

Project 3 Part1 Report

Task Tree Generation: Prompting Approaches and Performances

In the task of generating detailed task trees for preparing various dishes, different prompting approaches were used to guide the model in producing structured JSON outputs. Here's an analysis of the approaches and their performances:

Prompt #1:

Approach: Given the simple format of task tree as an example in a prompt to API to guide it.

This prompt resulting in JSON task tree effectively outlines the steps from ingredients on preparation to cooking.

Produces the output JSON files such that, there is only one input node with all the ingredients in it and multiple actions performed in the single motion node and output node containing of the final dish with all the ingredients.

This approach focuses on creating a structured JSON format in the specified format in prompt.

This approach is not much effective as it produces all motions in a single motion node.

This approach is not as expected.

Prompt #2:

Given a prompt to API more specific by giving the sample output included in the prompt to get the accurate results.

This prompt uses a similar task tree structure, but for a different cooking process.

This prompt does not include the kitchen items, so it used only the kitchen items in the sample output prompt given, for all the dishes or giving the container as null. Each step is logically connected, showcasing the transformation of ingredients throughout the process.

It describes inputs, motion activities and consequent outputs, as well as the state changes and ingredients involved at each stage.

This approach is good in terms of input, motion, output stages but it is not effective in using the utensils for in the intermediate and final steps.

Prompt #3: (Best)

for prompt 3, gave the sample output which is having multiple containers as utensils for a particular dish and given the file containing kitchen utensils and asked even more specifically to give detailed information for each dish.

This prompt appears to refine the task tree generation further, giving the specific input, motion, and output nodes for each cooking step.

The resulting JSON task tree demonstrates the creation of input, motion, and output nodes for each step, effectively illustrating the process of ingredient handling and transformation.

This prompt is effective in producing the results with all the ingredients and in the expected structure as input, motion, output and in utilizing the kitchen items available. This is the best approach so far in generating the task trees.

Analysis and performance:

The instructions take an organized approach, attempting to use the language model API to construct precise task trees for cooking procedures. Each prompt provided a set of instructions, enabling the model to focus on generating task trees relevant to the cooking process of that dish.

The prompts utilized structured formats with placeholders for key elements like ingredient names, utensils, and task details, which helped guide the model's generation process.

By fine-tuning the prompts (as seen in Prompt 3), can direct the API more precisely to generate task trees that fit the specifications.

More elaborate and specific prompts (such as Prompt 3) tend to produce better-defined and accurate task trees because they provide the API with explicit needs.

The quality of timely instructions, the vocabulary utilized, and the intricacy of the specified cooking activities all have an impact on performance.

In conclusion, these techniques offer a systematic way in guiding OpenAI's language model to generate detailed task trees for cooking processes. Clear objectives, structured guidance, and necessary details are given as prompts, can generate the task trees accurately. Moving forward, similar prompting approaches can be used to construct task trees for diverse cooking settings, allowing for the creation of structured and cohesive instructions.

#Prompt 1

```
prompt = (  
    f"Generate a detailed task tree for preparing {dish_name} with ingredients: "  
    f"{', '.join(dish_ingredients)} using utensils if needed only: "  
    f"{', '.join(utensils)}. Your task is to create a comprehensive task tree "  
    "describing each step in detail, including input, motion, and output nodes." +\  
    f"give the task tree in the json format as follows" +\  
    """"  
  
    [  
        {  
            "input_nodes": [  
                {  
                    "label": "<input_label_1>",  
                    "states": [],  
                    "ingredients": [],
```

```

        "container": "<any_container_used>"
    },
    {
        "label": "<input_label_2>",
        "states": [],
        "ingredients": [],
        "container": "<any_container_used>"
    }
    // Add more input nodes as needed
],
"motion_node": "<motion>"
"output_nodes": [
    {
        "label": "<output_label_1>",
        "states": [],
        "ingredients": [],
        "container": "<any_container_used>"
    },
    {
        "label": "<output_label_2>",
        "states": [],
        "ingredients": [],
        "container": "<any_container_used>"
    }
    // Add more output nodes as needed
]
}
]
""
)

```

Output Example:

```

{
  "input_nodes": [
    {
      "label": "Cooked Boneless Skinless Chicken Breast with Rib Meat",
      "states": [],
      "ingredients": [
        "Cooked Boneless Skinless Chicken Breast with Rib Meat"
      ],
      "container": "Cutting Board"
    },
  ],
}

```

```
{
  "label": "Salt",
  "states": [],
  "ingredients": [
    "Salt"
  ],
  "container": "Salt Shaker"
},
{
  "label": "Yellow Corn Flour",
  "states": [],
  "ingredients": [
    "Yellow Corn Flour"
  ],
  "container": "Mixing Bowl 1"
},
{
  "label": "Bleached Wheat Flour",
  "states": [],
  "ingredients": [
    "Bleached Wheat Flour"
  ],
  "container": "Mixing Bowl 2"
},
{
  "label": "Modified Corn Starch",
  "states": [],
  "ingredients": [
    "Modified Corn Starch"
  ],
  "container": "Mixing Bowl 3"
},
{
  "label": "Spices",
  "states": [],
  "ingredients": [
    "Spices"
  ],
  "container": "Mixing Bowl 4"
},
{
  "label": "Wheat Starch",
  "states": [],
  "ingredients": [
```

```
"Wheat Starch"
],
"container": "Mixing Bowl 5"
},
{
  "label": "Onion Powder",
  "states": [],
  "ingredients": [
    "Onion Powder"
  ],
  "container": "Mixing Bowl 6"
},
{
  "label": "Extractives of Turmeric",
  "states": [],
  "ingredients": [
    "Extractives of Turmeric"
  ],
  "container": "Mixing Bowl 7"
},
{
  "label": "Spice Extractive",
  "states": [],
  "ingredients": [
    "Spice Extractive"
  ],
  "container": "Mixing Bowl 8"
},
{
  "label": "Vegetable Oil",
  "states": [
    "Cold",
    "Hot"
  ],
  "ingredients": [
    "Vegetable Oil"
  ],
  "container": "Deep Fryer"
}
],
"motion_nodes": [
  {
    "label": "1. Cut Chicken into Nuggets",
```

```
    "description": "Use a knife to cut the cooked chicken breast into small, bite-sized nuggets."
  },
  {
    "label": "2. Season Chicken Nuggets",
    "description": "In a large bowl, combine the chicken nuggets with salt to taste."
  },
  {
    "label": "3. Prepare Breeding Mix",
    "description": "In a separate bowl, whisk together the yellow corn flour, bleached wheat flour, modified corn starch, spices, wheat starch, onion powder, extractives of turmeric, and spice extractive."
  },
  {
    "label": "4. Coat Chicken Nuggets in Breeding Mix",
    "description": "Dredge the chicken nuggets in the breeding mix, ensuring they are evenly coated."
  },
  {
    "label": "5. Heat Vegetable Oil",
    "description": "Heat the vegetable oil in a deep fryer or large skillet over medium-high heat until it reaches 375\u00b0F (190\u00b0C)."
  },
  {
    "label": "6. Fry Chicken Nuggets",
    "description": "Carefully drop the breaded chicken nuggets into the hot oil and fry for 3-4 minutes, or until golden brown and cooked through."
  },
  {
    "label": "7. Drain Chicken Nuggets",
    "description": "Once the chicken nuggets are cooked, remove them from the oil using a slotted spoon and drain them on paper towels."
  }
],
"output_nodes": [
  {
    "label": "Crispy Chicken Nuggets",
    "states": [
      "Hot",
      "Crispy"
    ],
    "ingredients": [
      "Cooked Boneless Skinless Chicken Breast with Rib Meat",
      "Salt",
```

```

    "Yellow Corn Flour",
    "Bleached Wheat Flour",
    "Modified Corn Starch",
    "Spices",
    "Wheat Starch",
    "Onion Powder",
    "Extractives of Turmeric",
    "Spice Extractive",
    "Vegetable Oil"
  ],
  "container": "Plate"
}
]
}

```

#Prompt2

```

prompt = (
  f"Generate a detailed task tree for preparing {dish_name} with ingredients: "
  f"{', '.join(dish_ingredients)}. Create a comprehensive task tree "
  f"give the task tree in the json format as follows" +\
  """"
  [
{
  "input_nodes":[
    {
      "label":"skillet",
      "states":[
        "empty"
      ],
      "ingredients":[

    ],
    "container":"stove"
  },
  {
    "label":"stove",
    "states":[
      "off"
    ],
    "ingredients":[

```

```
    ],
    "container": "None"
  }
],
"motion_node": "heat",
"output_nodes": [
  {
    "label": "skillet",
    "states": [
      "empty"
    ],
    "ingredients": [

    ],
    "container": "stove"
  },
  {
    "label": "stove",
    "states": [
      "on"
    ],
    "ingredients": [

    ],
    "container": "None"
  }
],
{
  "input_nodes": [
    {
      "label": "bowl",
      "states": [
        "not_empty"
      ],
      "ingredients": [
        "butter"
      ],
      "container": "None"
    },
    {
      "label": "skillet",
      "states": [
        "empty"
      ],
```



```
    ],
    "ingredients":[

    ],
    "container":"stove"
  }
],
"motion_node":"pour",
"output_nodes":[
  {
    "label":"bowl",
    "states":[
      "empty"
    ],
    "ingredients":[

    ],
    "container":"None"
  },
  {
    "label":"skillet",
    "states":[
      "not_empty"
    ],
    "ingredients":[
      "butter"
    ],
    "container":"stove"
  }
]
},
{
  "input_nodes":[
    {
      "label":"skillet",
      "states":[
        "not_empty"
      ],
      "ingredients":[
        "butter"
      ],
      "container":"stove"
    }
  ],
}
```

```

    "motion_node":"heat",
    "output_nodes":[
      {
        "label":"skillet",
        "states":[
          "not_empty"
        ],
        "ingredients":[
          "melted_butter"
        ],
        "container":"stove"
      }
    ]
  }
]
      """"

)

```

Output Example:

```

[
  {
    "input_nodes": [
      {
        "label": "chicken_breast",
        "states": [
          "raw"
        ],
        "ingredients": [],
        "container": "None"
      },
      {
        "label": "oil",
        "states": [
          "unapplied"
        ],
        "ingredients": [
          "canola_oil"
        ],
        "container": "None"
      },
      {
        "label": "salt",

```

```
"states": [
  "unapplied"
],
"ingredients": [
  "salt"
],
"container": "None"
},
{
  "label": "pepper",
  "states": [
    "unapplied"
  ],
  "ingredients": [
    "black_pepper"
  ],
  "container": "None"
}
],
"motion_node": "season",
"output_nodes": [
  {
    "label": "chicken_breast",
    "states": [
      "seasoned"
    ],
    "ingredients": [
      "salt",
      "black_pepper",
      "canola_oil"
    ],
    "container": "None"
  },
  {
    "label": "oil",
    "states": [
      "applied"
    ],
    "ingredients": [],
    "container": "None"
  },
  {
    "label": "salt",
    "states": [
```

```
    "applied"
  ],
  "ingredients": [],
  "container": "None"
},
{
  "label": "pepper",
  "states": [
    "applied"
  ],
  "ingredients": [],
  "container": "None"
}
],
},
{
  "input_nodes": [
    {
      "label": "skillet",
      "states": [
        "empty"
      ],
      "ingredients": [],
      "container": "stove"
    },
    {
      "label": "stove",
      "states": [
        "off"
      ],
      "ingredients": [],
      "container": "None"
    }
  ],
  "motion_node": "heat",
  "output_nodes": [
    {
      "label": "skillet",
      "states": [
        "empty"
      ],
      "ingredients": [],
      "container": "stove"
    },
  ],
}
```

```
{
  "label": "stove",
  "states": [
    "on"
  ],
  "ingredients": [],
  "container": "None"
}
],
},
{
  "input_nodes": [
    {
      "label": "chicken_breast",
      "states": [
        "seasoned"
      ],
      "ingredients": [
        "salt",
        "black_pepper",
        "canola_oil"
      ],
      "container": "None"
    },
    {
      "label": "skillet",
      "states": [
        "empty"
      ],
      "ingredients": [],
      "container": "stove"
    }
  ],
  "motion_node": "place",
  "output_nodes": [
    {
      "label": "chicken_breast",
      "states": [
        "seasoned"
      ],
      "ingredients": [
        "salt",
        "black_pepper",
        "canola_oil"
      ]
    }
  ]
}
```

```
    ],
    "container": "skillet"
  },
  {
    "label": "skillet",
    "states": [
      "not_empty"
    ],
    "ingredients": [],
    "container": "stove"
  }
]
},
{
  "input_nodes": [
    {
      "label": "chicken_breast",
      "states": [
        "seasoned"
      ],
      "ingredients": [
        "salt",
        "black_pepper",
        "canola_oil"
      ],
      "container": "skillet"
    },
    {
      "label": "skillet",
      "states": [
        "not_empty"
      ],
      "ingredients": [],
      "container": "stove"
    }
  ],
  "motion_node": "cook",
  "output_nodes": [
    {
      "label": "chicken_breast",
      "states": [
        "cooked"
      ],
      "ingredients": [
```

```

        "salt",
        "black_pepper",
        "canola_oil"
    ],
    "container": "skillet"
},
{
    "label": "skillet",
    "states": [
        "not_empty"
    ],
    "ingredients": [],
    "container": "stove"
}
]
}
]

```

#Prompt3 - Best

```

prompt = (
f"Generate a detailed task tree for preparing {dish_name} with ingredients: "
f"{', '.join(dish_ingredients)} using utensils if needed by the dish only: "
f"{', '.join(utensils)}. Your task is to create a comprehensive task tree "
"describing each step in detail, including input, motion, and output nodes."
" give the task tree in the json format as follows. use this as sample format only, do not
include these input or output in the actual dishes" +\
"""

```

```

[
{
    "input_nodes": [
        {
            "label": "cutting board",
            "states": [
                "empty"
            ],
            "ingredients": [],
            "container": null
        },
        {
            "label": "tomato",
            "states": [

```

```

        "whole"
    ],
    "ingredients": [],
    "container": null
}
],
"motion_node": "pick-and-place",
"output_nodes": [
    {
        "label": "cutting board",
        "states": [],
        "ingredients": [
            "tomato"
        ],
        "container": null
    },
    {
        "label": "tomato",
        "states": [
            "whole"
        ],
        "ingredients": [],
        "container": "cutting board"
    }
]
},
{
    "input_nodes": [
        {
            "label": "tomato",
            "states": [
                "whole"
            ],
            "ingredients": [],
            "container": "cutting board"
        },
        {
            "label": "knife",
            "states": [],
            "ingredients": [],
            "container": null
        }
    ],
    "motion_node": "slice",

```



```
"output_nodes": [
  {
    "label": "tomato",
    "states": [
      "sliced"
    ],
    "ingredients": [],
    "container": "cutting board"
  }
],
},
{
  "input_nodes": [
    {
      "label": "tomato",
      "states": [
        "sliced"
      ],
      "ingredients": [],
      "container": "cutting board"
    },
    {
      "label": "knife",
      "states": [],
      "ingredients": [],
      "container": null
    }
  ],
  "motion_node": "dice",
  "output_nodes": [
    {
      "label": "tomato",
      "states": [
        "cubed"
      ],
      "ingredients": [],
      "container": "cutting board"
    }
  ]
},
{
  "input_nodes": [
    {
      "label": "cutting board",
```

```

    "states": [],
    "ingredients": [
      "tomato"
    ],
    "container": null
  },
  {
    "label": "tomato",
    "states": [
      "cubed"
    ],
    "ingredients": [],
    "container": "cutting board"
  },
  {
    "label": "mixing bowl",
    "states": [
      "empty"
    ],
    "ingredients": [],
    "container": null
  }
],
"motion_node": "pick-and-place",
"output_nodes": [
  {
    "label": "mixing bowl",
    "states": [],
    "ingredients": [
      "tomato"
    ],
    "container": null
  },
  {
    "label": "tomato",
    "states": [
      "cubed"
    ],
    "ingredients": [],
    "container": "mixing bowl"
  }
]
},

```

```
]
""
    )
```

Example output:

```
[
{
  "input_nodes": [
    {
      "label": "Cooked Boneless skinless chicken breast with rib meat",
      "states": [
        "whole"
      ],
      "ingredients": [],
      "container": null
    },
    {
      "label": "knife",
      "states": [],
      "ingredients": [],
      "container": null
    },
    {
      "label": "cutting board",
      "states": [
        "empty"
      ],
      "ingredients": [],
      "container": null
    }
  ],
  "motion_node": "cut",
  "output_nodes": [
    {
      "label": "Cooked Boneless skinless chicken breast with rib meat",
      "states": [
        "bite-sized pieces"
      ],
      "ingredients": [],
      "container": "cutting board"
    }
  ]
}
```

```
}
]
},
{
  "input_nodes": [
    {
      "label": "bowl",
      "states": [
        "empty"
      ],
      "ingredients": [],
      "container": null
    },
    {
      "label": "yellow corn flour",
      "states": [],
      "ingredients": [],
      "container": "bottle"
    },
    {
      "label": "bleached wheat flour",
      "states": [],
      "ingredients": [],
      "container": "bottle"
    },
    {
      "label": "modified corn starch",
      "states": [],
      "ingredients": [],
      "container": "bottle"
    },
    {
      "label": "spices",
      "states": [],
      "ingredients": [],
      "container": "bottle"
    },
    {
      "label": "wheat starch",
      "states": [],
      "ingredients": [],
      "container": "bottle"
    },
    {

```

```
"label": "onion powder",
"states": [],
"ingredients": [],
"container": "bottle"
},
{
  "label": "extractives of turmeric",
  "states": [],
  "ingredients": [],
  "container": "bottle"
},
{
  "label": "spice extractive",
  "states": [],
  "ingredients": [],
  "container": "bottle"
}
],
"motion_node": "add",
"output_nodes": [
  {
    "label": "bowl",
    "states": [],
    "ingredients": [
      "yellow corn flour",
      "bleached wheat flour",
      "modified corn starch",
      "spices",
      "wheat starch",
      "onion powder",
      "extractives of turmeric",
      "spice extractive"
    ],
    "container": null
  }
]
},
{
  "input_nodes": [
    {
      "label": "bowl",
      "states": [],
      "ingredients": [
        "yellow corn flour",
```

```
    "bleached wheat flour",
    "modified corn starch",
    "spices",
    "wheat starch",
    "onion powder",
    "extractives of turmeric",
    "spice extractive"
  ],
  "container": null
},
{
  "label": "salt",
  "states": [],
  "ingredients": [],
  "container": "bottle"
}
],
"motion_node": "add and mix",
"output_nodes": [
  {
    "label": "bowl",
    "states": [],
    "ingredients": [
      "yellow corn flour",
      "bleached wheat flour",
      "modified corn starch",
      "spices",
      "wheat starch",
      "onion powder",
      "extractives of turmeric",
      "spice extractive",
      "salt"
    ],
    "container": null
  }
]
},
{
  "input_nodes": [
    {
      "label": "Cooked Boneless skinless chicken breast with rib meat",
      "states": [
        "bite-sized pieces"
      ],
    }
  ],
}
```

```
"ingredients": [],
"container": "cutting board"
},
{
  "label": "bowl",
  "states": [],
  "ingredients": [
    "yellow corn flour",
    "bleached wheat flour",
    "modified corn starch",
    "spices",
    "wheat starch",
    "onion powder",
    "extractives of turmeric",
    "spice extractive",
    "salt"
  ],
  "container": null
}
],
"motion_node": "coat",
"output_nodes": [
  {
    "label": "Cooked Boneless skinless chicken breast with rib meat",
    "states": [
      "coated"
    ],
    "ingredients": [
      "yellow corn flour",
      "bleached wheat flour",
      "modified corn starch",
      "spices",
      "wheat starch",
      "onion powder",
      "extractives of turmeric",
      "spice extractive",
      "salt"
    ],
    "container": "bowl"
  }
]
},
{
  "input_nodes": [
```

```
{
  "label": "pot",
  "states": [
    "empty"
  ],
  "ingredients": [],
  "container": null
},
{
  "label": "vegetable oil",
  "states": [],
  "ingredients": [],
  "container": "bottle"
},
{
  "label": "stove",
  "states": [
    "off"
  ],
  "ingredients": [],
  "container": null
}
],
"motion_node": "add, turn on stove to medium heat",
"output_nodes": [
  {
    "label": "pot",
    "states": [
      "with oil"
    ],
    "ingredients": [
      "vegetable oil"
    ],
    "container": null
  },
  {
    "label": "stove",
    "states": [
      "on"
    ],
    "ingredients": [],
    "container": null
  }
]
]
```



```
},
{
  "input_nodes": [
    {
      "label": "Cooked Boneless skinless chicken breast with rib meat",
      "states": [
        "coated"
      ],
      "ingredients": [
        "yellow corn flour",
        "bleached wheat flour",
        "modified corn starch",
        "spices",
        "wheat starch",
        "onion powder",
        "extractives of turmeric",
        "spice extractive",
        "salt"
      ],
      "container": "bowl"
    },
    {
      "label": "pot",
      "states": [
        "with oil"
      ],
      "ingredients": [
        "vegetable oil"
      ],
      "container": null
    }
  ],
  "motion_node": "fry until golden brown and crispy",
  "output_nodes": [
    {
      "label": "Cooked Boneless skinless chicken breast with rib meat",
      "states": [
        "crispy"
      ],
      "ingredients": [
        "yellow corn flour",
        "bleached wheat flour",
        "modified corn starch",
        "spices",
```

```
    "wheat starch",
    "onion powder",
    "extractives of turmeric",
    "spice extractive",
    "salt"
  ],
  "container": "pot"
}
]
},
{
  "input_nodes": [
    {
      "label": "Cooked Boneless skinless chicken breast with rib meat",
      "states": [
        "crispy"
      ],
      "ingredients": [
        "yellow corn flour",
        "bleached wheat flour",
        "modified corn starch",
        "spices",
        "wheat starch",
        "onion powder",
        "extractives of turmeric",
        "spice extractive",
        "salt"
      ],
      "container": "pot"
    },
    {
      "label": "plate",
      "states": [
        "empty"
      ],
      "ingredients": [],
      "container": null
    }
  ],
  "motion_node": "transfer",
  "output_nodes": [
    {
      "label": "Cooked Boneless skinless chicken breast with rib meat",
      "states": [
```

```
    "crispy"  
  ],  
  "ingredients": [  
    "yellow corn flour",  
    "bleached wheat flour",  
    "modified corn starch",  
    "spices",  
    "wheat starch",  
    "onion powder",  
    "extractives of turmeric",  
    "spice extractive",  
    "salt"  
  ],  
  "container": "plate"  
}  
]  
}  
]
```