Pic-a-pix Solver

Maayan Zehavi
What is it?

- Pic-a-pix is a paint by number logic puzzle, in which cells in a grid must be colored or left blank according to numbers at the side of the grid to reveal a hidden picture.
Project Goals

- Given a halved-solved puzzle picture and its dimensions, the project will solve the puzzle and will present the solution as well as the wrong marks.

- Given a halved-solved puzzle picture, its dimensions and an image of the solution, the project will present the solution as well as the wrong marks.
Step one – image aligning
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- Using Hough transform, for each angle:
  - an attempt to fit a rotated grid is made.
  - a score correlated with the fitting of that grid is calculated.

- This practice is executed in two iterations, the first one in rough accuracy and the second in a finer one.
Step two – grid recognition
Using Hough transform to locate all horizontal and vertical lines yields inaccurate results.

An improvement was acquired, using:
- A histogram of distances between each couple of consecutive lines of the same orientation.
- Identifying grid’s area (by identifying the white box on the top left corner and the blocking square).
- Calculations based on known numbers of columns and rows.
Step three - OCR
Step three - OCR

- The numbers located on the top and to the left of the grid are recognized by those steps:
  - Calculating approximate number size according to the grid size and spacing.
  - Resizing all digits templates to this size.
  - Executing Hough transform for each row or column (in specific zone), and for each digit.
  - Finding peaks over a certain threshold.
  - In case of several digits located on the same area, choosing the one that fits the most.
Step four - disappointment

- After rotating the image, the quality of the image is severely damaged.
- Some of the digits recognition turned out to be erroneous.
- Considering the implications of the tiniest inaccuracy on solving the puzzle, it was impossible to complete the goal.
Most pick-a-pix puzzles magazines contain puzzles’ solutions.

Peeking at those solutions and figuring out which marks were wrong is annoying.

**Given an image of the solution, the code will:**

- Analyze the image
- Find solution matrix
- Offer several options to reveal the solution.
Step 5 – solution analysis and presentation

- After processing the input, these options are available:
  - Validate
    - Shows original image and highlights wrong marks
  - Show a Hint
    - Picks randomly an unmarked square and highlights it.
  - Show Solution
    - Shows original image, highlights wrong marks and completes unmarked squares.
Step 5 – solution analysis and presentation

- **Input:**
  - $n=45$, $m=35$

- **Output - validate:**

![Image of input data]

![Image of output data]
Step 5 – solution analysis and presentation

• Input:
  • $n=45$, $m=35$

• Output - Hint:
Step 5 – solution analysis and presentation

- Input:
  - $n=45$, $m=35$

- Output - Show Solution:

![Image](image-url)
Conclusion

• The project turned out to be both rewarding and disappointing. Even after giving up on OCRing, the options offered by the code were helpful to me.

• Also, by improving and fine-tuning a little more, hopefully an autonomous solver is completely applicable.