

Block Puzzle

MITxSony

Team Introduction



Alex

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AMDP MEng '25

Favorite Game:
Rocket League



Enrique

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Favorite Game:
League of Legends



Stanley

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Favorite Game:
Elden Ring

Game Introduction

Instructions:



Place Piece



Remove Piece



Switch Piece



Rotate Piece



Flip Piece



Provide Hint



Solve Puzzle



Place Piece



Remove Piece



Switch Piece



Rotate Piece



Flip Piece



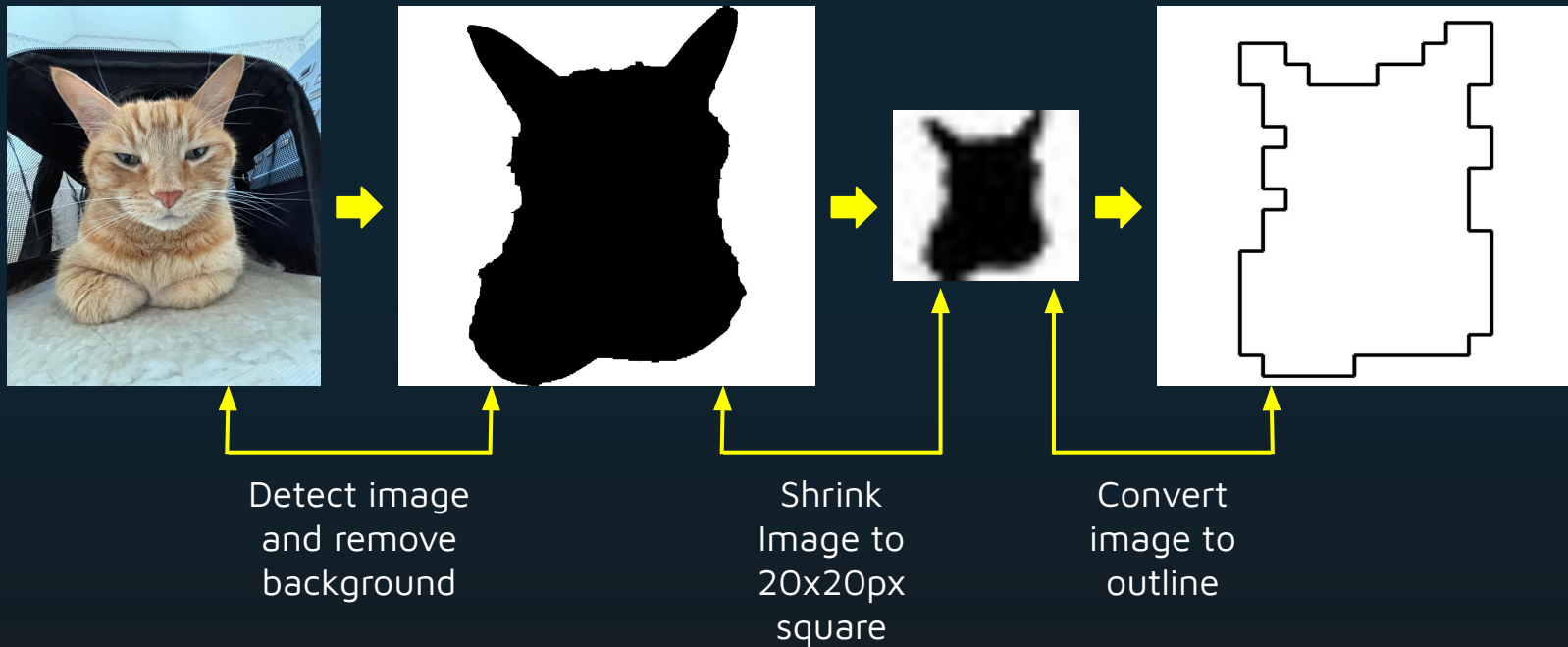
Provide Hint



Solve Puzzle

How does it work?

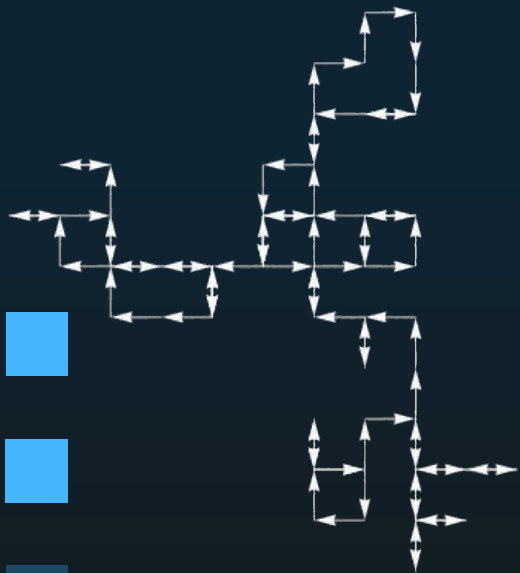
Edge Detection



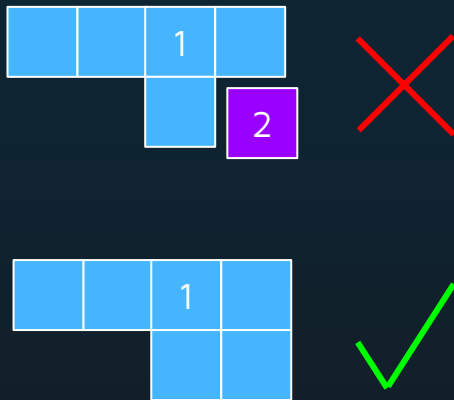
How does it work?

Piece Generation

Random walk algorithm



Piece Addition



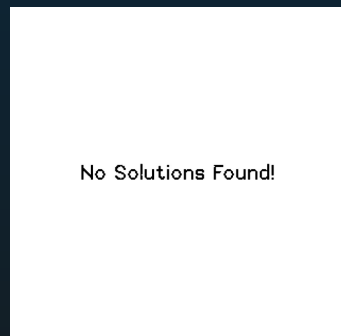
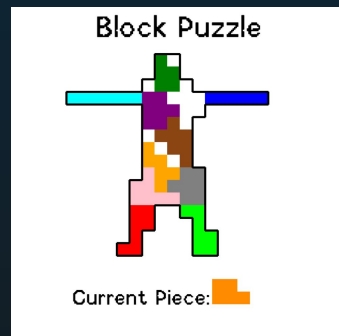
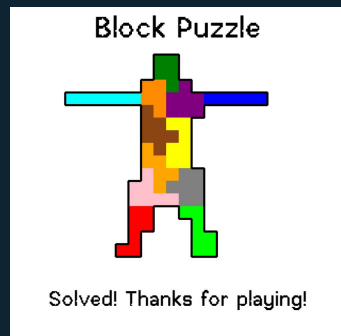
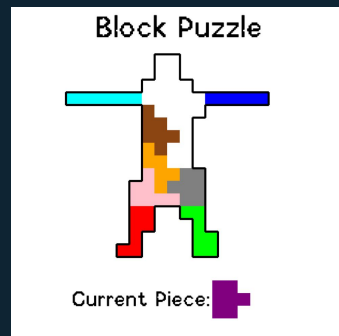
Size Iteration



How does it work?

Solver

1. Sort pieces by size and start with largest
2. Try piece in all locations starting with top left
 - Save locations that don't fit
3. Place piece when available
4. Continue until a piece cannot fit
5. Backtrack and continue
6. Repeat until all pieces are placed



Limitations of Traditional Hints

REVEALING



Pointing to where the next puzzle should be placed is too revealing

ONE TYPE



Hints are only in the form of visual pointers

PERSONA



There are no character personas



Can we create
a better hint
assistant?

LLM Hint Assistant

List of information fed to GPT-4o:

- Game overview
- Controls
- General role
- Hint level
- Guide persona
- Image of solved board
- Image of current board

Prompt

LLM Prompt

Game Overview

Block Puzzle is a game similar to pentominoes, where the user places colored pieces into a game board of a certain shape. In this game, each piece is made of a combination of blocks and the pieces can be rotated (in increments of 90 degrees) and flipped along the vertical axis when placing them on the board. Pieces cannot be placed outside of the board or overlapping other pieces. The user can remove pieces that are already placed. The user wins once all the blocks are placed. Please create an up-beat persona that will help the user solve the puzzles.

Controls

The list of controls are as follows:

- (1) Left click = place piece
- (2) Right click = remove piece
- (3) R button = rotate 90 degrees clockwise
- (4) F button = flip piece
- (5) H button = provide a hint
- (6) S button = solve the remaining board
- (7) Left and right buttons = switch between remaining pieces

General

You are playing the role of a hint generator to help guide players in the right direction to complete the objective of the game. The two images uploaded represent the current state of the board (unsolved board) and the solution (solved board). It is important to make sure that the hints provided guide players in the right direction. If the pieces on the board are in the right location, you should hint the next best piece to place on the board in the right location. Good blocks to hint at are those that are not yet placed that either fill in space on the edge of the board or touch pieces that have already been placed. Your role is to generate a short 1 sentence hint. Vague hints only give the color of a piece and a generalized location on the board for where the piece goes.

Hint Information

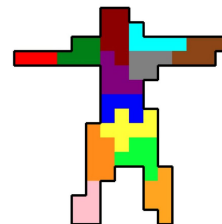
On a scale of 1 to 5, 1 being very vague and 5 being very specific, please generate a level `<insert number>` hint.

Guide Persona

In addition to the above, you are also playing the persona of a `<insert persona type>` and hints should be in the form of a `<insert hint type>`

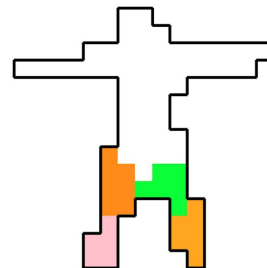
Images

Block Puzzle



Solved! Thanks for playing!

Block Puzzle



Can we vary the vagueness of hints?

Vague

Specific



1

"Try placing the blue piece somewhere near the center of the board!"

2

"Try placing the red piece on the left arm area of the board to connect with the existing edge."

3

"Place the red piece on the left arm of the figure, aligning it horizontally near the edge of the board."

4

"Place the yellow cross-shaped piece in the center of the board, directly above the green block and touching the orange pieces on both sides. Rotate it as needed to fit snugly."

5

"Place the red piece horizontally on the left arm of the figure, aligning it with the topmost edge of the board. Rotate it as needed to fit snugly into the outlined space."

Can we vary the type of hints?



Answer

"Try placing the blue piece near the center of the board to help connect the lower and upper sections!"



Question

"Have you tried placing the yellow cross-shaped piece near the center to connect with the green and orange pieces already on the board?"



Riddle

"To the left arm's edge, a crimson hue belongs; rotate it right, and you'll hear the puzzle's song!"

Can we vary character personas?

Gandalf



"Ah, young puzzler!
Seek the yellow
cross-shaped piece and
place it at the center of
the board, just above
the green block, to
illuminate your path
forward!"

Garfield



"Hey, pal! That red
piece looks like it
belongs on the left
arm—rotate it a bit and
slide it into place near
the edge of the board.
Let's get moving before
I take a nap!"

Spiderman



"Hey there,
web-slinger! Try placing
the blue piece near the
center of the board,
just above the green
and orange pieces—it's
the perfect fit to swing
us closer to victory!"

Sarcastic



"Alright, genius, grab
the red piece and slap it
onto the left arm of the
figure—yes, the one
sticking out like it's
waving at you."

Opportunities for Improvement

1

Hidden Solution

Develop a way to generate images of solved board without exposing to player

2

LLM Integration

Integrate hint button in-game that connects to LLM hint assistant

3

Verification

Program an additional step that verifies if the generated hint is valid

4

Board Difficulty

Automate varying the board difficulty based on player history data

A decorative border consisting of a grid of blue squares of varying shades (light blue and dark blue) arranged in a pattern that tapers towards the center, framing the text.

THANK YOU

to Sony and
MIT CSAIL

Format

Title Slide

Team introduction

Game Introduction / Gameplay

How it works:

- Upload image / edge detection (easier than we thought)
- Piece generation (easier than we thought)
- Solver (easy for a slow one)

Hint LLM

- Goals / questions asked
- Trying multiple models (hard to get licenses, image detection better than passing matrix shape)
- Prompt engineering (took way longer than we anticipated!) (show tests done) (show what worked and what didn't work) (frustration level) (hint specificity level)

Future work (passing image without user seeing) (LLM integration)

Thanks