# DOCTOR'S TRUSTWORTHINESS ASSESSMENT USING MACHINE LEARNING

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**Abstract -** The Doctors Trustworthiness Assessment project aims to address a critical problem in the healthcare industry - the difficulty of patients in assessing the credibility of doctors accurately. Patients often rely on subjective metrics such as word-of-mouth recommendations and online reviews and ratings on various platforms to evaluate the trustworthiness of a doctor. However, these metrics are prone to biases and inconsistencies, and patients may not have all the information to make an informed decision. To address this issue, the Doctors Trustworthiness Assessment project seeks to develop a comprehensive, reliable, and automated method for assessing the credibility of doctors accurately. The project aims to leverage advanced technologies such as machine learning to provide a trust score that reflects the trustworthiness of a doctor accurately. Patients can use this trust score along with other factors such as the doctor's medical qualifications, specialization, reviews from other patients, and any history of malpractice to make informed healthcare decisions. Moreover, the project aims to encourage doctors to maintain high standards of professionalism and ethical behaviour by providing them feedback on their trust scores. By creating a more transparent and trustworthy environment in the healthcare industry, the Doctors Trustworthiness Assessment project hopes to improve patient outcomes and help patients make informed healthcare decisions.

***Keywords:***

Doctors Trustworthiness Assessment, Healthcare industry, Credibility of doctors, Trust score, Medical qualifications, Specialization, Reviews from patients, Professionalism, Patient outcomes.

## 1.INTRODUCTION

In today's fast paced world, it has become increasingly important to assess the trust worthiness of doctors before we seek their consultation. While there are several parameters to gauge a doctor's credibility, it can be a daunting task for patients to collect and assess this information. This is where the use of advanced technologies like machine learning can effectively help patients make informed decisions about their healthcare choices. Doctors Trustworthiness Assessment involves the development of an intelligent machine learning algorithm that uses various parameters like the doctor's personal information, qualifications, specialization, and social information to calculate their trust score. The model can help patients quickly evaluate the reliability of a doctor and make an informed decision. The use of machine learning in healthcare is becoming increasingly popular, and our project aims to leverage this technology to enhance the doctor-patient relationship by providing better transparency and trust. We believe our project will revolutionize the healthcare industry by creating a more informed and trustworthy environment. In the ever-evolving landscape of healthcare, the trustworthiness of medical professional plays a pivotal role in ensuring patient confidence and fostering a secure healthcare environment. The project at hand delves into the realm of "Doctors Trustworthiness Assessment using Machine Learning," aiming to revolutionize the traditional methods of evaluating and enhancing the credibility of healthcare practitioners. This ground breaking initiative is propelled by the integration of advanced machine learning algorithms 1 to create a comprehensive and objective framework for assessing the trustworthiness of doctors. The healthcare sector's dependence on human judgment and subjective evaluations has spurred the need for a more data-driven and unbiased approach. Machine learning, with its ability to analyze vast datasets and

identify patterns, emerges as a transformative force in this context. The project leverages diverse data sources, including patient feedback, medical records, and professional credentials, to develop a robust model for evaluating doctors' trustworthiness. Central to the project is the creation of a predictive model that considers various factors contributing to a doctor's trustworthiness. This encompasses not only clinical competence but also communication skills, ethical conduct, and patient outcomes. By amalgamating these multifaceted dimensions, the machine learning model seeks to provide a holistic evaluation that reflects the nuanced nature of healthcare relationships. Ethical considerations are paramount in the development of such a system, and the project meticulously addresses concerns related to privacy, bias, and fairness. Rigorous validation processes ensure that the model avoids perpetuating existing disparities in healthcare and maintains a focus on objective evaluation. Moreover, the project places a strong emphasis on transparency, ensuring that the inner workings of the machine learning model are comprehensible to both medical professionals and the general public. A key highlight of this initiative is its potential to augment existing accreditation processes and regulatory frameworks. The integration of machine learning into trustworthiness assessment offers a dynamic and adaptive approach, capable of continuously learning and evolving with the changing landscape of healthcare practices. This not only enhances the efficiency of evaluating doctors but also contributes to the ongoing improvement of healthcare standards. As the project progresses, collaboration with medical professionals, ethicists, and technology experts becomes integral to refining and validating the machine learning model. The interdisciplinary nature of this endeavor underscores the commitment to Page 2 of 3 creating a solution that is not only technically robust but also aligned with the values and principles of the medical community. Ultimately, "Doctors Trustworthiness Assessment using Machine Learning" seeks to usher in a new era of objective, data-driven evaluations that strengthen the foundations of trust in healthcare relationships.

## 2. LITERATURE REVIEW

This section presents a thorough review of related works, referencing studies ([1], [2], [3], [4],[5]]) that contribute valuable insights to the doctor's trustworthiness assessment.

Jiang Jie Sun, Zhi Bo Zheng, Xue Li Jiang, [1] This study examined physician trust in patients (PTP) among doctors in Anhui hospitals using a PTP scale. Results showed low overall trust levels, with around half of doctors distrusting patients' integrity. Male doctors exhibited higher trust in patients' participation and follow-up visits. Trust varied with age, education level, professional titles, income, and department. The findings suggest demographic factors influence perceived behaviors of physician trust in patients (PBPTP), which could impact doctor-patient risk management strategies. The study recommends a new risk management model based on the "official-individual-social" triple action perspective.

This paper took doctors from 10 hospitals in Anhui province as the objects of investigation and conducted a questionnaire survey on doctors from various departments including internal medicine, surgery, obstetrics and gynecology, and pediatrics (choose the opportunity of weekly meeting of corresponding hospital to conduct questionnaire survey). The research sample size is not less than 10 times of the number of observed variables to ensure the validity of the research results [24]. Therefore, the sample size selected in this study is 30 times more than the observed variables. A total of 350 copies were distributed and 329 valid questionnaires were collected, with an effective recovery rate of 94%. The survey was conducted by postgraduate students of psychology, lecturer of psychology, and associate professor of psychology. Before the questionnaire was distributed, the respondents received a unified professional training and obtained the informed consent of the respondents.

Safikureshi Mondal, Anwesha Basu, Nandini Mukherjee[2], The paper discusses contemporary research on two main aspects: efficient data models for patient-doctor relationships and suitable algorithms for computing trust factors.

For patient-doctor data models, various approaches have been explored, including activity-passivity, guidance-cooperation, bioethics, clinical models, and cloud-based systems. These models range from paternalistic doctor-centric approaches to more collaborative and predictive systems. Some models propose graphical or multilayered graph based approaches to handle heterogeneous data effectively. However, technical implementations of these models in cloud storage systems are often lacking in detail.

In the realm of trust in doctor recommendation systems, trust and trustworthiness play crucial roles across various domains such as online communities, social networks, security, e-commerce, and the semantic web. Within the healthcare domain, recommender systems are utilized for personalized care, decision-making support, identifying

important medical opinions, and planning personalized therapy.

Overall, the paper surveys existing research efforts in these areas, highlighting the importance of robust data models for patient-doctor relationships and effective trust algorithms in healthcare recommendation systems.

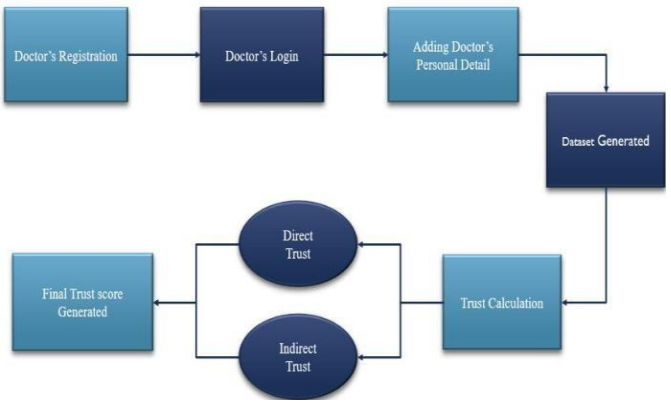
Kuldeep Singh, Anil Kumar Verma [3], This paper proposes a Trust Based Clustering Scheme (TBCS) for Flying Ad-hoc Networks (FANETs), where coordination and cooperation among nodes are crucial for efficient data transmission. The TBCS utilizes a multi-criteria fuzzy method to classify node behavior in the fuzzy and complex FANET environment, employing the Takagi-Sugeno-Kang fuzzy inference method. The scheme introduces a reward and punishment mechanism to convert node behavior into trust, aiding in the identification and isolation of malicious and misbehaving nodes within the network. Additionally, TBCS selects a secure Cluster Head (CH) based on calculated trust values, responsible for communication with ground control stations and facilitating inter-cluster communication. Comparative analysis with existing trust models demonstrates that TBCS exhibits higher accuracy, better performance, and adaptability in FANET scenarios.

Avijit Gayen, Somyajit Chakraborty [4], In this paper they will discuss about MedicaNet, which is a smart recommendation system whose sole purpose is to recommend doctors to potential patients based on symptoms provided by the patients. This recommendation system will automatically provide a list of doctors to the patients nearer to them. Our recommendation system will also automatically create a network among doctors-hospitals-patients based on trust scores. We are also adding a smart review system which will collect user reviews and update doctor ratings thus affecting the trust scores for better optimization. Finally, with all those features in mind, we will integrate it into a Smart-App

Yongjie Yan, Guang Yu, Xiangbin Yan [5], A system is designed to assist patients to find appropriate doctors. Based on the analysis of the current situation of the development of an online medical community (Haodf.com) in China, this paper puts forward recommendation suggestions of finding the right hospital and doctor to promote the rapid integration of Internet technology and traditional medical services. A new recommendation model called Probabilistic Matrix Factorization integrated with Convolutional Neural Network (PMF-CNN) is proposed in the pa per. Doctors' data in (Haodf.com) were used to evaluate the performance of our system. These model improves the performance of medical consultation recommendations by fusing review text and doctor information based on CNN (Convolutional Neural Network). The proposed PMF-CNN achieves better recommendation performances than the other state-of-the-art recommendation algorithms. And the recommendation system in an online medical website improves the utilization efficiency of doctors and the balance of public health resources allocation.

## 3. PROPOSED SYSTEM

"Finding a trustworthy doctor online can be difficult. Reviews can be biased, and information incomplete. Our system tackles this by providing a comprehensive assessment based on various data sources. Doctors get a Direct Trust Score based on their experience, qualifications, and university (weighted for importance). Additionally, a Patient Trust Score considers verified reviews and recommendations, offering a user-driven perspective. These scores combine into a final one, with a clear threshold to categorize doctors as trustworthy or not. This helps users make informed healthcare decisions with greater confidence."




The system would first require doctors to register on a platform by providing their personal details, such as name, email address, and password. After registration, doctors would log in to their accounts and enter their personal, professional, and demographic details. This information would be used to generate a dataset.

The system would then calculate a trust score for each doctor. This score would be based on two factors: direct trust and indirect trust. Direct trust would be calculated based on parameters such as the doctor's name, date of birth, age, experience, qualifications, specialization, university, and demographic information. Each

parameter would be assigned a weight, and the doctor's score for each parameter would be multiplied by the corresponding weight. The sum of these products would be the doctor's direct trust score.

Indirect trust would be calculated based on the number of recommendations received from people. The system would presumably assign more weight to recommendations from people who are themselves considered trustworthy. The sum of the weighted recommendations would be the doctor's indirect trust score.

The final trust score would be calculated by combining the direct and indirect trust scores. The system would set a threshold value, and doctors with a final trust score above this threshold would be considered trustworthy.

The system has the potential to be a valuable tool for helping people find trustworthy doctors. However, it is important to note that the system is only as accurate as the data it is based on. It is also important to remember that trust is a complex issue, and no single system can perfectly assess whether or not a doctor is trustworthy.

Overall, the proposed system has the potential to be a useful tool for helping people find trustworthy doctors. However, it is important to carefully consider the limitations of the system before using it to make important decisions about your health.

**Doctor Registration and Login:**

• Doctors first register on the platform by providing their personal details, such as name, email address, and password.

• After registration, doctors can log in to their accounts.

**Data Collection:**

• Once logged in, doctors enter their personal, professional, and demographic details.

• This data is used to generate a dataset for calculating the doctor's trust score

**Fuzzy Logic:** : Fuzzy logic can be employed to calculate trust scores by accommodating the uncertainty and imprecision inherent in trust relationships. Instead of relying solely on precise numerical values, fuzzy logic allows for the representation of trust levels using linguistic variables, such as "low," "medium," and "high." Here's a simplified explanation of how fuzzy logic can be applied to calculate trust scores:

1. Defining Input Variables: Identify factors or variables that contribute to trust, such as reliability, honesty, competence, etc. These factors can be represented as linguistic variables (e.g., "very reliable," "somewhat reliable," "not reliable").

2. Membership Functions: Define membership functions for each linguistic variable, which describe the degree of membership of a value to each category. These functions can be triangular, trapezoidal, or Gaussian, representing the fuzzy boundaries of each category.

3. Fuzzy Rules: Formulate a set of fuzzy rules that describe how input variables relate to trust levels. These rules capture the qualitative relationships between factors and trust. For example, "If reliability is high and competence is high, then trust is high."

4. Fuzzy Inference: Apply fuzzy inference to combine the input variables and fuzzy rules to determine the trust score. This process involves fuzzification (converting crisp inputs to fuzzy values), rule evaluation (determining the activation level of each rule), and inference (combining rules to generate a fuzzy output).

5. Defuzzification: Convert the fuzzy output back to a crisp value to obtain the final trust score. This can be done using methods such as centroid defuzzification, weighted average, or maximum membership principle.

**Trust Score Calculation:**

- The system calculates two types of trust scores for each doctor:
  - **Direct Trust Score:** This is based on the doctor's personal and professional information, such as name, age, experience, qualifications, and specialization. Each parameter is assigned a weight, and the doctor's score for each parameter is multiplied by the corresponding weight. The sum of these products is the doctor's direct trust score.
  - **Indirect Trust Score:** This is based on the number of recommendations received from people, presumably weighted by the trustworthiness of the recommender.

**Final Trust Score and Doctor Labeling:**

- The final trust score is calculated by combining the direct and indirect trust scores
- The system sets a threshold value and doctors with final trust score above this threshold are considered trustworthy.

## 4. TRUST SCORE FORMULA

- **Direct Trust ($T_i^d$)**

$$T_i^d = a * b^x + c * d^x + e * f^x$$

Where a, b, c, d, e are the parameters like qualification, university, experience, seniority, area. These parameters are multiplied by the corresponding weight. Then the sum of these all parameters will considered as direct trust score.

- **Indirect Trust ($T_i^R$)**

$$\sum_{i}^{n} = \frac{1}{n} T^R_i$$

Where n is the sum of followers of all doctors and i is no. of recommendation.

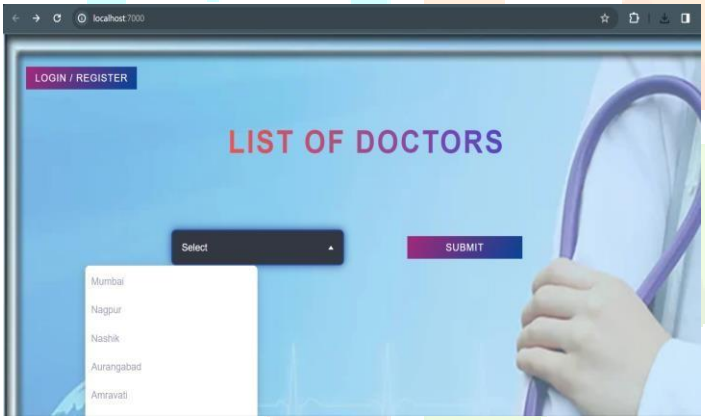
- **Total Trust Score**

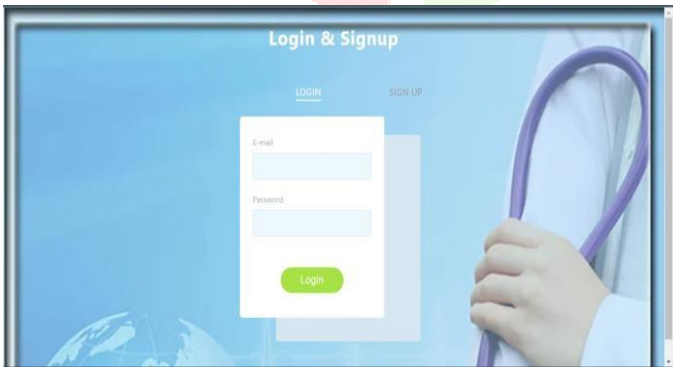
$$T^f_i = 0.7 * T^d_i + 0.3 * T^R_i$$

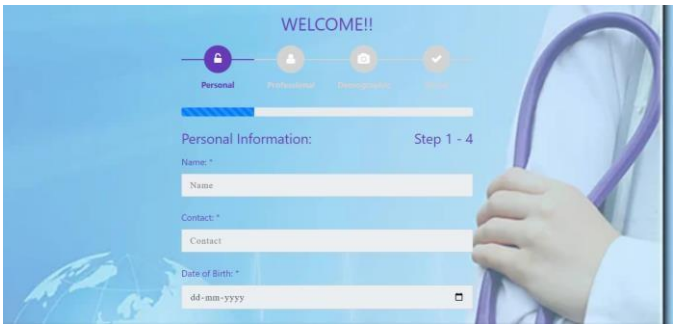
Where $T_i^d = Direct\ Trust$

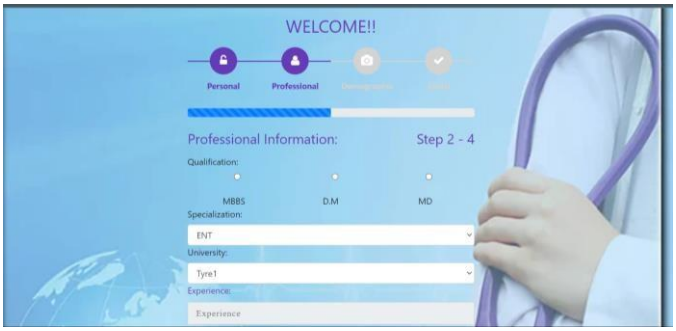
$T_i^R = Indirect\ Trust$

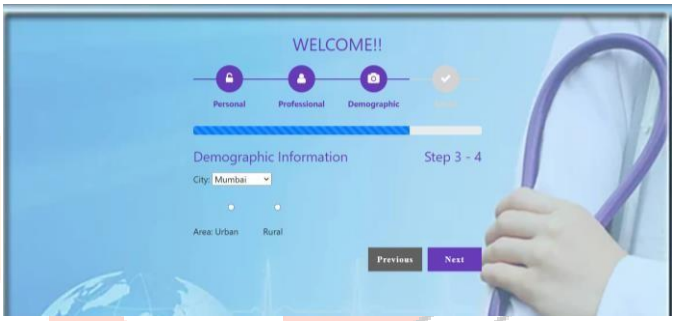
## 5. RESULTS

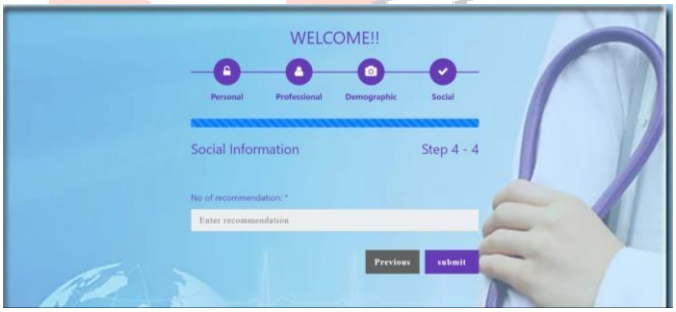


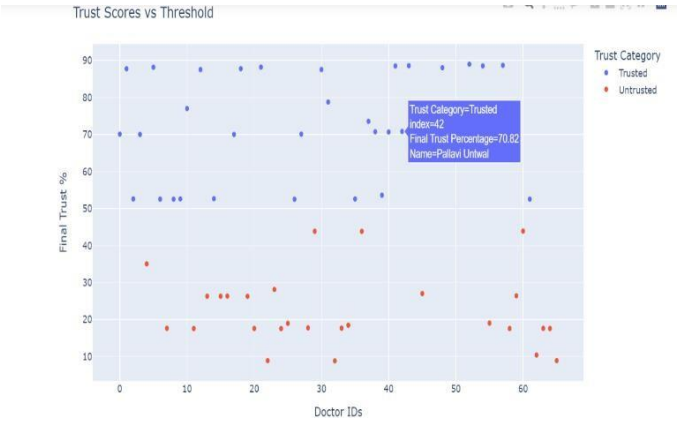



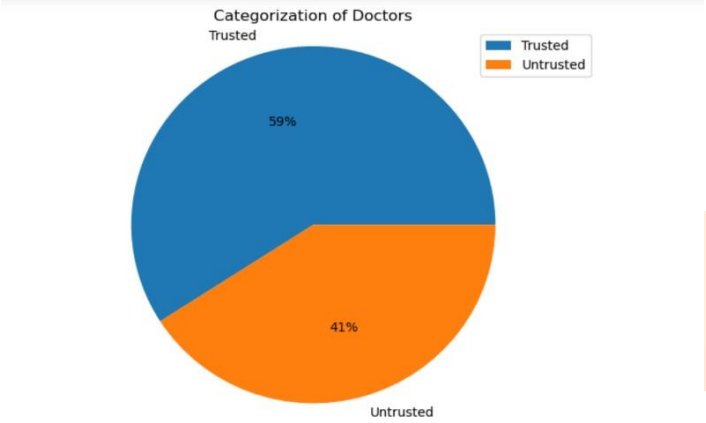

**Accuracy:**

```
Final Trust % saved to user_data.csv

                Name Final Trust %
0   Suruchi Mandrekar        70.11%
1     Milind Kulkarni        87.78%
2         Rohit Shool        52.59%
3   Ashish Shrivastav        70.03%
4    Harshad Patankar        35.03%
..                ...          ...
61       Ayush Sharma        52.54%
62     Ankesh Sahetya        10.39%
63     Ravindra Ghule        17.60%
64      Sanjeev Ahuja        17.56%
65         Vicky Jain         8.88%

[66 rows x 2 columns]
Fuzzy Model Accuracy: 64.28571428571429 %
threshold value:  51.92045454545454
```

**Scatter plot:**




**Pie Chart:**




## 6. CONCLUSIONS

Doctors' trustworthiness assessment is an important aspect of healthcare delivery that can help patients make informed decisions when seeking medical care. Using machine learning algorithms, we can assess doctors based on various criteria, such as their qualifications, experience, social factors, and past malpractices, to determine their trustworthiness score. By leveraging data analytics and natural language processing techniques, we can extract valuable insights from large amounts of data, allowing us to build a more accurate and reliable trust score system. In addition, we can use this system to identify trusted doctors in different fields and promote transparency within the healthcare industry. With technology-based solutions like this, we can enhance the quality of patient care and ensure that patients receive treatment from reliable and competent doctors.

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