Detour Dominating Algorithm and Applications.

Mathematics

KEYWORDS: Detour number ,Detour domination number, Detour Algorithm ,Dominating Algorithm, Detour Dominating Algorithm.

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ABSTRACT For vertices u and v in a connected graph G, the detour distance D (u,v) is the length of the longest u- v path in G. A u – v path of length D (u,v) is called a u – v detour. The detour distance is a metric on the vertex set V(G). Chart and et al introduced the concept of detour distance by considering the length of the longest path between the vertices uand v. The Detour set ,Dominating set and Detour Dominating set definition was given and used in image processing for image correction .Here the Detour, Dominating and Detour Dominating Algorithm was introduced and their applications are given.

Introduction

For a graph *G* = *(V, E) we* mean a finite undirected graph without loops or multiple edges. The order and size of *G* Iare denoted by *p* and *q* respectively. We consider connected graphs with atleast two vertices. For basic definitions and terminologies we refer to [1, 4].

For vertices u and v in a connected graph G, the detour distance D (u,v) is the length of the longest u – v path in G. A u – v path of length D (u,v) is called a u – v detour. It is known that the detour distance is a metric on the vertex set V(G). The detour eccentricity e_D (v) of a vertex v in G is the maximum detour distance from v to vertex of G. The detour radius, radDG of G is the minimum detour eccentricity among the vertices of G, while the detour diameter, diamDG of G is the maximum detour eccentricity among the vertices of G. These concept were studied by chartrand et al [2].A dominating set for a graph G = (V, E) is a subset S of V(G) such that every vertex not in S is adjacent to at least any one member of S. The **domination number** γ(G) is the number of vertices in a smallest dominating set for G.A set S⊆V(G) is called **a detour dominating set** of G, if S is a detour set and the **dominating** set of G.The **detour domination number** γ_d (G) of G is the minimum order of its detour dominating sets and any detour dominating set of order γ_d (G) is called a γ_d- set of G. Here we introduce the new Algorithms namely Detour Algorithm, Dominating Algorithm and also Detour Dominating Algorithm. And also we explain how the Detour Dominating concept used in the image processing in image correction.

1.DETOUR DOMINATING CONCEPT

In graph theory, for a graph G=(V,E),we mean a finite undirected graph without parallel edges or loops.The order and size of G are denoted by p and q respectively. We consider connected graph atleast two vertices. For vertices u and w in a connected graph G, the detour distance D(v,w) is the length of the longest v-w path in G. A v-w path of length D(v,w) is called a v-w detour.A detour set S⊆V(G) if every vertex in G lies on a detour joining a pair of vertices of S.

A **dominating** set for a graph G = (V, E) is a subset S of V(G) such that every vertex not in S is adjacent to at least any one member of S. The **domination number** γ(G) is the number of vertices in a smallest dominating set for G.

A set S⊆V(G) is called a detour dominating set of G, if S is a detour set and the dominating set of G.The detour domination number γ_d(G) of G is the minimum order of its detour dominating sets and any detour dominating set of order γ_d(G) is called a γ_d- set of G.

2.ALGORITHMS

Algorithm: Detour_set

```
S={}
for i = 1 to n-1
        for j = i+1 to n
        S_ij= set of all vertices of G contained in a detour joining
        S_DE(i) and S_DE(j)
        S = S U S_ij

        end for
end for
        if V(G)==S
        detour_set='yes'
        else
        detour_set='no'
        end if
end
```

Algorithm: Dominating_set

Input: A set of vertices $S_{DO}=\{v_1, v_2, \ldots, v_n\}$ of a graph G

Output: Yes or No

```
begin
        S={ }
        for i = 1 to n
                S_i= set of all vertices of G adjacent to S_DO(i)
                S = S U S_i
        end for
        if V(G)==S
                dominating_set='yes'
        else
                dominating_set='no'
        end if
end
```

Algorithm: Detour_Dominating_set

Input: A set of vertices $S_{DD}=\{v_1, v_2, \ldots, v_n\}$ of a graph G

Output: Yes or No

```
begin
        if detour_set(SDD)=='yes'
        &&dominating_set(SDD)=='yes'
                detour_dominating_set='yes'
        else
                detour_dominating_set='no'
        end if
end
```

3.APPLICATION OF DETOUR DOMINATING CONCEPT IN IMAGE PROCESSING

The **dominating set problem** concerns testing whether (*G*) ≤ *K* for

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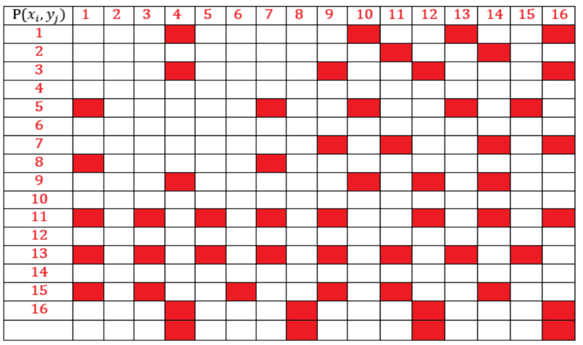
a given graph *G* and input *K*; it is a classical NP-complete decision problem in computational complexity theory (Garey& Johnson 1979).Likewise we introduce the detour dominating set, it is very much useful to select the minimum number of pixel to cover the maximum image with high threshold value pixel. Therefore, it is believed that there is no efficient algorithm that finds a smallest detour dominating set for a given graph.

Let us consider an image of M*N **strings** with 8 connectivity where the weighted pixels are selected by (DRAW) .For example let the image be

$$I=\begin{bmatrix} I_{11}I_{12} & \cdots & I_{1n} \\ \vdots & \ddots & \vdots \\ I_{m1}I_{m2} & \cdots & I_{mn} \end{bmatrix}$$

Figure 1.1

Let the pixels weight be 0.8 obtained from DRAW method and the weight pixel are shown as below Figure 1.2



For simplicity, let us assume 16*16matrix split in to four 8*8 matrix for easy explanation and understanding the concept of the dominating set and also to find easily the dominating number for the Graph. So that we take is as the following weight block of 8*8 be shown as by the below Figure 1.3

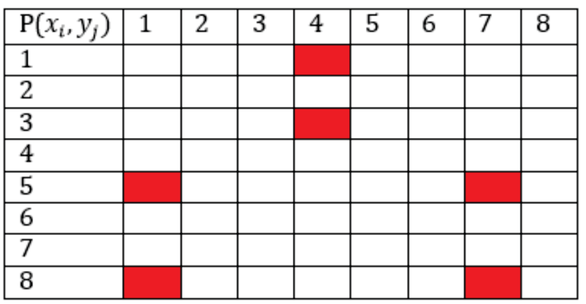


Figure 1.3

Let the shaded square represent the weighted pixels are (1,4) (3,4) (5,1) (5,7) (8,1)and (8,7)take it as a node of the graph and if the two nodes are joined by a line take that line as a edges of a connected graph G.Let us assume the connected graph is plotted for 8*8 matrix said above is drawn below for our reference.Let V_1, V_2 , ...V_6 are the vertices of the connected graph and E_1 , E_2 , ...E_6 be the edges of the connected graph G.Here the vertex are weighted pixels and edges are the lines connected by two weighted pixels. For easy process with the help Graph Theory we change the Figure 1.3 to Figure 1.4

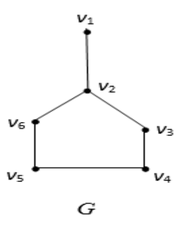


Figure 1.4

For the graph G given in Figure 1.4, $S_1=\{v_1,v_3\}$ and $S^2=\{v_1,v_6\}$ are the only two minimum detour sets of G so that dn(G)=2. Also $S_3=\{v_2,v_4\}$ and $S_4=\{v_2,v_5\}$ are the only two minimum dominating sets of G so that $\gamma(G)=2$. It is clear that no two element subsets of V(G) is a detour dominating set of G and so γ_d (G)≥3. Now $S_5=\{v_1,v_3,v_6\}$ is a detour dominating set of G so that γ_d (G)=3.There can be more than one γ_d -set of G. For the graph G given in Figure 1.4, $S_6=\{v_1,v_4,v_5\}$ is another γ_d -set of G. This concept cover the maximum image with minimum number of Pixels. We use the Detour Dominating set($S_6=\{v_1,v_4,v_5\}$) Pixels for the image correction using Fliters .We introduce the Detour Algorithm ,Dominating Algorithm and also Detour Dominating Algorithm.

4. APPLICATIONS OF DETOUR DOMINATING CONCEPT IN DAY TODAY LIFE.

In a IT company the Managing Director wish to tell some project detail to all staff members is difficult, so he convey the details to all team leaders , the team leader convey the message to all the staff members working under his team .In this way we easy transfer the message to all staff members .This is the best example for Detour Dominating concept. Likewise in Arts college ,Engineering College suppose the college Principal wish to tell some message to all staff members is difficult so he convey the details to all HOD's then the HOD's Pass the message to all the staff members working under their department.In this way the principal pass the message to all staff members using Detour dominating concept.

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