**Intro**

- This intro code generates sample trees with the right structure. We generate nodes indicating whether it's a target (talking to a human, for example), with the text ('press 2 for x'), and a list of children for giving the tree structure.

- The code allows for customization of the branching factor, as well as the depth, leaving us with a wide family of trees

- GPT3 is used as the base model for generation. We might experiment with the new Qwen model that just got released.

- A drawback we have is that sometimes the targets aren't well identified, as seen in the examples generated.

**Code**

import json

import os

import re

from typing import List, Optional

import openai

from pydantic import BaseModel, ValidationError

# Set your OpenAI API key

openai.api\_key = 'SECRET'

if not openai.api\_key:

raise ValueError("OPENAI\_API\_KEY is not set. Please set it in your environment variables.")

# Define the MenuNode class

class MenuNode(BaseModel):

number: int

text: str

is\_target: bool

children: List["MenuNode"] = []

class Config:

arbitrary\_types\_allowed = True

schema\_extra = {

"example": {

"number": 1,

"text": "For billing inquiries, press 1.",

"is\_target": False,

"children": []

}

}

# Update forward references for recursive MenuNode type

MenuNode.update\_forward\_refs()

# Utility function to extract JSON from text

def extract\_json(text: str) -> Optional[str]:

"""

Extracts the first JSON object or array from a string.

Args:

text (str): Input text.

Returns:

Optional[str]: JSON string if found, otherwise None.

"""

try:

match = re.search(r'(**\{**.\***\}**|**\[**.\***\]**)', text, re.DOTALL)

if match:

json\_str = match.group(0)

# Validate the JSON

json.loads(json\_str)

return json\_str

return None

except json.JSONDecodeError:

return None

# Function to generate children nodes using GPT

def generate\_children(path: List[str], branching\_factor: int, target\_number: int) -> List[MenuNode]:

"""

Generates structured child nodes for a given parent node using GPT.

Args:

path (List[str]): Path to the current node.

branching\_factor (int): Number of child nodes to generate.

target\_number (int): Number of `is\_target` nodes among the children.

Returns:

List[MenuNode]: Generated child nodes.

"""

try:

system\_prompt = f"""

You are an assistant generating a structured call center menu tree.

### Task:

Generate exactly {branching\_factor} child menu nodes for the current menu node.

### Requirements for Each Child Node:

- `number`: An integer corresponding to the option number (e.g., 1, 2, 3).

- `text`: A string describing the menu option (e.g., "For billing inquiries, press 1.").

- `is\_target`: A boolean indicating if this option leads directly to an agent (`true`) or not (`false`).

- `children`: An empty list (children will be generated recursively).

### Constraints:

- Exactly {target\_number} of the {branching\_factor} child nodes must have `is\_target` set to `true`.

- The `number` fields must be unique within the current set of children.

- The `text` field should clearly describe the action and include the press number.

### Current Path:

{' > '.join(path) if path else 'Root'}

### Output Format:

Return a JSON array of the child nodes only. Do not include any additional text, explanations, or code blocks.

"""

response = openai.ChatCompletion.create(

model="gpt-4",

messages=[{"role": "system", "content": system\_prompt}],

temperature=0.7,

max\_tokens=500,

)

raw\_content = response['choices'][0]['message']['content'].strip()

# Extract JSON from the response

json\_str = extract\_json(raw\_content)

if not json\_str:

raise ValueError("No valid JSON found in the response.")

children\_data = json.loads(json\_str)

# Validate and parse JSON into MenuNode objects

return [MenuNode(\*\*child) for child in children\_data]

except (json.JSONDecodeError, ValidationError, ValueError) as e:

print(f"Error generating children for path {' > '.join(path) if path else 'Root'}: {e}")

# Generate fallback child nodes in case of error

return [

MenuNode(

number=i + 1,

text=f"For option {i + 1}, press {i + 1}.",

is\_target=(i + 1 <= target\_number),

children=[]

)

for i in range(branching\_factor)

]

# Function to recursively generate a menu tree

def generate\_menu\_tree(depth: int, branching\_factor: int, target\_number: int) -> MenuNode:

"""

Recursively generates a menu tree structure.

Args:

depth (int): Depth of the tree.

branching\_factor (int): Number of children per node.

target\_number (int): Number of target nodes at each level.

Returns:

MenuNode: The root of the generated menu tree.

"""

def build\_tree(path: List[str], current\_depth: int) -> MenuNode:

is\_root = current\_depth == 0

children = []

if current\_depth < depth:

current\_branching = 1 if is\_root else branching\_factor

children = generate\_children(

path=path,

branching\_factor=current\_branching,

target\_number=target\_number

)

return MenuNode(

number=1 if is\_root else int(re.search(r'\d+', path[-1]).group()) if path else 1,

text="Welcome to our service." if is\_root else f"{path[-1]}",

is\_target=False,

children=[

build\_tree(path + [child.text], current\_depth + 1) for child in children

]

)

return build\_tree(path=[], current\_depth=0)

# Function to export the menu tree to a JSON file

def export\_menu\_tree\_to\_json(tree: MenuNode, filename: str):

"""

Exports the menu tree to a JSON file.

Args:

tree (MenuNode): The menu tree to export.

filename (str): The output file name.

"""

with open(filename, "w") as file:

json.dump(tree.dict(), file, indent=4)

print(f"Menu tree exported to {filename}")

# Main script

if \_\_name\_\_ == "\_\_main\_\_":

# Define tree parameters

tree\_depth = 4

branching\_factor = 3

target\_number = 1 # Number of target nodes at each branching

# Generate the menu tree

menu\_tree = generate\_menu\_tree(

depth=tree\_depth,

branching\_factor=branching\_factor,

target\_number=target\_number

)

# Export to JSON

export\_menu\_tree\_to\_json(menu\_tree, "menu\_tree4.json")

**Appendex**

**Example Trees generated**

**Tree 2**

{

"number": 1,

"text": "Welcome to our service.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For option 1, press 1.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For option 1, press 1.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For option 1, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "For option 2, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "For option 3, press 3.",

"is\_target": false,

"children": []

}

]

},

{

"number": 2,

"text": "For option 2, press 2.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For option 1, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "For option 2, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "For option 3, press 3.",

"is\_target": false,

"children": []

}

]

},

{

"number": 3,

"text": "For option 3, press 3.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For option 1, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "For option 2, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "For option 3, press 3.",

"is\_target": false,

"children": []

}

]

}

]

}

]

}

**Tree 3**

{

"number": 1,

"text": "Welcome to our service.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For customer service representative, press 1.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For technical support, press 1.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For software related issues, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "For hardware related issues, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "To speak directly with a technical support representative, press 3.",

"is\_target": false,

"children": []

}

]

},

{

"number": 2,

"text": "For billing inquiries, press 2.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For general billing questions, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "For specific invoice queries, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "For payment methods, press 3.",

"is\_target": false,

"children": []

}

]

},

{

"number": 3,

"text": "For questions about our products, press 3.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For information about product warranties, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "To speak with a product specialist, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "For information about product returns, press 3.",

"is\_target": false,

"children": []

}

]

}

]

}

]

}

**Tree 4**

{

"number": 1,

"text": "Welcome to our service.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For immediate assistance from a customer service representative, press 1.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For billing inquiries, press 1.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For inquiries about your current bill amount, press 1.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "To understand your bill breakdown, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "For payment options and details, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "To speak with an agent about your current bill amount, press 3.",

"is\_target": false,

"children": []

}

]

},

{

"number": 2,

"text": "For inquiries about your previous bills, press 2.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For inquiries about the current bill, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "To dispute a charge on your previous bill, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "For all other bill-related questions, press 3.",

"is\_target": false,

"children": []

}

]

},

{

"number": 3,

"text": "To speak with a billing representative, press 3.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For questions about your bill, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "For payment arrangements, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "To speak with a billing representative, press 3.",

"is\_target": false,

"children": []

}

]

}

]

},

{

"number": 2,

"text": "For technical support, press 2.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For software-related issues, press 1.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For issues related to software installation, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "For issues related to software updates, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "For issues related to software functionality, press 3.",

"is\_target": false,

"children": []

}

]

},

{

"number": 2,

"text": "For hardware-related issues, press 2.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For issues with computers, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "For issues with printers, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "If you're not sure what your hardware issue is, press 3.",

"is\_target": false,

"children": []

}

]

},

{

"number": 3,

"text": "To speak directly with a technical support representative, press 3.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For software related issues, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "For hardware related issues, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "To speak directly with a technical support representative immediately, press 3.",

"is\_target": false,

"children": []

}

]

}

]

},

{

"number": 3,

"text": "To update your account information, press 3.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For changing account password, press 1.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "To reset your password through email, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "To reset your password through text message, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "To speak to a customer service representative for password assistance, press 3.",

"is\_target": false,

"children": []

}

]

},

{

"number": 2,

"text": "To speak with a customer service representative, press 2.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "For password reset, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "To update your billing information, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "To directly connect with a representative, press 3.",

"is\_target": false,

"children": []

}

]

},

{

"number": 3,

"text": "For updating email address linked to the account, press 3.",

"is\_target": false,

"children": [

{

"number": 1,

"text": "To confirm the update, press 1.",

"is\_target": false,

"children": []

},

{

"number": 2,

"text": "To cancel the update and return to the previous menu, press 2.",

"is\_target": false,

"children": []

},

{

"number": 3,

"text": "To speak with a representative about the email update, press 3.",

"is\_target": false,

"children": []

}

]

}

]

}

]

}

]

}