DISEASE DETECTION EXPERT SYSTEM

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Introduction:

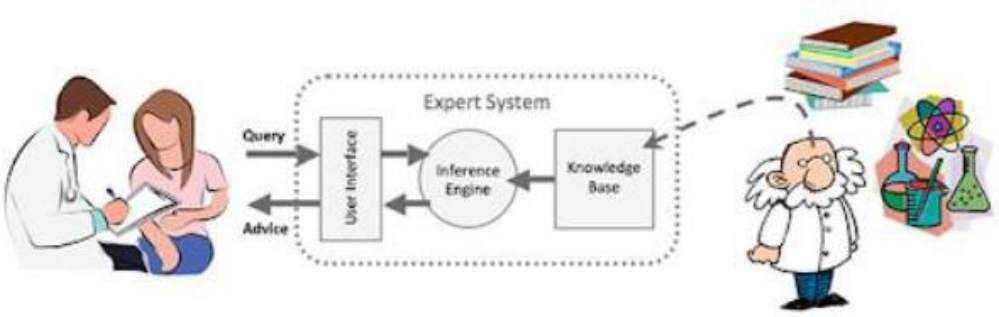
Expert System is one of the most common applications of artificial intelligence. It is a computer program that simulates the decision and actions of a person or an association that has specialist facts and experience in a particular field. Normally, such a system contains a knowledge base containing accumulated experience and a set of rules for applying the knowledge base to each situation.

A Diagnosis Expert System can help a great deal in identifying those diseases and describing methods of treatment to be carried out. This system provides information to non-professionals. In the process of diagnosing of diseases, first, it will check the symptoms that explained by the patient. The software makes inferences on basis of symptoms and provides the output (disease).

In many rural areas, access to medical advice is extremely poor. People drive long distances to hospitals or medical services, and most of these facilities have a shortage of medical experts. As a result, service is sluggish, and patients are forced to wait for lengthy periods of time without obtaining any assistance. As a result, medical expert systems can be useful in situations where medical expertise is required.

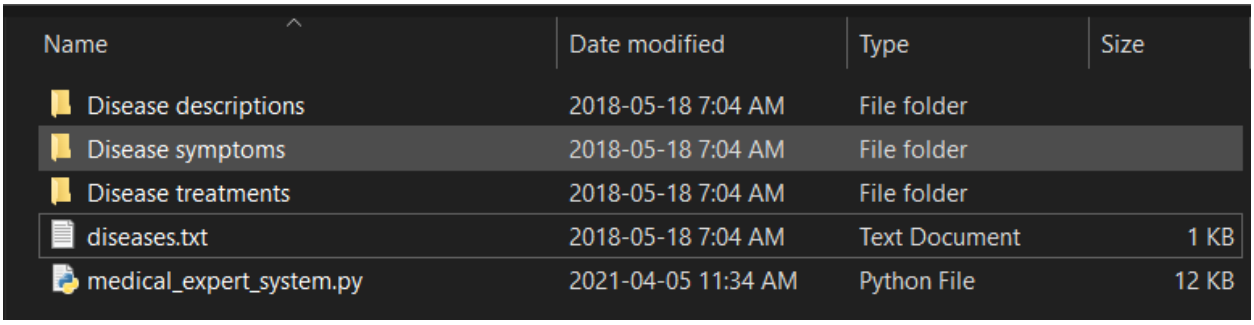
Task and Purpose of the Expert System:

Knowledge-based expert system provides the patients with medical advice and basic knowledge on various diseases. It should consider various symptoms and signs like chest pain, cough, fainting, fatigue, headache, back pain, sunken eyes, low body temperature, restlessness, sore throat, fever etc. along with its severity status and provide the patients with medical advice.



Knowledge Sources & Knowledge Acquisition:

We extracted the data manually by gathering information from variety of open data sources and public health databases.



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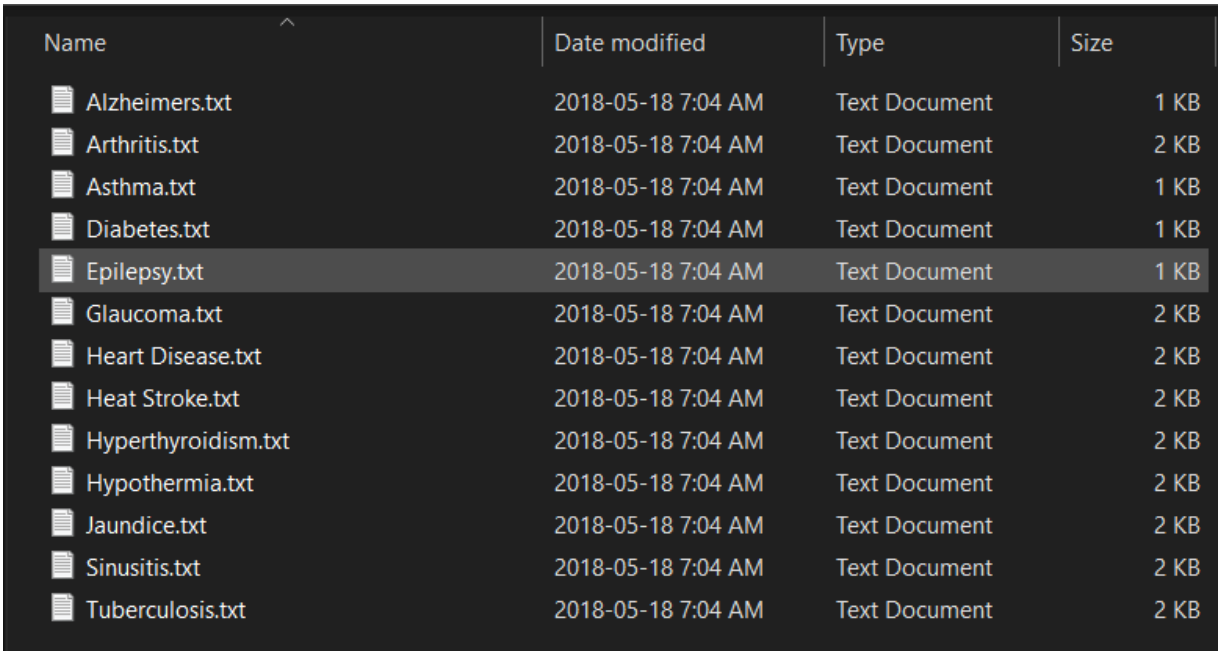
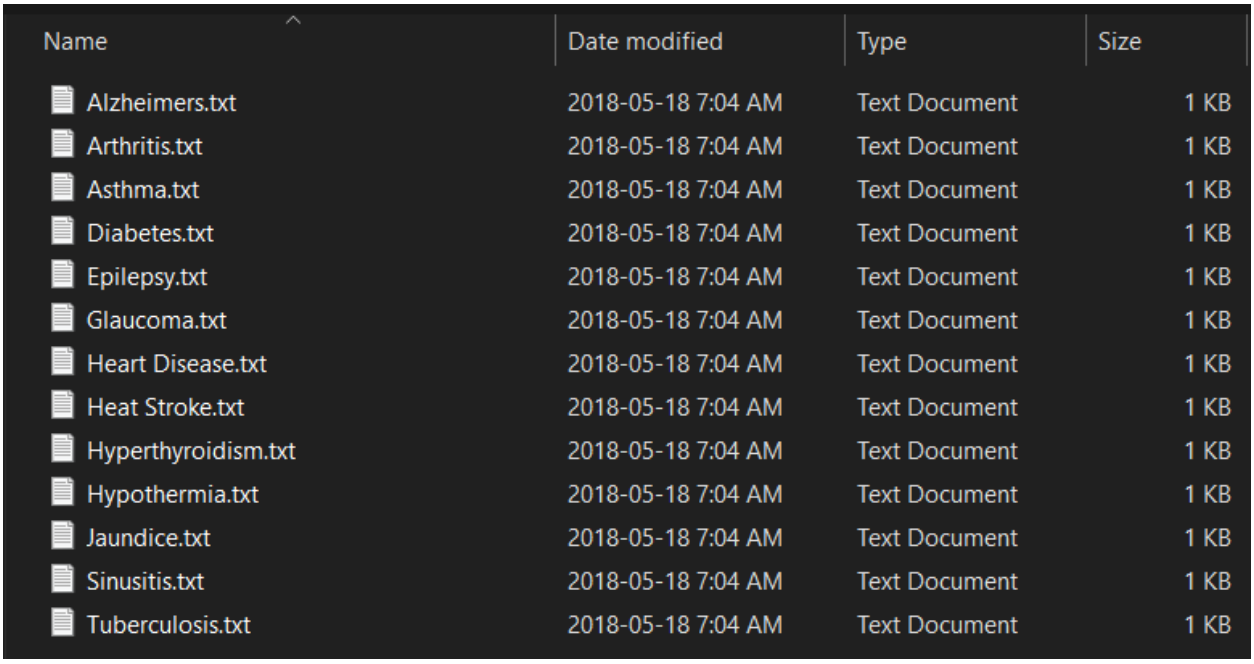
Disease descriptions	2018-05-18 7:04 AM	File folder	
Disease symptoms	2018-05-18 7:04 AM	File folder	
Disease treatments	2018-05-18 7:04 AM	File folder	
diseases.txt	2018-05-18 7:04 AM	Text Document	1 KB
medical_expert_system.py	2021-04-05 11:34 AM	Python File	12 KB

Disease Description:



Name	Date modified	Type	Size
Alzheimers.txt	2018-05-18 7:04 AM	Text Document	1 KB
Arthritis.txt	2018-05-18 7:04 AM	Text Document	2 KB
Asthma.txt	2018-05-18 7:04 AM	Text Document	1 KB
Diabetes.txt	2018-05-18 7:04 AM	Text Document	1 KB
Epilepsy.txt	2018-05-18 7:04 AM	Text Document	1 KB
Glaucoma.txt	2018-05-18 7:04 AM	Text Document	2 KB
Heart Disease.txt	2018-05-18 7:04 AM	Text Document	2 KB
Heat Stroke.txt	2018-05-18 7:04 AM	Text Document	2 KB
Hyperthyroidism.txt	2018-05-18 7:04 AM	Text Document	2 KB
Hypothermia.txt	2018-05-18 7:04 AM	Text Document	2 KB
Jaundice.txt	2018-05-18 7:04 AM	Text Document	2 KB
Sinusitis.txt	2018-05-18 7:04 AM	Text Document	2 KB
Tuberculosis.txt	2018-05-18 7:04 AM	Text Document	2 KB

Disease Symptoms:



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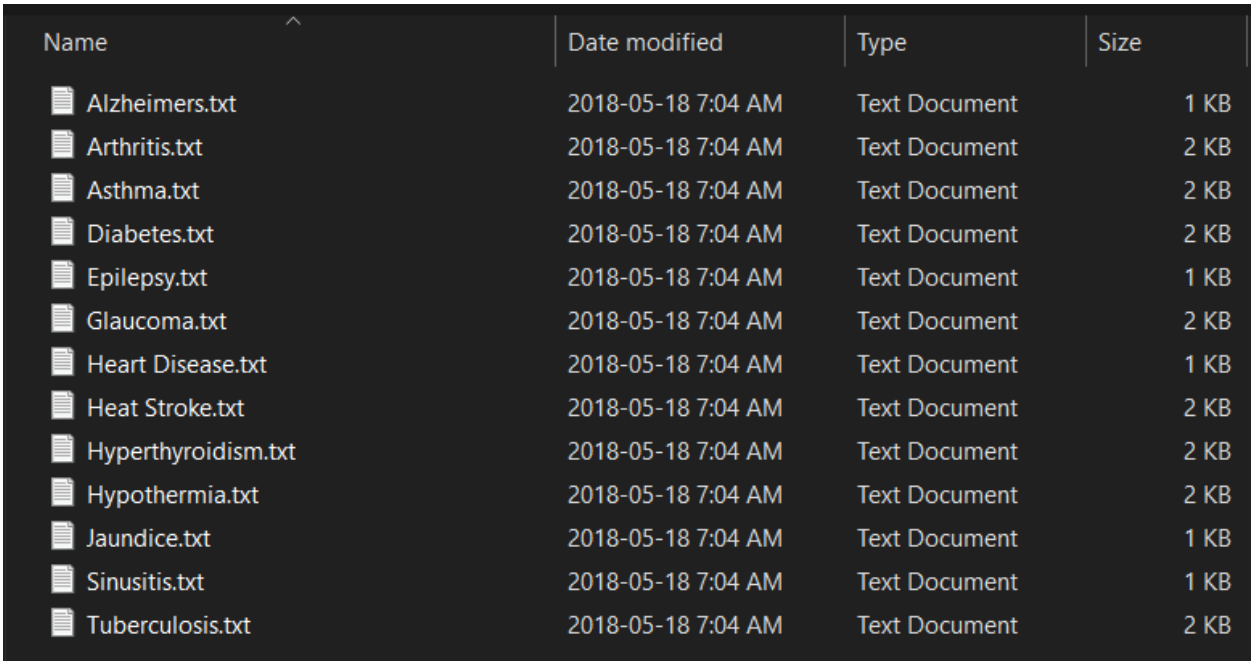
Sinusitis.txt	2018-05-18 7:04 AM	Text Document	1 KB
Tuberculosis.txt	2018-05-18 7:04 AM	Text Document	1 KB

Disease Treatments:



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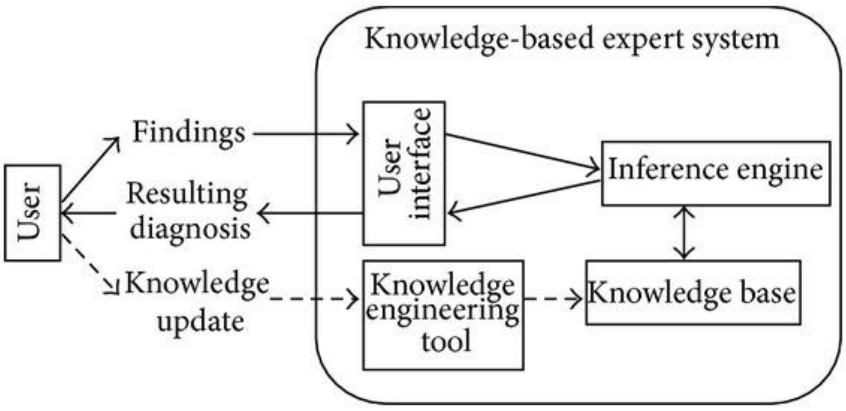
Knowledge Design & Engineering:

Based on the Symptoms Expert system prescribe the medicines, the data list contains on all the medicines that are referred to the software according to resultant disease. The Same action will be done in the case of tests and precautions. This panel consists of four data list named as a disease, medicine, test, and precautions. The output that we received is in four forms disease, medicine, test, and precaution. If we received all the outputs in the single data list, it creates a mess. To avoid this phenomenon, we distinguish them in different data lists. This will also provide us the better view of output and easier to understand. Because of this, the physician can better explain the prescription to the patient.

The architecture of the expert system usually consists of inference engine (IE), knowledge base design, user interface, knowledge acquisition unit and explanatory module.



Inference Engine: The inference engine is based on forward and backward chaining, examining the knowledge base (disease symptoms) for information that matches the user's query (kind of disease).

Knowledge Base Design: The knowledge domain was got from facts of a collection of data about the types of symptoms and diseases to be isolated and identified, the identification methods, the expected results. Data elicited for the isolation, identification of symptoms and possible recommendations on susceptibility patterns makes the knowledge base which was modeled into frames at the different levels of the decision trees and using the" IF—THEN" production rules, quick deductions are made

User Interface Unit: This unit allows a non-expert user to inquire (question) the expert system, and to find conclusion or advice. The user-interface is always designed as simple as it could be.

Knowledge Acquisition Unit: It is a process of acquiring knowledge from different sources mean acquiring, organizing, analyzing, and studying of knowledge before applying. We obtained and study data bout various disease.

Explanation Module: This section usually enables a knowledge worker to why this information has been explained and why a fact is desired.

Rules:

- In a rule- based expert system, the knowledge is represented as a set of rules.
- Each rule specifies a relation, recommendation, directive, strategy, or heuristic and has the IF (condition) THEN (action) structure.
- When the condition part of a rule is satisfied, the rule is said to fire and the action part is executed.

```
@Rule(Fact(action='find_disease'), NOT(Fact(nausea=W())),salience = 1)
def symptom_11(self):
    self.declare(Fact(nausea=input("Nausea: ")))

@Rule(Fact(action='find_disease'), NOT(Fact(blurred_vision=W())),salience = 1)
def symptom_12(self):
    self.declare(Fact(blurred_vision=input("blurred_vision: ")))

@Rule(Fact(action='find_disease'),Fact(headache="no"),Fact(back_pain="no"),Fact(chest_pain="no"),Fact(cough="no"),Fact(faint
def disease_0(self):
    self.declare(Fact(disease="Jaundice"))

@Rule(Fact(action='find_disease'),Fact(headache="no"),Fact(back_pain="no"),Fact(chest_pain="no"),Fact(cough="no"),Fact(faint
def disease_1(self):
    self.declare(Fact(disease="Alzheimers"))

@Rule(Fact(action='find_disease'),Fact(headache="no"),Fact(back_pain="yes"),Fact(chest_pain="no"),Fact(cough="no"),Fact(faint
def disease_2(self):
    self.declare(Fact(disease="Arthritis"))

@Rule(Fact(action='find_disease'),Fact(headache="no"),Fact(back_pain="no"),Fact(chest_pain="yes"),Fact(cough="yes"),Fact(fai
def disease_3(self):
    self.declare(Fact(disease="Tuberculosis"))
```

```
@Rule(Fact(action='find_disease'),Fact(headache="no"),Fact(back_pain="no"),Fact(chest_pain="no"),Fact(cough="no"),Fact(fainting="no"),Fact(sore_throat="no"),
def disease_0(self):
        self.declare(Fact(disease="Jaundice"))

@Rule(Fact(action='find_disease'),Fact(headache="no"),Fact(back_pain="no"),Fact(chest_pain="no"),Fact(cough="no"),Fact(fainting="no"),Fact(sore_throat="no"),
def disease_1(self):
        self.declare(Fact(disease="Alzheimers"))
```

User Interface:

The interaction between the User and Expert System is through inferences on basis of symptoms given by user as input and provides the predicted output (disease). The user needs to enter Yes/No for all the symptoms the system questions based on that the system suggests what disease it might be along with the prescriptions and tests.

```
In [9]: if __name__ == "__main__":
            preprocess()
            engine = Greetings()
            while(1):
                engine.reset()  # Prepare the engine for the execution.
                engine.run()  # Run it!
                print("Would you like to diagnose some other symptoms?")
                if input() == "no":
                    exit()
                print(engine.facts)
```

```
Hi! I am Dr.Yar, I am here to help you make your health better.
For that you'll have to answer a few questions about your conditions
Do you feel any of the following symptoms:

cough: yes
back pain: no
chest pain: yes
restlessness: no
fatigue: no
headache: yes
sore throat: yes
blurred_vision: yes
fainting: no
sunken eyes: yes
low body temperature: yes
fever: yes
Nausea: no

Did not find any disease that matches your exact symptoms
```

```
In [ ]:
```

```
The most probable disease that you have is Sinusitis

A short description of the disease is given below :

Acute sinusitis (acute rhinosinusitis) causes the cavities around your nasal passages (sinuses) to become inflamed and sw
ollen. This interferes with drainage and causes mucus to build up.

With acute sinusitis, it might be difficult to breathe through your nose. The area around your eyes and face might feel s
wollen, and you might have throbbing facial pain or a headache.

Acute sinusitis is mostly caused by the common cold. Unless a bacterial infection develops, most cases resolve within a w
eek to 10 days.

In most cases, home remedies are all that's needed to treat acute sinusitis. However, persistent sinusitis can lead to se
rious infections and other complications. Sinusitis that lasts more than 12 weeks despite medical treatment is called chr
onic sinusitis.

Acute sinusitis is most often caused by the common cold, which is a viral infection. In some cases, a bacterial infection
develops.
```

Implementation:

The programming language used for Expert System is Python and the Pyknow library. Pyknow is a Python library for building expert systems strongly inspired by CLIPS. The development tools used for the System is Jupyter Notebook.
Below is the list of diseases and their descriptions we are working with:

```
Jaundice
Alzheimers
Arthritis
Tuberculosis
Asthma
Sinusitis
Epilepsy
Heart Disease
Diabetes
Glaucoma
Hyperthyroidism
Heat Stroke
Hypothermia
```

```
Prevention:

Certain types of heart disease, such as heart defects, can't be prevented. However, you can help prevent many other types of heart disease by making the same lifestyle

Quit smoking
Control other health conditions, such as high blood pressure, high cholesterol and diabetes
Exercise at least 30 minutes a day on most days of the week
Eat a diet that's low in salt and saturated fat
Maintain a healthy weight
Reduce and manage stress
Practice good hygiene

Medications:

ACE Inhibitors
Antiarrhythmics
Beta-Blocker Therapy
Digoxin
Diuretics
```

Pre-Processing:

```
def preprocess():
        global diseases_list,diseases_symptoms,symptom_map,d_desc_map,d_treatment_map
        diseases = open("diseases.txt")
        diseases_t = diseases.read()
        diseases_list = diseases_t.split("\n")
        diseases.close()
        for disease in diseases_list:
                disease_s_file = open("Disease symptoms/" + disease + ".txt")
                disease_s_data = disease_s_file.read()
                s_list = disease_s_data.split("\n")
                diseases_symptoms.append(s_list)
                symptom_map[str(s_list)] = disease
                disease_s_file.close()
                disease_s_file = open("Disease descriptions/" + disease + ".txt")
                disease_s_data = disease_s_file.read()
                d_desc_map[disease] = disease_s_data
                disease_s_file.close()
                disease_s_file = open("Disease treatments/" + disease + ".txt")
                disease_s_data = disease_s_file.read()
                d_treatment_map[disease] = disease_s_data
                disease_s_file.close()
```

Defining Rules & facts:

```
@Rule(Fact(action='find_disease'),Fact(headache="no"),Fact(back_pain="no"),Fact(chest_pain="no"),Fact(cough="no"),Fact(fainting="no"),Fact(sore_throat="no"),
def disease_0(self):
        self.declare(Fact(disease="Jaundice"))

@Rule(Fact(action='find_disease'),Fact(headache="no"),Fact(back_pain="no"),Fact(chest_pain="no"),Fact(cough="no"),Fact(fainting="no"),Fact(sore_throat="no"),
def disease_1(self):
        self.declare(Fact(disease="Alzheimers"))
```

Group Members' Tasks:

Tasks	Allocated to:	Deadline
Project Selection & Work Division	All	Feb 27
Disease Selection & Descriptions	Srihitha	Mar 6
Data Pre-process and Greeting	Tarun	Mar 13
Rules & Facts	All	Mar 27
Report and Abstract	Srikanth	Apr 3
Presentation	Mohit	Apr 5