Title: Bridging Disease Diagnosis and Expert System Development: An Integrated Approach

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Abstract: An extensive examination of disease diagnostics and expert system development is provided by this assignment. The project creates disease-symptom and symptom-disease mappings, builds a knowledge base, and creates an interactive diagnosis user interface by utilizing Python modules. This shows how AI approaches can be used practically in healthcare decision support systems by analyzing a dataset that includes diseases, symptoms, disease descriptions, precautions, and symptom severity.

Introduction: Artificial intelligence is essential to the healthcare industry because it provides advanced instruments for making decisions and diagnosing illnesses. The integration of AI techniques to create an expert system for disease diagnosis is the focus of this project. This project intends to improve our understanding of how artificial intelligence (AI) can be utilized in healthcare to detect illness trends and facilitate accurate diagnosis by utilizing the capabilities of Python libraries and knowledge engineering techniques.

Methodology

1. Dataset Understanding:
    - Analyzed a dataset containing records of diseases and their symptoms
    - Analyzed a dataset containing records of 4,920 patients diagnosed with 41 distinct diseases.
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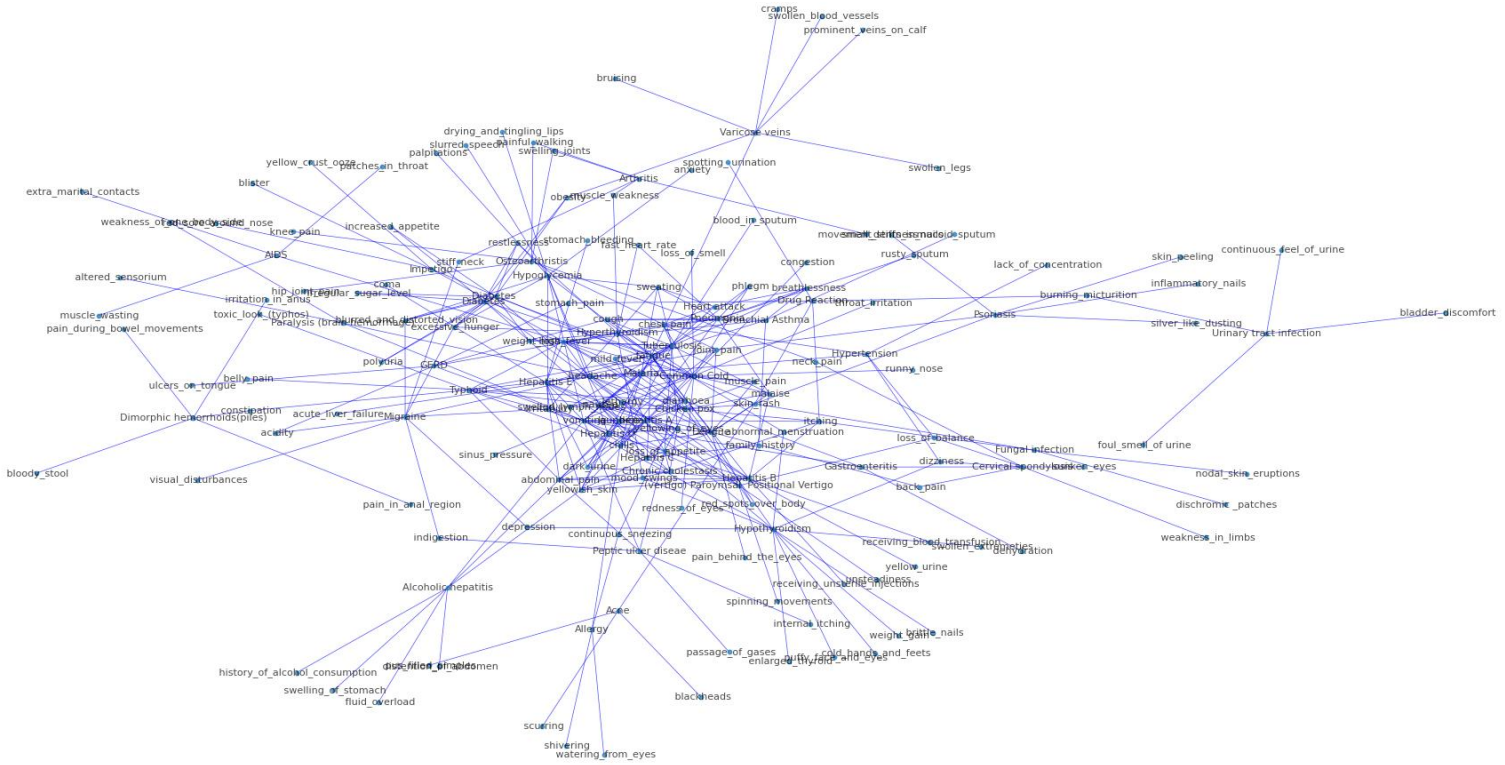

2. Knowledge Engineering:

- Built a rule-based medical knowledge base using clipspy, encoding mappings between symptoms and diagnosed diseases.
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```
(defrule Fungal_infection_8
   (or (symptom itching) (symptom skin_rash) (symptom dischromic__patches))
=>
   (assert (diagnosis "Fungal_infection"
      description "In humans, fungal infections occur when an invading fungus takes over an area of the body and is too much for the immune system to hand
      precautions "bath_twice, use_detol_or_neem_in_bathing_water, keep_infected_area_dry, use_clean_cloths"))


(defrule Fungal_infection_9
   (or (symptom itching) (symptom skin_rash) (symptom nodal_skin_eruptions))
=>
   (assert (diagnosis "Fungal_infection"
      description "In humans, fungal infections occur when an invading fungus takes over an area of the body and is too much for the immune system to hand
      precautions "bath_twice, use_detol_or_neem_in_bathing_water, keep_infected_area_dry, use_clean_cloths"))


(defrule Fungal_infection_10
   (or (symptom itching) (symptom skin_rash) (symptom nodal_skin_eruptions) (symptom dischromic__patches))
=>
   (assert (diagnosis "Fungal_infection"
      description "In humans, fungal infections occur when an invading fungus takes over an area of the body and is too much for the immune system to hand
      precautions "bath_twice, use_detol_or_neem_in_bathing_water, keep_infected_area_dry, use_clean_cloths"))


(defrule Allergy_1
   (or (symptom continuous_sneezing) (symptom shivering) (symptom chills) (symptom watering_from_eyes))
=>
   (assert (diagnosis "Allergy"
      description "An allergy is an immune system response to a foreign substance that's not typically harmful to your body.They can include certain foods
      precautions "apply_calamine, cover_area_with_bandage, use_ice_to_compress_itching"))
```

1. **User Interface Development:**
    - Developed an interactive user interface using a Python library Flask
    - Enabled users to input symptoms and receive relevant information about diseases, including names, symptoms, precautions, and descriptions.
    - Implemented dynamic symptom lists that update based on user input, facilitating efficient symptom selection and diagnosis.
    - Organized the resulting diseases based off number of matching symptoms and their severity levels

Select Your Symptoms

- [ ] bruising
- [ ] swelling_of_stomach
- [ ] depression
- [ ] acute_liver_failure
- [ ] pain_in_anal_region
- [ ] increased_appetite
- [ ] small_dents_in_nails
- [ ] red_spots_over_body
- [ ] stiff_neck
- [ ] nausea
- [ ] yellow_crust_ooze
- [ ] blood_in_sputum
- [ ] swollen_blood_vessels
- [ ] mild_fever
- [ ] blackheads
- [ ] enlarged_thyroid
- [ ] mucoid_sputum
- [ ] knee_pain
- [ ] blister
- [ ] pain_behind_the_eyes
- [ ] acidity
- [ ] irritation_in_anus
- [ ] swelling_joints
- [ ] excessive_hunger
- [ ] hip_joint_pain
- [ ] headache
- [ ] continuous_feel_of_urine
- [ ] skin_rash
- [ ] congestion
- [ ] vomiting
- [ ] weight_loss
- [ ] weakness_of_one_body_side
- [ ] shivering
- [ ] throat_irritation
- [ ] malaise
- [ ] pus_filled_pimples
- [ ] visual_disturbances
- [ ] altered_sensorium
- [ ] yellow_urine
- [ ] blurred_and_distorted_vision
- [ ] obesity
- [ ] distention_of_abdomen
- [ ] mood_swings

Results

- **Disease:** Fungal infection
  Description: In humans, fungal infections occur when an invading fungus takes over an area of the body and is too much for the immune system to handle. Fungi can live in the air, soil, water, and plants. There are also some fungi that li
  microbes, there are helpful fungi and harmful fungi.
  Symptom Match Count: 4
  Severity Score: 8
  Matched Symptoms:
    - skin_rash
    - nodal_skin_eruptions
    - itching
    - dischromic _patches
  Precautions:
    - bath twice
    - use detol or neem in bathing water
    - keep infected area dry
    - use clean cloths
- **Disease:** Chicken pox
  Description: Chickenpox is a highly contagious disease caused by the varicella-zoster virus (VZV). It can cause an itchy, blister-like rash. The rash first appears on the chest, back, and face, and then spreads over the entire body, causing
  Symptom Match Count: 2
  Severity Score: 4
  Matched Symptoms:
    - skin_rash
    - itching
  Precautions:
    - use neem in bathing
    - consume neem leaves
    - take vaccine
    - avoid public places
- **Disease:** Drug Reaction
  Description: An adverse drug reaction (ADR) is an injury caused by taking medication. ADRs may occur following a single dose or prolonged administration of a drug or result from the combination of two or more drugs.
  Symptom Match Count: 2
  Severity Score: 4
  Matched Symptoms:
    - skin_rash
    - itching
  Precautions:
    - stop irritation
    - consult nearest hospital
    - stop taking drug
    - follow up

Discussion:

Because symptoms of a disease might overlap and patient presentations can vary, diagnosing a disease frequently entails navigating uncertainty and complexity. Expert systems can handle complex diagnostic circumstances because propositional logic offers a formal framework for expressing and debating logical propositions. But it is important to recognize that medical diagnosis is inherently uncertain, particularly when there may be vague or inconclusive symptoms. A probabilistic method for modeling uncertainty is provided by Bayesian networks, which enable the system to include probabilistic relationships between symptoms and diseases and make informed diagnostic decisions.

The use of expert systems in clinical settings to diagnose diseases presents significant ethical and legal issues. It is critical to guarantee the precision, dependability, and security of the system's suggestions in order to protect patients from any injury. Openness about

the system's features, constraints, and underlying algorithms is necessary to build patient and healthcare provider confidence. Furthermore, maintaining patient security and confidentiality requires adherence to pertinent privacy and data protection laws.

Conclusion:

To sum up, the combination of propositional logic, ontology representation, and Bayesian networks presents a viable method for creating reliable expert systems for illness detection. AI-powered diagnostic systems have the ability to transform healthcare delivery and enhance patient outcomes by tackling issues with information representation, uncertainty modeling, knowledge engineering, and ethical considerations. To guarantee these technologies' successful integration into clinical practice and to further refine them, more research and development work would be required.