人工智慧
x
Puzzle Game

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01

遊戲簡介

簡介

主頁面

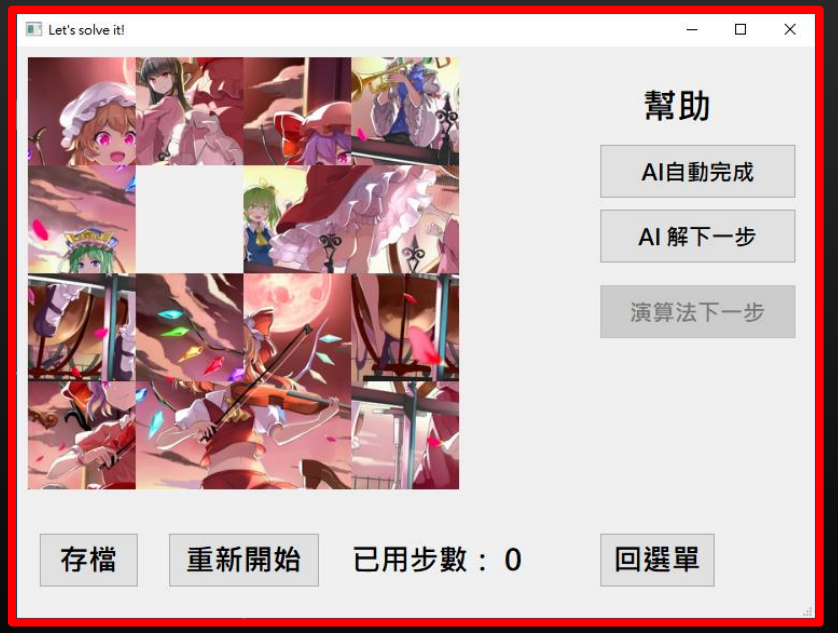
- 自由選擇圖片
- 自由調整行/列數
- 讀取存檔

準備頁

- 自由選擇空格開始位置

遊戲頁

- AI、演算法幫助
- 手動遊玩
- 存檔



02

圖形化介面

圖片分割

```python
def cropImage(self, image, cropNum):
    width, height = image.size
    item_width = int(width / cropNum)
    box_list = []
    for i in range(0, cropNum):
        for j in range(0, cropNum):
            box = (j * item_width, i * item_width, (j + 1) * item_width, (i + 1) * item_width)
            box_list.append(box)
    image_list = [image.crop(box) for box in box_list]
    self.save_img(image_list)
    pixmapList = [self.ConvertPILtoPixmap(img) for img in image_list]
    return pixmapList
```

借助python的pillow的函式庫，
得以輕鬆的以crop，搭配box獲取指定區域的圖片

檔案讀寫

```python
def writeJson(savePath, obj):
    print(json.dump(obj, open(savePath, "w"), cls=UserJSONEncoder))
    print("write json")


def readJson(loadPath):
    jsonData = json.load(open(loadPath))
    print("load json")
    return jsonData
```

由於 python的字典，與 json格式的轉換容易，
我們能精簡的用dump 將字典轉換成 json格式；load 則反之，
引此我們選用json來做紀錄檔的存取之媒介。

信號

```
class Signal(QtCore.QObject):
    signal = QtCore.pyqtSignal(str)

    def __init__(self):
        super().__init__()

    def Shoot(self, message):
        self.signal.emit(message)
```

△定義信號

```
self.data.dataSignal.Shoot("Goto3")
```

△發射信號

```
def ReceiveMessage(self, message):
    if message == "Goto3":
        print("Receive! " + message)
        self.ClearWindowsData()
        self.CreateRandomPuzzle()
```

△接收信號

```
self.data.dataSignal.signal.connect(self.ReceiveMessage)
```

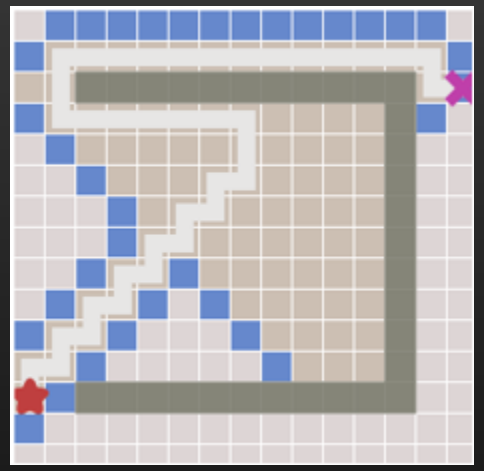
△綁定信號

PyQt有一種獨特的方式，讓不同的視窗間可以溝通，那就是signal。

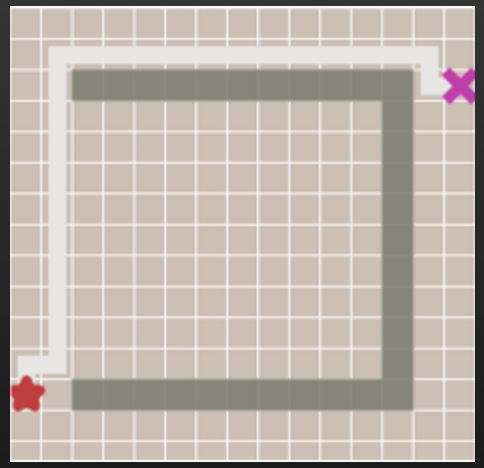
03

演算法

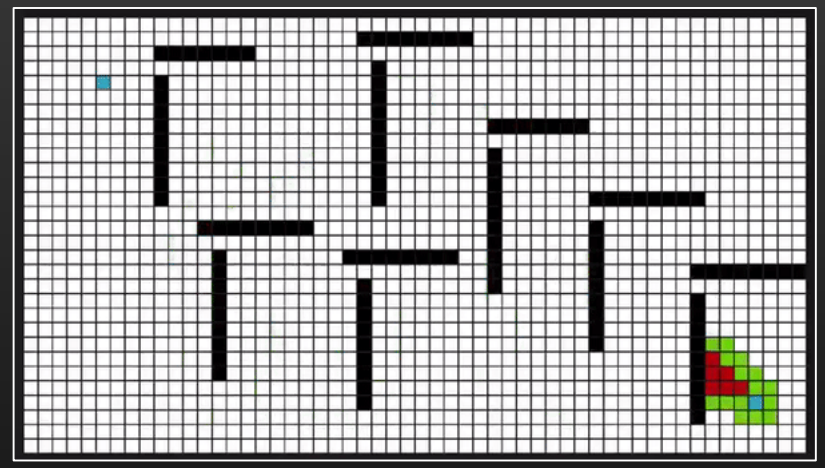
演算法 - 蓋覽



- 最佳優先搜尋



- 廣度優先搜尋



- A*

演算法 - A*

```
cur = self.open[0]
while(len(self.open) > 0):
    cur = self.open[0]
    if(self.h(cur.data,goal) == 0):
        break
    for i in cur.generate_child():
        i.parent = cur
        i.fval = self.f(i,goal)
        if self.stateInStates(i,self.closed):
            continue
        if not self.stateInStates(i,self.open):
            self.open.append(i)
        if self.stateInStates(i,self.open) and  i.fval < self.GetStateFromStates(i,self.open).fval:
            self.open.remove(self.GetStateFromStates(i,self.open))
            self.open.append(i)
    self.closed.append(cur)
    del self.open[0]
    """ sort the opne list based on f value """
    self.open.sort(key = lambda x:x.fval,reverse=False)
```

g = 起始狀態到目前狀態走了幾步(啟發式函數)

h = 目前狀態與最終狀態的曼哈頓距離總和

cost = g + h(對應程式碼內的 astar函數)

1. 建立一個open list(存放從close list拓展出來的狀態)和close list(存放走過的狀態)
2. 將初始狀態加入open list中
3. 若是open list的數量 > 0，則代表已經找到結果
4. 將open list中cost最小的狀態設為current state，並將此狀態從open list中移除並加入close list中
5. 尋找可以從current state拓展出去的狀態並加入neighbor list(每次會重置)中
6. 尋訪每個neighbor list中的狀態，若是此狀態不在open list中，或是在open list中，但由這個狀態拓展出去的cost比原先在open list中的cost小的話，則將此狀態新增(覆蓋)到open list中
7. 回到3

演算法 - BFS

```
#判斷可否向上
def CanUp(state, spaceOrder):
    return (spaceOrder - gameTypeNum) >= 0
```

```
#BFS
currentNode = Node(None, srcOrder)
count = 0
while currentNode.state != destOrder:
    for neighbor in FindNeighbor(currentNode):
        nodes.put(neighbor)
    currentNode = nodes.get()
    count = count + 1
```

演算法 - DFS

```
#DFS
currentNode = Node(None, srcOrder)
count = 0
stack = []
stack.append(currentNode)
isInStack = False
while currentNode.state != destOrder:
    if(len(currentNode.child) == 0 and not currentNode.searched):
        currentNode.child = FindNeighbor(currentNode)
    if(len(currentNode.child) != 0):
        if(len(currentNode.child) == 1):
            currentNode.searched = True
        currentNode = currentNode.child.pop()
    for i in stack:
        if (i.state == currentNode.state):
            isInStack = True

    if (isInStack):
        currentNode = currentNode.parent
    else:
        stack.append(currentNode)
    if currentNode.searched:
        currentNode = currentNode.parent
        stack.pop()
    print(count)
    count = count + 1
    isInStack = False
```

04

Demo

參考資料

- **A* Pathfinding (E01: algorithm explanation)**
  https://www.youtube.com/watch?v=-L-WgKMFuhE
- **樹搜尋、回溯與分支定界演算法**
  http://slidegur.com/doc/150452/alg4-1203-nomark-
- **Pillow - Image Module**
  https://pillow.readthedocs.io/en/stable/reference/Image.html
- **PyQt5 - Reference Guide**
  https://www.riverbankcomputing.com/static/Docs/PyQt5/

Thank You