Wikipedia Maps

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I first got the idea of this project when playing “The Wikipedia Game”. For those who haven’t played, you start on one Wikipedia page and think of another, by only clicking the links on each page, try to get to the target page. (Project Python file in GitHub)

Defining the problem

An example of a simple route on WikipediaMaps is Civil War to Abraham Lincoln. Since Abraham Lincoln was the leader of the Union Army, he is listed on the page for Civil War. This gives the route a length of 1. For basketball to baseball, the route could be Basketball to Michael Jordan to Michael Jordan’s short-lived baseball career to baseball. This gives the route a length of 3. The goal is to find the route with the smallest length.

Approach to the Problem

The solution I came to was to use a WebCrawler and a Breadth-First-Search (BFS). The WebCrawler looks at the HTML code of the Wikipedia pages and looks for any URLs. These URLs are then looked through in BFS. The first page will have all its’ links checked to see if it’s the target. If they are not, the first link will be explored for all its’ links. If that isn’t it, we check again and again. If we hit a dead end, we go all the way back to the top and keep looking.

Example: Basketball -> Michael Jordan, Kobe Bryant, Spalding

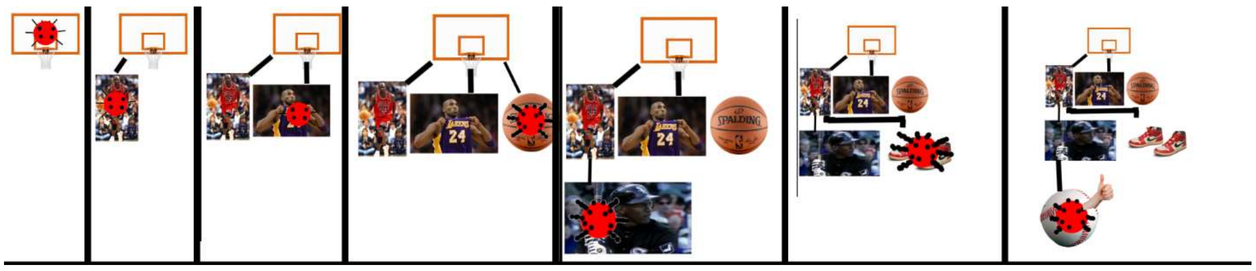
It would then move to Michael Jordan, the first link to look for baseball.

Michael Jordan-> Michael Jordan Baseball Career, Michael Jordan Shoes

After not finding baseball, the first link is taken again.

Michael Jordan Baseball Career -> Baseball

Now that the target is found, the path can be returned.



Visual of the process of how WikipediaMaps would go from Basketball to Baseball, through MJ and his baseball career. The ladybug represents the WebCrawler's position.

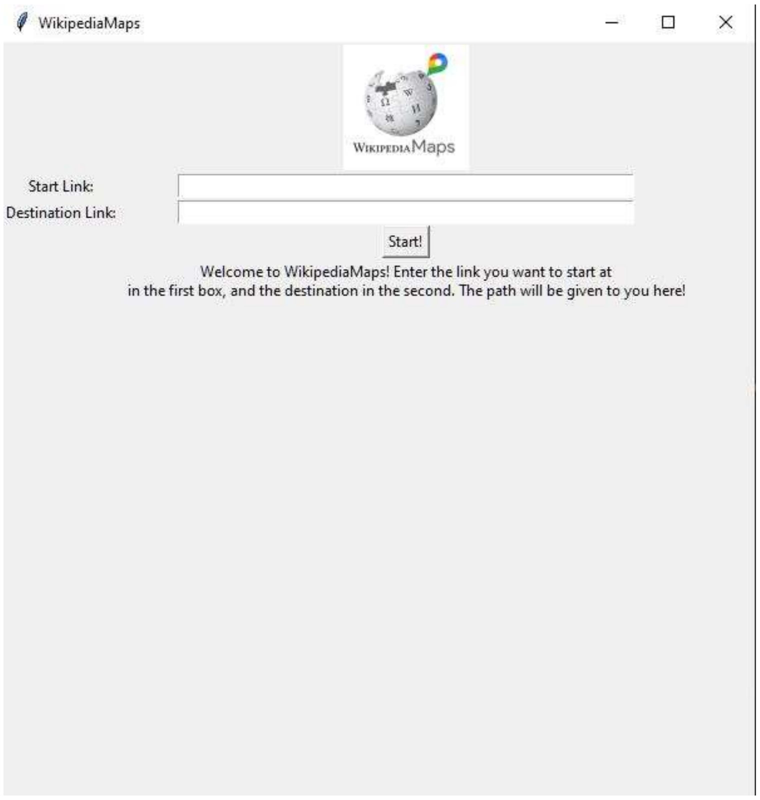
Problems and Limitations

This algorithm will absolutely work for “easier” examples of the problem. BFS is a useful search algorithm because it can find a page in O(b^d) Time where b is the maximum links per page, and d is the depth of the target page. If each page has 5 links and we go for 3 pages, the maximum number of operations to find the target is 5^3=125 operations. This is on the lower end of other search algorithms. Another great perk of BFS is that it is safe to use in trees with cycles. With other algorithms its very likely to get stuck in a loop (Michael Jordan -> Jordan Nike Shoes -> Nike -> Basketball -> Michael Jordan -> …). Given the size of Wikipedia, there are probably gigantic cycles that could overflow the RAM of a normal computer without it knowing it’s in a cycle.

The issues lie within two things, the first is the size of Wikipedia. b can be in the hundreds, and d could be very far away.

The other lies in that we need to recreate our path, this makes the Space complexity O(b^m). Where m is the maximum depth, this is the page that is the furthest away from the starting. This could be The Stone Age and the Apple II Computer, literally the furthest away. To take this past a few page jumps, further I would need either a lot stronger computer or a smarter algorithm.

UI/UX Design



Welcome to WikipediaMaps! Enter the link you want to start at
in the first box, and the destination in the second. The path will be given to you here!

To create the GUI for this program, I used the Tkinter and Image Pillow library. I first played with the window to get a good size, 600x600 felt good. I gave the window its title and moved into making a grid. The grid is a 2 x 5 that looks like the following:

```
[pillow image object(centered),              ]
[Start Link: ,            text box           ]
[Destination Link: ,      text box           ]
[Start button(centered),                     ]
[Welcome message/output,                     ]
```