EXTRACTING SERVICES IN CIRCULAR RANGE USING PRIORITY SEARCH TREE

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Abstract- Extracting surrounding services system is developed in user defining range that will figure out the user location and searching the desired services around user. Location-based services allow users on the go with access to geographic data from micro-laptops, tablet, mobile devices, PCs, PDA etc. In this paper, the new data structure of Priority Search Tree combine with the Vincenty's Method to query the data-points according to the user's defining circular range. In my propose system, enumerate a circular range around a point with user preference distance and generating the latitudes and longitudes of the services at that circular range to extract accurate services according to their geographic coordinates. After the specific information (eg; ATM, Hospital, Hotel, Shopping Center… etc.,) according to user is extracted by the preference ring range, their coordinate are converted to image coordinate and show on the map.

Keywords- Circular Range, Priority Search Tree, Vincenty's Method.

I. INTRODUCTION

Extracting surrounding services system allows user to search for businesses and other requriement services that satisfy the user define geographical constraint. This system offer many advantages to the users to retrieve the information about their current locaion and retrieve data to get more useful informaton near from their location. Extracting surrounding services system allows users to access geographic data from portable devices. The traditional web search engines, current local search services rely heavily on static, structured data, a limited coverage and limited suport for using landmarks and neighborhood names in queries. Most are also not consider the user defined range. Sometimes, they are not able to meet the user's requirement. Moreover, they display the ambiguous and unexpected result for user. There is necessary to defined specific location range so the user can decide to choose their destination more easily and quickly and displaying the map is very easy to understand for users. The system provice for searching desired servics on desired distance range around user according to user preferences.

Minati De, Anil Maheshwari, Subhas C. Nandy, Michiel Smid(2011) introduce the combination of a binary search tree and a min-max heap which is the min-max priority search tree. They show that all the standard queries which can be done in two separate versions of a priority search tree can be done with a single min-max priority search tree. They present an in-place algorithm to enumerate all maximal empty axis-parallel rectangles amongst points in a rectangular region R in R^2 in O(m log n) time with O(1) extra-space, where m is the total number of maximal empty rectangles.

Robin Y. Flatland, Charles V. Stewart (2000) present algorithms that obtain efficient overall query times by performing novel searches of multiple range trees and extending k-nn trees, a new data structure is introduced. In two dimensions, when queries eventually incorporate $\Theta(N)$ points or require $E = \Omega(N)$ extensions, the overall retrieval time of their algorithms is $O(E+N)$. They extending L_∞ k-nn algorithm immediately provides a new solution to the traditional L_∞ k-nn problem, improving upon previous results. Their search techniques and data structures generalize to algorithms for extending fixed polytope range queries and extending k-nn using polytope distance functions. Their research give efficient algorithms for two instances of extending neighborhood problems stated as extending orthogonal range reporting and extending L_∞ k-nearest neighbors.

Haibo Hu and Dik Lun Lee(2006) consider the ranges as (hyper)rectangles and propose efficient in-memory processing and secondary memory pruning techniques for RNN queries in both 2D and high-dimensional spaces. Their techniques are generalized for kRNN queries, which return the k-nearest neighbors for every point in the range. Their research show an auxiliary solution-based index EXO-tree to speed up any type of NN query. EXO-tree is orthogonal to any existing NN processing algorithm and, thus, can be transparently integrated.

Sunil Arya, David M. Mount (2006) show that given a bounded range Q of diameter ω and $\varepsilon < 0$, an approximate range query treats the range as a fuzzy object, meaning that points lying within distance $\omega\varepsilon$ of the boundary of Q either may or may not be counted. They show that in any fixed dimension d, a set of n points in R^d can be preprocessed in O(nlogn) time and O(n) space, such that approximate queries can be answered in $O(\log n+(1/\varepsilon)^d)$ time. The only assumption we make about ranges is that the intersection of a range and a d-dimensional cube can

be answered in constant time (depending on dimension). For convex ranges, we tighten this to $O(\log n+(1/\varepsilon)^{d-1})$ time. They also present a lower bound for approximate range searching based on partition trees of $\Omega(\log n+(1/\varepsilon)^{d-1})$, which implies optimality for convex ranges (assuming fixed dimensions)

This system is possible for users to use GIS and mapping system for location searching. Location-based services aim to provide new services to their users based on the knowledge of their locations. In this system, GPS device is used to define and collect geographic coordinates for all places on earth. Download these points onto computer and integrate them with mapping programs.

The own Data-Set is created for Yangon region which containing the latitude, Longitude, Position and each Sub-Images (approximately 0.15 km2) grabbed from Google Earth. Calculating a Circular Range around a point with user preference distance and generating all latitudes and longitudes at a given circle range to extract accurate services according to their geographic coordinates. In this system, combination process of the sub images to achieve the map which involve the user's current location and desire service location according to the user define range. Coordinate converting Algorithm is introduced for converting the geographic coordinate to image coordinate system and then the ring range is displayed on the map.

II. PRIORITY SEARCH TREE

Priority search tree algorithms can be used effectively as subroutines in diverse applications. With them one can answer questions of intersection or containment in a dynamic set of linear intervals. They can be used in combination with a well known plane-sweep technique, to implement off-line algorithms for enumerating all intersecting pairs of rectangles. Priority search trees can also be used to implement best-first-fit storage allocation.

Let D be a dynamic set of ordered pairs [x,y] over the set 0,1,2,…,k-1 of integers. Consider the following operations applied to D:

InsertPair (x,y): Insert a pair [x,y] into D.

DeletePair (x,y): Delete a air [x,y] from D.

MinXInRectangle (x_0,x_1,y_1): Given test integers x_0, $x_1$and y_1 among all pairs [x,y] in D such that $x_0 \le x \le x_1$ and $y \le y_1$, find a pair whose x is minimal.

MaxXInRectangle (x_0,x_1,y_1): Given test integers x_0, x_1 and y_1 among all pairs [x,y] in D such that $x_0 \le x \le x_1$ and $y \le y_1$, find a pair whose x is maximal.

MnYInXRange (x_0,x_1): Given test integers x_0 and x_1, among all pairs [x,y] in D such that $x_0 \le x \le$, find a pair whose y is minimal.

Enumerate Rectangle (x_0,x_1,y_1): Given test integers x_0, x_1 and y_1, enumerate those pairs [x,y] in D such that $x_0 \le x \le x_1$ and $y \le y_1$.

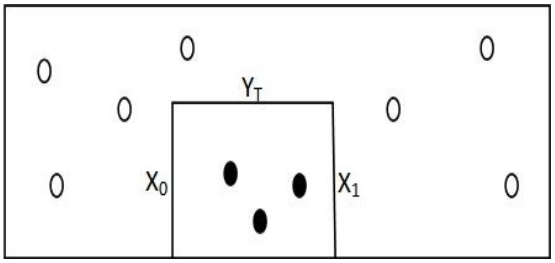
Priority search tree have basically two types;(i) Radix Priority Search Tree and (ii)Balanced Priority Search Tree. In our propose system radix priority search tree is emphasized.

A radix priority search tree is characterized by a fidelity condition and two data structural invariants. The fidelity condition asserts that if the tree is representing a set D of pairs, then each pair of D will appear in the p field of exactly one node (or RPST record) of the tree. Thus a tree representing a set of n pairs occupies O(n) words of storage, where each word is O(log k) bits long. In conventional algorithm-analytic terms, a radix priority search tee is a linear-space data structure.

The first invariant is a priority queue invariant on y-values. It asserts that for any node t in a radix priority search tree, if t.left is not NIL then t.p.y ≤ t.left ↑.p.y, and if t.right is not NIL then t.p.y ≤ t.right ↑ p.y. This first invariant constrains only direct ancestor-descendant relations; it does not constrain sibling relations at all.

The second invariant is a radix search tree invariant on x-values. It asserts that associated with each node t in a radix priority search tree is an x-interval [lower, upper] within which t.p.x lies. The x-interval associated with the root of the radix search tree is the interval KeyBound. For any node t such that t.left is not NIL, the x-interval associated with the node t.left ↑ is [lower .. floor(lower+upper)/2)). For any node t such that t.right is not NIL, the x-interval associated with the node t.right ↑ is [floor((lower + upper)/2)..upper).

EnumerateRectangle is a depth-first enumeration that calls the functionReport whenever a pair is found within the constraint rectangle. Report returns TRUE if the enumeration should continue, and FALSE if it should terminate.EnumerateRectangle return all elements in the rectangle defined by the lines, $x=x_L$, $x=x_R$, $y=y_0$, $y=y_T$, $x_L \le x \le x_R$ and $0 \le y \le y_T$.



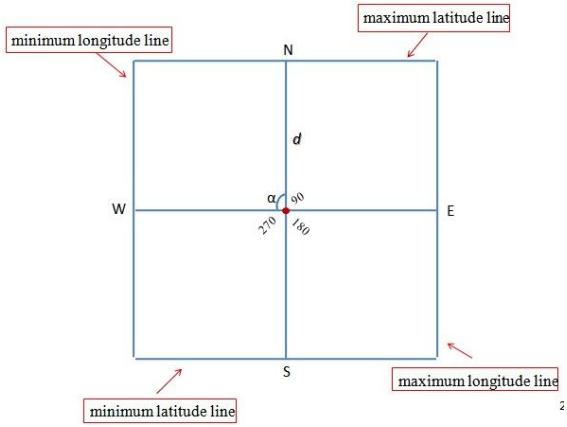
```
Function EnumerateRectangle(t : RPSTPtr; x0, x1, y1, KeyRange;
    Function Report(Pair) : BOOLEAN;
    lowerX : KeyRange; upperX; KeyBound; BOOLEAN;
    VAR
        continue: BOOLEAN;
        middleX : KeyRange;
    BEGIN
    IF t <> NIL THEN
      IF t.p.y <= y1 THEN
          BEGIN(*node passes y test*)
          IF (x0 <= t.p.x) AND (t.p.x <= x1) THEN
              continue:= Re port(t.p)
          ELSE continue:= TRUE;
          middleX := (lowerX + upperX) / 2;
          IF continue AND (x0 < middleX) THEN
              continue:= EnumerateRectangle
                        (t.left, x0, x1, y1, Report, lowerX, middleX);
          IF continue AND (middleX <= x1) THEN
              continue:= EnumerateRectangle
                        (t.right, x0, x1, y1, Report, middleX, upperX)
          EnumerateRectangle:= continue;
          END
          ELSE EnumerateRectangle:= TRUE(*node fails y test*)
    ELSE EnumerateRectangle:= TRUE;(*empty subtree*)
    END;(*of EnumerateRectangle*)
```

III. PROPOSE SYSTEM

In this system, the circular range searching is developed by using priority search tree and vincenty's method. Vincenty's method is used to define the rectangular range which covers the circular with user requirement range. By using rectangular range is defined in preprocessing step, the execution time can be reduced. Vincenty's formulae are two related iterative methods used in geodesy to calculate the distance between two points on the surface of a spheroid, developed by Thaddeus Vincenty (1975).

They are based on the assumption that the figure of the Earth is an oblate spheroid, and hence are more accurate than methods such as great-circle distance which assume a spherical Earth. The first (direct) method computes the location of a point which is a given distance and azimuth (direction) from another point. The second (inverse) method computes the geographical distance and azimuth between two given points. They have been widely used in geodesy because they are accurate to within 0.5 mm (0.020″) on the Earth ellipsoid.

Firstly, we use Vincenty's direct method to determine the maximum and minimum bounded that cover for the user requirement range. When defining the ring range for user preference distance, Vincenty Direct method computes the location of a point which is a given distance and azimuth (direction) from another point. Latitude and Longitude of user current location as lat_1, lon_1, user's define range is used as s and α have four variable such as 0°, 90°, 180° and 270°. In geographic coordinate system, true north is 0° and it is used for maximum latitude, 90° is maximum longitude, 180° is minimum latitude and 270° is minimum longitude. After processing this step, we get the two pairs of latitude and longitude which are minimum latitude, minimum longitude and maximum latitude, maximum longitude. These two pair are cover the user define range.



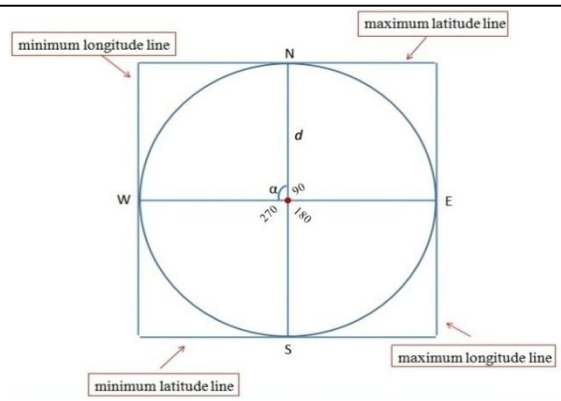
When we get the min/max latitude and longitude, these are use as input to the proposed algorithm which is modifying the EnumeratedRectangle to eliminate the data point which are not include in user define rectangular range.

Proposed Algorithm $(R; x_0; y_0; x_{mi}; x_{mx}; y_{mi}; y_{mx})$

1. $Input\ R = \{(x_1, y_1), (x_2, y_2), ..., (x_n, y_n)\}$;
2. $Define : t = Ptr$;
   - $new\,\mathrm{Pr} = pair \in R$;
   - $x_{mi} = \mathrm{minLat}$; $x_{mx} = \mathrm{maxLat}$;
   - $y_{mi} = \mathrm{minLon}$; $y_{mx} = \mathrm{maxLon}$;
   - $x_0 = user's\ current\ x$; $y_0 = user's\ current\ y$;
   - $t.p = (x_0, y_0)$;
   - $D = t.p$
3. $for\ i = 1 : n$;
   - $if\ (x_{mi} \le new\,\mathrm{Pr}.x\ \ and\ \ x_{mx} \ge new\,\mathrm{Pr}.x)\ \ then$;
     - $if\ (y_{mi} \le new\,\mathrm{Pr}.y\ \ and\ \ y_{mx} \ge new\,\mathrm{Pr}.y)\ \ then$;
       - $t_i.left.p = new\,\mathrm{Pr}$;
       - $D = t_i.left.p$;
     - $else$
       - $t_i.right.p = new\,\mathrm{Pr}$;
     - end
   - $else$
     - $t_i.right.p = new\,\mathrm{Pr}$;
   - end

   end
4. Return $D = \{(x_1, y_1), (x_2, y_2), ..., (x_r, y_r)\} \subset R$;

Finally, we are using the binary search tree to exactly extract the data point in circular range. In this part Vincenty's inverse formula is used to determine the distance between two points, i.e., from the current location to service location in a rectangular range.



Binary search trees provide an excellent structure for searching a list and at the same time for inserting and deleting data into the list. The common properties of binary search trees are as follows:

~ The left sub-tree of a node contains only nodes with keys less than the node's key.
~ The right sub-tree of a node contains only nodes with keys greater than the node's key.
~ The left and right sub-tree each must also be a binary search tree.
~ Each node can have up to two successor nodes.
~ There must be no duplicate nodes.
~ A unique path exists from the root to every other node.

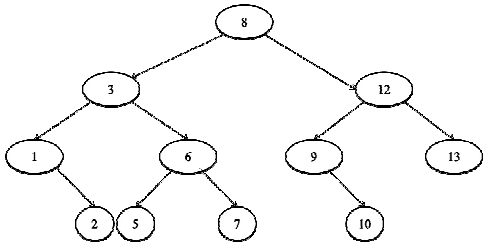


Fig 1: Example of Binary Search Tree

IV. SUB-IMAGES INTEGRATION

When the image integration, sub images are selected from data-set which is containing the sub-images of Yangon region. Each of sub-images is grabbed from Google earth and which are stored in data-set with their sub-image number, latitude, longitude and position. Generally, when selecting the sub-images, emphasizes on the image which include the user preference name of the place. After sub-images are selected, these are integrated to be a panoramic view.
Image mosaicing has been used in various arenas of image engineering. The main purpose the work is to mosaic of two non-overlapping sub-images with minimum distortion and no visible seam. In the method of (Achala Pandey, Umesh C. Pati), images are mosaiced using the pyramid technique and Savitzky-Golay filter is used for smoothing the seam between the images in the generated mosaic. Savitzky-Golay filter, is based on the least square fitting of polynomial functions of image intensities. It effectively reduces the noise and preserves the image information content resulting in a visually pleasing mosaiced image.

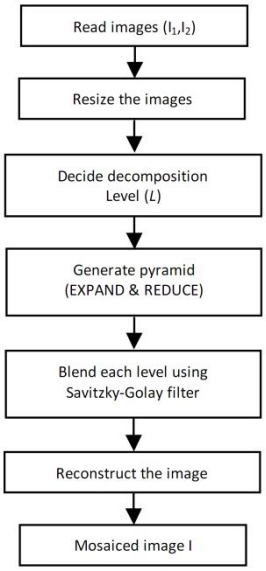


Fig 2: Flow chart of image mosaicing

They proposed a blending algorithm for the mosaicing of two non-overlapping unrelated images. The input images are mosaiced using pyramid method and blending is carried out using Savitzky-Golay filter. Smoothing is the major operation of blending in image mosaicing. Savitzky-Golay filter is applied for smoothing the seam while retaining the image information.

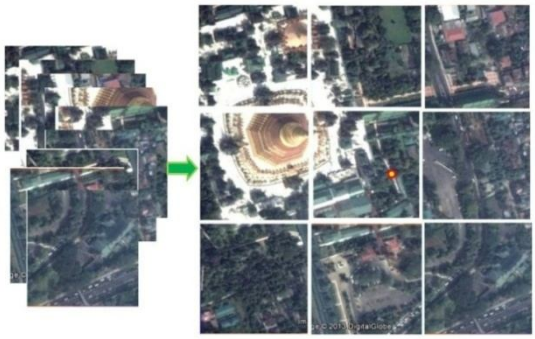


Fig 3: Selecting sub-images and arranged in order by square puzzle approach

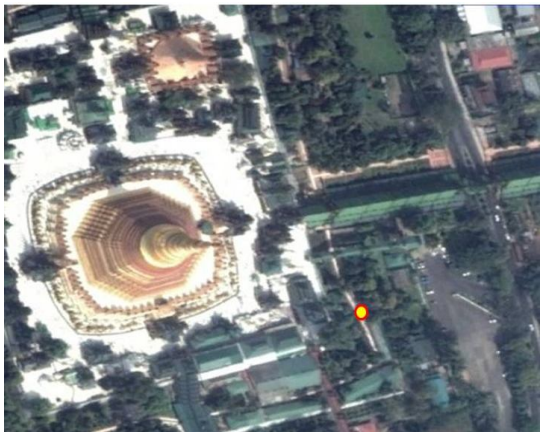


Fig 4: The result of integrating the sub-images

VI. COORDINATE TRANSFORMATION

For displaying the services in circular range on the map, there is needed to convert geographic coordinate to image coordinate of all services. Direct transformation by Grid-on-Grid method is used to rectify raw images which are built up by a rectangular array of pixels with variable values. Simplest transformation model is, (x',y') -> (x,y).

Affine transformation allows for different scales in the directions of the two axes. Affine transformation is a linear transformation and relates two 2D cartesian coordinate systems through a rotation, a scale change in x- and y- direction and translations.

$$X' = s_x X \cos(\alpha) - s_y Y \sin(\alpha) + x_0$$

$$Y' = s_x X \sin(\alpha) + s_y Y \cos(\alpha) + y_0$$

where ;

α is angle of rotation.

s_x and s_y are scale factor.

x_0 and y_0 are translation parameters.

Coordinate Converting Algorithm

1. define $\alpha = 0$;
2. define x_0 = origin shift in longitude at raster point (0,0);
3. define y_0 = origin shift in latitude at raster point (0,0);
4. *calculate scale factor*

$latLim = [latMax\ latMin]$, $lonLim = [lonMax\ lonMin]$

$rastersize = [m\ n]$

$$s_x = \frac{lonMax - lonMin}{n},\ s_y = \frac{-latMax + latMin}{m}$$

5. $p[]$ = latitudes to transform, $q[]$ = longitudes to transform

for $i = 0 : p - 1$;

$$x = \frac{q[i] - x_0 + s_y y \sin(\alpha)}{s_x \cos(\alpha)}$$

$$y = \frac{p[i] - y_0 + s_x x \sin(\alpha)}{s_y \cos(\alpha)}$$

end

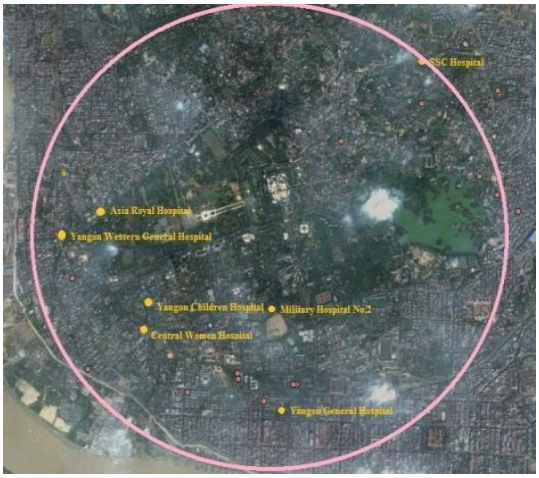


Fig 5: Displaying the services according to user preference distance

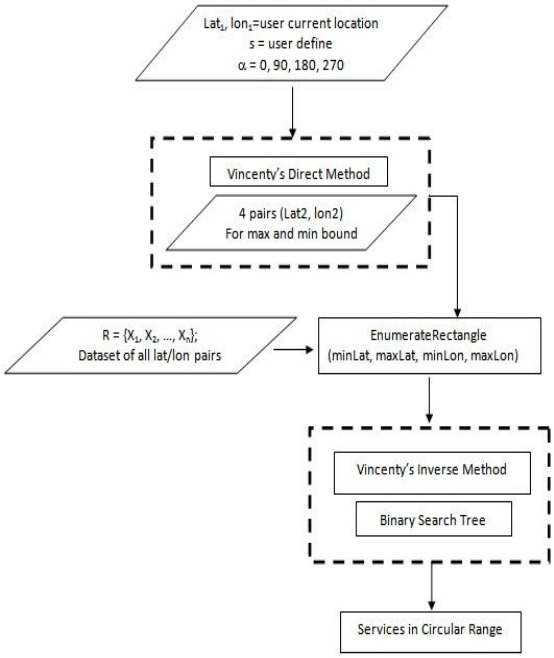


Fig 6: System flow diagram

RESULT AND DISCUSSION

In this paper, we demonstrate about the modifying Enumerate Rectangle operation of radix priority search tree for circular range searching. The analysis of Enumerate Rectangle is complicated because each Report calls itself recursively on both sons of a tree node. Enumerate Rectangle can visit a node only if the pair in the node's father was Reported. It follows that if Enumerate Rectangle in fact enumerates S pairs, it runs in a time bound of O(log k+S). This is true whether or not the enumeration is terminated by the Report function. In our system, we are only searching all nodes in defining range in dataset not identically to the Enumerate Rectangle operation. In Enumerate Rectangle operation, the root node is not NUL. Therefore our system is similar to the combination of Insert operation and Enumerate Rectangle operation. This implies the time of O(log k) on depth of recursion and the number of nodes visited.

CONCLUSION

Extracting surrounding services system is also useful for foreigner to easily search nearest bus stop, restaurant, department station and easily to estimate how far from there. Most current location based services are providing on online and need wireless connection while ignoring various forms of user preference. The system is based on geographic coordinates and map so useful in online or offline. The system provide for searching desired services on desired location range according to user preferences.

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