

ArthriCare AI-Intelligent Arthritis Prediction and Monitoring System

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ABSTRACT- Arthritis is a condition that affects the joints. It causes a lot of pain and stiffness. This makes it hard for people to move around. We need to find out if someone has arthritis and keep an eye on them so that things do not get really bad. Arthritis is a problem and we want to help people who have arthritis. That is why we made this AI to help people with arthritis. ArthriCare AI is a system that uses computers to predict if someone will get arthritis. It looks at a lot of information about the person like how old they're what symptoms they have what they eat and what diseases they have had. All this information helps ArthriCare AI to make predictions about arthritis. We use a computer program called XGBoost to help us figure out if someone is likely to get arthritis. This program is really good at looking at a lot of information and making predictions about arthritis. We also made a website that doctors can use to keep track of their patients' health over time. Doctors can see how their patients are doing and make decisions, about how to help people with arthritis. When we tested ArthriCare AI it worked well. ArthriCare AI was able to predict who would get arthritis with a degree of accuracy.

KEYWORDS- Arthritis Prediction, Machine Learning, XGBoost, Healthcare Analytics, Artificial Intelligence, Disease Prediction System

I. INTRODUCTION

Arthritis is a term medical condition that causes inflammation of joints leading to pain, stiffness and limited in to the mobility. It is one of the common health problems around mobility. The world and it really affects the quality of life of patients. To prevent joint damage and long-term disability it is very important to detect and monitor arthritis early. Traditional arthritis diagnosis methods are based on examinations, laboratory tests and radiographic imaging like X-rays. These methods are effective. They often need special medical facilities and may delay early detection especially in areas that are far away from cities. Machine learning algorithms can look at a lot of healthcare data. Find patterns that are linked to disease risk. This paper talks about ArthriCare AI. An Intelligent Arthritis Prediction and Monitoring System. This system is driven by Artificial Intelligence. It looks at patient health parameters to predict arthritis risk. The system uses machine learning, data preparation methods and a web-based interface to provide efficient arthritis risk assessment. ArthriCare AI is designed

to help patients with arthritis and it focuses on arthritis, which's a big health problem. The goal of ArthriCare AI is to help people with arthritis and to make it easier to detect arthritis early which is very important for patients, with arthritis.

Machine learning techniques have significantly improved healthcare analytics by enabling early disease prediction and decision support systems [13]. These methods can analyze large volumes of patient data to identify hidden patterns associated with disease risk. The integration of artificial intelligence in healthcare systems enhances diagnostic accuracy and supports continuous monitoring of patients [12].

II. RELATED WORK

The use of machine learning in healthcare is something that has been studied a lot. Machine learning models can look at a lot of data and find patterns that doctors might not see otherwise. Machine learning is being used in healthcare to predict and diagnose diseases.

Peng et al. [1] proposed a neural network approach to diagnose rheumatoid arthritis using X-ray images, achieving high accuracy. Hetland et al. [2] analyzed data to predict infection risks in rheumatoid arthritis patients undergoing treatment.

Mendoza-Pinto et al. [3] explored machine learning models to predict patient response to treatment, highlighting the importance of personalized healthcare.

Dudek et al. [4] developed computational methods to detect arthritis early using antibody data. Rajesh et al. [5] proposed a method for segmenting X-ray images to improve arthritis detection. Mehta et al. [6] used classification algorithms to distinguish between osteoarthritis and rheumatoid arthritis. Litjens et al. [7] conducted a survey on deep learning in medical image analysis, demonstrating its effectiveness in healthcare diagnostics. These studies [8] [9] [10] shows that machine learning plays an important role in disease detection. However, most existing systems only focus on prediction or diagnosis and do not provide recommendations. The ArthriCare AI [11] system addresses this gap by offering a solution for both prediction and monitoring.

III. EXISTING SYSTEM

The existing healthcare systems for arthritis diagnosis mostly. Use clinical methods like physical examination,

laboratory tests and radiographic imaging techniques including X-rays and MRI scans. Doctors look at symptoms such as joint pain, stiffness, swelling and reduced mobility to see if the patient has arthritis. These diagnosis procedures need medical equipment and expert doctors, which are not always available at all healthcare facilities especially in rural or remote areas. In cases arthritis is only diagnosed after the disease has gotten really bad. Traditional diagnosis approaches mainly look for symptoms that can be seen or damage to the joints, which makes it hard to find the disease.

Also, these methods can take a time and cost a lot of money making it hard for patients to get checked regularly. Arthritis diagnosis is very important. Arthritis treatment is often delayed because of these old methods.

IV. PROPOSED SYSTEM

The ArthriCare AI system is a way to predict and monitor arthritis. It uses a kind of computer program called machine learning to help figure out if someone is at risk of getting arthritis early on. The ArthriCare AI system looks at lots of information about a person’s health like how old they’re what symptoms they have what their medical history is, how they live their life and other important details to find patterns that might mean they will get arthritis. The ArthriCare AI system takes all the health information it collects. Does some work to make sure it is good and useful. This means it cleans up the data makes sure everything is consistent and picks out the important parts. This helps the computer program get the information so it can make good predictions. The main part of the ArthriCare AI system is a

computer program that uses something called the XGBoost algorithm to make predictions. The XGBoost algorithm is really good, at helping computers make decisions. It works very well for tasks that involve looking at lots of information and picking out the important parts. The system applies data preprocessing techniques such as cleaning and feature selection, and uses the XGBoost algorithm to analyze patient data and predict arthritis risk accurately. The proposed system utilizes the XGBoost algorithm for arthritis prediction due to its high efficiency and performance in classification tasks [1].

V. SYSTEM ARCHITECTURE

The ArthriCare AI is a system that helps predict and monitor arthritis. It is made up of parts that work together to collect data get it ready use machine learning to make predictions and let users interact with it through a website. This system is designed to process data and accurately predict the risk of arthritis using machine learning. The way the system works is that users, like patients or doctors start by putting in their health information through the website. This includes things like how old they’re what symptoms they have what their medical history is and what kind of lifestyle they lead. After all the information is put in it goes to a part of the system that gets the data ready. The proposed ArthriCare AI system is shown in Figures 1 to 6. Figure 1 shows the system design. The design has parts like collecting data, cleaning data using machine learning to make predictions and a user interface. The design shows how patient information, like symptoms and medical history is used to predict arthritis risk.

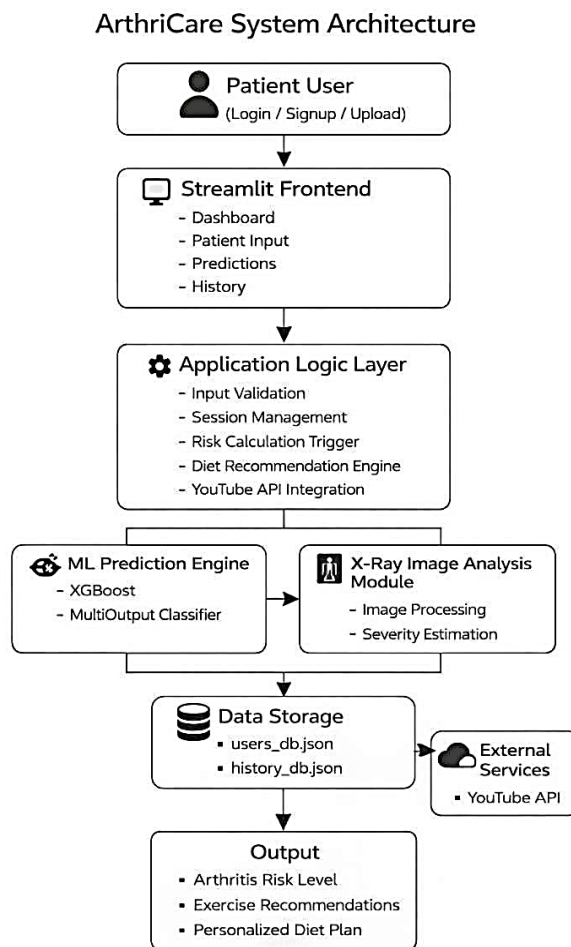


Figure 1: Architecture of the ArthriCare AI System illustration patient interaction, X-ray image analysis module

In the above [Figure 1](#), we illustrate the ArthriCare System Architecture, showing the end-to-end workflow of an AI-based healthcare application for arthritis prediction and management.

The process begins with the patient/user, who interacts with the system through a Streamlit frontend that provides features like dashboard access, patient data input, prediction viewing, and history tracking. The input is then processed in the application logic layer, which handles validation, session management, risk calculation, diet recommendations, and integration with external services (e.g., YouTube API).

Next, the system uses two core analytical modules: an ML prediction engine (using XGBoost and multi-output classification) and an X-ray image analysis module for

image processing and severity estimation. All relevant data is stored in database files (users and history JSON files).

Finally, the system generates outputs such as arthritis risk level, exercise recommendations, and a personalized diet plan, providing actionable insights to the user.

VI. IMPLEMENTATION

The ArthriCare AI. Intelligent Arthritis Prediction and Monitoring System is built using Python and many machine learning and web development tools. This system uses the XGBoost algorithm to predict arthritis risk based on health data. The data includes symptoms, age, lifestyle factors, and medical history. The ArthriCare AI helps predict arthritis risk. It uses data to make predictions. The system relies on XGBoost for results.

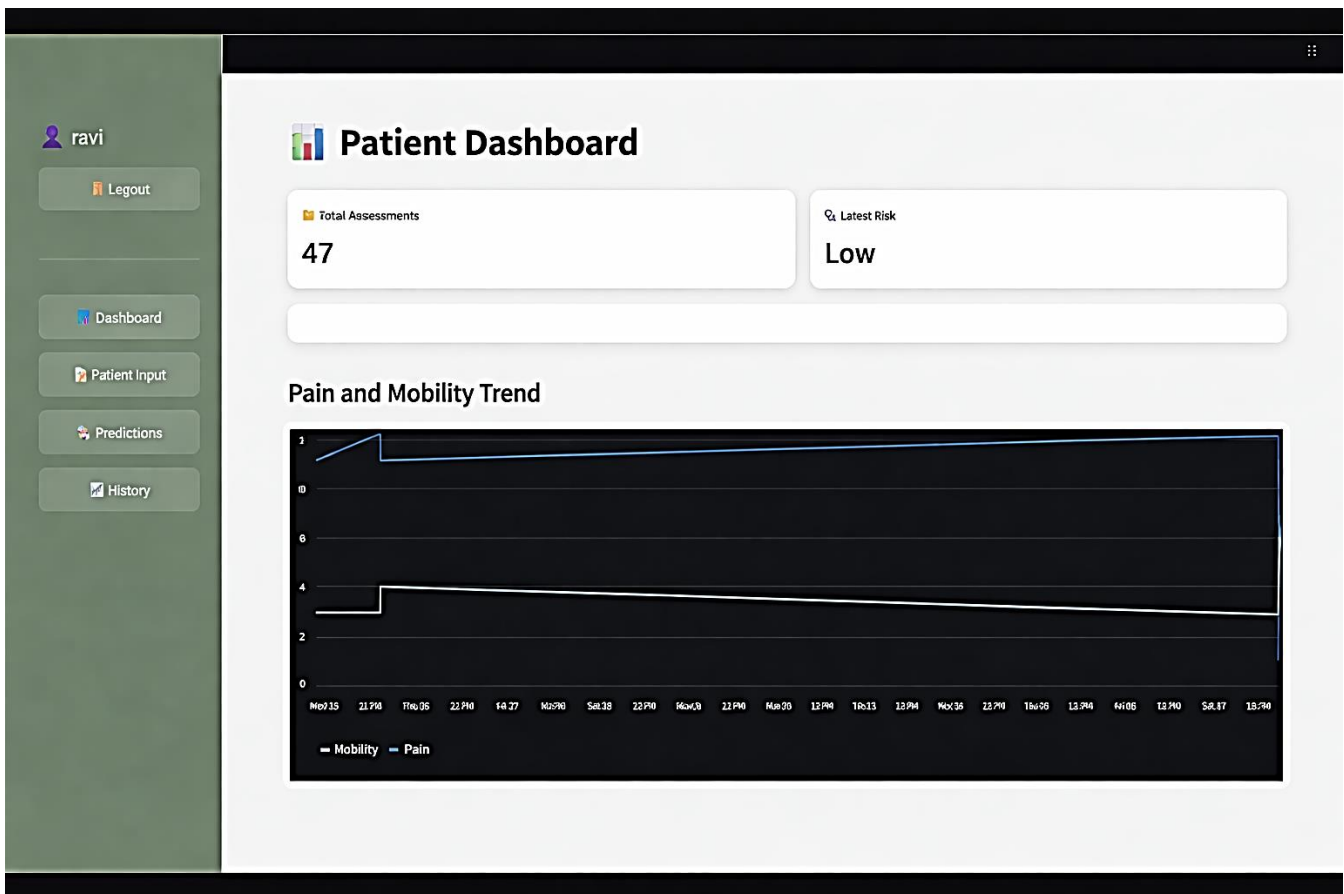


Figure 2: ArthriCare AI Dashboard for Monitoring Patient Health.

In [Figure 2](#) we shows the dashboard of the system. The dashboard helps users track health and see prediction results. It provides a summary of the patient's health status, including total assessments (47) and the latest risk level

(Low). The left sidebar allows navigation to different sections such as dashboard, patient input, predictions, and history.

Patient Assessment

* Fields marked with * are mandatory.

Age *
25

Gender *

Male
 Female
 Other

How do you want to give input?
 Upload X-ray images
 Enter manually (no images)

Select all affected joints *

Elbows x

Upload X-ray images (YouTube allowed)

Limit: 200MB per file: JPG, JPEG, PNG

Browse Files

elbowr.jpg

Figure 3: Patient Data Entry Form in ArthriCare AI System

In Figure 3 we shows how patients’ data is entered into the system. Users enter health and lifestyle information for analysis. This is a data entry screen for recording patient

details, vital signs, and uploading medical documents, likely used by healthcare professionals for diagnosis or monitoring.

Arthritis Prediction & Recommendations

Risk Level
High

Gender: Male

Affected joints: **Elbows**

X-rays uploaded: 1

Pain Score: 9

Mobility Score: 3

Recommended Exercises (Videos)

- Elbows

Figure 4: Arthritis Prediction Result with Recommendations

In the above Figure 4, it shows the prediction results. It displays arthritis risk levels. Suggests ways to prevent it. This interface presents AI-based arthritis risk assessment

along with personalized exercise recommendations, helping doctors or patients understand severity and manage the condition effectively.

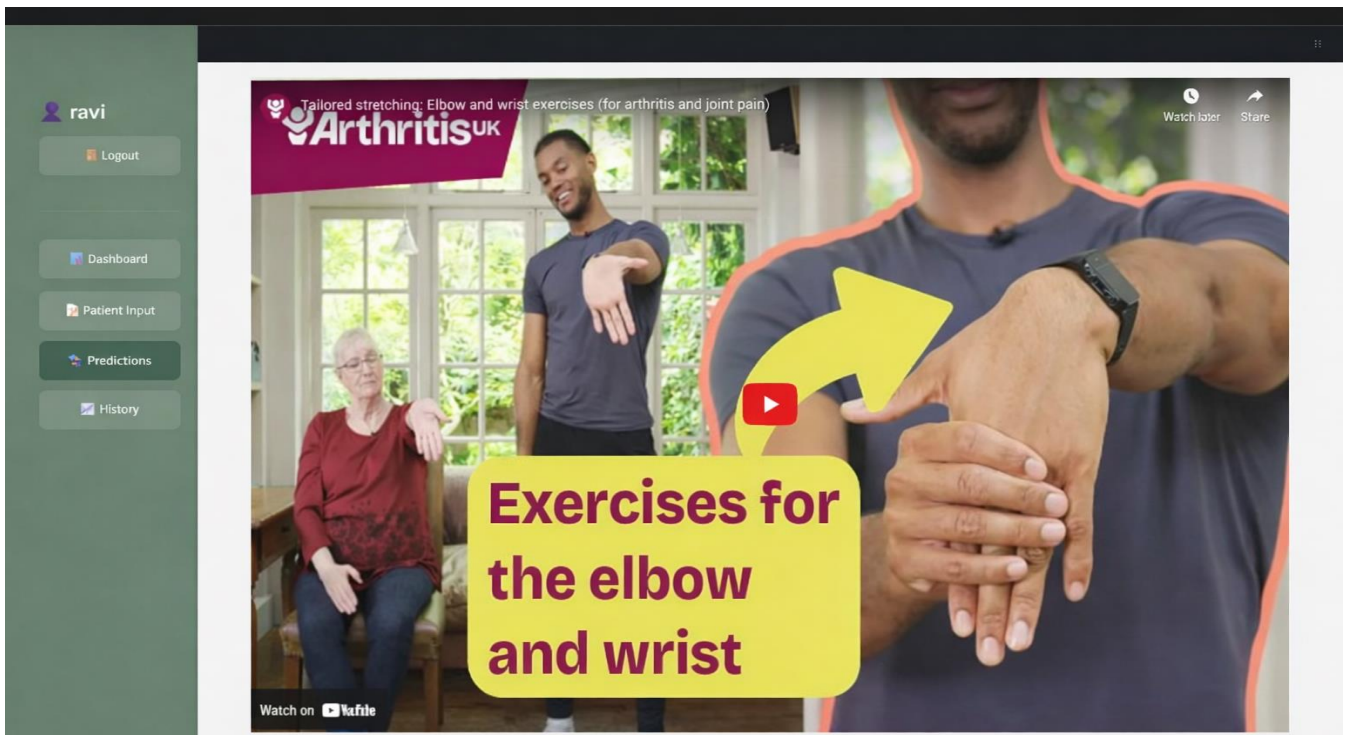


Figure 5: Recommended Exercise Video of ArthiCare

In Figure 5, it shows exercise suggestions. The system recommends exercises to improve mobility. This figure highlights how ArthiCare not only predicts arthritis risk but

also offers interactive rehabilitation support through exercise videos, enhancing patient care and self-management.

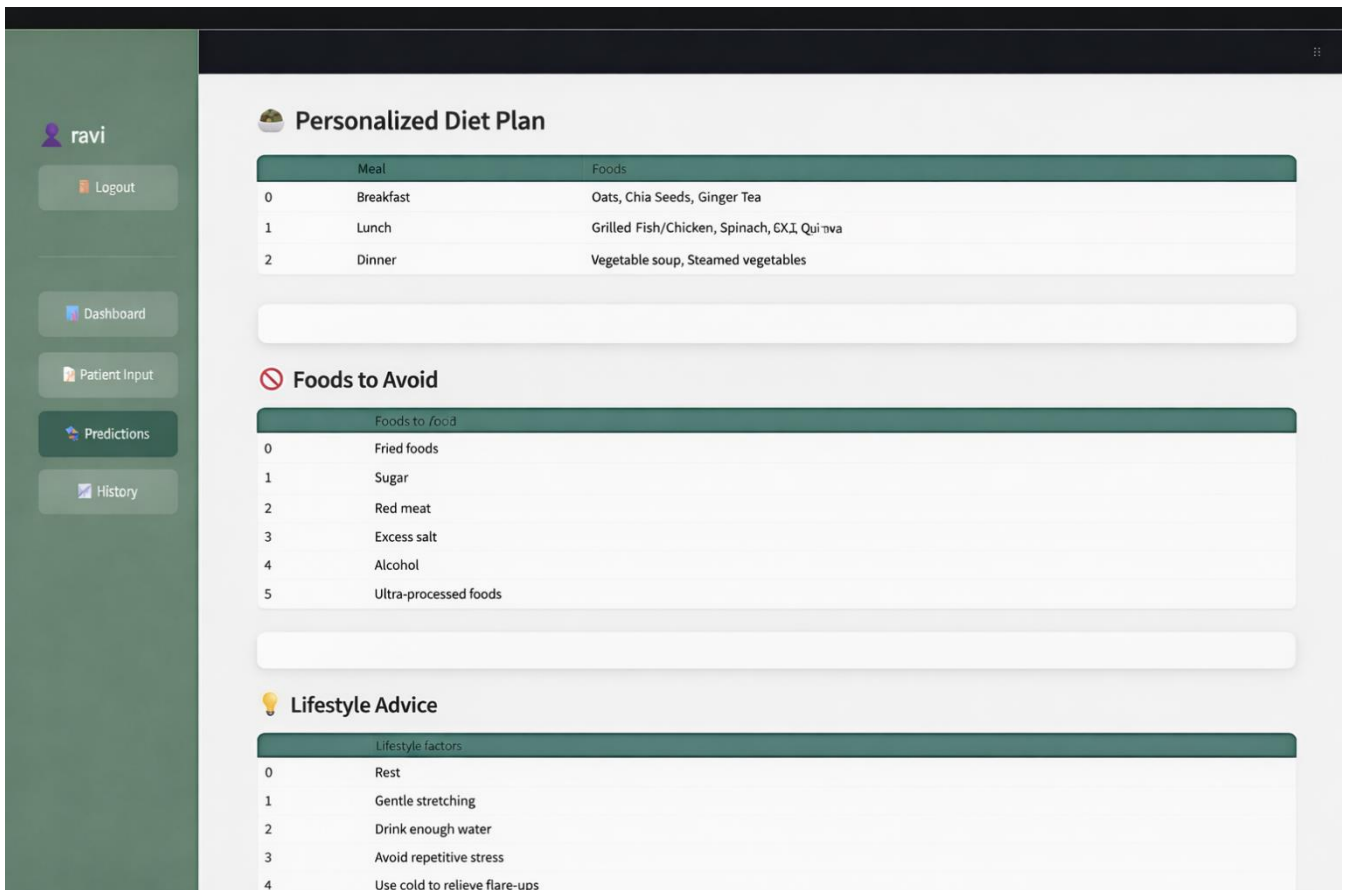


Figure 6: Personalized Diet Plan and LifeStyle Advice

In Figure 6, it shows a personalized health recommendation module in the ArthriCare system, focusing on diet and lifestyle management for arthritis patients. It gives advice to help patients manage arthritis symptoms. These figures show how the ArthriCare AI system works and how users interact with it. The ArthriCare AI system helps patients, with arthritis.

VII. RESULT AND DISCUSSION

A. System Performance Analysis

The ArthriCare AI systems performance was tested using metrics. The model did well in predicting arthritis risk levels from data and X-ray images. It achieved overall performance with balanced accuracy. The system used both information and X-ray images to make predictions, which made it more reliable. The researchers compared machine learning models to see which one worked best. The models tested were XGBoost, Random Forest and Support Vector Machine. XGBoost performed best while Random Forest also did well. The Support Vector Machine model did not do well but still worked fairly well in classifying arthritis risk levels. These results show that the ArthriCare AI system can help detect arthritis and assist healthcare professionals in making decisions. The proposed system is capable of supporting arthritis detection and assisting healthcare professionals in decision-making. The ArthriCare AI system is a tool, for identifying arthritis risk levels.

Recall: 89%

F1-score: 89.5%

Support Vector Machine model:

Accuracy: 88%

Precision: 87%

Recall: 86%

F1-score: 86.5%

These results show that ArthriCare AI can help detect arthritis and support healthcare professionals in making decisions.

The ArthriCare AI systems results are good. The ArthriCare AI system can be used for early detection.

The system is helpful, for healthcare professionals.

B. Prediction Accuracy

The arthritis prediction model is pretty good at predicting the results. We checked how well it did by looking at the results and what it predicted. The model is really good at telling the difference between people who're at different risk levels for arthritis. We used a different way to measure how well it did like precision and recall and something called F1-score. When we compared the machine learning models, we found out that the XGBoost algorithm is the best at making predictions. The Random Forest model is also good. The Support Vector Machine model gives us another way to look at the results. This means that our system works well for all kinds of patients and can be used to figure out who is at risk for arthritis. The XGBoost algorithm and the arthritis prediction model are important for making predictions. We think the arthritis prediction model is a tool because it can help us understand arthritis risk levels.

C. User Interface And System Usability

The ArthriCare AI system has a simple and easy to use interface. The main page gives us an overview of information what we think will happen and what happened before. We can enter details choose which joints are affected and add X-ray pictures to the patient assessment part. The ArthriCare AI system also shows us how pain and mobility are changing over time. The ArthriCare AI system interface is designed to be easy for patients and healthcare professionals to use.

D. Discussion of Results

The test results show that our system can accurately predict arthritis risk. It does this by combining symptoms with medical imaging data. The system uses machine learning to find patterns that are hard to spot manually. This helps doctors diagnose arthritis early and track how symptoms change over time. The system is a tool, for keeping an eye on patients and catching problems early. The patient data and visualization tools are also really useful. They help doctors see how symptoms progress and make decisions. Our system makes it easier to monitor patients continuously. It provides insights that can inform treatment plans. The results are. Show that our system can be a valuable asset. It can help doctors predict and manage arthritis effectively, which it helps to the doctors to diagnose the arthritis which can we spot it.

E. Model Testing

The arthritis prediction model was trained using a labeled dataset that has symptoms and medical imaging information. The dataset was divided into two parts: one for training and one for testing to see how well the model works with data. When the model was being trained it found patterns that are associated with arthritis risk levels. The testing part was used to check if the model can really predict things correctly and to make sure the system works well when we use it with patient data.

Table 1: Different machine learning models

Model	Accuracy	Precision	Recall	F1-Score
XGBoost	94%	93%	92%	92.5%
Random Forest	91%	90%	89%	89.5%
Support Vector Machine	88%	87%	86%	86.5%

In the above Table 1, it shows how different machine learning models do when it comes to predicting arthritis. These models are XGBoost, Random Forest and Support Vector Machine. We looked at how accurate they're how precise they are, how well they recall things and their F1-Score. XGBoost did the best it got 94 percent of the predictions right. This makes XGBoost the best model for figuring out if someone's at risk for arthritis. Random Forest also did a job it was just a little less accurate than XGBoost. Support Vector Machine did not do well as the other two. This comparison shows that choosing XGBoost as the model, for the ArthriCare AI system was a good idea.

The data used for developing the ArthriCare AI system was collected from medical datasets and simulated patient records for testing purposes. The dataset includes details like age, gender, joints affected pain level and mobility.

Also X-ray images of joints were added to help with image analysis. The collected data was carefully checked Reviewed to ensure it was consistent and reliable before being used to develop the model.

VIII. CONCLUSION

The ArthriCare AI system is what this paper is about. The ArthriCare AI system is a tool that helps doctors figure out if someone is going to get arthritis. It does this by using information from patients and looking at X-ray pictures. The ArthriCare AI system uses something called machine learning. It is easy to use the ArthriCare AI system. This means the ArthriCare AI system can tell people if they are at risk of getting arthritis in a way that's accurate and fast. The people who made the ArthriCare AI system tried it out. It worked well. The ArthriCare AI system was good at predicting if someone would get arthritis by looking at their symptoms and X-ray pictures. The ArthriCare AI system is a start. This will make the ArthriCare AI system more accurate.

IX. FUTURE SCOPE

We can make the system better by using deep learning algorithms like Convolutional Neural Networks for analyzing X-ray images and detecting arthritis. This will help us find arthritis better. The system will work better if we train it with more medical data from different people. This means the system will be more accurate and work well for all kinds of patients. We can make a mobile app version of the ArthriCare AI system so patients can check their arthritis risk and track how they are feeling on their smartphones. On the system might work with wearable health devices to get real information about how people move their joints how active they are and how well they can move around. The system can also be used to find joint problems, like osteoporosis or rheumatoid arthritis by using the same kind of artificial intelligence approaches, which will help us detect arthritis and other joint diseases.

CONFLICT OF INTEREST

The authors declared that they have no conflict of interest.

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