Project Proposal: Image Maze Generator

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Abstract:

Mazes are complex objects. Solving and creating them are even more complicated, involving graph theory and strategic generation. Nonetheless, they make for a very captivating puzzle, especially if there is something intrinsically interesting and unique about the maze. That is what I seek to achieve. Through any ordinary image (though maybe with some exception), I seek to generate a plausible and appealing maze, solve it and add a user interface element to it by letting the user be a character in the maze with plenty of treats, obstacles and monsters.

Problem to solve:

Take any ordinary image and make a maze out of it, and especially efficiently. Make sure this maze is solvable, and should have a unique solution. Then, the maze should act as the playground of the user, as a Pacman, with several monsters and points to reach. Perhaps the maze generation algorithm can have several “modes” which will have various difficulty of the maze after each successful solving (just an idea if I have modes: chose these modes with markov chains).

If time allows, I can use NEAT python library to add AI to the ghosts.

Methodology:

* Modules to Use:
  + Pillow - All image processing will be done with Pillow
  + Math - Self-explanatory: required for mathematical calculations/constants
  + Numpy - May use if it makes calculations faster
  + Matplotlib - To use matlab like features (ex. Ginput, color wheel, etc.)
  + PyGame (if not Tkinter): To add the user interface part of my project, I will use pygame (or tkinter) to display my project in an appealing manner, and implement a game (like pacman) inside my maze.
  + Maybe:
    - OpenCV - To do real time image processing. Or if user might want to take image with their computer for processing.
* Plan of execution:
  + 1) Take any maze, of any orientation and shape, and I can find a solution from it
  + 2) Edge detection algorithm to find points of importance when it comes to maze generation.
  + 3) Maze generation algorithm with given edges.
    - Alternative method is generating maze and solving it simultaneously with each intersection as a node on a graph.
  + 4) Make user interface game of Pacman in the maze
  + Bonus: Have several modes for user to experience how the maze was generated.
  + Note: the maze might be adjusted to be rectangular to expedite solving. If time allows, I may try non-rectangular maze solving. (perhaps make it a rectangle, but make the outside rectangular edges invisible, or fill the negative space of the shape vs. rectangle with black, so maze never goes into it).
    - Perhaps I will bold the image edges to make it even clearer.
    - The pacmans/player’s size will increase/decrease depending on the diameter of the maze channel at their given position.

Significance:

* As something amusing and interesting, this maze generation algorithm and game will serve as a form of educational entertainment for the user. It will the source of an infinite number of possible mazes for the user to experience. With the complex image edge detection techniques, my project will also allow the user to see an image or reality in completely different ways: any small edge can serve a pivotal role in the construction of the whole object. The success of the project requires a deep appreciation of the nuanced features of an image.