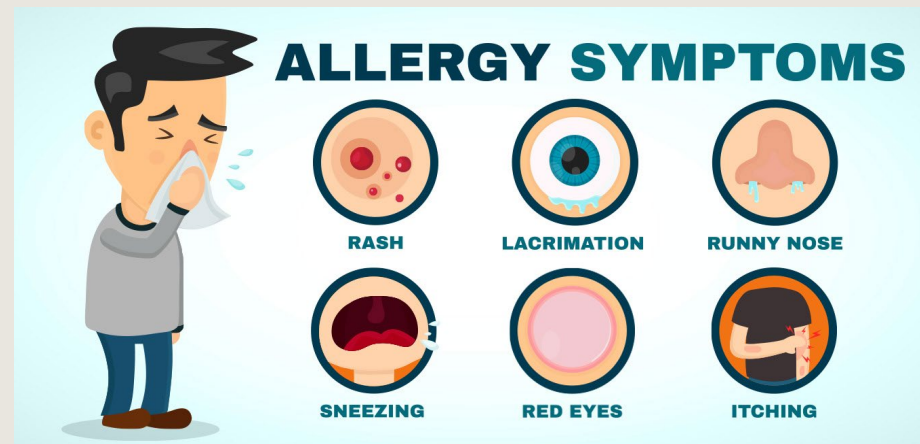


LLM TUTORIAL

By: Preetam Bhamidipati

BACKGROUND

For this assignment, I decided on looking into if LLMs (such as ChatGPT) can properly understand allergic symptoms and determine what type of allergy a patient has. Furthermore, I also tested whether LLMs can suggest appropriate medication for patients to avoid their allergic symptoms/reactions. I used the allergies.csv dataset from the following link: <https://synthea.mitre.org/downloads>.



METHODS (SHOT LEARNING)

First, I used zero-shot learning, one-shot learning, and few-shot learning to see if ChatGPT would be able to determine the right allergy for a patient with wheal and abdominal pain as symptoms. From the dataset, a patient that had these two symptoms was allergic to aspirin. Below are the prompts that were used:

- 1) What type of allergy does a patient have if they have the following two symptoms: wheal and abdominal pain? (Zero Shot Learning)
- 2) Assume you are a doctor who specializes in allergy detection. What type of allergy does a patient have if they have the following two symptoms: wheal and abdominal pain? (One Shot Learning)
- 3) Assume you are a doctor who specializes in allergy detection. A patient that had the symptoms of wheal and anaphylaxis was found to have an allergy towards tree nuts. Another patient that had the symptoms of wheal and allergic angioedema had an allergy to peanuts. Based on this info, is it possible for a patient with abdominal pain and wheal as symptoms to be allergic to medication? If so, which types of medicine? (Few Shot Learning)

RESULTS (SHOT LEARNING)

Results for the prompts:

- 1) This patient may have a food allergy. (Zero Shot Learning)
- 2) It is possible that the patient has a food allergy. The wheal may indicate an allergic reaction on the skin, while the abdominal pain could be a symptom of a gastrointestinal reaction to the allergen. Further testing and evaluation would be necessary to determine the specific allergen causing the symptoms. (One Shot Learning)
- 3) Yes, it is possible for a patient with abdominal pain and wheal as symptoms to be allergic to medication. The types of medication that could cause this type of allergic reaction include antibiotics, nonsteroidal anti-inflammatory drugs (NSAIDs), and certain types of pain relievers. It is important for the patient to seek medical attention and receive proper testing to determine the exact cause of their symptoms. (Few Shot Learning)

EVALUATION (SHOT LEARNING)

Based on the prompts and results generated, we can clearly see that as more information is provided to ChatGPT (such as info about symptoms that other patients faced and what type of allergy they had) the better and more accurate the response. Like I said before, the example I used in the prompt was from the dataset itself and that patient had an allergic reaction to aspirin. Therefore, in the few shot learning prompt, when I asked ChatGPT if this patient could be allergic to medication and if so what types of medicine, ChatGPT correctly identified that patients that have these symptoms could be allergic to medication such as antibiotics, pain relievers, and NSAIDs. When I further asked ChatGPT what drugs classify as NSAIDs, it responded with aspirin as one of the answers. So therefore, ChatGPT was able to correctly determine the possible allergy that the patient had with a little help from us.

METHODS (CHAIN/TREE OF THOUGHTS)

Next, I used chain of thoughts and tree of thoughts as methods. I used different prompts to see if ChatGPT would perform any different. Note: The ANSWER portion of the prompts below were answers from ChatGPT that I asked before and then included in the prompt for the methods stated above. Below are the prompts that were used:

- 1) Assume you are a doctor who specializes in allergy detection. A patient comes in and seems to have an allergy from the environment. What are some possible allergies that the patient has? ANSWER:Some possible allergies that the patient may have include: Pollen from trees/grasses/weeds, Dust mites, Mold, Pet dander, Insect bites or stings, Certain foods or medications, Latex, Chemicals or irritants in the air (such as smoke or perfume. INSTRUCTION: Now we find out that the patient has a cough as a symptom. What allergy could the patient have? ANSWER:If the patient has a cough as a symptom, it could be a sign of an allergic reaction to environmental irritants such as pollen, dust mites, or mold. It could also be a symptom of an allergic reaction to pet dander, certain foods or medications, or irritants in the air such as smoke or chemical fumes. However, a cough can also be a symptom of non-allergic conditions such as a viral infection or asthma. Therefore, further diagnostic tests and evaluation are necessary to. INSTRUCTION: Now we also discover that the patient has a symptom of Rhinoconjunctivitis along with a cough? If we were to narrow down to one allergy, which allergy could the patient have? (Chain of Thoughts)
- 2) Assume you are a doctor that specializes in allergy detection. A patient has an allergy to animal dander. Assuming the patient is a female, what are possible symptoms that the patients could have? ANSWER:Possible symptoms of an allergy to animal dander in a female patient may include: sneezing, runny or stuffy nose, itchy eyes, nose, or throat, coughing, wheezing, difficulty breathing, skin rash or hives, and/or swelling of the face, lips, tongue, or throat. INSTRUCTION:What medication could be administered to help the patient from getting this allergy? (Tree of Thoughts)

RESULTS (CHAIN/ TREE OF THOUGHTS)

Results for the prompts:

- 1) If the patient presents with symptoms of both a cough and rhino conjunctivitis (which includes symptoms such as nasal congestion, runny nose, and itchy/watery eyes), it could be indicative of an allergic reaction to pollen from trees, grasses, or weeds. Other possible allergens that could cause these symptoms include dust mites, mold, and pet dander. However, it is important to note that further diagnostic tests and evaluation are necessary to determine the exact cause of the...(Chain of Thoughts)
- 2) Antihistamines, such as loratadine (Claritin), cetirizine (Zyrtec), or fexofenadine (Allegra), can help relieve allergy symptoms such as sneezing, runny nose, and itchy eyes. Nasal corticosteroids, such as fluticasone (Flonase) or mometasone (Nasonex), can help reduce inflammation in the nasal passages and relieve congestion. In severe cases, a doctor...(Tree of Thoughts)

EVALUATION (CHAIN/ TREE OF THOUGHTS)

Similar to the results from the previous methods, as more information was provided ChatGPT gave more accurate and better responses. One thing that I observed and was impressed with for these two methods was that ChatGPT remembered the context of our conversation for each question. So therefore, when I was asking subsequent questions, it was using its previous answers as information and was generating responses accordingly. One difference was that in these methods as the length of the conversation progressed, ChatGPT gave longer responses that were precise and accurate to the context of the patient and their allergy.

OTHER

Furthermore, apart from looking at these methods I also wrote a small class which took in a dataset and gave suggestions of allergy medication for each patient (each row) based on their symptoms, the severity of their symptoms, and the allergy that they had. I tested this class by passing in the allergies dataset which I filtered to only include rows that had no NaN values. Then I created a prompt from these extracted values and used that prompt to generate a response from ChatGPT. Based on the results, ChatGPT gave great suggestions. For example, one of the patients had a nut allergy. ChatGPT suggested that there is no medication to avoid this allergy, so it is very important to make sure that this patient does not come in contact with any food items that contain nuts. In this case, the prompt only asked ChatGPT to recommend a medication and it could've just responded with no medication available, but ChatGPT responded that there is no medication available and furthermore suggested a precautionary measure for the patient to stay safe.

POSSIBLE IMPROVEMENTS

Overall, I was very impressed with ChatGPT and the responses that it generated. It was very knowledgeable in medical concepts and terminology. Personally, I don't see much more room for improvement currently because I was truly satisfied and impressed with the responses it generated based on my prompts. One thing that the responses could add is a link to a source which can help the user validate the information given. Especially since we are talking about medical information it would be nice to have a link to a source to make sure that the information that ChatGPT is giving us is valid and can be used for medical purposes. Apart from that, this was a great assignment as it helped me understand how we can use LLMs in the healthcare industry.

A series of white, thin, overlapping geometric lines on a black background, creating a complex, abstract pattern on the left side of the slide. The lines form various polygons and intersect at several points.

THANK YOU