



# **Large Language Models and their applications in treating ADHD**

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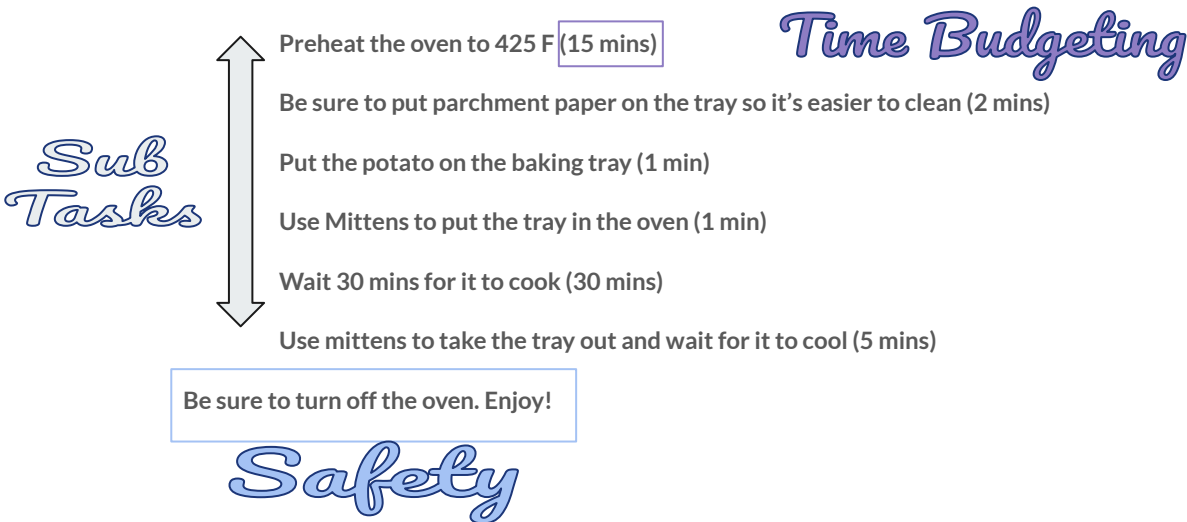
# Motivations

- **Attention-Deficit/Hyperactivity Disorder (ADHD)**
  - Children with ADHD may have trouble paying attention, controlling impulsive behaviors or be overly active.
- **Personalized Support and Accessibility**
- **Behavioral Strategies and Coaching**
  - Breaking down the task into sub-tasks, include time budgeting, tackle forgetfulness
- **Educational and Information Resource**
- **Emotional Support and Mental Health**

# Ideal Response

User: Help me bake a sweet potato

Agent: Sure, here is the list of ingredients you need - Sweet Potato





# Chain of Thoughts Prompting

## 1. Zero shot

Tl;dr: Add “A: The answer is “ in the prompt.

## 2. Zero shot CoT

Tl;dr: Add: “A: Let's think step by step.” in the prompt.

## 3. Manual CoT

Tl;dr: Manual-CoT achieves stronger performance by eliciting the CoT reasoning ability with effective manual demonstrations. The demonstrations for the reasoning process are manually designed.



# Manual CoT Example

## Example: Manual-CoT

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### Test Question:

Help me bake a sweet potato?

\*\*\*\*\*

### Prompted Input:

Let's think step-by-step. First you would need to get all the necessary ingredients and the cooking equipment needed to cook. Moreover, since ADHD restricts the working memory and time management, we need to ensure that we include the time taken at each step to finish the task. Finally, we need to ensure that the process is safe and we operate the oven with caution.

- So, here is the item you need - Sweet Potato, oven, oil, salt and pepper.
- Preheat the oven to 425 F (15 mins)
- Wash the sweet potato, dry it and season with salt & pepper and oil (5 mins)
- Put the potato on the baking tray (1 min)
- Use Mittens to put the tray in the oven (1 min)
- Wait 30 mins for it to cook (30 mins)
- Use mittens to take the tray out and wait for it to cool (5 mins)
- Be sure to turn off the oven. Enjoy.

Help me bake a cake?

A:

\*\*\*\*\*

### Output:

\*\*\*\*\*

Manually  
designed



# Manual CoT Example

## Output:

Baking a cake is a delightful task, and just like baking a sweet potato, it can be broken down into simple, manageable steps. To bake a cake, you'll first need to gather all the necessary ingredients and equipment. Since ADHD can affect working memory and time management, I'll outline each step with the estimated time it will take. Safety is crucial, especially when using an oven, so remember to handle everything with care. Here's a basic cake recipe with step-by-step guidance:

### Ingredients and Equipment

- Flour
- Sugar
- Baking powder
- Salt
- Eggs
- Milk
- Vegetable oil or butter
- Vanilla extract (optional)
- Mixing bowl
- Measuring cups and spoons
- Mixer or whisk
- Cake pan
- Oven
- Cooling rack
- Mittens for handling hot items

### Steps

- Preheat the Oven to 350°F (10 mins): Start by preheating your oven. This ensures the cake will bake evenly.
- Prepare the Cake Pan (5 mins): Grease the cake pan with butter or oil and lightly dust it with flour. This prevents the cake from sticking.
- Mix Dry Ingredients (5 mins): In a bowl, mix together the flour, sugar, baking powder, and a pinch of salt.
- Add Wet Ingredients (5 mins): Beat in the eggs, milk, oil/butter, and vanilla extract until the batter is smooth.
- Pour Batter into Pan (2 mins): Transfer the cake batter into the prepared pan.
- Bake the Cake (25-30 mins): Place the pan in the oven and bake for 25-30 minutes. You can check if it's done by inserting a toothpick into the center of the cake; if it comes out clean, the cake is ready.
- Cool the Cake (30 mins): After baking, let the cake cool in the pan for a few minutes, then transfer it to a cooling rack to cool completely.
- Decorate (Optional, 10 mins): Once cool, you can frost or decorate the cake as desired.
- Enjoy and Clean Up (10 mins): Enjoy your homemade cake! Remember to turn off the oven and clean up your baking area.

This basic cake recipe can be customized with different flavors, frostings, and decorations. Remember, baking is not only about the final product but also enjoying the process. Happy baking!

Manually  
designed



# Prompt Tuning

- Tailoring responses to ADHD-related challenges
- Utilizing soft prompts for context-specific understanding
- Incorporating recent advancements like OPRO (Optimization by PROMpting) for more effective prompt generation



# Prompt Tuning Examples

- **Task Management:**

- *General Prompt:* "How can I manage my daily tasks more effectively?"
- *Tuned Prompt:* "For ADHD: Can you provide a step-by-step guide to managing daily tasks, incorporating techniques like time blocking, use of visual aids like planners or apps, and regular short breaks to maintain focus?"

- **Improving Concentration:**

- *General Prompt:* "What are some strategies to stay focused?"
- *Tuned Prompt:* "For ADHD: Detail methods to bolster concentration, including structured daily routines, environment optimization for reduced distractions, and usage of focus-enhancing tools."





# Prompt Tuning Example - Cook a sweet potato

Baking a sweet potato is a straightforward process, but it's important to approach it methodically, especially when considering attention to detail and safety. Here's a step-by-step guide that breaks down the process into manageable sub-tasks, with safety measures and time estimates included:

## 1. Preparing the Sweet Potato

- Task: Wash and Dry
  - Sub-tasks:
    - Rinse the sweet potato under cold water.
    - Scrub the skin with a clean brush to remove any dirt.
    - Pat the sweet potato dry with a towel.
- Time Estimate: 5 minutes
- Safety Measure: Ensure the sweet potato is thoroughly dried to prevent steam burns when baking.

## 2. Preheating the Oven

- Task: Preheat Oven
  - Sub-task:
    - Turn on the oven to 425°F (220°C).
    - Wait for the oven to reach the desired temperature.
- Time Estimate: 10-15 minutes
- Safety Measure: Stay in the kitchen while the oven is preheating to monitor any unusual smells or smoke.

## 3. Preparing the Sweet Potato for Baking

- Task: Poking Holes and Oiling
  - Sub-tasks:
    - Poke holes in the sweet potato using a fork (about 8-10 times).
    - Lightly oil the skin if desired for a crispier texture.
- Time Estimate: 5 minutes
- Safety Measure: Poke holes gently to avoid slipping and injuring yourself.



# Prompt Tuning Examples

## 4. Baking the Sweet Potato

- Task: Bake
- Sub-tasks:
  - Place the sweet potato on a baking sheet.
  - Put the baking sheet in the oven.
  - Bake for 45-50 minutes.
- Time Estimate: 45-50 minutes
- Safety Measure: Use oven mitts when placing the sweet potato in the oven and when removing it.

## 5. Checking Doneness

- Task: Test Sweet Potato
- Sub-task:
  - Insert a fork into the sweet potato; it should slide in easily if done.
- Time Estimate: 2 minutes
- Safety Measure: Be careful of steam when testing the sweet potato.

## 6. Serving

- Task: Remove and Serve
- Sub-tasks:
  - Remove the sweet potato from the oven using oven mitts.
  - Cut open the top and fluff the inside with a fork.
  - Add toppings if desired (like butter, cinnamon, or brown sugar).
- Time Estimate: 5 minutes
- Safety Measure: Let the sweet potato cool for a few minutes before cutting into it to avoid burns.

## Additional Tips:

- Set Timers: Use a kitchen timer or your phone to remind you when to check the oven.
- Stay Organized: Keep your work area clean and organized to avoid distractions.
- Safety First: Always stay in the kitchen while the oven is on, and don't forget to turn it off after use.

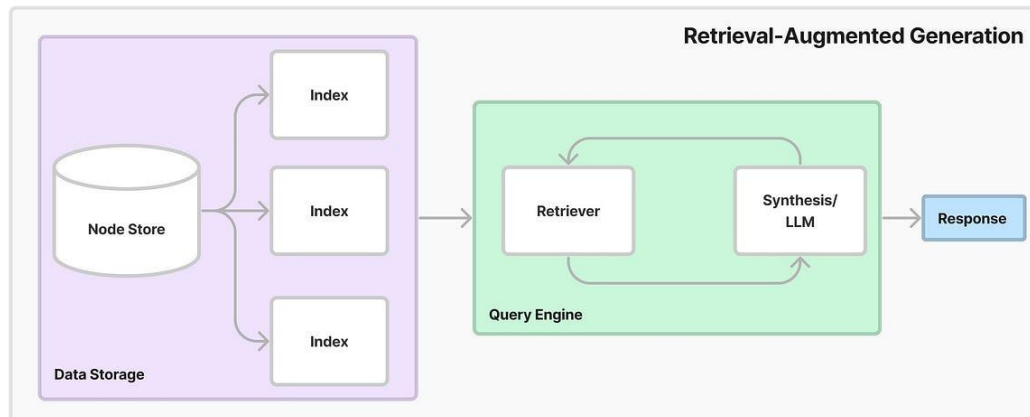
This breakdown should help you stay on track and ensure a safe and enjoyable cooking experience. Enjoy your sweet potato!



# Retrieval Augmented Generation

- **RAG**
  - Create database of relevant ADHD documents containing best practices on work, socialization, relationships, studies etc.
  - Extract relevant ideas from documents and add it to the prompt to get factual response and augmented with general best practices.
- **Active Retrieval Augmented Generation**
  - Actively decide when and what to retrieve across the generation
  - It uses predictions of upcoming sentences to anticipate future content and retrieve documents to regenerate the sentence if it contains low-confidence tokens

# RAG



```

1 id: ObjectId('655aaa8682389de731c92db2')
2 array (4) : 1
3   typ...: "constructor"
4   + i...: Array (4)
5     0: "langchain"
6     1: "schema"
7     2: "document"
8     3: "Document"
9   + kwarg...: Object
10    page_content...: "5sitting or quiet behavior is expected
                        PBlurting out answers before hearing the whole question
                        PHaving difficulty waiting in line or taking turns.
                        Inattention
                        Children who are inattentive have a hard time keeping their
                        minds on any one thing and may get bored with a task after
                        only a few minutes. If they are doing something they really
                        enjoy, they have no trouble paying attention. But focusing
                        deliberate, conscious attention to organizing and completing
                        a task or learning something new is difficult."

```

ObjectId  
Int32  
String  
Array  
String  
String  
String  
String  
Object  
String

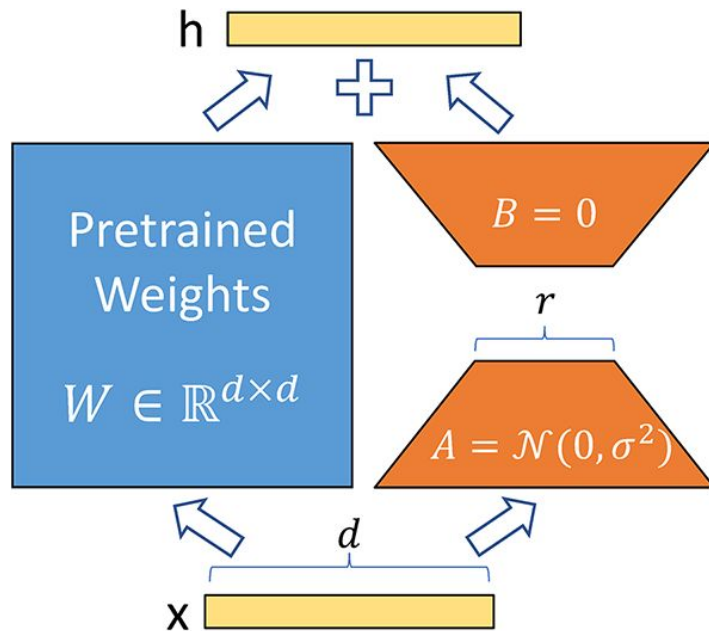


# Retrieval Augmented Generation

- RAG

- Create your own office or workspace.
- Find a space at home that suits you.
- Avoid placing near windows or turning on any distracting equipment.
- Use the following pieces in a way that is best for a person with ADHD:
  - 1. Give everything a home.
  - 2. Use color-coding.
  - 3. Organize your belongings and environment in a orderly way.
  - 4. Set a deadline for getting tasks done.
  - 5. Schedule "clean up time".
  - 6. Ask your parent or teachers to support you.
  - 7. Reward yourself.
  - 8. Follow these strategies to get more organized!
- Use the pieces of retrieved context as best practices to help the reader answer the question in a way that is best for a person with ADHD. Use the following phrases to help the reader understand how to apply the strategies: Example: To do this, find a space at home that suits you and organize your belongings in a way that makes sense for you. Example: Try giving each item a special place to live, and make sure you put things back where they belong after you use them. Example: Set aside some time each day to tidy up and make sure everything has a home. Example: Use color-coding to help you stay organized. For instance, you could use blue for your school assignments, red for your personal items, and green for your favorite toys. Example: Set a deadline for getting tasks done and use a planner or agenda to keep track of important dates and deadlines. Example: Take time each day to tidy up your workspace and make sure everything has a home. Example: Ask your parent or teacher for help to stay organized and make sure you have the support you need. Example: Give yourself a reward each time you complete a task or reach a goal. This could be something small like a sticker or a special treat. By using these strategies, you can create your own office or workspace that is tailored to your needs and helps you stay organized and focused. Remember to always take breaks and ask for help when you need it, and don't be afraid to reward yourself for a job well done!

# Fine-tuning





# Fine-tuning

- 100 custom prompts covering topics on driving, cooking, dating, daily tasks etc.
- **Prompt: Help me bake a sweet potato:**

Baking a sweet potato is a simple and delicious task. Here's a breakdown into manageable steps with time estimates for each. After the steps, I'll create a visual aid to help you stay on track.

  - Preheat the Oven (5 minutes)
    - Set your oven to 425°F (220°C). It will take about 5 minutes to heat up.
  - Prepare the Sweet Potato (5 minutes)
    - Wash the sweet potato thoroughly.
    - Dry it with a towel.
    - Prick the sweet potato several times with a fork. This allows steam to escape during cooking.
  - Season the Sweet Potato (Optional, 2 minutes)
    - Rub it with olive oil (this is optional but recommended for crispy skin).
    - Sprinkle with salt and any other desired spices (like cinnamon or paprika).
  - Bake the Sweet Potato (45 minutes)
    - Place the sweet potato on a baking sheet.
    - Bake for about 45 minutes, or until it's soft inside. You can check by inserting a fork or knife; it should slide in easily.
  - Cool and Serve (5 minutes)
    - Once done, remove the sweet potato from the oven.
    - Let it cool for a few minutes before cutting it open and adding any toppings like butter, brown sugar, or marshmallows.

Total Time: Approximately 1 hour and 2 minutes
- Lacks safety



## Evaluations - out of 10 cases each

Approach	Safety	Relevance	Time Estimates
Prompt	10	10	10
CoT	8	10	10
RAG	0	10	0
Fine-tuning	0	10	3 (partial)





# Conclusion

- Prompts, and CoT methods - Good but prone to invalid assumptions about ADHD
- RAG - Factual but Bad at inferring solutions
- Fine-tuning - Okay but prone to assumptions

Combine them all!



## Q&A