

Advanced Algorithms

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Project Files Explanation

1) SRC and INCLUDE FOLDER:

1. main.cpp: This file serves as the entry point for the application. It includes the main function which reads input data (points and polygons) from JSON files, initializes the RangeSearch object with these points, performs range queries to determine which points lie within specified polygons, and writes the output results back to JSON files. This file utilizes functionalities provided by other parts of the project, such as the ANN library for spatial indexing and the JSON for Modern C++ library for handling JSON formatted data.

2. Point.cpp: This file implements the Point class, which represents a two-dimensional point with x and y coordinates. This class provides the basic data structure for handling points on the plane. The file contains methods for constructing points, accessing their coordinates, and utility functions for manipulation or distance calculations.

3. Polygon.cpp: This file contains the implementation of the Polygon class, which is used to represent a polygon as a collection of points (vertices). The file includes the constructor and destructor of the class, and other methods that manage the geometric properties of polygons, such as computing the area, checking containment, and other polygon-specific operations crucial for range searching tasks.

4. RangeSearch.cpp: This file implements the RangeSearch class, which encapsulates all the functionalities for performing spatial queries using kd-trees. It includes methods for building the kd-tree from a set of points, performing queries to count or find points within a polygon, and utilities for geometric calculations like checking if a point is inside a polygon or computing bounding boxes. This class heavily interacts with the ANN library to leverage optimized spatial index structures for efficient query performance.

5. Point.h: The header file for the Point class, Point.h, declares the structure of the Point class including its properties (x and y coordinates) and basic functionalities such as constructors and accessor methods. It ensures that points are universally manageable across other components of the project which deal with geometric computations.

6. Polygon.h: Polygon.h outlines the structure of the Polygon class in the header file, detailing the constructors, destructors, and any additional methods required to manipulate polygon data.

7. RangeSearch.h: This header file declares the RangeSearch class which includes methods for initializing the kd-tree, querying it, and performing auxiliary geometric checks such as point-in-polygon tests. It acts as a central point for managing spatial queries, which is critical to the functionality of the application, especially in providing efficient and accurate range searching capabilities.

2) BIN FOLDER FILES :

This folder contains all the executable files

3) ANN FOLDER:

The 'ann' directory within the project is fully equipped with the essential modules of the Approximate Nearest Neighbor (ANN) library, pivotal for conducting spatial queries with high efficiency through the use of kd-trees. The architecture of this directory is thoughtfully designed, encompassing binary executables tailored for both demonstrations and tests (bin), static libraries that facilitate linking (lib), indispensable header files that support development activities (include), and the foundational source code (src) that encapsulates the primary operations of the ANN library, including the construction of kd-trees, advanced search algorithms, and a suite of utility functions for the adept handling of kd-trees.