REAL TIME DETECTION AND CLASSIFICATION OF YOGA POSE USING TENSORFLOW MOVENET

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ABSTRACT

Presenting a paper about real-time yoga pose classification using tensorflow movenet. The application utilizes a Tensor flow MoveNet to extract key points and a neural network to detect and classify different yoga poses. The Neural network is trained on a large dataset of yoga images, which are pre-processed to extract relevant features using deep learning techniques. The model which is embedded to a website, is designed to work with a webcam or a camera attached to a device and allows users to view themselves in real-time as they perform different yoga poses. The model then provides feedback on the correctness of their pose based on the classification results obtained from the neural network. The proposed web application can be useful for yoga practitioners who want to improve their pose accuracy, as well as for instructors who want to monitor their student's progress remotely.

Keywords: ***Tensor flow MoveNet, Neural network, Yoga pose, Classification, Computer vision, Web application.***

1. INTRODUCTION

Yoga poses, also known as asanas, are physical postures that are practiced in the ancient tradition of yoga. These poses are designed to help promote physical health, mental clarity, and spiritual awareness. Each pose has its own unique benefits, and when practiced regularly, yoga can help improve flexibility, strength, balance, and overall well-being. Yoga poses can range from gentle stretches to more challenging inversions and arm balances, and can be modified to accommodate different skill levels and physical abilities. Whether you are a beginner or an experienced practitioner, incorporating yoga poses into your daily routine can have a positive impact on your mind, body, and spirit.

Practicing yoga has become popular over the years, and with the rise of technology, it is now possible to develop applications that can help people improve their yoga practice. One such application is a real-time yoga pose classification system using computer vision. Computer vision is the field of artificial intelligence that deals with enabling machines to interpret and understand images or videos. By using computer vision techniques, it is possible to create a system that can analyze a user's yoga pose and provide real-time feedback on its correctness. The proposed system aims to utilize neural network algorithms to accurately classify yoga poses in real-time.

The system will use a webcam or other camera-equipped device to capture video of the user performing the pose. The video stream will then be processed by the computer vision system, which will identify the pose and provide feedback on its correctness. The system will use a Tensor flow MoveNet to extract the key points, such as a neural network, to classify the poses. The model will be trained on a dataset of labeled yoga poses, which will allow it to

recognize a wide range of poses accurately. The system will provide real-time feedback on the user's pose, including information on the correct alignment, positioning, and balance required for each pose. The user will be able to see the feedback on their screen, making it easy to adjust their pose and improve their yoga practice.

The proposed system will be designed as a web application, which means that it will be accessible from any device with an internet connection. Users will be able to access the application through their web browser, and the system will utilize web technologies such as HTML, CSS, JavaScript and React JS to provide a responsive and user-friendly interface. The system can accurately classify yoga poses in real-time and provide users with valuable feedback on their form and technique. The web application will make the system accessible to a wide range of users, and its user-friendly interface will make it easy to use and understand.

2. LITERATURE SURVEY

Numerous studies on real time detection and classification of yoga pose using Tensor flow MoveNet systems have been conducted in relevant fields over the last few years.

This research paper Real time recognition of yoga poses using computer vision for smart healthcare. Two main algorithms used for creating the skeleton for yoga pose and the second algorithm for finding the mudra and it gives 92 % accuracy.In this yoga pose around 400 to 500 images are trained for each yoga pose and it contains the 5 mudra for identifying the yoga pose[1].

In this model paper Implementation of machine learning Technology for identification of yoga poses it utilizes a convolutional neural network (CNN) to classify different yoga poses using image data.It uses a publicly available dataset of yoga poses to train the system and evaluate the system. The proposed system achieves high accuracy in identifying different yoga poses, which can potentially be used in yoga teaching and practice. The proposed system has the potential to be a useful tool for yoga practitioners, instructors, and researchers to accurately assess and monitor yoga performance and it gives 99% accuracy[2].

This research paper on dynamic Hand Gesture recognition from a complex background and finger identification using RGB colors is an exciting field of research that combines computer vision and machine learning techniques to recognize hand gestures and identify fingers from complex backgrounds using RGB colors. Hand gesture recognition system has become popular due to its potential applications in a variety of fields, including human-computer interaction, sign language recognition, and virtual reality. The complexity of the background and the identification of fingers add an additional layer of challenge to this problem, requiring sophisticated algorithms that can accurately detect and segment hand gestures and identify fingers based on their RGB colors. In this field, researchers are developing innovative techniques and algorithms to enhance the accuracy and robustness of hand gesture recognition systems, making them more reliable and efficient for a wide range of applications[3].

“Efficient Hand Pose Estimation from a Single Depth Image” is a research paper that proposes a novel method for accurately estimating the 3D pose of a hand from a single depth image. Estimation of hand pose has numerous applications, including human-computer interaction, virtual reality, and robotics.The proposed algorithm utilizes a two-stage approach that first detects the hand region in the hand image and then estimates the joint locations using a convolutional neural network (CNN). The authors also introduce a new dataset, called NYU Hand Pose Dataset, which consists of over 72,000 hand pose annotations on depth images[4].

This paper detection and classification of yoga poses using machine learning and neural networks involves using computer vision techniques to analyze images or videos of people practicing yoga and identify the different yoga poses they are performing. This technology has the potential to be useful in a number of settings, such as yoga studios, fitness centers, and online yoga classes.The process involves collecting a large dataset of labeled images of people performing various yoga poses, training a machine learning or neural network model on this data, and then using the model to automatically detect and classify yoga poses in new images or videos[5].

3. PROPOSED WORK

Real-time classification yoga pose is a challenging task that requires the use of deep learning techniques such as neural networks and computer vision. In this proposed work, we will discuss the steps involved in building a web application for real-time yoga pose classification using neural networks and TensorFlow MoveNet.

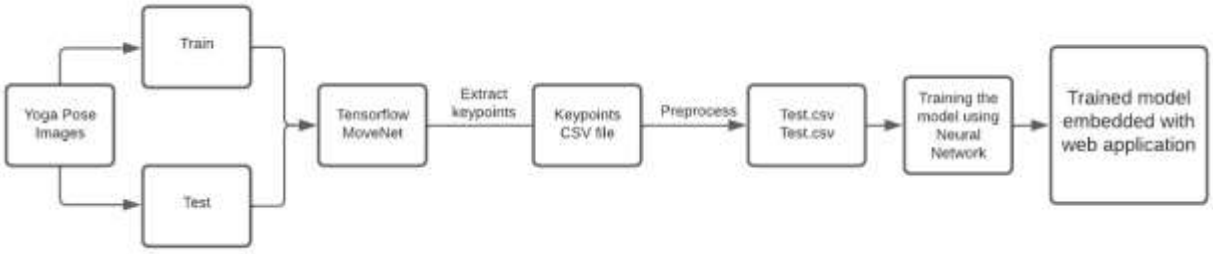

Figure 1: Proposed Architecture

3.1 Tensorflow MoveNet

The model is built using tensorflow MoveNet which is an accurate and fast model for detecting keypoints in the human body. It detects 17 key points from the body. Thunder and Lightning are the two models offered by this model on TF hub. Both run fast and accurately in real time with 30 FPS. These models work well on modern desktops, mobiles and modern laptops. This model is more used in health and fitness.

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Tensorflow moveNet follows a bottom-up approach, which uses heatmap to localize key points from the human body. There are two factors to consider in this architecture: set of prediction heads and extractor points. CenterNet which is used in prediction schemes to increase speed and delicacy. Object detection API of tensorflow is used to train the models. MoveNet and MobileNetV2 are used to extract points, which helps in high resolution.

The first step in building any deep learning application is to collect and preprocess the data. In the case of real-time yoga pose classification, we need to collect a dataset of images of people performing different yoga poses and measure the angle of each pose. The images should be of high quality and should cover a variety of poses.After collecting the data, the data to be preprocessed by resizing the images and converting them to a CSV format that can be used by our neural network. Then each image should labeled with the corresponding yoga pose.

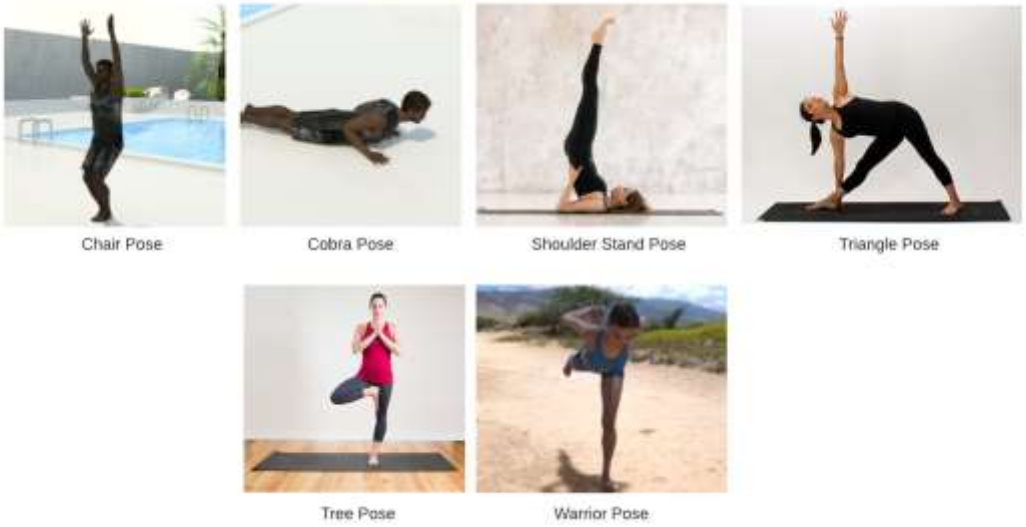

Figure 2: Example images

For the real time classification of yoga poses, we need to extract key points from the images. The key points, Which is extracted, are the joints that are important for recognizing the yoga poses. Several techniques are used for extracting key points from the image of the human body, but the proposed model will be using the Tensor flow MoveNet library. Tensor flow MoveNet is a deep learning library which is able to detect key points from images of the human body using neural networks. Using Tensor flow MoveNet to detect the key points from the images and then convert these key points to CSV files. The converted key points (CSV file) is feed into the neural network for classification.

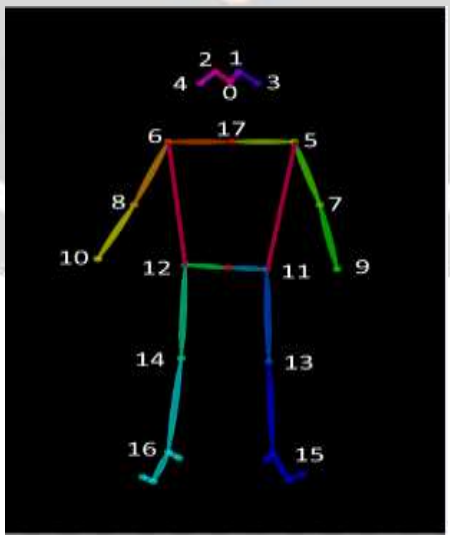

Figure 3: Human Keypoints

Once we have extracted the key points from the images, we can use them to build a neural network for classification. We will be using TensorFlow, which is a popular deep learning framework for building neural networks.We will start by designing the architecture of our neural network. The architecture will consist of several layers, including convolutional layers, pooling layers, and fully connected layers. We will also need to choose an

appropriate activation function for each layer. After designing the architecture, we will train the neural network using the preprocessed data. We will split the data into training and validation sets and use the training set to train the neural network. We will then use the validation set to evaluate the performance of the neural network and make any necessary adjustments to the architecture.

Once we have trained the neural network, we can integrate it with our web application. We will be using the React framework to build the web application.We will start by creating an endpoint in our web application that accepts an image as input. We will then use Tensor flow MoveNet to extract the key points from the image and feed them to the neural network for classification. Finally, we will return the predicted yoga pose to the user.

The final step is to test and refine the web application. We will start by testing the application using a variety of poses to ensure that it can accurately classify the yoga poses in real-time.

4. RESULT AND ANALYSIS

Neural Network is used for identifying yoga poses. The accuracy obtained for the training is represented in chart 1. An accuracy of 99% is obtained for training.

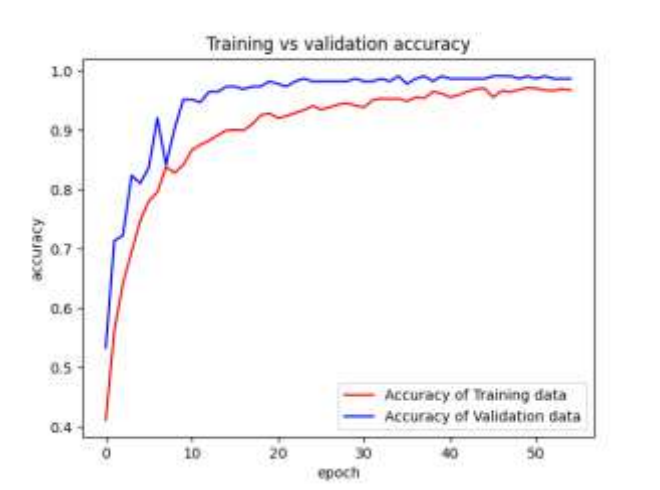

Chart 1: Training and validation Accuracy

The obtained training and validation loss is represented in Chart 2. The training loss obtained is 0.017786 and the validation loss obtained is 0.0437.

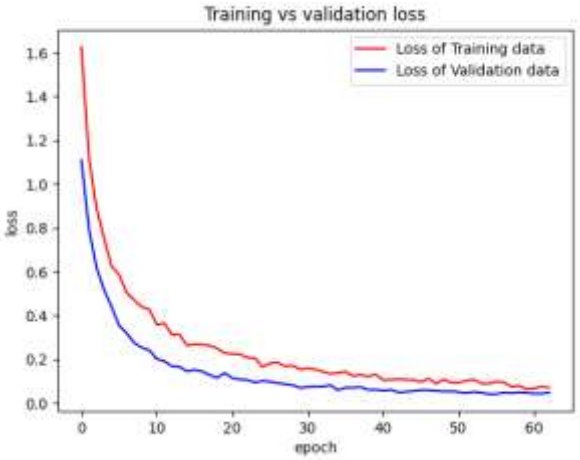

Chart 2: Training and validation Loss

Below Tables 1 and 2 illustrate the Precision, recall, and f1 score utilized to depict the experiment outcomes. The final precision is 1.00, recall is 0.96, f1-score 0.98, support 139.

Table 1: Transitivity outcomes

	Precision	Recall	f1- score	Support
0	0.98	1.00	0.99	168
1	0.99	1.00	1.00	194
2	1.00	1.00	1.00	169
3	1.00	1.00	1.00	2
4	1.00	1.00	1.00	8
5	0.91	1.00	0.95	10
6	1.00	1.00	1.00	187
7	1.00	0.96	0.98	139

Table 2: Transitivity outcome for CNN model

	Precision	Recall	f1-score	Support
Accuracy			0.99	877
Macro average	0.99	0.99	0.99	877
Weighted average	0.99	0.99	0.99	877

5. CONCLUSION

In conclusion, real-time yoga pose classification using neural networks and detecting key points using TensorFlow MoveNet in computer vision is a promising approach to aid individuals in their yoga practice. With the increasing popularity of yoga and the growing demand for digital wellness tools, this technology has the potential to enhance the user experience and provide personalized feedback and guidance.

By utilizing neural networks and computer vision techniques, the system can accurately detect the user's body movements and classify the yoga poses in real-time. This can help the user to correct their posture and alignment,

prevent injuries, and track their progress over time. Additionally, the system can provide personalized feedback and guidance based on the user's level of experience and fitness goals.

Overall, the real-time yoga pose classification system has the potential to revolutionize the way individuals practice yoga by providing accurate, real-time feedback and personalized guidance, ultimately helping users achieve their health and wellness goals.

6. REFERENCES

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