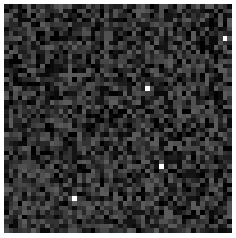
INTRODUCTION

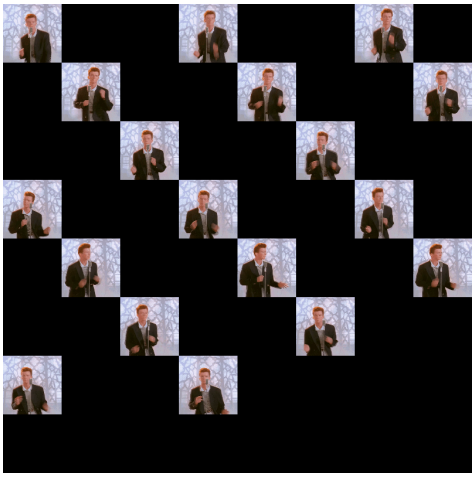
This problem is actually a series of problems to be solved. Firstly I solved the first part to find the filter to be applied (by comparing the pixel values with digits of pi, as they were 30 10 40 10 50, 3.1415…..). Then the filter was applied in XOR with the image of picasso to get the original image.Next just found this picture in the collage by brute force method(polynomial complexity). All this gave rise to a password of a zip file which had a maze in it and was supposed to be solved by the RRT algo.

PROBLEM STATEMENT



Pi_image.png

artwork_picasso.png

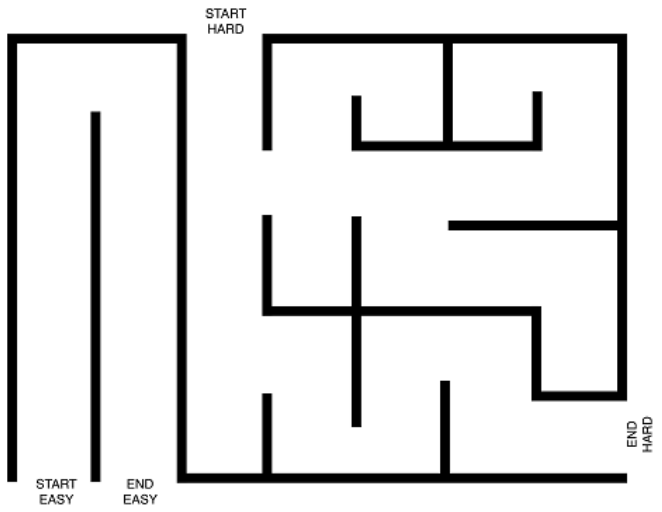


collage.png

(i)The image pi_image.png is somehow related to digits of pi, The digits of π that were distorted can be each multiplied by 10*π and converted respectively to the greatest integer less than or equal to them. The resulting numbers can be arranged in descending row major order and used as a 2x2 filter.

(ii)The image artwork_picasso.png was obtained by applying a bitwise operator (AND,OR or XOR) on some image.One has to recover the original image by applying the above 2*2 filter obtained on the new image in some bitwise fashion.

(iii)The original image obtained from above has to be found in the grayscale version of collage.png, the coordinates will give rise to the password of the zip file (floor of pi * (sum of abscissa and ordinate)



(iv) Apply RRT algorithm on the above maze from start point to end point.

Algorithms used:

(i)Just found the pixel values of each pixel of the pi image and they came as 30 10 40 10 50…., ie 3.1415…, so just looked at the complete white squares as they would have pixel values of 255 which cant be at pi, so compared those 4 positions to actual value of pi there ,ie, at (8 , 49) (19 , 32) (36 , 35) (43 , 16) .

(ii)Now we know that the picasso image is formed by applying the 2*2 filter in some bitwise fashion to some original picture.But the question hints at recovering the original picture by applying the filter back on the new image. The only BITwise operator which is possible in both ways is XOR operator.

As, a ^ b = c,

(a ^ b) ^ b = c ^ b

a ^ (b ^ b) = c ^ b

a ^ 0 = c ^ b

a = c ^ b where, a = original, b= filter, c=new image

(iii)Once found the original image, i resized the image to 100*100 as collage was 800*800 (also converted collage to GRAYSCALE) Now just compared the pixel values by brute force of the original image in collage , it will have O(rows*columns) complexity.
It came out as 100,100, so I found the password as 628.

(iv)First converted the maze to grayscale and added the walls as obstacles as 4 coordinates, 2 for starting width, 2 for ending width. Then just implemented the RRT class, which expands as a tree everywhere till it encounters an obstacle (walls) with a maximum iteration limit set as 15000.

DIFFICULTIES

The first difficulty which i faced was finding the exact filter. As initially one obtains it as (0,80) in 1st row and (30,90) in 2nd row. Then on applying the filter in XOR way at the picasso image, the image i obtained was almost clear that it is at (100,100) of the

collage. But in the brute force search it didn't gave the result as the filter was not accurate . So did reverse engineering. I found the filter by cropping the collage image to [100:200,100:200], then XORed it with the picasso image, to get the exact filter as (251,219) in 1st row and (94,0) in the second row.

Another difficulty was learning the RRT algorithm, as it was a completely new topic and required depth analysis of trees.

RESULTS AND OBSERVATIONS

2*2 filter : **251 219**
94 0
Password of the zip file : **628**

CONCLUSION

This question was a great exercise in checking the CV skills as it was in the form of a puzzle until and unless you solve one part, you can't go to another, so it was very enjoyable. This I don't think has any direct applications with ARK but certainly it was good for brain nourishing.