International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 04 | April - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Scoliosis and Knee Osteoarthritis Classification and Detection using X-Rays

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Abstract - Medical imaging plays a pivotal role in the early detection and accurate classification of musculoskeletal disorders. This study focuses on the development of a robust and efficient system for the detection and classification of two prevalent musculoskeletal conditions: scoliosis and knee osteoarthritis, using X-ray images. Scoliosis is a lateral curvature of the spine, while knee osteoarthritis involves the degeneration of knee joint cartilage and underlying bone.The proposed system leverages state-of-the-art deep learning techniques to automatically detect and classify these conditions from X-ray images. The workflow involves three main stages: preprocessing, feature extraction, and classification. During preprocessing, the X-ray images are normalized, noise-reduced, and anatomical landmarks are identified for accurate alignment.

Key Words: Detection and classification, knee osteoarthritis, ordinal classification, X-rays.

1.INTRODUCTION

Scoliosis and knee osteoarthritis are two distinct medical conditions that affect the musculoskeletal system. Detecting and classifying these conditions using X-rays is an important medical application that can aid in early diagnosis and treatment planning. Scoliosis is a medical condition characterized by an abnormal curvature of the spine. It can occur in various degrees of severity and can affect people of all ages. The curvature can be in the shape of an ”S” or a ”C.” Scoliosis is typically categorized as mild, moderate, or severe, depending on the angle of the curvature. Knee osteoarthritis is a degenerative joint disease that primarily affects the knee joints. It occurs when the protective cartilage that cushions the ends of bones wears down over time, leading to pain, stiffness, swelling, and reduced joint mobility.

Description: Knee osteoarthritis (KOA) is one of the major causes of lower limb disability. This study aims to develop a computer-based approach to discriminate KOA individuals from controls by using entropy-based features, and therefore to provide an auxiliary, quantitative tool for KOA diagnosis. The surface EMG (sEMG) data were collected from the vastus lateralis, vastus medialis, biceps femoris, and semitendinosus when KOA participants and controls were walking barefoot on ground at a self-paced speed. We employed and compared three different entropy measures, including 1) approximate entropy, 2) sampleentropy, 3) fuzzy entropy, for extracting KOA-related features from the sEMG signals for classification.The differences between the KOA group and healthy controls are primarily shown in the fuzzy entropy features extracted from the vastus medialis and biceps femoris muscle pair.

2.Existing System

The motivation behind developing a system for the detection and classification of scoliosis and knee osteoarthritis using X-rays stems from several important factors: Early Detection and Intervention: Early detection of medical conditions is crucial for effective treatment and management. By identifying scoliosis and knee osteoarthritis at an early stage through X-ray analysis, medical professionals can implement interventions and therapies to prevent further progression of these conditions, potentially improving patients' quality of life.

3.Methodology

Admin : In this module,the Admin has to log in by using valid user name and password. After login successful he can do some operations such as View All Users and Authorize

End User : In this module, there are n numbers of users are present. User should register before doing any operations. Once user registers, their details will best or to the database. After registration successful,he has to login by using authorized user name and password.

Data Flow Diagram (DFD) :

Below is a simplified Data Flow Diagram (DFD) illustrating the flow of data and processes for the mentioned system functions:

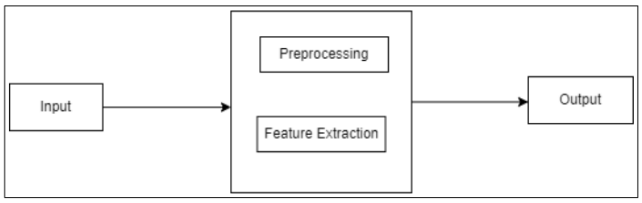


Figure 4.3: Data Flow(1) diagram

Figure 1: Data Flow Of Process 1

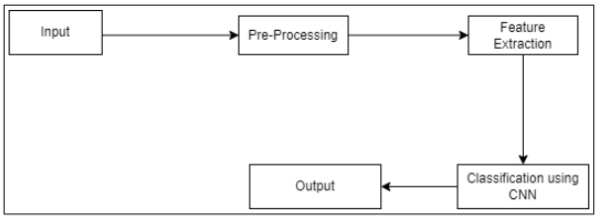


Figure 4.4: Data Flow(2) diagram

Figure 2: Data Flow Of Process 2

In this DFD, data flows from left to right, representing the progression of user interactions within the system. Users start with registration or login, move on to searching for the nearest shop, view offer details, and receive realtime notifications. The system processes these actions to deliver a tailored shopping experience based on location and user preferences.

Tool Used:

The tools used in this system include:

1. Anaconda : Anaconda comes bundled with a vast collection of popular data science and scientific computing packages like NumPy, Pandas, Matplotlib, Scikit-learn, and TensorFlow. This saves you time and effort from installing each package individually.

2. Sql Lite : SQLite is an embedded, serverless, and zero-configuration relational database management system (RDBMS).

3.Python Programming Language: Used for developing the Model due to its concise syntax, null safety, and interoperability .

Algorithm Explanation:

A Convolutional Neural Network (CNN) is a type of deep learning algorithm that excels at tasks involving images and videos. Inspired by the structure of the animal visual cortex, CNNs are particularly adept at identifying patterns and relationships within spatial data.

How CNNs work:

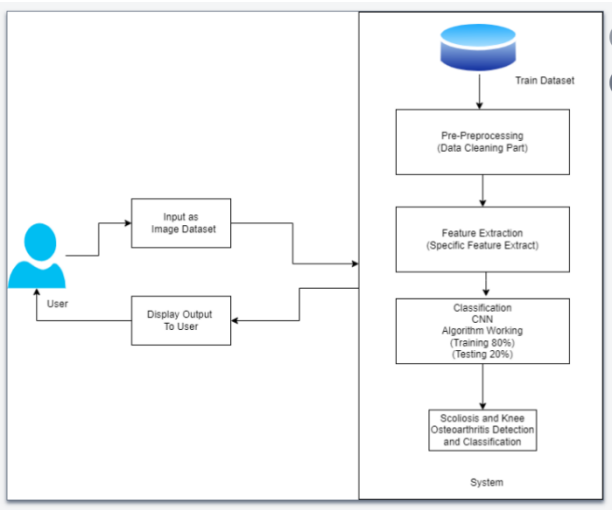
Convolutional Layers: These layers apply filters (like small squares with learnable weights) to the input image. As the filter slides across the image, it performs element-wise multiplication, capturing specific features like edges or lines. By using multiple filters, the network can learn various features from the image.

Pooling Layers: These layers downsample the data extracted by the convolutional layers. This reduces the network's computational complexity and helps control overfitting. Common pooling techniques include max pooling, which takes the highest value in a specific region.

Fully Connected Layers: These layers function similarly to regular artificial neural networks, taking the extracted features and using them to make predictions on the image, such as classifying its content or recognizing objects within it.

System Architecture :

System Architecture for your "Scoliosis and knee ostearthritis" system plays a pivotal role in its successful operation. This architecture forms the foundation that enables your system to seamlessly.

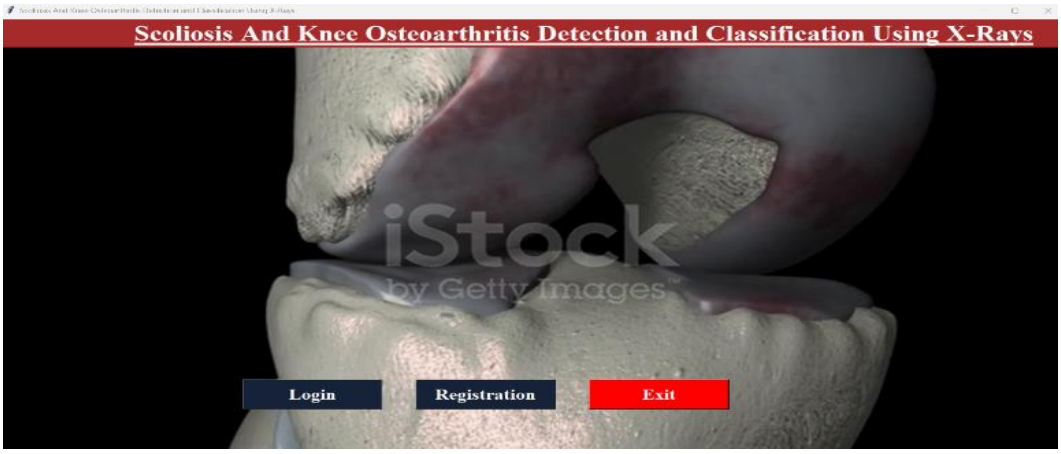


Implementation :

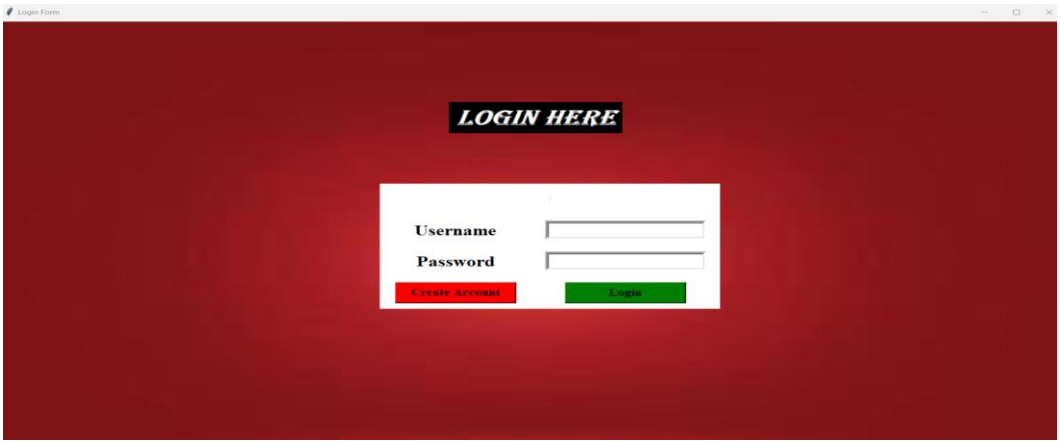
The System process takes place in the following way:

Below is the snapshot of our system:

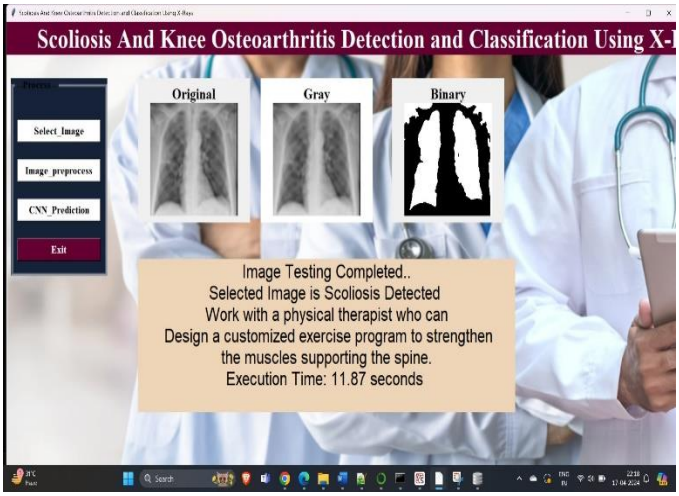
1.Main Interface:

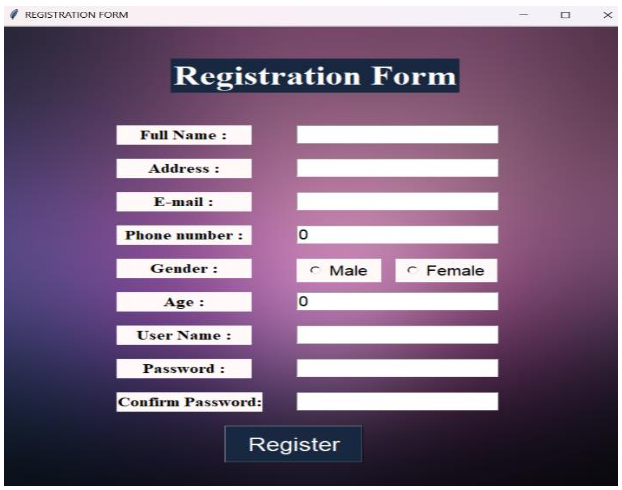


2.Login and Registration page



3.Output





6.Software and Hardware Requirements

1. Operating System: Windows 10, 11
2. LDE : Pycharm, Spyder
3. Programming Language: Python
4. Intel Core i3, i5
5. Speed : 2.80 GHz
6. RAM : 4GB, 8GB
7. Hard-Disk : 500 GB, 512 GB
8. Key Board : Standard Windows Keyboard

7. Conclusions

In conclusion, this study has demonstrated the potential of using advanced image processing and machine learning techniques for the detection and classification of scoliosis and knee osteoarthritis using X-ray images. While the results are promising, further research, validation, and collaboration between medical professionals and AI experts are necessary to translate these findings into effective clinical tools that can enhance patient care.

8.References

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