AUTO-DETECTION OF DIFFERENT YOGA POSES

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Abstract : Today "Fit India" movement is on its heights and also a healthy body is the need of the hour and everybody wants to achieve it. For which they find yoga as a perfect and cheaper option. But as a fresher everyone needs a trainer to guide them with yoga poses. But in yoga no one can serve as a perfect trainer due to lack of excellence and knowledge thus automatic detection may help in doing proper yoga exercises. Work out must be done in correct way or correct posture. Any change in the posture may adversely affect the body so we need a trainer for proper work out.

In automatic detection of yoga postures, the main intention is practicing yoga without a trainer. So, my motivation is those who either can't afford trainer or shy of doing yoga in the presence of others. This research is an intent to help those who can't find a trainer to tell them about accuracy in pose. With this research they have to click their images in different poses and compare them with reference images by image detectors. Following are the main outlines of current research: Total 18 poses were detected under this research work these 18 are the most common yoga poses which are usually performed for fitness and better physique. Both GFD and ANN are used for achievement of research objectives that is detection and comparison of yoga poses. The accuracy by GFD method is more than 93%. Along with shape descriptor, the key-point angle method serve for maximum precision of the results. 600 database images are created for covering all the 18 yoga postures. HoG and SOBEL is used as a shape descriptor.

IndexTerms **– Yoga poses, detection, shape, key features, descriptor.**

I. INTRODUCTION

A joyful life is an unchallenged dream of every human being and this dream turns into reality only when we are physically fit. As, it is only the physical fitness which imparts mental resilience. Physical fitness can be maintained with exercises, yoga asanas (yoga poses), work out at gym (gymming), etc. But today is the time where looks make the difference. There is no one in the world who don't want to maintain perfect body. For achievement of this goal people opt regular work out at gym or doing regular yoga. With different people, expectations from yoga are different, but the common in all is a "Superb yoga trainee". If anyone wants to bag the ticket to perfect body through yoga, he have to do proper and regular exercise which implies that the postures of doing yoga must be perfectly fine that is possible only under the supervision of a good trainee.

But, today is the time when we want to reduce the need of personnel and achieve 100% efficiency with machines only. In yoga too we can make it true i.e. we can reduce the need of trainer and make computers to serve as trainer with better efficiency. Regular work out strengthens our body, helps in making muscles, increases stamina, reduces those more inches and boosts the immune system. But practically no one knows the precise postures of yoga. The benefits of yoga are limited to body only due to imprecise posture whereas yoga with excellence can result in uniting the body, mind and breath.

II. YOGA AND ITS NEED

The exercises which are performed without special equipments to burn those unwanted extra calories or to fine tune the body or simply shaping of body in an open area or room is known as "Yoga". In yoga, there are hundreds of exercises that could be performed and each of them has their own particular posture. Training of yoga at initial stage for beginners should be only under an authorized trainer otherwise it could adversely affect our body. Sometimes, people suffers from some health issue which restricts them from doing certain yoga exercises but being unaware of the fact, they perform these restricted exercise which makes the problems severe. So, a proper guidance of trainee is must for getting proper benefits of workout through yoga. We need to do regular yoga for the following purposes:

- To maintain shape of body,
- To increase strength and stamina,
- To relax or reduce work stress,
- For body building and maintaining muscles,
- To fight certain health issues.
- To maintain body weight, etc.

III. PRESENT INVESTIGATION

In this research of mine the main focus is to detect yoga postures automatically from an input image. After the detection of the posture its accuracy is also checked. Different body posture analysis are done by generating skeleton of the person or by finding the joint or by using the depth image technique. And depending on the detected yoga posture the prototype is sorted out from stored standard postures. Now, from the posture of the person and prototype posture, the similarity value can be detected by using algorithms

like SIFT, SURF, Fourier descriptor etc. In this work, for extraction of body features, the most common shape descriptor HoG (Histogram of gradient) is used. Here the actual requirement is to find out the shape of the posture. So, it is sufficient that the feature is extracted only from the skeleton or boundaries of the image. Because for yoga edge is the complete descriptor of the shape.

3.1 OBJECTIVES OF PRESENT INVESTIGATION

This investigation is a practice made to serve these three objectives as follows:

i) **Detection of posture:** Skeleton of person doing work out is detected and from shape detector, edges are detected for proper evaluation.

ii) **Detection of prototype:** From the stored postures the standard posture with reference to the posture made by the person, is sorted out and termed as prototype.

iii) **Checking accuracy:** By using various algorithms the exactitude of the posture performed by the person from the prototype is compared.

3.2 LITERATURE REVIEW

Many works on shape recognition and comparison of recognized shapes were carried out in the past years. Following are the some important works served as a foundation to my present investigation:

D. You et al 2015 worked to carry out biomedical image classification. In their investigation they used contour based shape descriptor. "In this contour based shape descriptor, to extract shape informations, colour, texture, etc. PHOG was used".

Md. F. Zakaria et al 2012 had proposed a method for recognition of shape, especially for object on the conveyer with simple algorithm with low computational time. Use of intensity value from the input image can be seen in this method but this technique was then threshold by Otsus method to obtain the binary image. Otsus method automatically selects the threshold from the greyscale histogram and the threshold image holds two regions, i.e., foreground and background. Median filtering is adopted to eliminate noise and Sobel operator is applied to find the edges. To remove unwanted edge pixels thinning method is used, where these pixels may be counted in the parameter estimation algorithm, hence increase the false detection. Compactness of the region is the parameter to detect the shape. After the analysis of this method, it is said that this method archives 85% accuracy when implemented in selected database. But Poor lightning condition image is major drawback which bring complexity in Otsus threshold algorithm and the desirable outcome is not achieved.

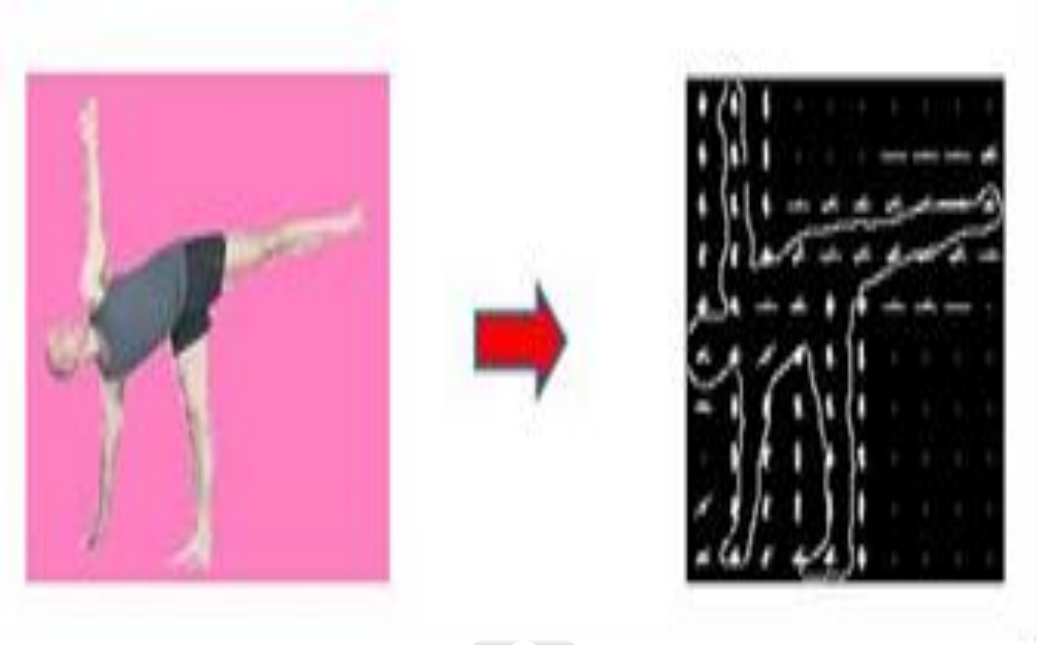
S. Belogie et al 2002 proposed a simple, safe and error free algorithm to find the correlation between input shapes and their standard shapes. These input shapes must be represented by the set of points which were extracted from shape contours. These points ranges to about 100 pixels from the output of edge detectors. They also embellished the concept of shape detectors in their investigation. The main concern of their investigation was finding equivalence between two images and providing the most similar images.

M. Raptis et al 2011 investigated or worked on skeleton animations to find out the dance form performed by the skeleton. Thus, in their investigation they provided a new approach of dance classification from skeleton animation. They used in their research a natural user image interface namely, XBOX Kinect System, through which a depth mapping stream at 30 frame per second was passed for the estimation of real time position of wireframe skeleton of moving user. This wireframe skeleton comprises of 16 pre-defined points. Algorithms were provided by them to understand the motion of skeleton animation and for the estimation of their correlation with standard dance forms.

3.3 RESEARCH METHODOLOGY

For attainment of final results number of processes are carried out. Yoga is an exercise format that must be done precisely otherwise there is either no or little benefit of doing yoga.

In the preparatory step of current investigation, number of poses are analysed to obtain number of images these images are the raw material for current investigation. For this research work I constructed a database with 600 images. Rest of the procedure goes step wise.



Converting and Extracting Shape descriptor

Step-1: Construction of dataset: A data base is constructed which contains all the images so collected.

Step-2: Normalisation of images: Images are pre-processed for obtaining normalized images

Step-3: Feature extraction: Shape descriptor is used for the extraction of information of images from which the contour of the input image.

Step-4: Image classification: These features extracted by shape descriptor are used for classification of images with respect to corresponding poses.

Step-5: Check for accuracy: After sorting out exact pose, the main work starts which is verification of poses for accuracy.

EXPERIMENTATION

All the experimentation and the results thus obtained are tabulated in subsequent pages. In the present research work, 18 yoga poses are studied in all with precision. The 18 poses thus studied are the most common poses or exercises which are generally performed by us for fitness and maintaining better physique. These poses include: Ardhchandrasana; Bhujagasana; Chakrasana; Bharadasana; Padhmasana; Pincha mayurasana; Trikonasana; Vasishtasana; Utihtta Parsvakonasana; Sarvagasana; Sheershasana; Mayurasana; Paripurnanavasana; Natarajasana; Chaturanga-Dandasana; Anjaneyasana and Veerabhadrasana.

A database of 600 images was created to cover up these 18 poses. There are used 30 images per asana. In these 30 images; fifteen are captured for left pose and rest fifteen for the right pose. For HoG feature extraction the total vector size of image is 600 * 2916. Output of this extraction is then served as an input to model the ANN.

In preliminary stage there are more than 20 poses are tested which totals to 60 images. All these images of test poses are then directed for feature extraction. The features thus extracted are checked for accuracy. The poses with requisite accuracy with respect to ideal pose are sorted out. So, only 18 poses which came victorious on the aspect of accuracy are on major concern of this research work. These 18 poses showed accurate pose detection and more precision among other test poses. The poses selected for final research are on the basis of their accuracy, with respect to actual pose, and similarity in posture with slight or no differences. So these yoga poses can be grouped in category of better physique exercises categories due to identical features and similar positive effects on human body.

Reference images or source images for all the 18 poses which are taken to calculate the accuracy of exercise performed by the person. These are assumed to be 100 percent accurate and can be used to make a comparison for checking precision in posture performance. The reference figures are as shown below.

Natrajasana

Chakrasan

Paripurnanavasana

For each asana 10 different images are captured of either different or same individual. Here is provided results of some poses studied. Results are tabulated as follows. The three tables show distance measurements for the ten recorded images for Bhujangasans; Trikonasanas and Ardhasanas respectively from their prototypes. These distance values show the discrepancy of the posture from the ideal posture. In simple words, these distances are a measure of the extent of variation of actual poses.

IV. RESULTS AND DISCUSSION

At first image of yoga practitioner in different poses are captured in RGB Scale and then converted into Gray Scale image and after having other preprocesses the SOBEL shape descriptor is used to extract important features of the image and key points are marked. These key points are later on checked with the key points of reference image for the same pose.

4.1 Results of Ardhachandrasan

GFD algorithm is used to obtain the desired results. Also key point angle method is used to obtain the distance matrix and compare it with another. Figure shows result of this method.

Key-points for forming angle is marked in figure

This figure shows the ardhchanderasana. There are pointed six different key angles which help in accuracy check. These six angles are designated as PQR, PQS, RQS, TSU, QSU and QST, from the points in figure.

The discrepancy in angles are studied with respect to reference image. Two images are used to serve different observations and the records are tabulated as follows:

Comparing angle values obtained from reference image and two input images

Ardhachandrasana	Distance	Angle PQR	Angle PQS	Angle RQS	Angle TSU	Angle QSU	Angle QST
Reference Image	-	179.17	71.92	106.95	96.00	170.10	74.34
Input image 1	0.1091	178.10	70.73	107.87	97.93	170.58	73.43
Input image 2	0.4950	172.40	51.00	135.80	114.98	175.50	59.00

From the above table it is inferred that the person with input image 1 is doing this yoga posture more accurately than the person with input image 2. Greater the angular discrepancy lesser the accuracy. Similarly other poses are checked.

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