Heart Expert System using Bee Colony Optimization(BCO) Algorithm and Biogeography Based Optimization (BBO) Algorithm

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Abstract
In Artificial Intelligence Machine learning allows computers to learn based on data. In this paper rule-based techniques and machine-learning algorithms are used to create Human Heart disease database. The machine-learning algorithms used are Bee Colony Optimization (BCO) and Biogeography Based Optimization (BBO). The BBO and BCO techniques are used to diagnoses the diseases for the entered symptoms by the user. If the symptoms entered by the user matches to the rules available in the Knowledge base then it displays the actual disease, else it displays a message that the knowledge is incomplete. BBO technique is used in order to get the optimistic solution for the entered symptoms by the user. The proposed system is also supported by another feature called Bee Colony Optimization.

Keywords
Machine Learning, BCO, BBO, Rule Based, Probalistic Application, Expert Systems

I. Introduction

The Expert systems are the computer programs that capture some knowledge from the database. Neural Networks and Machine learning algorithms enhance the capabilities of Expert systems. Knowledge base is a collection of rules for symptoms to the diseases. Rules are structured using If/Then statements. Working memory contains the data and the values in this are used to evaluate antecedents.

A. Bee Colony Optimization

Bee Colony Optimization is a population based search algorithm that mimics the food foraging behavior of swarms of honey bees. The Algorithm is based on the dancing behavior of honey bees while moving from the nectar source to their hives. There are two different honey bee groups. First, there are the employed bees that are currently exploiting a food source. Second, there are unemployed bees that are continually looking for a food source. Unemployed bees are divided into scout bees that search around the nest and onlookers that wait at the nest and establish communication with the employed bees. The swarm is divided into employed bees, scouts and onlookers.

B. Biogeography Based Optimization

Biogeography is nature's way of distributing species, and is analogous to general problem solutions. A good solution is analogous to an island with a high HSI, and a poor solution represents an island with a low HSI. This is similar to representatives of a species migrating to a habitat. Poor solutions accept a lot of new features from good solutions. This addition of new features to low HSI solutions may raise the quality of those solutions. This new approach to problem solving is called biogeography-based optimization (BBO).

II. Problem Specification

In the Machine Learning Architecture the rule base information is provided in the knowledge by two different Machine learning techniques. The Bee Colony Optimization technique is used to give the Probabilistic disease and the Biogeography Based Optimization technique is used to give the Narrowest Disease. This expert system is used to answer the questions asked by the user related to the heart problems. Database provides connectivity between the end users ant the system. The system is divided into static part and the dynamic part. The static part is that where users can get information regarding disease and the treatment from the disease by selecting the symptoms. The dynamic Part is that where the users having an interaction with the expert system, the user has to answer the questions asked by the Expert System in Self.

III. Review of Literature

Singh et al., (2010) Biogeography based optimization (BBO) is a new inclusive vigor based on the science of biogeography. Biogeography is the schoolwork of geographical allotment of biological organisms. BBO employs migration operator to share information between the problem solutions. The problem solutions are identified as habitat and sharing of features is called migration.

Prasad Babu et al., (2011) discussed both sheep and goat disease database is created using Artificial Bee Colony and Particle Swarm Optimization algorithms. These techniques are also applied on this database to develop expert systems to diagnose the diseases affected to sheep and goat animals. This is used to determine disease with which the animal is suffering. Here the PSO technique is grouping by the intelligence in order to get the optimistic solution for the entered symptoms by the user. The proposed system is also supported by another feature called as Artificial Bee Colony Optimization i.e., a probabilistic application to enhance the capabilities.

Selva kumar et al., (2011) discusses the design of garlic expert systems using Artificial Bee Colony Optimization (ABCO) algorithms in machine learning to advice the farmers in villages through online. Here ABCO algorithm is used as backend in the knowledge base it display the major diseases when user enter the symptoms and display the best solution (disease) related to entered symptoms. Artificial Bee Colony (ABC) Algorithm was implemented which gives better results compared to implementation of Rule Based Algorithm on the system.

IV. Proposed Work

The Proposed Expert System deals with providing information to heart diseases and treatment from these diseases online. Machine learning Biogeography Based Optimization technique is used to calculate the Narrowest Heart Disease by inputting the symptoms by user. In this the Islands are the Diseases and Symptoms with some position and weight initially. The Bee Colony Optimization technique is used to find the Probabilistic heart disease. In BCO the Food Sources is Desired Disease, Employed Bees – gives

the accurate disease, Onlookers – which gives you the neighbor disease, Scouts – where there is no matching.

A. Knowledge Base - Sample Symptoms Collected By interviewing the Heart Patients

S1 = Defect in the walls separating the chambers
S2 = Heart rate Increased.
S3 = Patient profuse sweaty
S4 = Blood pressure High.
S5 = The blood returning to right side of the heart
S6 = Chest pain (tightness, heaviness, burning).
S7 = Feeling tired or light-headed
S8 = Feel Weakness and fatigue
S9 = Shortness of breath
S10 = Dizziness
S11 = Infection in blood
S12 = Losing consciousness
S13 = Fainting attacks

B. Rule Base Collected from the Domain Experts

Table 1. RULES (1=YES, 0=NO)

Table Head	Symptoms	Diagnose	Treatment
Rule 1	S1=0,S2=0,S3=0, S4=0,S5=0,S6=1, S7=1,S8=0,S9=1, S10=0,S11=0, S12=1,S13=0	Arrhythmia Disease	These methods include relaxation techniques to reduce stress, limit intake of caffeine, nicotine, alcohol and stimulant drugs.
Rule 2	S1=0,S2=0,S3=0, S4=0,S5=0,S6=1, S7=0,S8=0,S9=1, S10=0,S11=0, S12=0,S13=0	Atherosclerosis Disease	Dark green, leafy vegetables contain substantial amounts of a substance called lutein and lower incidences of atherosclerosis.
Rule 3	S1=0,S2=0,S3=0, S4=0,S5=0,S6=1, S7=0,S8=1,S9=1, S10=0,S11=0, S12=0,S13=1	Rheumatic Disease	Medication will aim to avoid overexertion. Surgery may be needed to replace the damaged valve.

V. Algorithm

A. Narrowest Disease (BBO)

Step 1: Initialization of diseases with Islands (destinations). Inputting the symptoms.
Step 2: Evaluate HSI value for each disease. Disease is provided by symptoms.
Step 3: If the Best SIV is found then carry on and goto step 5.
Step4: Else if fails then go with neighbor Island for the solution goto step 2.
Step 5: Update the results with optimized island According to HSI value.
Step 6: Stop by giving HSI value of the Island.

B. Probabilistic Disease (BCO)

Step7: Initialize the food to the Disease. Inputting the symptoms.
Step 8: Repeat steps 9 to 11.
Step 9: Employed bees gets food source, and dances in hive. Find disease related to selected symptoms.
Step 10: Onlooker bees identify the employed bee to match disease if disease found then goto step 13.
Step 11: Else onlooker bees go with the neighbor disease goto step 9.
Step 12: Scout bees when they don't have a single match of food sources in hive. If the symptoms doesn't match in database then it displays message knowledge is incomplete.
Step 13: Display the Disease (food source).

VI. Results

Fig. 1: Heart Expert System

Fig. 2: Section of Symptoms

Fig. 3: Display the Disease and Treatment Methods

VII. Conclusion and Futurework

This system is used to provide user friendly interface for giving details regarding heart diseases by providing dynamic interaction between the system and the user. In future we can design audio and video interfaces for the users for direct communication.

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