
Algorithm 1 dijkstra GPU SSSP

Input: $G(V, E)$, source vertex s ;

Output: $dist(v)$, ($v \in V$), the weight of the shortest path from s to v ;

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1:
2: function initial( $s, V$ )
3:   for each  $v \in V$  do
4:      $dist(v) \leftarrow +\infty$ ; ▷ initialize  $dist$  to positive infinity;
5:   end for
6:    $dist(s) \leftarrow 0$ ; ▷ set the source distance to 0;
7: end function
8:
9: function dijkstraCudaFunc( $G(V, E), dist, predist$ ) ▷  $G(V, E)$ , the initially distance array  $dist$ , a
   temporary distance array  $predist$ ;
10:    $u0 \leftarrow threadId$ ; ▷ get the thread id;
11:    $offset \leftarrow blockDim$ ; ▷ get the number of threads in a block;
12:    $flag \leftarrow (\_shared\_memory) \ 1$ ; ▷ whether the  $dist$  has changed;
13:
14:   while true do
15:     if  $flag = 0$  then
16:       break;
17:     end if
18:      $flag \leftarrow 0$ ;
19:
20:      $u \leftarrow u0$ ;
21:     while  $u < |V|$  do
22:       if  $dist(u)$  is not modified then
23:         continue; ▷ this IF can speedup;
24:       end if
25:       for each  $(u, v, w) \in E$  do
26:          $atomicMin(\&predist(v), dist(u) + w)$ ; ▷ use the atomic opt to exclusive mutually;
27:       end for
28:        $u \leftarrow (u + offset)$ ; ▷ reuse the thread;
29:     end while
30:
31:      $\_syncthreads()$ ; ▷ synchronize all threads in the same block;
32:
33:      $u \leftarrow u0$ ;
34:     while  $u < |V|$  do
35:       if  $predist(u) < dist(u)$  then
36:          $dist(u) \leftarrow predist(u)$ ;
37:          $flag \leftarrow 1$ ; ▷ some vexter is updated;
38:       end if
39:        $u \leftarrow (u + offset)$ ;
40:     end while
41:
42:      $\_syncthreads()$ ; ▷ synchronize all threads in the same block;
43:
44:   end while
45: end function
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46:
47: initial(s, V);
48:
49: host_to_device(dist), host_to_device(G(V, E));    ▷ copy the dist and G(V, E) from main memory to
    GPU memory;
50:
51: dijkstraCudaFunc();                                ▷ call the CUDA kernal;
52: device_to_host(dist);                                ▷ copy the dist back;
53:
54: return result
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