

# Hangman with Cozmo

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# Solution Approach



Speech  
Input

CV +  
4-layer  
CNN

GPT

Guess

```
guess_state: StateNode()
guess: self.Guess()
guess => self.SayGuess() =C=> guess_state
guess_state =Hear("cozmo (what|what's|what is) your?(next|) (guess|gas)?")=> guess
```

```
--> Listening...
_A T I _ [ ]
Word 3: _ A T I _
The word is 5 letters long, and you may guess any letter.
--> Got audio data: length = 75,776 bytes.
--> Recognizer found no words.
--> Listening...
Speaking: 'Is there a N'
```

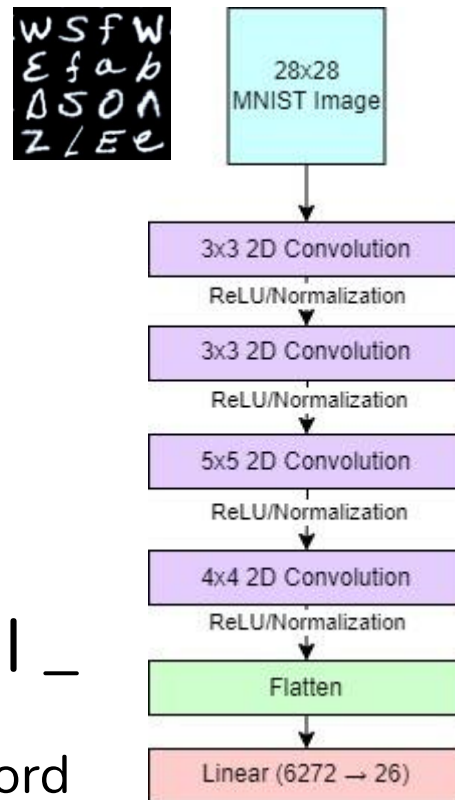


# Vision

- Letter Recognition Model
  - EMNIST
  - Multi-CNN for accuracy
- Bounding Box/CV
  - 5x5 Gaussian Blur, dilation (lines thicker), open (remove noise) to get bounding box



Only use letters above lines for word





# Getting GPT to Play

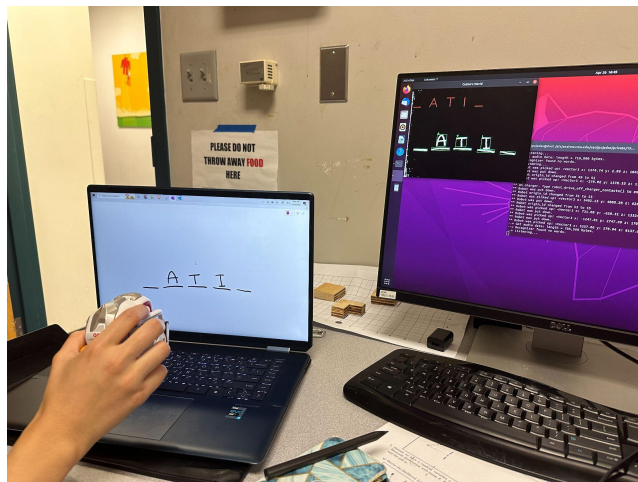


- Naive approach
  - GPT Hangman works out of the box
  - Only guesses most common English letters
  - Doesn't think about the word
- Prompt Engineering
  - Very specific rules
  - Must guess one letter, English word
  - Provide justification → improves guess
- Few-shot learning
  - Give a few examples of desired output
  - Forces GPT to match formatting
  - Encourages “thinking about” guesses; letters which are likely to make up a word

```
###  
Word 1: _ V I _ T O, R  
The word is 7 letters long, you cannot guess E.  
  
Letter 1: A  
I would guess A because inserting it into the first  
and fourth spots would yield the word "AVIATOR", and  
the letter I guessed is not E. AVIATOR does not have  
an E, and E was not one of the letters in the given string.  
  
###  
Word 2: _ A _ E _ _ A N  
The word is 8 letters long, and you cannot guess Q, W, or R.  
  
Letter 2: S  
Putting an \"S\" in the first and fifth spots and an \"L\"  
in the third spot gives the word SALESMAN. \"SALESMAN\" is  
8 letters long and the letter I guessed is not Q, W, or R.  
SALESMAN does not contain any of these letters either. and S  
was not any of the letters given.
```

# Results

- Success getting Cozmo to play and reasonably guess
- Difficulties:
  - Accurate CV Results
    - Noisy images, lighting, glares
    - Distinguishing lines/letters
  - Prompt Engineering
    - Extremely difficult to get reliable output
    - Would repeatedly guess used letters/non-English words
  - Proper Bounding Box
    - Attempting to match training set with padding
    - Could spill over onto line (e.g. misclassified T as I)





# Extendable Work

- Improved Computer Vision
  - Average letter prediction across multiple frames
  - Augmenting dataset with lines
- Algorithms besides ChatGPT
  - Better suited for Hangman
  - Crossword solvers, hangman solvers



Step 1 \_\_\_\_\_

How many letters are in the word?

Step 2 \_\_\_\_\_



The solver thinks there's an **E** in your word.  
Please add this letter to Your Word or the list of Incorrect Letters below.

Your Word:

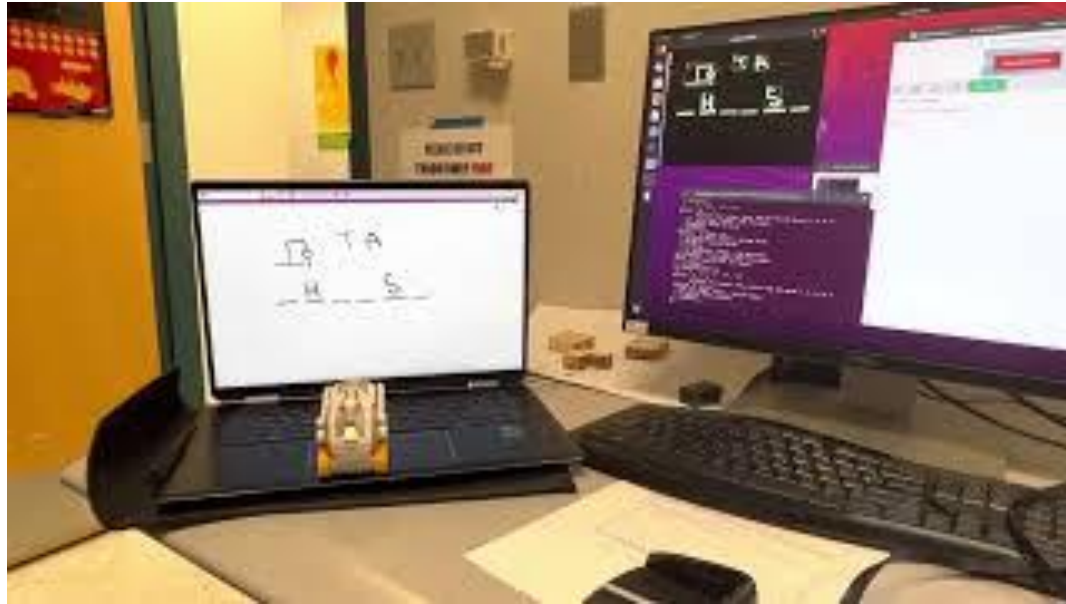
|   |   |   |   |   |   |
|---|---|---|---|---|---|
| C | H | ? | ? | S | ? |
|---|---|---|---|---|---|

Incorrect Letters:

|   |   |   |   |
|---|---|---|---|
| I | O | U | + |
|---|---|---|---|



# Cozmo in Action



<https://www.youtube.com/watch?v=rQwKHhc6bYI>