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# Subway Distribution Path Optimization Issues Based on Dijkstra Algorithm

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***ABSTRACT:*** *In order to realize the requirements of green life, energy saving and consumption reduction, the subway that provides low-carbon and efficient distribution service can be used as the backbone network of urban distribution, and combined with the curriculum work requirements of "Transportation Engineering", the problem of subway distribution path optimization based on Dijkstra algorithm is put forward, taking the point of the station as the starting point, the end point, optimizing the target as the shortest distance of the distribution path. The model is established in Matlab to solve the calculation, and the algorithm and model are verified by taking the Beijing subway network as an example.*

***KEYWORDS****: Dijkstra algorithm; Metro delivery; Matlab*

Subway as an important part of public transport, presents a trend of punctuality, high efficiency, high frequency, its site location is based on the distribution of population density of commercial and residential centers, goods according to the needs of residents and merchants distribution, metro cargo transportation has a high punctuality rate, fast characteristics, and to a certain extent can reduce the simple use of trucks to transport goods caused by traffic congestion, air and noise pollution and other problems. In this paper, the subway network as the research object, not only consider a line, but focus on several major lines composed of the network, transit point is not fixed one or several, but the selected line of all subway transit stations as an alternative transit point, to a given subway station as a starting point, the end point, optimize the target for the shortest distance of the distribution route. [1]

## 1. Model building

### *1.1 Description of the problem*

The problem of urban distribution path based on the subway can be described as follows: The subway network formed by several subway lines, there are several distribution centers near the subway station point, goods from the distribution center near the subway station point through the subway network to the customer.

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Therefore, it is necessary to determine which transit points to choose through in the distribution network, design and plan the shortest distribution path.

### *1.2 Assumptions conditions*

After departure from the distribution center, each subway station (transit point) is visited and only visited once, and then sent to the customer; there is no secondary path connection between any two transit points; the travel time between stations on the subway line is fixed, and the line change time is fixed.

### *1.3 Model building*

Dijkstra algorithm is a typical single-source short path algorithm, the so-called single source is in a directional graph, from a vertex, constantly through the connected point to find the shortest distance to other points, and finally get the shortest path of the problem. In this article is the shortest distribution path from one subway station to the other [2].

In a subway network, there are nodes that have determined the shortest path from the starting point and nodes that have not yet determined the shortest path. Starting from the starting point, in an increment of the length of the shortest path, add the section points that have not yet been specified the shortest distance to all section points that the starting point can reach. In the process, the shortest path is constantly updated [3], always keeping the shortest path length from the starting point to the nodes of the shortest path that has been determined Distance is not greater than the path length from the starting point to any node of the shortest path that has not yet been determined.

Between the section point and the node corresponds to a distance value, the distance corresponding to the section point of the shortest path has been determined is the shortest path length from the starting point to this node, and the distance value corresponding Starting point to the section point of the shortest path has not yet been determined is the shortest path length from the shortest path node to the starting point.

## 2. Model Design

(1) Algorithm Design

```
function [distance, path]=dijkstra(A, s, e)
  A Weight matrix (distance between nodes in subway distribution network)
    S Start point of search (starting point)
    e The end of the search (the last store that passed by)
n=size (A, 1);
D=A(s, :);
path=[];path
```

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```
 visit=ones(1,n);
visit(s)=0;
parent=zeros(1,n);
for i=1:n-1
      temp=zeros(1,n);
```

From the starting point, look for the next point of the shortest distance, each time will not repeat the original track, set to determine whether the node is accessed

```
    count=0;
    for j=1:n
        if visit(j)
            temp=[temp(1:count) D(j)];
        else
            temp=[temp(1:count) inf];
        end
        count=count+1;
    end
    [value,index]=min(temp);
    j=index; visit(j)=0;
    for k=1:n
        if D(k)>D(j)+A(j,k)
            D(k)=D(j)+A(j,k);
            parent(k)=j;
        end
    end
end
distance=D(e);
```

Shortest distance backtracking looks for search paths from the tail

```
if parent(e)==0
    return;
end
path=zeros(1,2*n);
t=e; path(1)=t; count=1;
while t~=s && t>0
    p=parent(t);
    path=[p path(1:count)];
    t=p;
    count=count+1;
end
if count>=2*n
    error(['The path preallocation length is too short.',...
        'Please redefine path preallocation parameter.']);
end
path(1)=s;
```

The shortest distance sought

```
path=path(1:count);
```

(2) Call code

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```
clc; clear; close all;
lines = load('Distance.txt');
A=lines;
A(find(A>1000))=inf;
s =input('ÊäÈëÆðµã');
e =input('ÊäÈëÖÕµã');
[distance,path0] = dijkstra(A,s,e);
fprintf('\n Use Dijkstra the Min Distance is: %.2f\n', distance);
fprintf('\n Use Dijkstra the Min Distance path is: \n');
disp(path0);
for i = 1 : length(path0)
    if i == length(path0)
        temp = [path0(1) path0(i)];
    else
        temp = [path0(i) path0(i+1)];
    end
end
```

## 3. Model validation

### *3.1 Instance Pick*

Subway distribution network select Beijing Metro Line 1, Line 2, Line 5, node network as shown in Figure 1, the distance between nodes and nodes as shown in Figure 2.

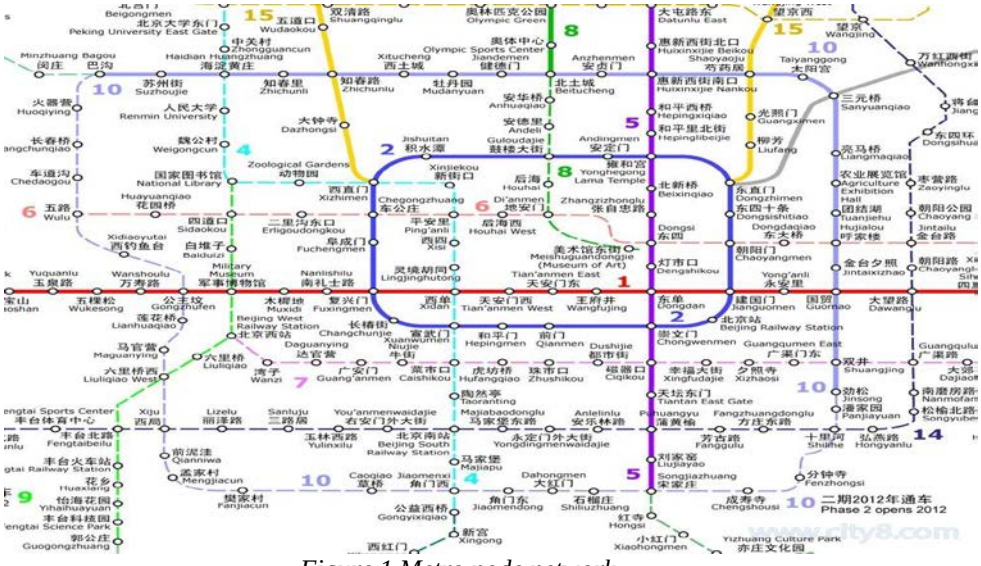

*Figure 1 Metro node network*

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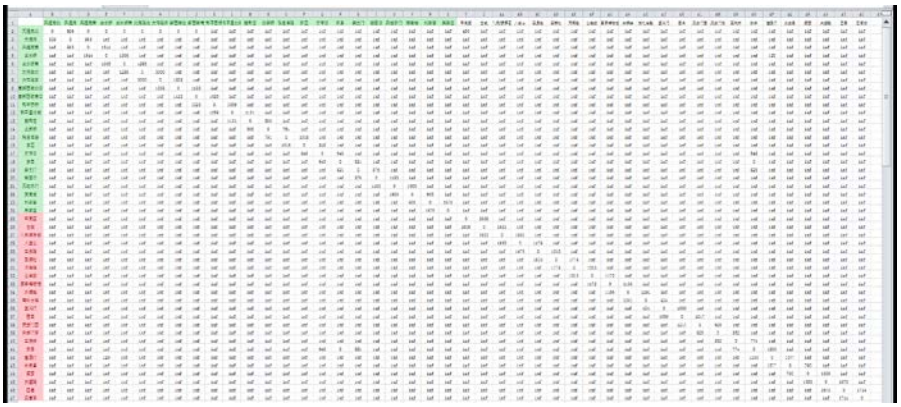

*Figure 2 Distance from Node to Node*

### *3.2 Model solve*

The distance between the section and the node shown in Figure 2 is taken as The Distance.txt.In the call code, and as shown in Figure 3, when any input is made to the node corresponding to the start and end point (subway station), the shortest distribution distance optimized between the starting and ending points and the node (subway station) passed under the shortest distribution distance.

```
输入起点3
输入终点9

Use Dijkstra the Min Distance is: 973.00

Use Dijkstra the Min Distance path is:
    3     4    10     9
```

*Figure 3 Model Solve Results*

As shown in the table data, from Tiantongyuan South to Huixin West Street South mouth for distribution, the shortest distribution distance of 73 km, through the site for the water bridge and peace west bridge.

## 4. Conclusion

Making full use of the subway system and sharing the city subway network to

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transport goods, based on the Dijkstra algorithm, this paper puts forward the subway distribution path problem and optimization model, and gets the shortest route of distribution under the given starting point and end point. Using Matlab programming, the model is designed and the model is analyzed as an example of the Beijing subway network, and the validity of the algorithm is verified.

**References**

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