DETECTION OF WRONG YOGA POSTURES

ABSTRACT

Yoga is an ancient Indian method of maintaining physical and mental well-being through physical postures called asanas, voluntary controlled breathing exercises called pranayama, meditation, and relaxation methods. The number of yoga practitioners has increased dramatically since the pandemic, with many engaging in unsupervised practice. Through the use of deep learning-based techniques that can estimate the correct stance executed by a practitioner, this study was designed to make the work of such practitioners easier. Four distinct deep-learning architectures were used in the study to apply this strategy: MediaPipe, OpenPose, PoseNet, and EpipolarPose. The images from S-VYASA were used to train each of these architectures independently. recognized as a university. Five popular yoga poses were represented by the photographs in this database: warrior stance, half-moon pose, triangle pose, tree pose, and mountain pose.

Keywords:

- Pose estimation
- Convolutional Neural Networks (CNNs)
- Image processing
- Feature extraction
- Classification algorithms

1. Introduction

Improved Yoga Practice: Using Machine Learning to Identify Incorrect Postures.Because yoga has so many advantages for both physical and mental health, it has become incredibly popular all around the world. But adopting the wrong posture during a yoga position might cause harm and lessen the benefits of the practice. Many yoga practitioners find it difficult to maintain perfect form, especially when practicing alone, even with the availability of online courses and instructors. As with any workout, it is crucial to perform yoga postures correctly because incorrect posture is counterproductive and can even be harmful. This means that when doing yoga, you should have a teacher around. With today's lifestyle, it is not always possible to have a teacher or to attend yoga courses. A system powered by AI assists in recognizing yoga poses and provides feedback.

Utilizing machine learning for precise yoga posture recognition enhances practice by reducing the risk of injury and maximizing benefits. Automated systems provide valuable feedback, particularly beneficial in solitary practice or absence of instructors. Existing methods, such as DeepPose and Yoga Tutor, employ diverse techniques like deep neural networks and body mapping for accurate pose identification. However, challenges persist, including depth sensor dependency and localization issues. The project aims to overcome these challenges by preprocessing datasets and employing classification networks for improved accuracy.

2.Methodology

The system is divided into two phases: the training phase, which is where machine learning models are learned, and the testing phase, which is where the trained models are tested and their performances are evaluated.

Training Phase: Preparing the System for Yoga Pose Recognition

Setting Up the Learning Environment: This initial step involves creating a workspace equipped with the necessary tools, similar to a student gathering their supplies before a lesson. These tools come in the form of software libraries that provide functionalities for numerical computations (NumPy), data manipulation (Pandas), data visualization (Seaborn), machine learning algorithms (Scikit-learn), computer vision tasks (OpenCV), and most importantly, pose estimation (MediaPipe) - crucial for identifying body postures within video frames

Data Preprocessing and Feature Engineering: Similar to a student refining their understanding through analysis, the system performs data preprocessing to ensure the information is suitable for the machine learning model. Normalization techniques are applied to scale all values within the dataset, typically to a range between 0 and 1. This helps various machine learning algorithms function more effectively. Feature engineering goes a step further, extracting even more meaningful information from the existing data. This might involve converting keypoint coordinates into vectors and subsequently calculating joint angles between body parts. These joint angles effectively capture the relative positions of limbs and represent additional features that can aid in pose classification.

Testing Phase: Evaluating the System's Yoga Pose Classification Ability

Preparing the Test Data: Just as a student prepares for an exam by reviewing similar material, the testing data undergoes the same preprocessing steps (normalization and feature engineering) used on the training data. This ensures the testing data is presented to the model in a format it understands.

Putting the Model to the Test: The preprocessed testing data is fed into the trained model, similar to a student taking an exam to demonstrate their learned knowledge. The model then makes predictions about the yoga poses within the testing data.

Performance Evaluation: The system's accuracy is assessed by comparing the model's predictions to the actual poses in the testing data. This evaluation helps gauge the model's effectiveness in recognizing yoga poses and identify areas for potential improvement, akin to a student receiving feedback on their performance.

Figure 1: Workflow of the training phase

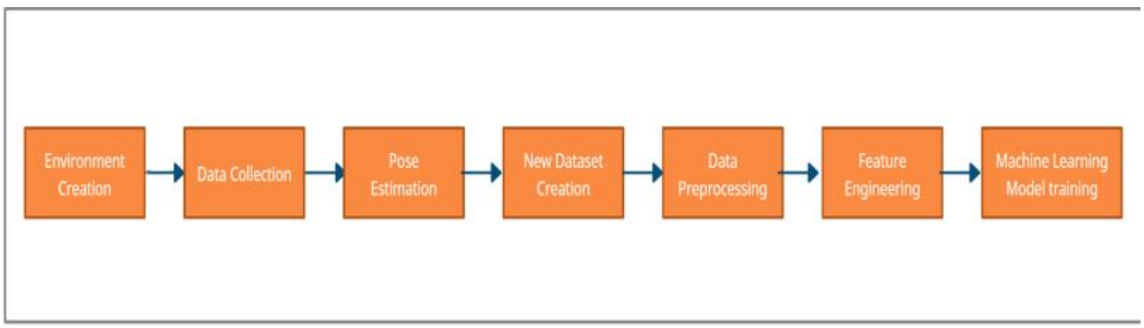


Figure 1: Workflow of the training phase

Figure 2: Workflow of the testing phase

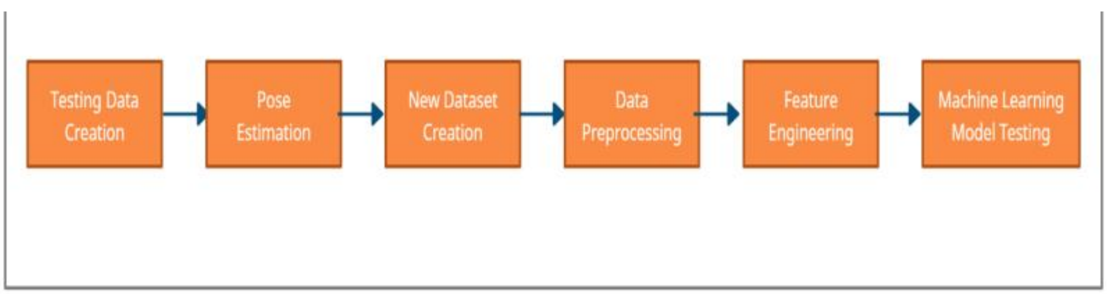
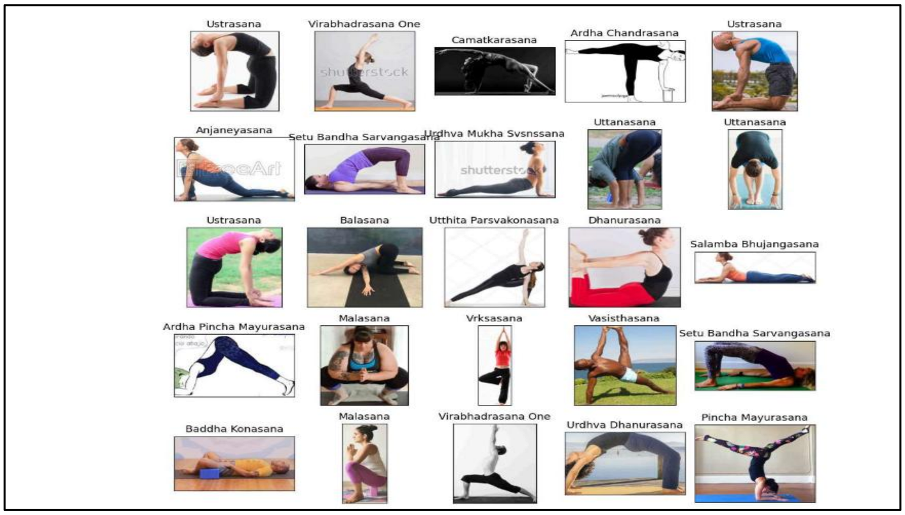


Figure 2: Workflow of the testing phase

3.Dataset:

Our dataset contains 2759 Files of which 2314 .png images and 41 .jpg and 401 jpeg files.

Visualizing images from the dataset:



Here we displayed 25 pictures from the dataset with their labels using random_index function and sub plotted using matplot lib.

Computing Error Rate Analysis:

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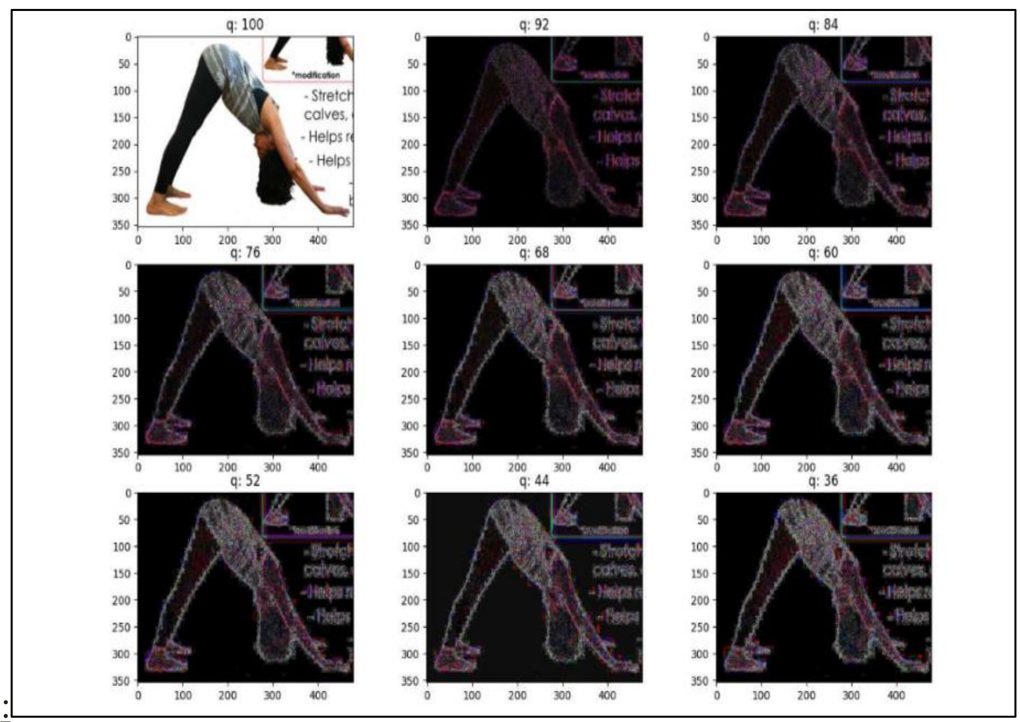


Here, we took a random sample of Adho Mukha Svanasana from the dataset and calculated and computed the error rate analysis of the sample image.

4.Result Analysis

Final epoch 100/100

95/95 [==============================] - 17s 175ms/step

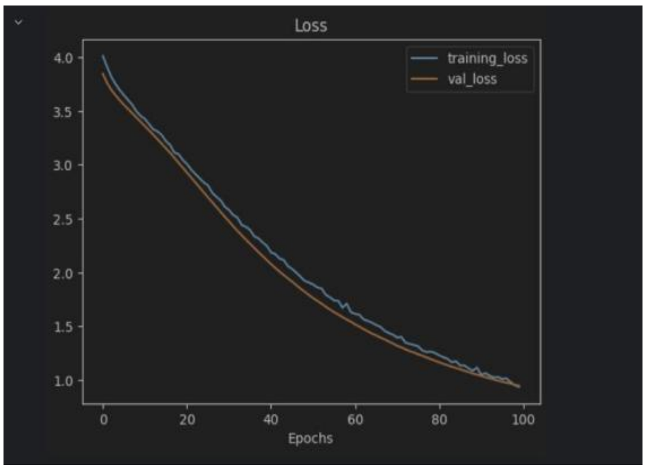
loss: 0.9377

accuracy: 0.7632

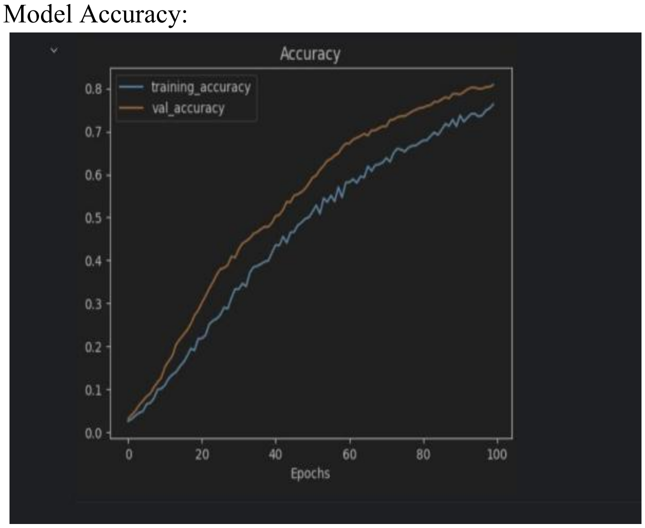
val_loss: 0.9473

val_accuracy: 0.8088

Model loss:



Model Accuracy:



5.Conclusion

In conclusion, the "Detection of Wrong Yoga Postures" project offers valuable insights into yoga practice and its risks due to incorrect posture alignment.
Utilizing advanced technology like computer vision and machine learning, we've developed a machine to identify and alert practitioners to incorrect postures in real time, enhancing safety and injury prevention in yoga. This project underscores the importance of leveraging technology across various domains and promotes safer environments for yoga enthusiasts. The gained insights serve as a foundation for further research in health monitoring and corrective guidance. By refining detection algorithms, we aim for greater accuracy. This project demonstrates the potential of interdisciplinary collaboration between technology and traditional practices, offering innovative solutions for global health and well-being.

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