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Artificial Intelligence and its associated application in medical field

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ABSTRACT

Prediction is a crucial facet within the medical domain. This paper encourages the utilization of Artificial Intelligence for prediction in medical life as technological support. There's a powerful impact upon all activities because of health, and human consultants should have the power to choose the adequate treatment which is able to be the evolution of the patient throughout the treatment. Since the mechanisms of AI have many advantages that are appropriate for this, it assists human intelligence in decision-making/prediction. The preciseness of mathematics and also the power of current technologies are the two robust qualities used in the system when they are combined to produce positive options as a result.

Keywords— *Artificial Intelligence, Prediction, Human intelligence*

1. INTRODUCTION

Artificial Intelligence performs an important and growing function in research of management science and operational research areas. Basically, intelligence is considered as the capability to collect, understanding the data. Complex predictions with proper reasoning will make use of the intelligent machines that will replace human efforts and abilities in the medical domain. AI looks at the smart machines and software that can motive, study, gather information, manipulate, and perceive the objects. The aim is to allow machines behave like extra effective, smarter and beneficial. The fundamental areas of AI are natural language processing, speech knowledge, robotics, and sensory structures, scene recognition, neural computing. The various strategies implemented in AI are neural networks, fuzzy computation, evolutionary computing, and also hybrid artificial intelligence. AI is at greater constant, everlasting and much less expensive, also, it has the ease of duplication and dissemination. AI has many programs but considering its utility especially in medical prediction have a number of mechanisms. The final medical decision belongs to people; some automatic systems are useful for two important reasons:

- Physicians have difficulty in estimating the dangers of illness, frequently erring toward over-estimation. This problem originates from cognitive biases wherein the risk of an adverse final result is exaggerated, which includes base price fallacy.
- When implemented as part of a crucial pathway, prediction fashions have shown viable consequences on health effects and institutional resource usage. The greater intensively prediction guidelines are implemented in daily clinical care and health centre protocols, the more benefit is predicted to occur.

A medical decision-making system can gain a few crucial benefits of technology: it is not perturbed through causes which are precise to people (stress, fatigue, reduced attention), it has a superior speed large quantities of data being capable of making complicated connections among them. These systems can select or generate vital facts that are very useful for physicians. Medical domain is characterized by an exponential evolution of the knowledge. In medical lifestyles chance of errors apparition is being tired to reduce with help of various tools. Diagnosis, which is the first step from healing movements, has a crucial role here. The mechanisms of this field can be successfully used to solve problems connected to large variety of applications that need to have intelligent behaviour. It creates tools that should function better than humans. Even if technology provides power and speed, features that exceed the human ability to perform calculation, the technology is far away from the human judgment. Artificial Intelligence (AI) is a study to emulate human intelligence into computer technology. The potential of AI in medicine has been expressed by a number of researchers. The potential of AI techniques in medicine are:

- Provides a laboratory for the examination, organization, representation, and cataloguing of medical knowledge.
- Produces new tools to support medical decision-making, training, and research.
- Integrates activities in medical, computer, cognitive and other sciences.
- Offers a content-rich discipline for future scientific medical specialty.

2. LITERATURE SURVEY

It considers the unique application of artificial intelligence in medical prediction. It is concerned with providing an approach that is suitable for medical predictions and is based on probabilistic reasoning. The main task is to simplify the efforts required by the doctors since it predicts the accurate prediction based on provided data [1]. This paper uses the decision tree technique, based on prediction mechanism to predict the future occurring diseases and, avoiding before it is forthcoming. It is designed using visual studio, and the decision tree algorithm uses entropy and information gain to construct decision tree. All patients and doctors can be benefited by implementing AI and ML in their hospital management system [2]. It makes use of different AI techniques and neural networks, such as fuzzy expert systems, evolutionary computation and hybrid intelligent systems that are been used in clinical predictions. It mainly focuses on the diagnosis, treatment, and predicting outcome in many clinical scenarios [3]. It aims its application using natural language processing, which is a method to communicate with standard systems using natural language like English and make use of robots to perform as per client instructions [4]. This paper is concerned with an approach that is suitable for medical predictions such as a system based on probabilistic reasoning. This approach is used when the information handled by the system is large and complex. Since knowledge-based reasoning cannot handle complex databases. The accuracy of this decisional system is 73.33% [5]. Adriana ALBU presents two approaches suitable for medical predictions: a knowledge-based system that involves logic and a system based on probabilistic reasoning. The knowledge-based solution approach is used to implement the human process of reasoning applied to a representation of knowledge, and it represents the things that an automated decisional system should know in order to generate a solution to the problem it was developed for. In this system, it always produces a correct result, but if the graph becomes too complex, then unexpected results can be encountered. The probabilistic solution is provided by the statistical methods and its solution offered is more accurate compared to previous solution. The statistical approach associates a probability to each possible output by making use of Bayes' theorem. The accuracy of this system is 73.33% [6]. Siraj explores the potential of artificial intelligence techniques particularly for web-based medical application and a model for web-based medical diagnosis and prediction is proposed. The prediction module utilizes neural networks techniques to predict patient illness. Diagnosis module consists of expert system and fuzzy logic techniques to perform diagnosis tasks. For the prediction tasks, neural networks have been proven to produce better results compared to other techniques [7]. This paper gives a glimpse of AI's application in cardiovascular clinical care and discusses its potential role in facilitating precision cardiovascular medicine. This is implemented using deep learning with unsupervised features for big data analytics and an associative memory classifier has accuracy: 93.7% that is proved better than random forest: 88.3% and SVM: 87.4% [8].

3. THE MECHANISMS

The artificial intelligence domain provides a large variety of solutions for problems that require reasoning. This paper presents an approach suitable for medical prediction: a system based on probabilistic reasoning [1].

Probabilistic Reasoning is used in the case wherein the information to be handled by the system is very large and complex. There are two types of' Knowledge-based reasoning and reasoning based on statistical methods. For example, once a patient is diagnosed with hepatitis B., his medical investigation continues. The problem rises is connected to the evolution of the patient's medical condition. There are 3 evolutionary types of this disease (usual, with relapses and with de-compensations) and six severity levels (easy, medium, serious, prolonged, cholestasis and comatose). The solution to this can be provided by statistical methods. Thus, in a database all the standardized premises for as many patients as possible will be stored. For a new patient, the database is processed by statistical methods in order to calculate the probability of each evolutionary type and severity level of hepatitis B and so the solution offered by this method is more accurate than the previous type which is basically based on logic. The statistical approach associates a probability of each possible output. Bayes' theorem is the concept used for implementing probabilistic approach and formula for it is:

$$p(D_K|S) = \frac{p(S|D_k).\,p(D_k)}{p(S)} \tag{1}$$

This theorem describes the connection between two events $D_k$and S where D_k is the diagnosis and S is the available evidence which in this case is the vector that stores the patient's symptoms and laboratory test results in a standard form. The patient's features have a binary form like sex (M/F). Other features that can be divided into intervals and these were in the following range such as less than 20 years, more than or equal to 20 and less than 30 years, more than or equal to 30 and less than 45 years and more than or equal to 45 years (<20 years/ [20,30) / [30,45) / >45). If a patient is 34 years old will have the binary representation as 0, 0, 1, 0. Next we consider the starting time of infection in 3 ranges (7 days / [8, 21] / 22) and if the starting time was 21 days, then the values associated are 0, 1, 0 [6]. There are other features to be considered. The probability of (p($S|D_k$)) is more efficient than the probability of diagnosis direction ($p(D_K|S)$). The frequency of disease is denoted by Ω is known as a statistical population.

The probability p (D_k) is very simple to be calculated and is shown in (2). The frequency of a disease in the statistical population Ω; the number of records r that have a diagnosis D_K=1.

$$p(D_k) = \frac{\text{cardinal}\{r \in \Omega | D_k(x)=1\}}{\text{cardinal } \Omega} \tag{2}$$

The probability $p(S|D_k)$ is calculated by considering the conditional independence of all symptoms for a disease D_k. In (3), calculates this probability where n is the number of value in the input vector S, 34 is considered here, and σ_i is a symptom.

$$p(S|D_k) = \prod_{i=1}^{n} p(\sigma_i|D_k) = \prod_{i=1}^{n} \frac{p(\sigma_i, D_k)}{p(D_k)} \tag{3}$$

The probability $p(\sigma_i, D_k)$ is known as compound probability and which specifies that both events $\sigma_i$and $D_k$happen at the same time i.e., a patient with the symptom σ_i also has the disease D_k. This probability is calculated using (4) where the frequency of σ_i and D_k in population Ω is taken that must be equal to 1.

$$p(\sigma_i, D_k) = \frac{\text{cardinal } \{r \in \Omega | D_k(r)=1, \sigma_i(r)=1\}}{\text{cardinal } \Omega} \quad (4)$$

It is obvious that hepatitis B cannot influence in two different directions for the same patient and at the same time, it cannot have two different severity levels. Hence, the p(S) is calculated by knowing that the diseases are mutually exclusive i.e., only one disease is present at a time. Equation (1) is used in (5) to calculate the vector symptoms S, the probability of not having the particular disease $D_k(\neg D_k)$.

$$p(\neg D_k|S) = \frac{p(S|\neg D_k).\, p(\neg D_k)}{p(S)} \quad (5)$$

From (1) to (5) the 1/ p(S) is considered as normalization constant and its sum of probabilities is equal to 1. If their sum is not equal to 1, then it can be solved by dividing each one of their sums, and this sum is replaced by p(S) as shown in (6):

$$p(S) = p(S|D_k).\, p(D_k) + p(S|\neg D_k).\, p(\neg D_k) \quad (6)$$

Equation (7) represents the exact form of Bayes' theorem that will be applied for each of the 3 evolutionary types of hepatitis B and for each of the 6 severity levels of this disease. The results will be in numbers ranged from [0, 1]. Hence $p(D_k|S) =$

$$\frac{p(D_k).\prod_{i=1}^{n} p(\sigma_i|D_k)}{p(D_k.\prod_{i=1}^{n} p(\sigma_i|D_k) + p(\neg D_k).\prod_{i=1}^{n} p(\sigma_i|\neg D_k)} \quad (7)$$

Investigation for such mechanisms contained 165 patients, among them 15 were reserved for system's validation. Thus, the accuracy of this decisional system is 73.33%. To improve the performance of the system that it should predict a diagnosis for a patient can be done in two ways. Initially, the statistical population Ω should be large enough and include uncommon diseases. Second, if the number of analyzed inputs such as symptoms and laboratory test results are increased, then better accuracy is obtained. This decisional system doesn't provide an accurate and clear result, its output results in uncertainty, offering a level of summary.

4. CONCLUSION

The paper presented here is based on the concept of artificial intelligence that will simplify the efforts required by the doctors or physicians since it is utilized to predict the accurate prediction based on the available data. Medical diagnosis and prediction can be made more interactive for consultation using AI techniques. In clinical decision making, it requires reasoning hence; expert systems and fuzzy logic are the preferred techniques for dealing with partial evidence and with regard to the effects of proposed interventions. In case of prediction of diseases, neural networks have been proven to produce better results compared to other techniques such as statistics. Such techniques are used to explore and integrate into the system for medical diagnosis and prediction.

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