

CS-521 Term Project Report

COVID19 SYMPTOM CHECKER

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Background:

According to the coronavirus pandemic, there comes an overwhelming amount of people who needs to get tested. However, the test kits are in short supply in the US. Given that shortage, we need to come up with a practical approach for the huge demands of testing. People who may not sure if they have infected by the coronavirus (COVID-19) need to seek to another way to get assessed immediately.

Motivation:

CDC collaborates with Apple to build an app and website based COVID-19 symptom checker. In addition, many other big tech companies also start building symptom checker in response to this pandemic.

Data:

I followed the COVID-19 screening protocol written by CDC & Apple to make a conversation-based prototype to simulate the chatbot that Apple has already released early on. (see <https://www.apple.com/covid19/>)

Analysis Steps:

1. Follow CDC's screening protocol.
2. Write the code in Python to implement the procedures.
3. Upload my code & documents to GitHub for the people who might be interested to use it.

Code:

Code snippet.

```
import json
import pandas as pd

class Screen:
    def __init__(self):
        self.age = ''
        self.covid_contact = False
        self.covid_exposure = False
        self.new_cough = False
        self.fever = False
        self.shortness_breath = False
        self.sore_throat = False
        self.muscle_ache = False
        self.nurse_facility = False
        self.heart_conditions = False
        self.immunocompromised = False

    def load_dialog_data():
        with open('covid19-dialog.JSON') as json_file:
            json_data = json.load(json_file)
            return json_data

    def load_testing_facilities_data():
        with open('mass-covid19-testing-sites.JSON') as json_file:
            facilities = json.load(json_file)
            df = pd.DataFrame(facilities['testing facilities'], columns=['name', 'contact'])

            return df

    def start_diagnoser():
        question_1()

    def get_valid_input():
        while True:
            try:
                option = int(input("1-Yes 2-No 3-Not sure >> "))
                if option == 1 or option == 2 or option == 3:
                    return option
            except:
                pass
            print("\nIncorrect input, try again")

    def ask_user_to_do_covid_test():
        print("\n" + data["7"]['dialog'])
        print('\nCOVID-19 Testing Sites in Massachusetts')
        print(df_mass_test_facilities)

    def ask_user_to_continue_monitor():
        print("\n" + data["15"]['dialog'])
        print('\nCOVID-19 Testing Sites in Massachusetts')
        print(df_mass_test_facilities)

if __name__ == '__main__':
    data = load_dialog_data()
    df_mass_test_facilities = load_testing_facilities_data()
    screen = Screen()
    start_diagnoser()
```

For the main part (decision tree-based conversation), the tester will be directed to the next question based on the protocol. (questions and responses are stored in the form of JSON)

```
def question_1():
    print("\n" + data["1"]["dialog"])
    option = get_valid_input()
    if option == 1:
        print(data["1"]['yes_injection'])
        question_3()

    elif option == 2:
        print(data["1"]['no_injection'])
        print("\n" + data["2"]['dialog'])

    else:
        print(data["1"]['not_sure_injection'])
        question_3()

def question_3():
    print("\n" + data["3"]["dialog"])
    option = get_valid_input()
    if option == 1:
        screen.age = "60+"
        print(data["3"]['yes_injection'])

    elif option == 2:
        screen.age = "18-60"
        print(data["3"]['no_injection'])

    else:
        screen.age = "60+"
        print(data["3"]['not_sure_injection'])

    question_4()

def question_4():
    print("\n" + data["4"]["dialog"])
    option = get_valid_input()
    if option == 1:
        screen.covid_contact = True
        print(data["4"]['yes_injection'])

    elif option == 2:
        screen.covid_contact = False
        print(data["4"]['no_injection'])

    else:
        screen.covid_contact = True
        print(data["4"]['not_sure_injection'])

    question_5()
```

COVID-19 Dialog (JSON)

```
"1":{
  "dialog": "Hi there, I'm FauciBot!\nWelcome to COVID-19 Checker. \nIf you are experiencing life-threatening symptoms, call 911 immediately! \n\n== Disclaimer ==\nThis tool is not intended to be a substitute for professional medical advice, diagnosis or treatment.\nBy using this tool, you attest that you are at least 18 years old and agree to related Terms and Conditions of Use and Privacy Policy. \nNext, you'll see a series of Yes/No questions designed to evaluate your condition and provide guidance. \nLet's get started.\n\nFauciBot: Are you 18 or older? ",
  "type": "Question",
  "yes_injection": "FauciBot: Got it.",
  "no_injection": "FauciBot: Sorry!",
  "not_sure_injection": "FauciBot: Got it."
},

"2":{
  "dialog": "FauciBot: Unfortunately, for legal reasons, you must be at least 18 years old to use this assessment tool. \nPlease have an adult help you if you'd like to try again or you can refer to cdc.gov for more information.",
  "type": "Close",
  "yes_injection": "",
  "no_injection": "",
  "not_sure_injection": ""
},

"3":{
  "dialog": "FauciBot: Now for the next question, are you 60 or older?",
  "type": "Question",
  "yes_injection": "FauciBot: OK.",
  "no_injection": "FauciBot: OK.",
  "not_sure_injection": "FauciBot: OK."
},

"4": {
  "dialog": "FauciBot: Have you been in contact with someone known to have coronavirus also known as COVID-19?",
  "type": "Question",
  "yes_injection": "FauciBot: OK.",
  "no_injection": "FauciBot: OK.",
  "not_sure_injection": "FauciBot: OK."
},

"5": {
  "dialog": "FauciBot: Have you been told by a public health official or your employer you may have been exposed to coronavirus also known as COVID-19?",
  "type": "Question",
  "yes_injection": "FauciBot: Got it. To evaluate you further, please answer these next 5 symptom-related questions.",
  "no_injection": "FauciBot: Got it. To evaluate you further, please answer these next 5 symptom-related questions.",
  "not_sure_injection": "FauciBot: Got it. To evaluate you further, please answer these next 5 symptom-related questions."
},
```

Demo:

Test Case #1: The tester might be ok but needs to continuously monitor themselves. A list of Urgent Care in Massachusetts will be provided by the bot.

```
C:\Users\dylan>cd C:\Users\dylan\PycharmProjects\covid19-checker
C:\Users\dylan\PycharmProjects\covid19-checker>python covid19-checker.py

Hi there, I'm FauciBot!
Welcome to COVID-19 Checker.
If you are experiencing life-threatening symptoms, call 911 immediately!

== Disclaimer ==
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By using this tool, you attest that you are at least 18 years old and agree to related Terms and Conditions of Use and Privacy Policy.
Next, you'll see a series of Yes/No questions designed to evaluate your condition and provide guidance.
Let's get started.

FauciBot: Are you 18 or older?
1-Yes 2-No 3-Not sure >> 1
FauciBot: Got it.

FauciBot: Now for the next question, are you 60 or older?
1-Yes 2-No 3-Not sure >> 2
FauciBot: OK.

FauciBot: Have you been in contact with someone known to have coronavirus also known as COVID-19?
1-Yes 2-No 3-Not sure >> 3
FauciBot: OK.

FauciBot: Have you been told by a public health official or your employer you may have been exposed to coronavirus also known as COVID-19?
1-Yes 2-No 3-Not sure >> 2
FauciBot: Got it. To evaluate you further, please answer these next 5 symptom-related questions.

FauciBot: Have you started coughing within the past few days?
1-Yes 2-No 3-Not sure >> 2

FauciBot: Do you have a fever that's 100.4 degrees Fahrenheit or higher?
1-Yes 2-No 3-Not sure >> 2

FauciBot: Are you experiencing new shortness of breath?
1-Yes 2-No 3-Not sure >> 2

FauciBot: Are you experiencing new sore throat?
1-Yes 2-No 3-Not sure >> 2
FauciBot: Just a couple more questions about recent symptoms.

FauciBot: Do you have any muscle aches?
1-Yes 2-No 3-Not sure >> 3

FauciBot: Have you recently been in a skilled nursing facility, like a nursing home?
1-Yes 2-No 3-Not sure >> 2
FauciBot: Finally, a quick review of your health history.

FauciBot: Do you have any conditions such as Congestive Heart Disease, Kidney Disease, Liver Disease or Lung Disease?
1-Yes 2-No 3-Not sure >> 2
FauciBot: Great!

FauciBot: Do you have a weakened immune system such as patients that have had a transplant or are receiving chemotherapy?
1-Yes 2-No 3-Not sure >> 2

Based on your responses, the best thing to do is to continue monitoring how you feel, and practice good hand hygiene and social distancing.

If you develop additional symptoms, you can use this tool again or contact your doctor by phone or eCare before coming to a clinic or hospital.
You may also contact the Virtual Clinic or schedule a telehealth visit through eCare. Goodbye. Stay Home and stay healthy

COVID-19 Testing Sites in Massachusetts

```

	name	contact
0	AFC Urgent Care Swampscott	(781)790-4281
1	AFC Urgent Care Waltham	(781)412-7096
2	AFC Urgent Care Stoneham	(781)905-8092
3	AFC Urgent Care North Andover	(978)548-6843
4	AFC Urgent Care Arlington	(781)262-3260
5	PhysicianOne Urgent Care Westwood	(781)776-4094
6	PhysicianOne Urgent Care Chestnut Hill	(617)608-3215
7	PhysicianOne Urgent Care Waltham	(781)736-1800
8	PhysicianOne Urgent Care Medford	(781)776-4094
9	Carewell Urgent Care Tewksbury	(978)851-4683
10	Carewell Urgent Care Peabody	(978)826-5950
11	Carewell Urgent Care Billerica	(978)362-2443
12	MedExpress Urgent Care Chicopee	(413)533-3049
13	Brigham and Women's Hospital(Boston main campus)	(617)732-5500
14	Brigham and Women's Hospital(Chestnut Hill cam...)	(617)732-5500
15	Tufts Medical Center	(617)636-7216
16	Metrowest Medical CenterFramingham	(508)383-1221

Test Case #2: The tester has severe symptoms and the condition is urgent. Testers will be asked to seek to urgent medical care immediately. A list of Urgent Care in Massachusetts will be provided by the bot.

```
C:\Users\dyllan\PycharmProjects\covid19-checker>python covid19-checker.py

Hi there, I'm FauciBot!
Welcome to COVID-19 Checker.
If you are experiencing life-threatening symptoms, call 911 immediately!

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By using this tool, you attest that you are at least 18 years old and agree to related Terms and Conditions of Use and Privacy Policy.
Next, you'll see a series of Yes/No questions designed to evaluate your condition and provide guidance.
Let's get started.

FauciBot: Are you 18 or older?
1-Yes 2-No 3-Not sure >> 1
FauciBot: Got it.

FauciBot: Now for the next question, are you 60 or older?
1-Yes 2-No 3-Not sure >> 1
FauciBot: OK.

FauciBot: Have you been in contact with someone known to have coronavirus also known as COVID-19?
1-Yes 2-No 3-Not sure >> 2
FauciBot: OK.

FauciBot: Have you been told by a public health official or your employer you may have been exposed to coronavirus also known as COVID-19?
1-Yes 2-No 3-Not sure >> 2
FauciBot: Got it. To evaluate you further, please answer these next 5 symptom-related questions.

FauciBot: Have you started coughing within the past few days?
1-Yes 2-No 3-Not sure >> 2

FauciBot: Do you have a fever that's 100.4 degrees Fahrenheit or higher?
1-Yes 2-No 3-Not sure >> 1

FauciBot: Are you experiencing new shortness of breath?
1-Yes 2-No 3-Not sure >> 1

Based on your responses, it seems like your situation is urgent.
You should go to the nearest Emergency Room. If you cannot safely get there on your own, call 911.
IMPORTANT: You should call ahead to make sure the ER can prepare for your arrival.
Be sure to tell them that you were potentially exposed to the coronavirus and you also have severe difficulty breathing.

COVID-19 Testing Sites in Massachusetts

```

	name	contact
0	AFC Urgent Care Swampscott	(781)790-4281
1	AFC Urgent Care Waltham	(781)412-7096
2	AFC Urgent Care Stoneham	(781)905-8092
3	AFC Urgent Care North Andover	(978)548-6843
4	AFC Urgent Care Arlington	(781)262-3260
5	PhysicianOne Urgent Care Westwood	(781)776-4094
6	PhysicianOne Urgent Care Chestnut Hill	(617)608-3215
7	PhysicianOne Urgent Care Waltham	(781)736-1800
8	PhysicianOne Urgent Care Medford	(781)776-4094
9	Carewell Urgent Care Tewksbury	(978)851-4683
10	Carewell Urgent Care Peabody	(978)826-5950
11	Carewell Urgent Care Billerica	(978)362-2443
12	MedExpress Urgent Care Chicopee	(413)533-3049
13	Brigham and Women's Hospital(Boston main campus)	(617)732-5500
14	Brigham and Women's Hospital(Chestnut Hill cam...	(617)732-5500
15	Tufts Medical Center	(617)636-7216
16	Metrowest Medical CenterFramingham	(508)383-1221
17	St Vincent Hospital at Worcester Medical Center	(508)363-6194
18	Baystate Medical Center	(413)794-0000
19	Berkshire Medical Center	(413)447-2000
20	Holy Family Haverhill	(978)374-2000
21	Morton Hospital	(508)828-7000
22	Carney Hospital	(617)296-4000
23	Emerson Hospital	(978)360-1400
24	Sturdy Memorial Hospital	(508)222-5200
25	Lawrence General Hospital	(978)683-4000
26	Lowell General Hospital Saints Campus	(978)937-6000
27	Beth Israel Deaconess Hospital Plymouth	(508)746-2000

Summary:

This project is my starting point for chatbot development. Since it is a Rule-Based chatbot, a dialog tree is implemented. It's good for fulfilling simple tasks but not good enough for a real social interaction (like human conversation). To take the chatbot to the next level, you have to turn it to a AI powered chatbot by using Natural Language Processing algorithms (NLP).

Future works:

1. Build an UI for the chatbot.
2. Implement Deep Learning NLP algorithm.
3. Deploy the chatbot on Heroku/Facebook Messenger/Telegram.

References:

CDC COVID-19 Protocol

https://github.com/CDCgov/covid19healthbot/blob/master/screening_protocols/covid_19_screening_protocol_cdc_apple.pdf

News - Apple releases new COVID-19 app and website based on CDC guidance

<https://www.apple.com/newsroom/2020/03/apple-releases-new-covid-19-app-and-website-based-on-CDC-guidance/>

COVID-19 Screening Tool by Apple

<https://www.apple.com/covid19/>

My Github repository for this project

<https://github.com/dylan-kuo/covid19-checker>