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A REVIEW ON: YOGA POSE DETECTION USING DEEP LEARNING

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Abstract - The angle between body parts is crucial in the variety of asanas that yoga has to offer. If done correctly, yoga is an excellent form of physical exercise that is very good for your health. However, if yoga is practiced incorrectly, it can be harmful to one's health. Therefore, it's crucial to have a trainer when practicing yoga who can show you the proper form for each pose and keep an eye on it. This project carries a non-profit system that helps to strengthen the core muscles using yoga-like poses Virtual yoga asana practice is possible thanks to the totally accurate position detection provided by the suggested method. This system assists yoga enthusiasts with different yoga poses and validates them for correctness. Integrating computer vision techniques and deep learning techniques, the proposed system analyses the user's human pose then based on the domain knowledge of yoga, the user is directed to correct the pose. Due to high computation requirements and a lack of available datasets, precise pose recognition in yoga is a challenging task. Different feature extraction and preprocessing techniques are applied to the dataset for the accurate detection of the yoga pose, achieving high accuracy just by using machine learning algorithms. The Human Pose Estimation technique, based on computer vision, is used to make the system effective and affordable.

Keywords: computer vision, feature extraction, learning (artificial intelligence), pose estimation

1. INTRODUCTION

Yoga originated in ancient India, and it is a group exercise associated with mental, physical, and spiritual strength. Yoga and sports have been attracting people for so many years but in the last decade, many people are adopting yoga as part of their life. This is due to the health benefits. It is important to do this exercise in the right way, especially in the right posture. It has been observed that sometimes due to a lack of assistance or knowledge people don't know the correct method to do yoga and start doing yoga without any due to poor posture, people hurt themselves during self-training without sufficient instruction. Yoga should be done under the guidance of a trainer, but it is also not affordable for all people. Nowadays people use their mobile phones to learn how to do yoga poses and start doing that but while doing that they don't even know whether the yoga pose they are doing is the right way or not. There has been a lot of work done to circumvent these restrictions. Software that acts as a trainer for AI systems has been created using computer vision and data science methodologies. This software talks about the advantages of that pose. It also talks about the accuracy of the performance. With the aid of this programmed, one may do yoga independently of a trainer. There are various picture datasets that comprise 10 yoga positions that have been generated to be used with machine learning and deep learning modules. Features have been extracted using computer vision and the TF-pose Algorithm. By identifying every joint in the body and linking them, this algorithm creates a stick diagram that represents the skeleton of the human body. Coordinates and the angles made by the joints can be extracted using this algorithm and then used those angles as features for machine learning models. Several machine learning models have been used to calculate the test accuracy of the model. Random Forest classifier gives the best accuracy among all the models.

2. LITERATURE REVIEW

1. This system detects the difference between the actual and target positions and corrects the user by delivering real-time image output and necessary instructions to correct the identified pose. This study employs computer vision algorithms and Open pose (an open-source library) to assess human postures and a person's yoga stance. The recommended strategy often achieves real-time speed while maintaining excellent accuracy. The proposed model was trained with 90% of data and tested with 10 % of same with real-time testing, resulting 94 % of accuracy[3].
2. A unique method is suggested with the purpose of assisting yoga practitioners with various yoga positions and validating it for accuracy. The suggested system examines the user's human stance using computer vision methods, then, using domain expertise in yoga, directs the user to fix the pose. Precise recognition of yoga poses is a difficult task because of high computation and lack of availability of datasets. Different feature extraction and pre-processing techniques are applied to the dataset for the accurate detection of the yoga pose, yielding 97.4% accuracy just by using machine learning algorithms. The Human Pose Estimation approach, based on computer vision, is employed to make the system effective and affordable.
3. This proposed system, the system can identify poses performed by the user and guide the user visually. To be more engaging with the user, this procedure must

be carried out in real-time. In this study, a vision-based methodology was used to recognise yoga postures. The mobile camera may be used by the Infinity Yoga Tutor application to record user motions, which are subsequently broadcast at a resolution of 1280 720 at 30 frames per second to the detecting system. The system is composed of two primary modules: a posture estimation module that employs Open posture to identify 25 critical human body points using the BODY_25 dataset, and using a series of frames, a posture detection module may analyse and forecast a user's pose or asana using a Deep Learning model that employs time-distributed Convolutional Neural Networks, Long Short-Term Memory, and SoftMax regression. The chosen model, which use Open position for position estimation and was trained to categorise 6 distinct asanas, has a 99.91% accuracy rate. Finally, the system notifies the users on their performance visually in the user interface of the Mobile application [8].

3. GOALS AND OBJECTIVE

- To develop a machine learning and computer vision-based low-cost system that helps to detect and correct yoga pose.
- To employ deep learning approaches to increase the precision of current object detection systems.
- To set up the system in the cloud so that it can be accessed from anywhere at any time.

4. PROPOSED SYSTEM

The system consists of major steps pre-processing, feature extraction, and classification. In the testing phase verification is done using the training dataset.

Pre-processing - Preparing the input image for feature extraction is the goal of the pre-processing stage. Noise reduction, scaling, binarization, thinning, clutter elimination, and normalization are the main components of the pre-preprocessing step.

Feature Extraction - When the input data for an algorithm is extremely large and repetitive, feature extraction is necessary. Then, this extra information is transformed into a basic and concise arrangement of features. The term "feature extraction" refers to this method.

Classification - Information is sorted during the classification process. When adding to the framework, additional information frequently becomes effectively recognized as fitting into a particular class.

Verification - In this step prepared classifier verifies the test yoga pose images against a set of test sample yoga pose images, it has pertained to during the classification stage. If the match is found over a certain threshold, then the input image is considered correct else it is considered wrong.

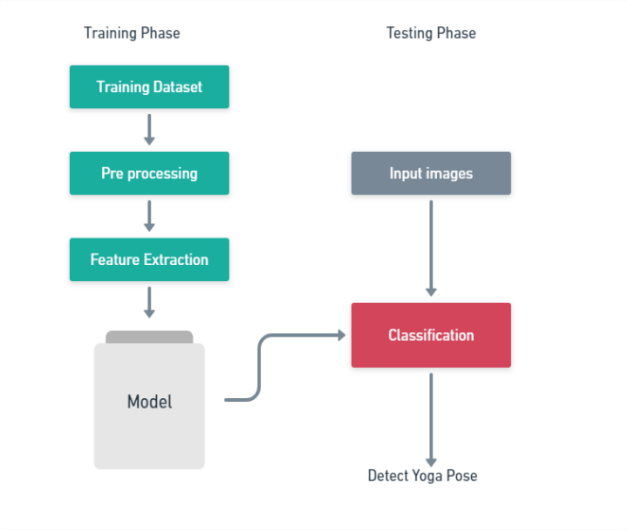

Figure 01: Proposed System

5. ALGORITHM

1. The suggested methods employ a variety of methodologies, including Open Pose, LSTM neural networks, and key point extraction with the Mediapipe library. Videos of people performing yoga poses make up the selected datasets. The suggested solutions create a full yoga class environment at the user's house by recognising and correcting yoga positions in real-time. The categorization of yogic postures is the major topic of study on pose estimation for yoga. Because the input is a picture of a person in a posture, and the output is the categorization of the position, the algorithm for yoga pose recognition using deep learning uses neural networks to understand the relationship between the input and output.
2. Deep learning has been used to recognise and classify yoga poses using the KNN algorithm. For instance, Posenet and KNN were used in a study to identify and correct yoga positions. employed deep learning to recognise and categorise yoga positions as well, and then the KNN algorithm to sort fresh photographs. A work that included KNN identified sun salutation yoga positions using four machine learning algorithms.
3. Yoga position identification technology may be included into lessons to help practitioners with various poses and evaluate their accuracy. Deep learning may be applied to the technology to categorise and identify yoga positions. Computer vision may be used to recognise yoga

positions in real-time for self-assistance-based yoga and smart healthcare. Yoga practitioners may receive immediate feedback on their poses and make required adjustments to enhance their technique by incorporating this technology into their lessons.

4. Yoga positions may be recognised by an algorithm in live footage. A video or live stream of a person practising a certain yoga position may be used to train the algorithm so that it can recognise the movements made in real-time. To increase the accuracy of the detection, the algorithm can additionally employ the pose landmarks from the preceding frame, in general, is a real-time, precise, and low latency model that may be utilised for yoga stance identification in real-time videos.

6. DESIGN AND IMPLEMENTATION

1. **Dataset creation:** A custom dataset of labeled images of various human poses is created. The dataset includes images of people standing, sitting, walking, and performing other actions. The images are captured from different angles to ensure variability and accuracy.

2. **Data preprocessing:** The images in the dataset are preprocessed using the KNN framework. The framework extracts feature such as joint positions, angles, and distances from the images.

3. **Model selection:** KNN architecture is selected for pose classification. The KNN model is designed to take the features extracted by the KNN framework as input and produce pose classification output.

4. **Model training:** The KNN model is trained on the preprocessed dataset using a supervised learning approach. The training process involves adjusting the model's weights to minimize the difference between the predicted and actual pose labels.

5. **Model evaluation:** The trained model is evaluated on a validation dataset to measure its accuracy, precision, recall, and other performance metrics.

6. **Real-time pose classification:** The trained model is integrated into a real-time application using the KNN framework. The application captures live video footage and processes it uses the KNN framework to extract features. The KNN model then uses these features to classify the pose in real-time.

Proposed system uses the KNN framework for data preprocessing and real-time processing. The KNN model is trained using Python and TensorFlow, and the real-time application is developed using Python and OpenCV. The project also involves several hyperparameter tuning techniques, such as learning rate scheduling and early stopping, to improve the model's accuracy and performance.

Overall, system demonstrates the feasibility and effectiveness of combining machine learning with computer vision and real-time processing for accurate and reliable pose classification.

7. ANALYSIS

For the purpose of applying deep learning to identify yoga poses, we have performed many analyses. The suggested method employs deep learning algorithms to precisely detect and identify different yoga positions. The movies in the selected datasets show participants in various yoga poses, and the Mediapipe library is used to extract the users' keyframes. For the purpose of identifying yoga poses, the suggested models combine long short-term memory (LSTM) with KNN. Yoga poses may be recognized by the models, which can then offer feedback or adjustments as necessary. The suggested models are designed to simulate a full yoga session at the user's house, with the system detecting and correcting any incorrect poses. A variety of posture estimation techniques, key point detection techniques, and classification algorithms including random forest and support vector machine are also included in the analysis. The findings show that deep learning approaches have a lot of potential for precise and effective yoga stance identification and recognition.

Advantages

- helps to detect and correct yoga pose with high accuracy.
- Easy-to-use application
- Cloud deployed – anytime and anywhere access.

Disadvantages

- Costly
- Basic technology skills required.
- Less accurate in dark environments

Application areas

- Online Yoga Training Application
- Realtime yoga pose detection system for Live session.
- Yoga practice applications

8. RESULT AND DISCUSSION

Yoga pose detection using deep learning involves using computer vision techniques and deep learning algorithms to recognize and classify different yoga poses from images or videos.

Overall, yoga pose detection using deep learning is an active area of research with promising potential for improving yoga practice and wellness. As the technology continues to develop, it may become more widely available in the form of mobile apps, wearable devices, and other digital tools.

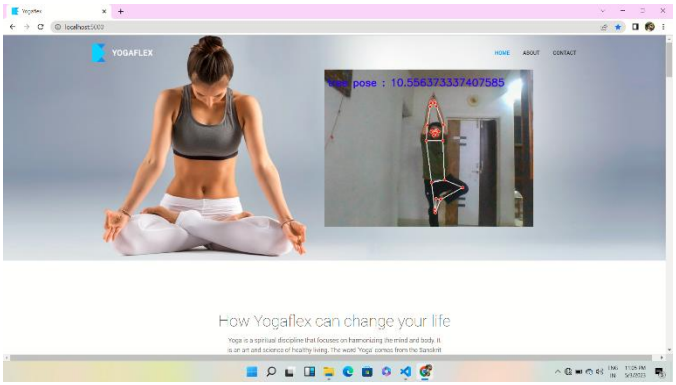

Figure 02: Tree Pose

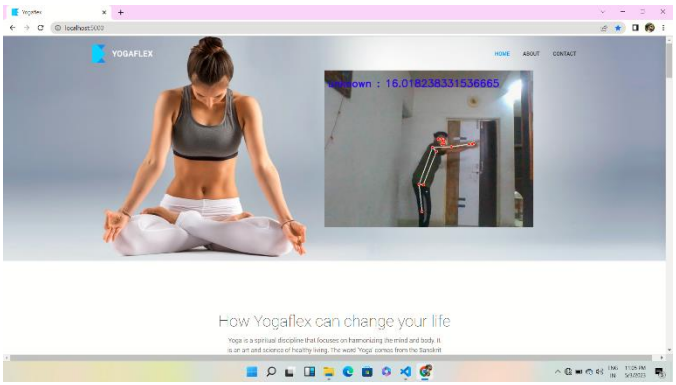

Figure 03: Unknown Pose

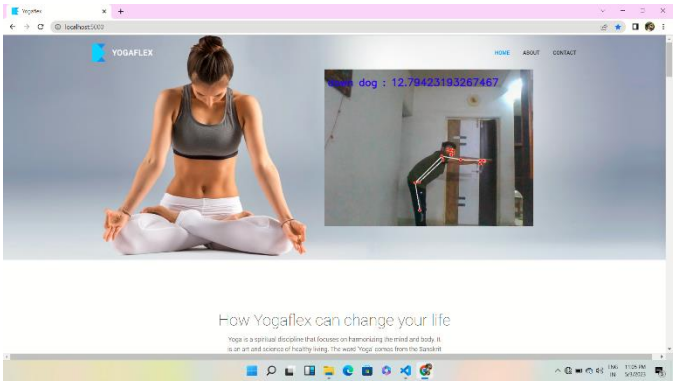

Figure 04: Down dog pose

9. CONCLUSIONS

The approaches presented in this research are based on deep learning to detect incorrect yoga postures and advise the user to improve the pose by specifying where the yoga pose is going wrong. Users of the proposed system can submit recorded videos of their practice positions for yoga and choose the preferred stance for practice. Angles from monitoring operations have been retrieved by the research and employed as a feature as they are scaled.

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