

Dialogue Systems 2 – Project Report

PLEASE, HELP ME DOCTOR!

Why medical dialogues?

To get an appointment in a hospital or a medical center, is sometimes frustrating especially here in Sweden when getting a condition checked out might require waiting for several weeks or sometimes months which would mean that a certain condition could look as if it disappeared by itself when there are no obvious symptoms anymore, or even it could develop. This kind of systems could help detect emergencies and prioritize the conditions and emergency appointments when used in the healthcare systems as well as reducing the waiting time when the case is closed and was not reopened.

Used API

I have used a fake API as a json file which has all the information needed to give diagnosis, advice, and medications if applicable as shown below:

```
ddd > http-service > {} medical_conditions.json > {} Bowel Inflammation
You, 7 hours ago | 1 author (You)
1  {
2    "Hypertension": {
3      "symptoms": ["headache", "shortBreaths"],
4      "inform": "you have Hypertension but it's not too severe.",
5      "advices": "avoid stress, salty food and spices, smoking and Alcohol while it's recommended to do some
light sports or jogging, eat healthy, measure your blood pressure gradually, especially during the
seizure. alright?",
6      "prescriptions": "For Emergencies, during the seizure, take Captopril 25mg, but not when your blood
pressure is below 160/110."
7    },
8    "Migrain": {
9      "symptoms": ["headache", "agitated", "one_sided", "eye_face_pain"],
10     "inform": "you have a condition we call Head Migraine.",
11     "advices": "avoid stress, smoking, alcohol, and caffeine in small amounts, while it's recommended to
do some light sports or jogging, and eat healthy. Finding a calm environment, dark quiet rooms, and
applying hot or cold compresses on your head and neck are recommended",
12     "prescriptions": "For Emergencies, during the seizure, take Sumatriptan 100mg. If still there is no
relief after 2 hours you can take another dose."
13   },
```

Data Collection

Scenario:

A patient seeks help from the _doctor DDD to diagnose his medical condition and return the diagnosis and advice and medications required to get better by examining the symptoms he is having and eliminating other possible diagnosis by asking the right questions

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Collected Material:

3 original conversations which were introduced in the first lab and added to it three branches, one of each original conversations to illustrate how two medical conditions can have common symptoms until one symptom will have the final say in the diagnosis after the answers of the patient differ in each diagnosis.

Distillation and Analysis results:

The distillation process was already done in the first lab and it was mostly modifying the human dialogues to be handled by the system but kept the same coherence and order as it is fundamental to arrive at diagnosis.

Implementation

- Ask a patient about his main symptom
- the main symptom (out of 3) will lead us to perform a main action which has two roads (two other actions), each will arrive at a single diagnosis
- In the main action we have the symptoms of which two medical conditions have in common and it will “jumpto” the final action once a certain symptom differs between both conditions
- The symptoms will be passed as parameters for an invoke query which will allow us to access our API and pick the medical condition that has the symptoms we collected from the patient and then give us back the diagnosis and advice.
- Before the dialogue end the user will be able to ask about medications (if he desires) but only after the diagnosis is given and it will also use an invoke query to go to the API and fetch the prescribed medications

Sample Dialogues handled by my system:

Dialogue 1:

```
S> Hello! What are you suffering from?  
U> I have been having a severe headache for some time  
S> How old are you?  
U> 32  
S> What do you do for a living?  
U> I am an accountant  
S> Is the headache agitated by any specific stimulants, loud  
sound, or bright light?  
U> yes  
S> Are the lights in your workplace brighter than normal? or does  
it annoy you when you are home when the children are playing or  
yelling?  
U> yes
```

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S> Is your headache one-sided or does it spread randomly?
U> it is one sided
S> Could you describe any pain you feel during the seizure?
U> there is a clear pain in the left eye and left side of my face
S> Do you have any neck pains?
U> no
S> Do you wear pre-scripted glasses, or do you have any eye or sight problems?
U> yes
S> Any other symptoms?
U> no
S> According to your symptoms you have a condition we call Head Migraine.
U> is there any medications that could help easing the pain
S> as for the medications, For Emergencies, during the seizure, take Sumatriptan 100mg. If still there is no relief after 2 hours, you can take another dose.
U> done
S>Great! Let's continue then
U>
S> According to your symptoms you have a condition we call Head Migraine.
U> done
S> All you need to do is avoid stress, smoking, alcohol, and caffeine in small amounts, while it's recommended to do some light sports or jogging and eat healthy. Finding a calm environment, dark quiet rooms, and applying hot or cold compresses on your head and neck are recommended
U> done
S>let's take the next patient then, what are you suffering from?

Dialogue 2:

S> Hello! What is the problem?
U> I have a severe stomach pain
S> Since when are you feeling this way?
U> since two weeks ago
S> Is there a burning sensation in your chest?
U> No
S> Do you suffer from nausea or belching?
U> yes
S> Any problems with your defecation/gases?
U> no
S> What colour is your urine?
U> yellow to orange
S> According to your symptoms you probably have a condition called Gallstones.
U> okay
S> All you need to do is drink as much water and clear fluids as you can until your body ejects it out. Nothing to worry about.
U> do you recommend any medications for me to take?

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S> as for the medications, we recommend you take Ciprofloxacin 500mg 2 times/day for 10 days if you feel any rise in your temperature.
U> I understand
S> Great! let's continue then.
U>
S> All you need to do is drink as much water and clear fluids as you can until your body ejects it out. Nothing to worry about.
U> fine
S> let's take the next patient then, what are you suffering from?

Dialogue 3:

S> Hello! What are you suffering from?
U> I am fatigued and exhausted
S> Could you please describe what extra symptoms you have if any?
U> I have nausea and diarrhea
S> Since when are you feeling this way?
U> it started yesterday
S> So, How many times did you defecate?
U> about 6 times
S> Is the texture watery or loose and what colour is it?
U> watery and brown
S> Is there any stomachache?
U> yes
S> Have you eaten fast food or outside lately?
U> yes
S> Do you have any appetite for food?
U> no
S> According to your symptoms what you have is called bowel inflammation.
U> okay
S> All you need to do is follow a strict diet by increasing your intake of water and fluids, in addition to fiber which you can find in vegetables and fruits, for at least 3 to 4 days to compensate the loss. Then, if the condition persists, we urge you to return for a check up.No medications required.
U> do you advice me to take any medication?
S> as for the medications, There is no prescriptions for your case of Bowel Inflammation, just stick to what I have advised you to do
U> I understand
S> Great! let's continue then.
U>
S> All you need to do is follow a strict diet by increasing your intake of water and fluids, in addition to fiber which you can find in vegetables and fruits, for at least 3 to 4 days to compensate the loss. Then, if the condition persists, we urge you to return for a check up.No medications required.
U> done
S> let's take the next patient then, what are you suffering from?

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Discussion

Capabilities:

- It can collect information about the patient's health habits and history, and symptoms from the user and make a final diagnosis.

Limitations:

- Cannot read the vital signs from another device e.g., a smart watch instead of asking the user to do all the work, which he may not be able to do sometimes
- Some diagnosis requires to do an ECG, an echo examination, measure the oxygen saturation or even take a blood sample to get an accurate result, and here that is not possible
- If a patient has problem with his skin, it might be also good to upload a picture or check it by camera, but that too was not possible
- Access the journals on 1177 to check the medical history of the patient and save a lot of time and questions to make a more precise diagnosis

TDM Limitations:

- I think “jumpto” is not functioning correctly, but I was forced to use it as it was the only way (that I know of) to literally “jump” between the actions based on the registered symptoms. After jumping to an action there is no way to back to the main goal even though I tried jumping back to “top” as follows:

```
<goal type="perform" action="gallstones_action">
  <plan>
    <findout type="yn_question" >
      <proposition predicate="is_belching" />
    </findout>
    <if>
      <proposition predicate="is_belching" />
      <then>
        <assume_shared>
          <proposition predicate="extra_symptoms" value="nausea_belching" />
        </assume_shared>
        <findout type="yn_question" >
          <proposition predicate="has_probs" />
        </findout>
        <if>
          <proposition predicate="has_probs" value="false"/>
        <then>
          <findout type="wh_question" predicate="urine_color" />
        </if>
      </then>
    </if>
  </plan>
</goal>
```

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```
<invoke_service_query predicate="diagnosis" type="wh_question"/>
<invoke_service_query predicate="inform" type="wh_question"/>
<get_done action="patient_inform" />
<invoke_service_query predicate="get_advice" type="wh_question"/>
<get_done action="advices" />
<inform>
  <proposition predicate="diagnosed" value="diagnosis_done" />
</inform>
</then>
</if>

</then>
</if>

<jumpto type="perform" action="top"/>
<signal_action_completion />
</plan>
</goal>
```

- Because of the decision I made to jumpto “top” the inform stopped working as well but that stopped the loop that appears after the diagnosis is done the last action has ended.
- Th yn_question was a very hard task as the documentation did not really have a clear example about how to deal with it in the findouts or in the if-else elements.
- I believe the documentation should be reviewed and rewritten to make it easier for the user. I had help from Jose he was the one to guide me through it.
- I tried using a validator, but it turned out a validator does not work with a previously triggered parameter and that was a disappointment.
- We can also add the limitations mentioned in the previous labs.

Future Work

Educational Tool:

- This tool for now is an instructional tool but would love for it to be used for educational purposes especially in surgeries
- Use cameras to guide the user through the steps with a better judgement based on what the camera is catching

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- The ability to also show videos to the user to do a specific process (e.g., how to measure blood pressure)

Enhancements:

- Give access to the 1177 journals to view medical history
 - Get the blood pressure, ECG, and oxygen saturation by access a smart watch vital signs or upload documents or even measure it using the system itself
 - Taking urine and blood samples provided by the user and test it by the system for a specific purpose.
-

The distilled extra three dialogues (not in Lab 1):

Dialogue 1:

S> Hello, what seems to be the problem?

U> Hello, I have been having a severe headache for some time

S> Since when?

U> About 6 months

S> How old you are?

U> I'm 36

S> what do you do for a living?

U> I am an accountant

S> Is the headache agitated by any specific stimulants, loud sound or bright light?

U> Actually, yes. Mostly when I am at work and back home when my children are playing and yelling.

S> Are the lights in your workplace brighter than normal?

U> Yes

S> Is your headache one-sided or does it spread randomly?

U> Mostly it hits on the right side.

S> Does anything else hurt during the seizure?

U> I feel pain in my right eye and right side of my face

S> Okay. Do you have any neck pains?

U> No

S> Do you have any eye or sight problems?

U> Yes, but i have checked with my ophthalmologist, nothing new.

S> Any other symptoms?

U> No not really.

S> Well, according to the description of your symptoms, you have a condition we call Head Migraine.

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First, we need to take a CT-Scan for your head to exclude any other reasons for your headache.

Then we shall do the routine CBC blood work.

U> Sure!

S> Your blood work seems normal. No sign of inflammation or any focuses to be causing the headache. So, we probably have no reason to be worried

U> ok!

S> All you need to do is avoid stress, smoking, alcohol, and caffeine in small amounts, while it's recommended to do some light sports or jogging and eat healthy.

Finding a calm environment, dark quiet rooms, and applying hot or cold compresses on your head and neck are recommended

U> Yes!

S> For Emergencies, during the seizure, take Sumatriptan 100mg.

If still there is no relief after 2 hours, you can take another dose.

Dialogue 2:

S> Hello! What is the problem?

U> Hello! I am fatigued and exhausted!

S> What are you suffering from?

U> Nausea and diarrhea

S> And since when are you feeling this way?

U> Since yesterday

S> How many times you defecated?

U> About 6 times

S> Is the texture watery or loose and what color is it?

U> Watery and the color is normal light brown

S> Also, is there any stomachache?

U> Just a little, when I need to defecate

S> Have you eaten fast food or outside lately?

U> No

S> Do you have any appetite for food?

U> Yeah, its fine

S> Was there any vomiting?

U> Thankfully not

S> Have you been taking any new medication lately?

U> Yes, a drug my Otolaryngologist prescribed it for my year infection.

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S> Do you recall its name?

U> Yes, Clarithromycin

S> And how many days have you been taking it?

U> 2 days

S> And the nausea and diarrhea started yesterday?

U> well the nausea started 2 days ago, but the diarrhea began suddenly yesterday.

S> Well, according to the description of your symptoms, you probably have a condition called Drug-induced diarrhea. We recommend you stop taking this drug forever, then visit your doctor and ask him to change your prescription.

You need to follow a diet by increasing your intake of water and fluids, in addition to fiber which you can find in vegetables and fruits, for at least 3 to 4 days to compensate the loss.

Then, if the condition persists, we urge you to return for a checkup and further tests. No medications required.

U> Alright! Thanks a million!

Dialogue 3:

S> Hello! What seems to be the problem?

U> I have a severe stomach pain

S> Since when do you feel so?

U> It has been a while, but the last 2 weeks it increased substantially

S> Is there a burning sensation in your chest?

U> No not really

S> Do you suffer from nausea or belching?

U> Nausea, but not till lately

S> Where exactly is the pain on your stomach?

U> Well it started on my waist and disappeared. Later it came back in the area of my lower stomach.

S> Ok. Any problems with your defecation/gases?

U> No

S> What color is your urine?

U> Yellow - orange

S> According to your symptoms, you probably have a condition called Gallstones. We just need to do an Echo examination of your abdomen, and we will need a urine sample from you to run some tests and know for sure.

U> Okay, sure.

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S> Well, as the results show there is a stone in your bladder, that is 5mm in diameter, and it is probably what was causing the pain all this time. All you need is to drink as much water and clear fluids as you can until your body ejects it out. Nothing to worry about. But, during our tests we noticed a slight rise of your temperature. So, for further safety, we recommend you take Ciprofloxacin 500mg 2 times/day for 10 days.

U> Will do that, Thank you so much!
