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Algorithm of Route Searching for Mine Geographic Network

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Abstract

According to the features of mine geographic network, the paper presents an algorithm of route searching for mine geographic network called tree growth. This algorithm can improve the searching efficiency for avoiding searching for the intersection part of the routes. If the node of the subsequent growing branch is the same as any element of the intersection namely node (or called meeting with a refusal), it will immediately change the direction. The tree growth algorithm can avoid the problem of searching combination explosion and is applicable to route searching for large-scale mine.

Key words: mine geographic network; network route; search; algorithm; tree growing

1. Introduction

In the mine network analysis, route searching problem such as mine power network is often involved. It needs to check all the power lines from the central substation to a mining area; For another example, when a major mine disaster happens, and needs to search for the underground workers, all the routes between two or more points should be searched. In the geographic network, when analyzing a shortest route for the undirected graph (such as roadway network), all routes between the two points should be first determined in order to reduce the search range, improve efficiency and save resources. The other network edges not on the route are excluded from analysis.

When traversing the undirected graph, for connected graphs, the search procedure is called only once. In other words, that is, from any vertex in the graph, each vertex in the graph can be traversed. For non-

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connected graph, you need repeatedly call the search process, and each time the vertex access sequence get by the call is exactly the vertex set of each connected components.

Let E(G) is the set of all edges in the connected graph G, then from any vertex of the graph traversing the connected graph, it will make E(G) into T(G) and B(G), where T(G) is the set of edges in the process of traversing the graph, B (G) is a collection of remaining edges. Obviously, all vertices in the T(G) and graph G together make up the minimal connected sub graph of the connected graph G, and are also a spanning tree of connected graphs. The spanning tree obtained by the breadth-first search is called breadth-first spanning tree, and the spanning tree obtained by the depth-first search is called depth-first spanning tree.

All the route search of large network, according to the traditional search method, will produce the "combination explosion" problem [1]. In view of the characteristic of mine geographical network, this paper puts forward a more efficient feasible method, called "tree growth" method [2].

2. The basic idea of tree growth algorithm

Routes should be acyclic, and the tree is also acyclic. For any two routes, such as R_i , R_j , it may be $R_i \cap R_j \neq \Phi$. The intersection of paths which is from the root to any two leaves is not null. Based on these similar properties, if the same parts of all the routes are combined as the tree branch, one route tree is formed. However, this is a special tree of which roots are mine network nodes i, leaves are nodes j, the intersection of branches corresponds to route nodes. Moreover, the tree is different from a spanning tree (sustaining tree) of the graph G (V, A) so that you can simulate the growth of the tree to search for the route. We assume that the lateral growth of the tree is the branch growth, the vertical growth is the growth of leaves, and the tree grows from the roots and branches. Afterwards, following the "vertical first and lateral second, branch first and leaf second" principle, a tree grows. In other words, the roots grow firstly, and next a branch is generated, soon afterwards several branches grow from the end of the branch nodes in one direction, and finally the leaves grow. After the growth of leaves, new leaves grow in another direction from the end of the branch nodes. If leaves can't grow(meeting with a refusal), they will grow towards other directions. If leaves are unable to grow in all directions, step back and begin leaves growth. When retreated to the roots, another branch begins to grow and then repeat the above process of growth. If branches can't grow, the growth ends, and the growth routes is the whole routes. The growth process is "depth-first growth, changing the direction meeting with a refusal" process, called DFG for short.

3. The tree growth algorithm

The intersection part of routes is remembered with a stack (LIFO for the stack) plus marks. The arc out of stack achieves changing the direction meeting with a refusal, and the arc into the stack realizes the tree depth-first growth. Mark (v) means v-point .Marked points show that they are in the stack, and prevent the generation of rings. Search-times (v) means the searched adjacent nodes of node v. Father (v) is the parent node of node v. ROAD stores the route that has been full-grown. The union and intersection, which refer to EMP-ROAD and the nodes, save and realize the route growth [3-4]. Steps of the tree growth algorithm are shown in Figure 1.

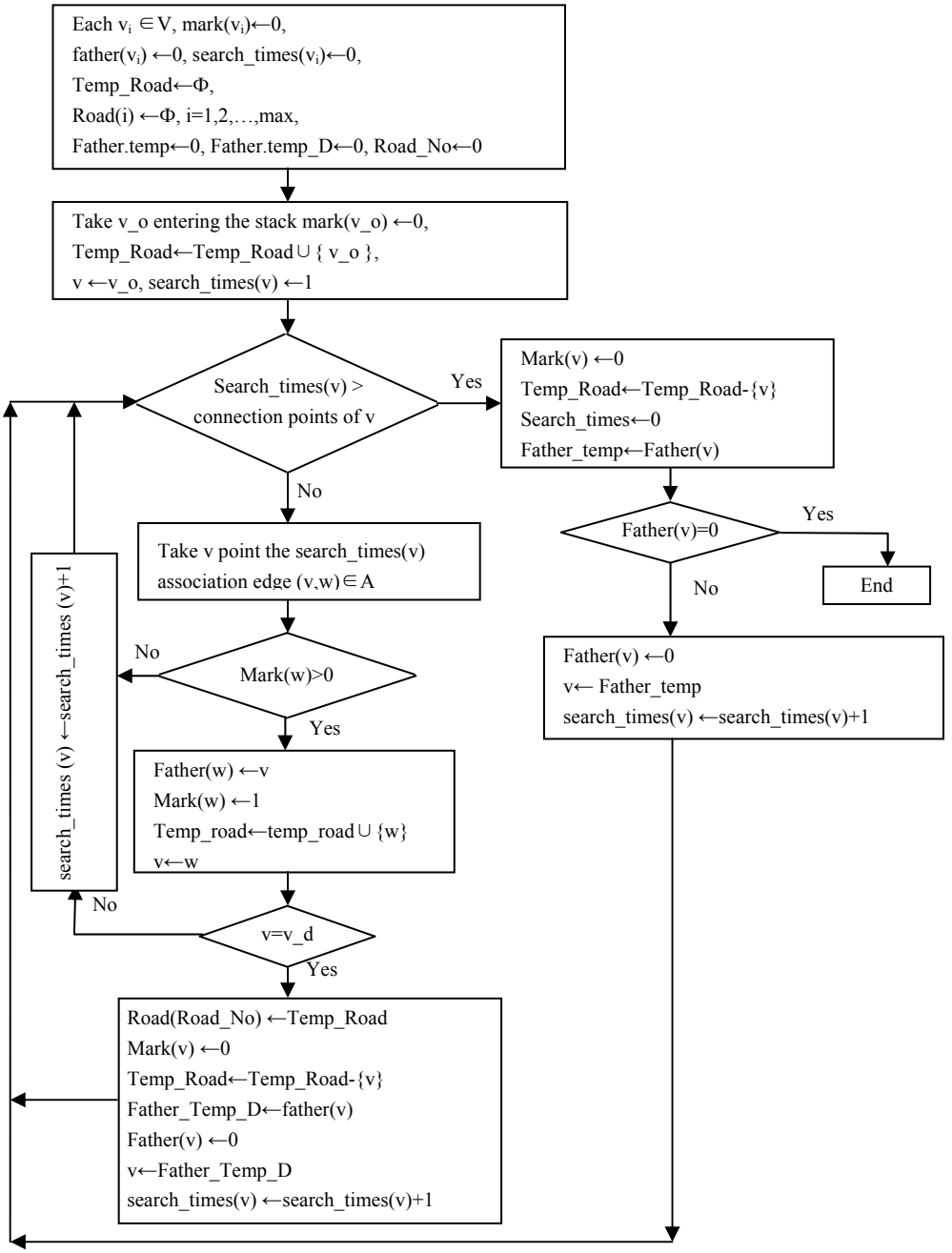

Fig.1 .The process of route search algorithm

4. Examples

Figure 2(a) shows a miniature roadway network, and each side is two-way. Figure 2(b) expresses a route tree growing with the tree growth algorithm following Figure 1 steps.

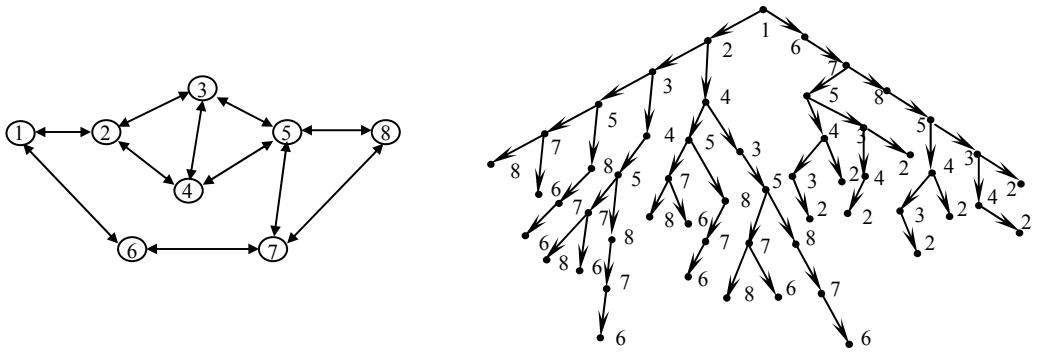

Fig.2. Roadway route search (a) local roadway network; (b) tree growth

5. Conclusions

The route tree grows with the tree growth (DFG) algorithm, of which the algorithm can improve the searching efficiency for avoiding searching for the intersection part of the routes. If the node of the subsequent growing branch is the same as any element of the intersection namely node (or called meeting with a refusal), it will immediately change the direction. The tree growth algorithm can be applicable to route searching for large-scale mine.

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