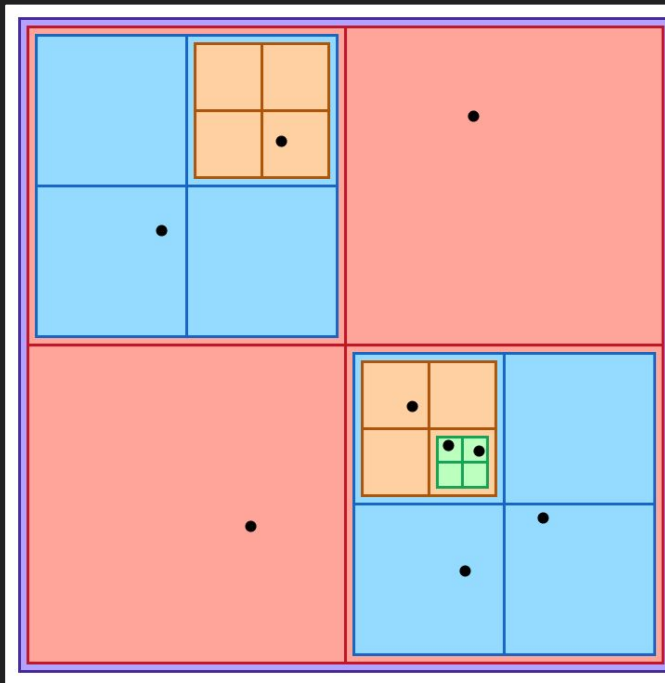
- They decompose space into adaptable cells.
- Each cell (or bucket) has a maximum capacity. When maximum capacity is reached, the bucket splits.
- The tree directory follows the spatial decomposition of the quadtree.

So to speak in layman's term, A *quadtree* is a tree whose nodes either are leaves or have 4 children. The children are ordered 1, 2, 3, 4.

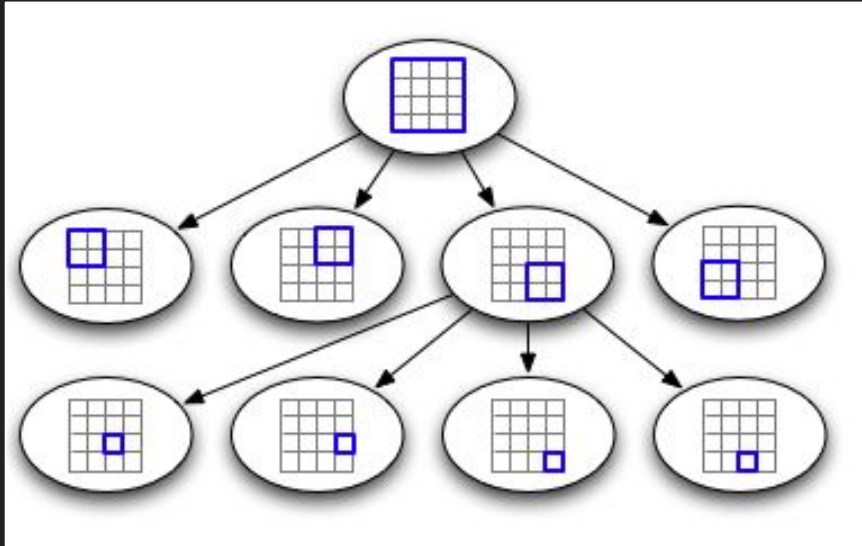
What is QuadTree?



A data structure for
organizing objects based on
their locations in a
two-dimensional space.



A similar partitioning is also known as a *Q-tree*.

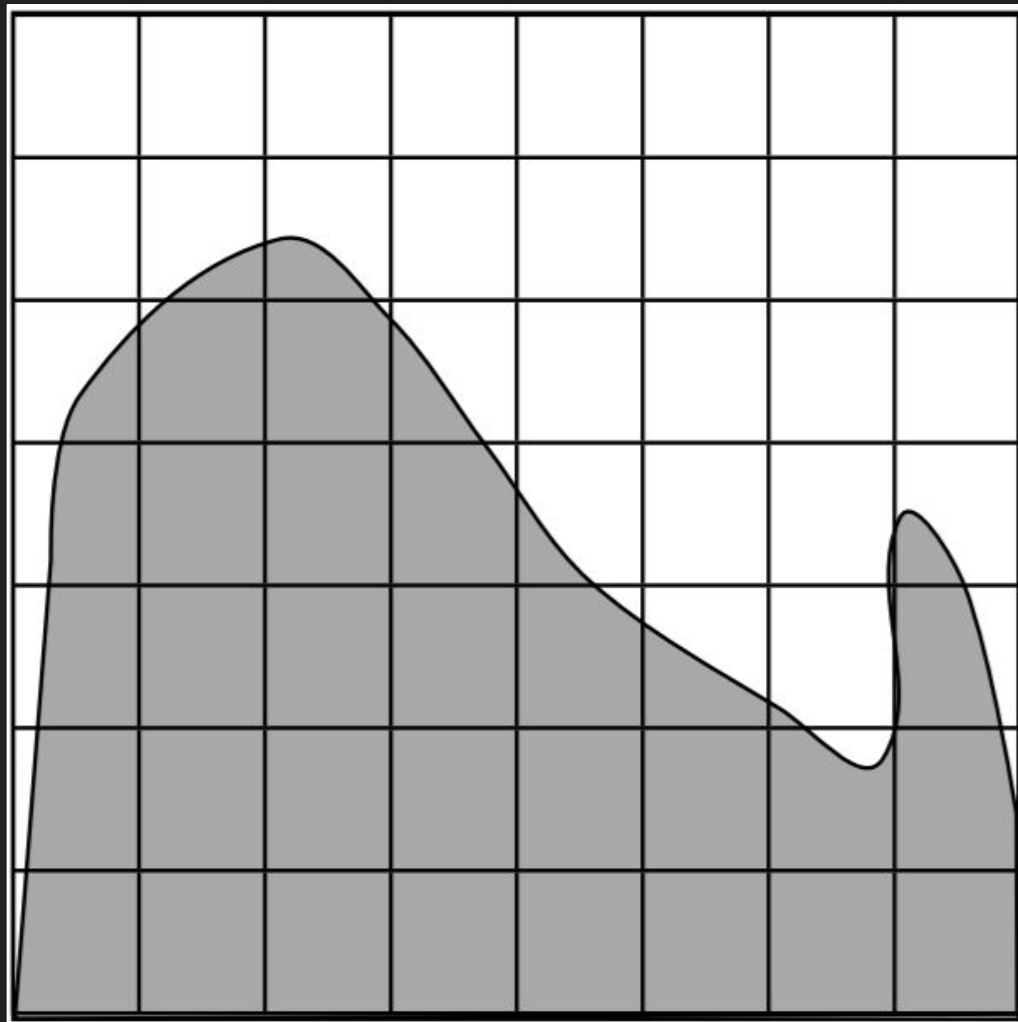


The quadtree partitioning strategy divides space into four quadrants at each level. When a quadrant contains more than one object, the tree subdivides that region into four smaller quadrants, adding a level to the tree.

How does QuadTree Works?



Subdivide into uniform blocks

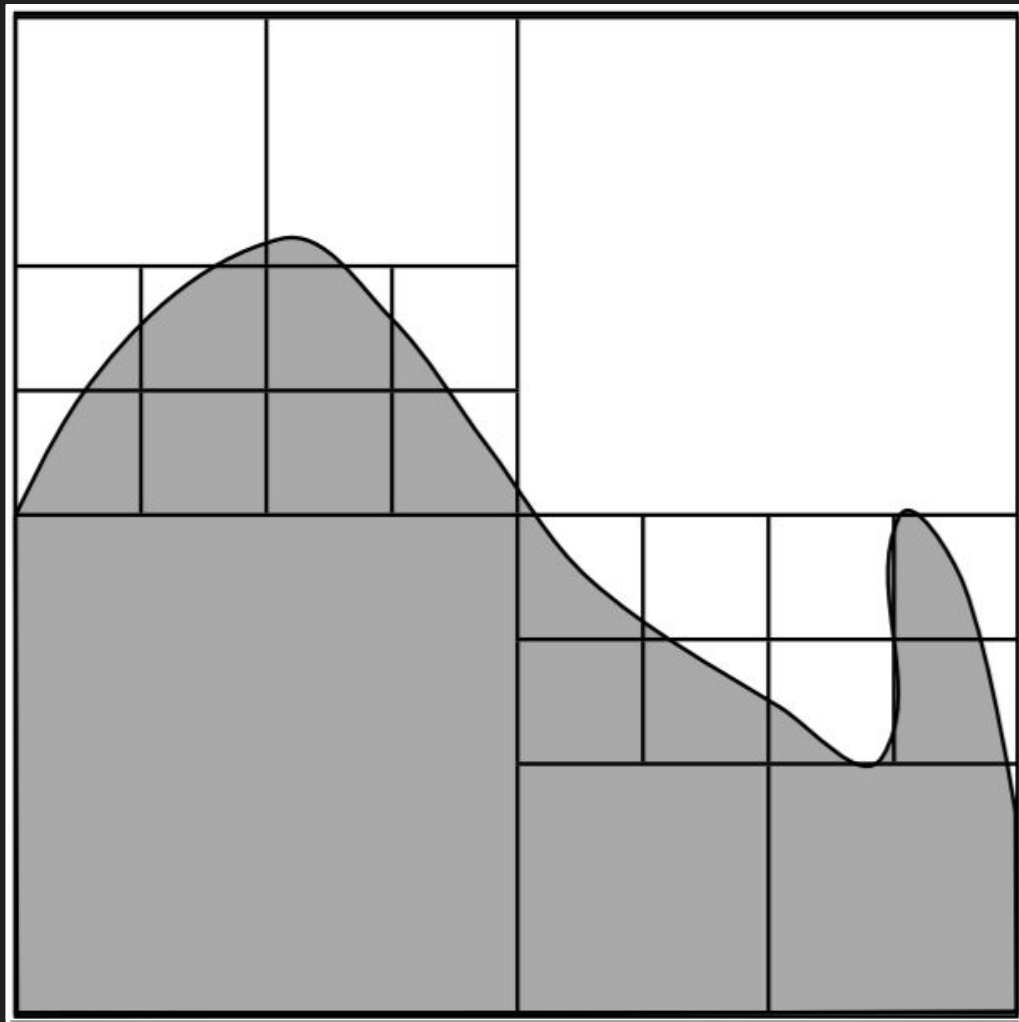


How does QuadTree Works?



Subdivide into uniform blocks

Merge Similar Brothers



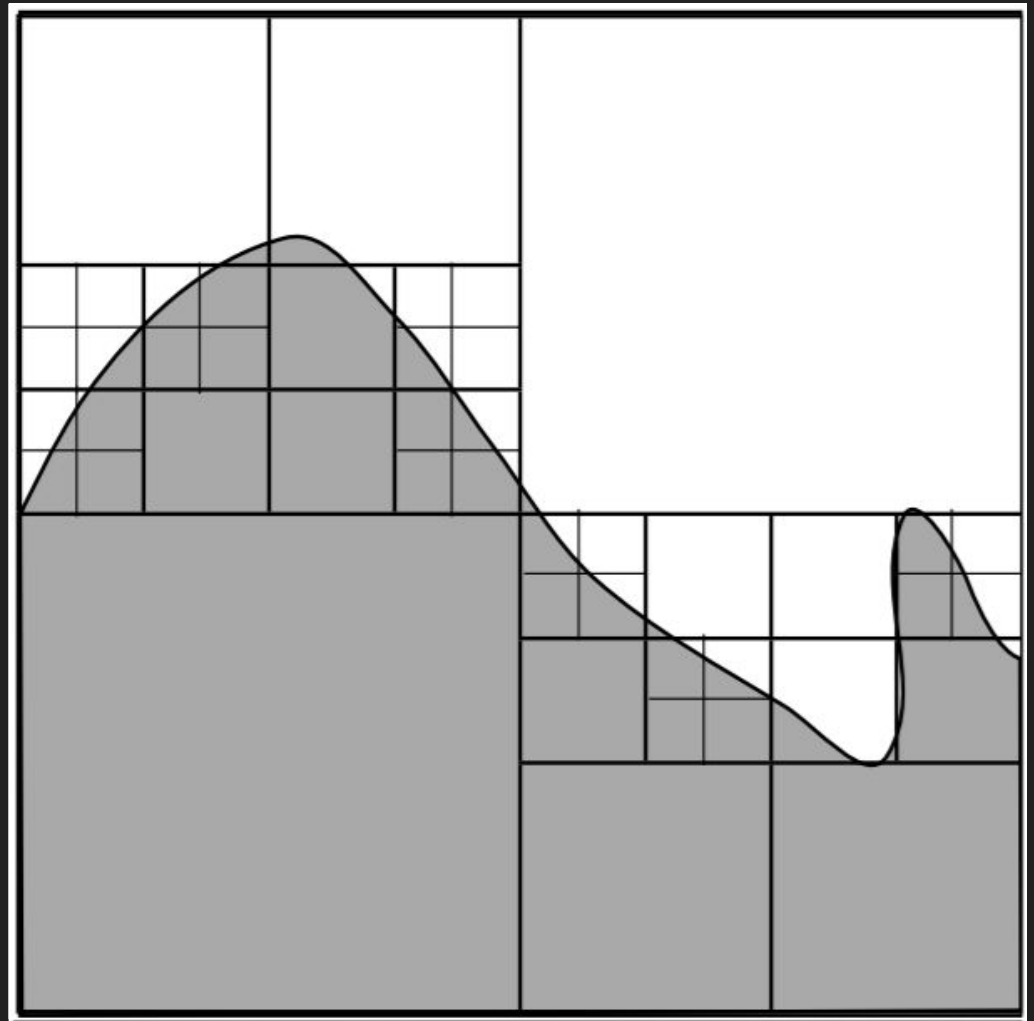
How does QuadTree Works?



Subdivide into uniform blocks

Merge Similar Brothers

Subdivide Non-homogenous Cells



How does QuadTree Works?

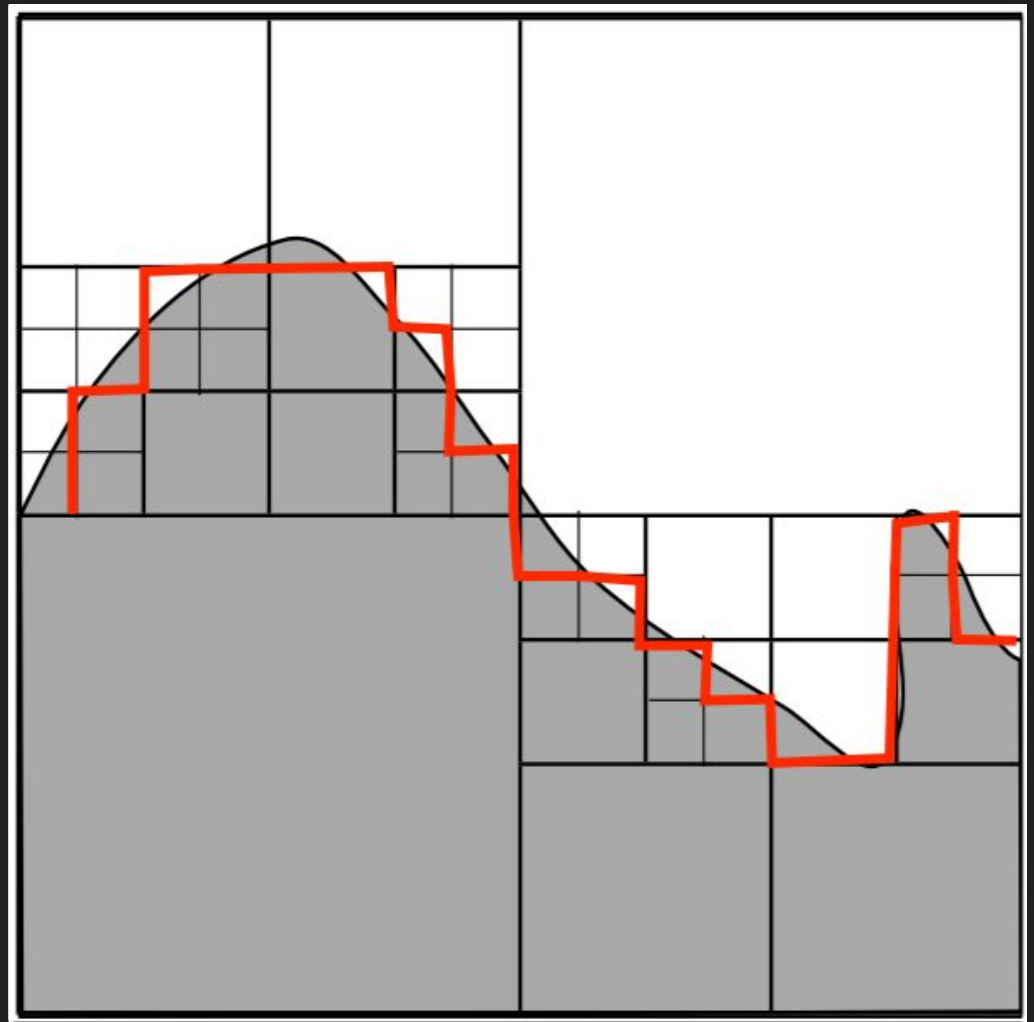


Subdivide into uniform blocks

Merge Similar Brothers

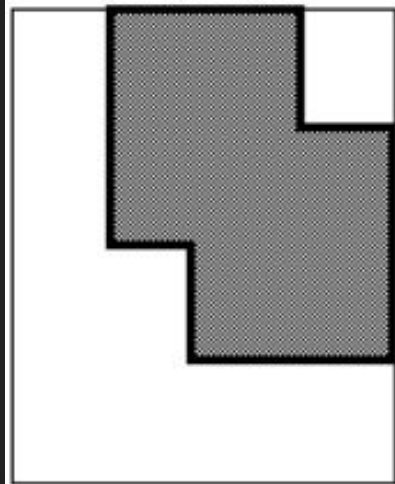
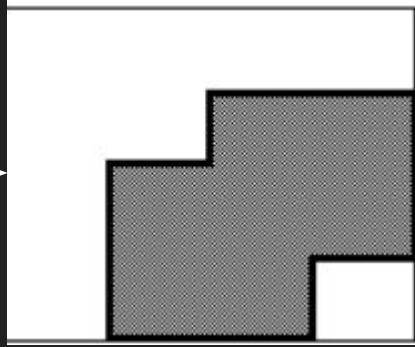
Subdivide Non-homogenous Cells

**Group Identical Blocks
to get regions**



LIMITATIONS OF QUADTREE

First Image

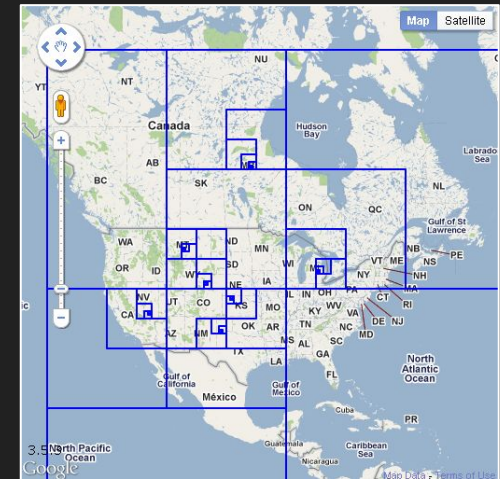
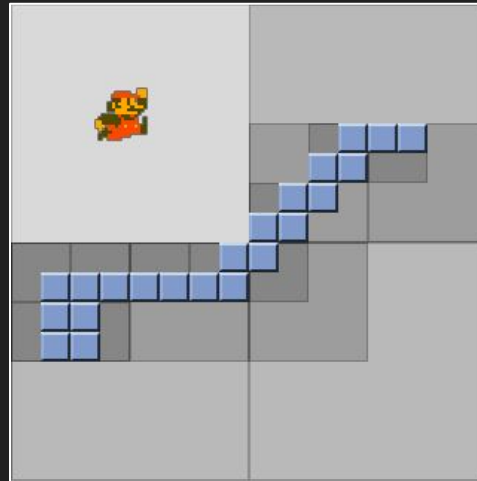
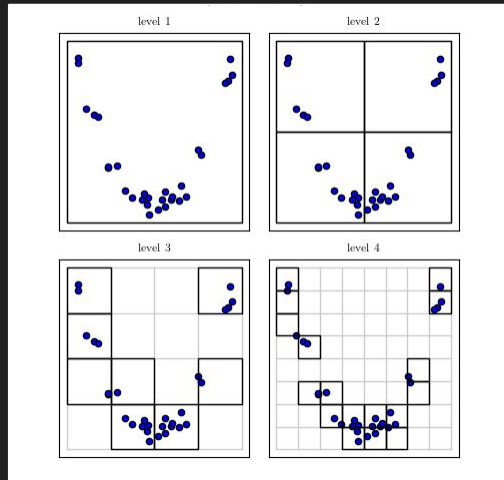


Rotated Image

- The main disadvantage of quadtrees is that it is almost impossible to compare two images that differ only in rotation or translation. This is because the quadtree representation of such images will be so totally different.
- The algorithms available for rotation of an image are restricted to rotations of 90 degrees (or multiples thereof). No other rotation is available, nor is there a facility for translation.

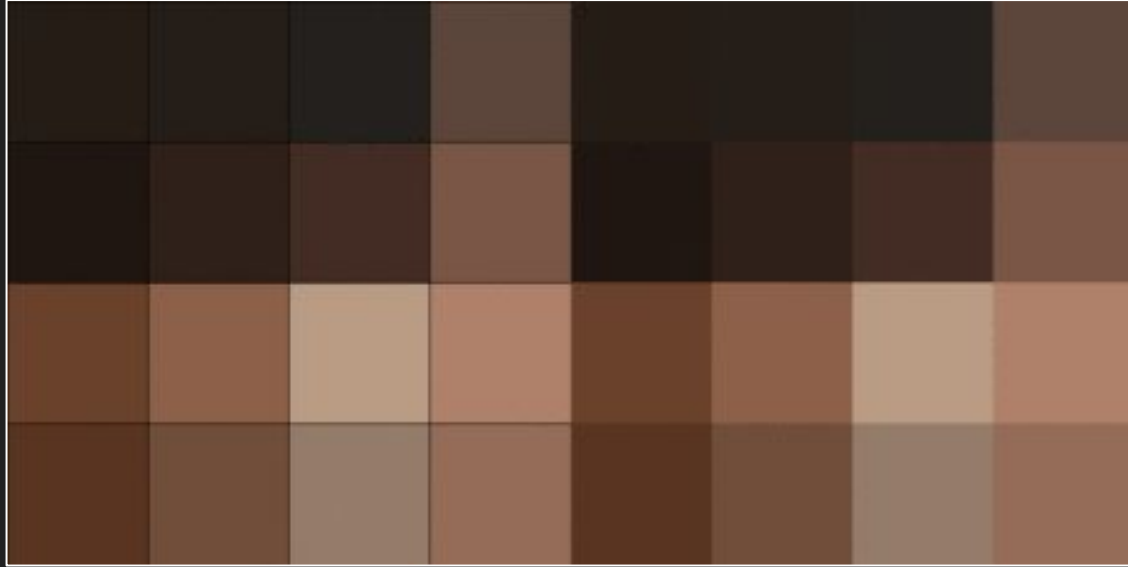
APPLICATIONS OF QUADTREE DATA STRUCTURE

- Computer Graphics, Games, Movies
- Computer Vision, CAD, Street Maps (Google Maps/Google Earth)
- Human-Computer Interface Design (Windowing Systems)
- Virtual Reality
- Visualization (Graphing Complex Functions)



QuadTree Compression of an image

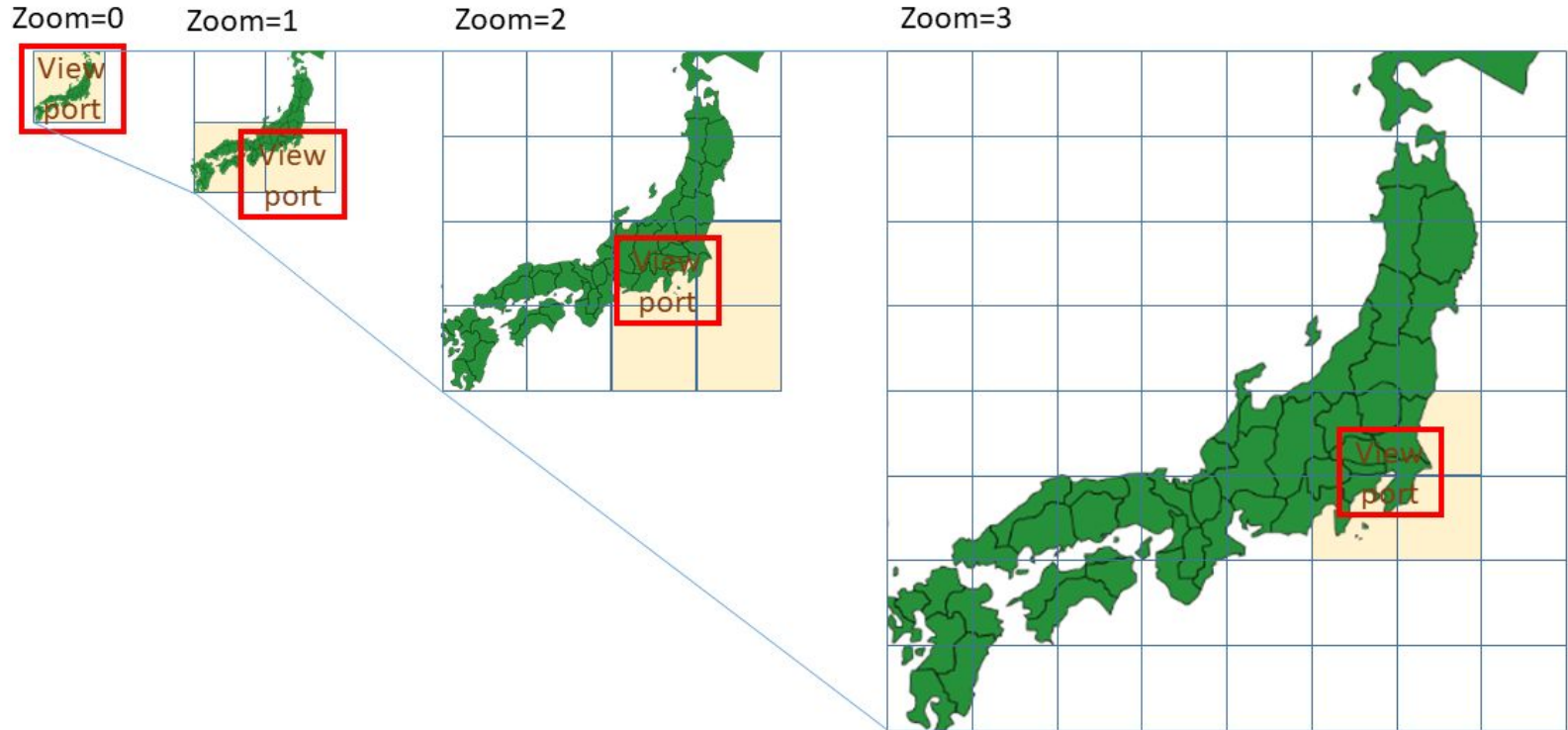
step by step



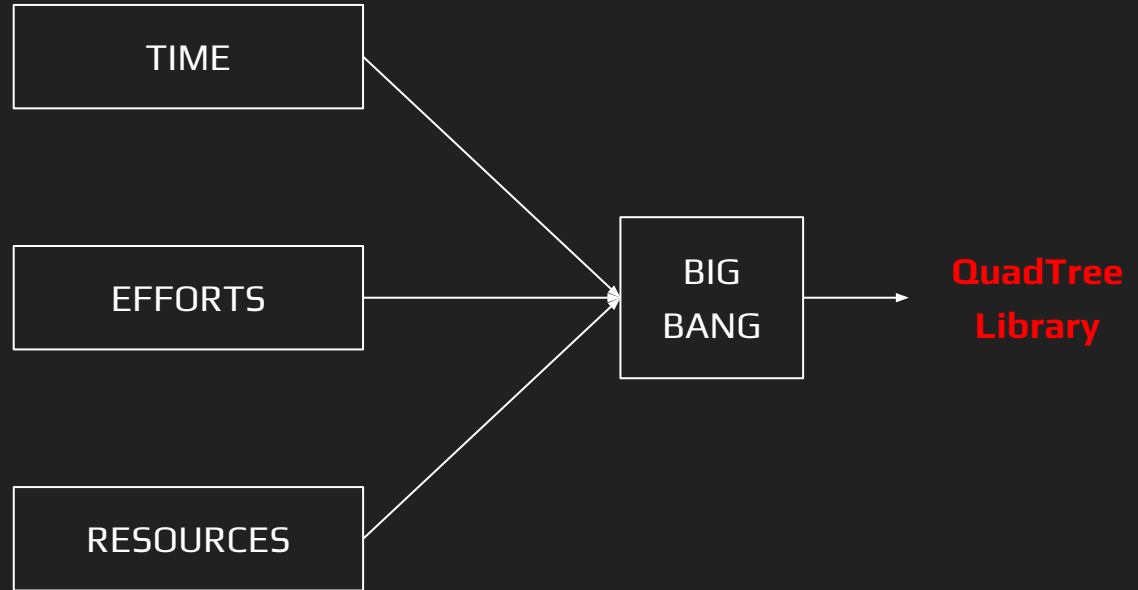
Left shows the compressed image with the tree bounding boxes
while the right shows just the compressed image.

Pyramid of tiles

- To be able to read efficiently according to zooming



THE BIG BANG MODEL



TOOLS AND TECHNOLOGIES USED

TOOLS USED

- GitHub Pages
- CMake
- Visual Studio Code

TECHNOLOGIES USED

- C/C++ Language

PROJECT PLAN

#	Task	Start Date	End Date
1	Understand Object-Oriented Programming in C	17-09-2021	01-10-2021
2	Understand Design Patterns in C	01-10-2021	15-10-2021
3	Learn how to use TinyXml	15-10-2021	29-10-2021
4	Define ADT for QuadTree	29-10-2021	12-11-2021
5	Define the file format for QuadTree	12-11-2021	26-11-2021
6	Get your hands on the pcf_ui library	26-11-2021	10-12-2021
7	Understand the Drawing View Control of pcf_ui	10-12-2021	24-12-2021
8	Sequence diagram for your final application	24-12-2021	08-01-2022
9	Implement the Visualizer	08-01-2022	05-02-2022
10	Design the architecture of the application	05-02-2022	12-02-2022

REFERENCES

- Q. Cai and Y. Zhou, "A quadtree-based hierarchical clustering method for visualizing large point dataset," 2016 Sixth International Conference on Information Science and Technology (ICIST), 2016, pp. 372-375, doi:10.1109/ICIST.2016.7483441.
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- "Optimal quadtree construction algorithms" Computer Vision, Graphics, and Image Processing, Volume 37, Issue 3, March 1987, pp 402–419, doi:10.1016/0734-189X(87)90045-4

THANK YOU