J. Basic. Appl. Sci. Res., 4(7)115-125, 2014

ISSN 2090-4304
Journal of Basic and Applied Scientific Research
www.textroad.com

A Publicly Available RGB-D Data Set of Muslim Prayer Postures Recorded Using Microsoft Kinect for Windows

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Received: April 16, 2014
Accepted: June 25, 2014

ABSTRACT

In computer vision applications, availability of dataset for the training and testing of any newly developed system is always a key requirement. Most of the time, people use dataset built by other researchers. In case of unavailability of particular type of dataset, they built the dataset by their own. The datasets for the evaluation of computer vision systems could be of various types. These could be of thumb impressions, retinal scans or images of human activities/postures. The prayer performed by Muslim community also comprises of activities/postures which are the subset of the activities performed by an individual. In order to train and test the human activity recognition system on prayer activities/postures, the availability of prayer dataset is much needed. To the best of our knowledge, no such dataset is available in this area. In order to fulfill this requirement, we have recorded a dataset of prayer postures for an individual in a closed environment. The dataset comprises of RGB, Depth and skeleton frames of an individual from different pose and varying distance. We have recorded this dataset by using Microsoft Kinect for Windows sensor. We have captured more than 1700 RGB, Depth and skeleton frames of different actions comprises of positive and negative examples. We have labeled data and provided in various file formats like .xls, .mat and .arff. We are hopeful that the dataset developed by us will not only enforce the research community working on Human activity/posture recognition to test their system on this particular type of dataset but also to add more to the dataset. It will also help provide them understanding that how to record their own dataset using Kinect if need arises. Apart from that, this wills also a publicly available bench mark in this particular domain.
KEYWORDS: Muslim Prayer, Microsoft Kinect, RGB, Depth, Skeleton

I. INTRODUCTION

Dataset for the training and testing of developed Computer vision applications is always an essential requirement. A large collection of datasets developed by various researchers are publicly available on the web. Liu, h et al has presented study congaing information about datasets recorded for the purpose of research on human activity systems [1].

By the introduction of Microsoft Kinect as motion sensing device people took a completely different look towards the subject of human activity recognition and recorded several datasets by using Kinect. People developed driver programs and SDK's to capture data from Kinect. Initially, the focus was on Kinect for XBOX, its drivers and SDK's [2-5]. Later Kinect for Windows replaced Kinect for XBOX [6]. People modified their drivers and SDK's to work with Microsoft Kinect. In the mean while, Microsoft also provided its SDK and drivers for Kinect for Windows edition [7-9].

We have recorded a data set of Muslim Prayer postures using Microsoft Kinect. We selected NUICapture as an appropriate studio application for Kinect as it suits our work. The dataset recorded using Microsoft Kinect requires a mass storage space due to depth information in these. In our work, a complete Two-Rakat for 24 people along with negative examples has been recorded. The recording is being performed by creating distance variation from the camera. It was in both ways; 1) static object and moving camera and 2) static camera and moving object. Another important aspect while recording the prayer was pose variation which was from zero degree to 75 degree with a gap of 15 degree. Section II in our work discusses various properties of our recorded dataset recording procedure like pose variation and change in distance. Section III presents the samples from recorded dataset. The creation of various file formats along with its structure and posture distribution is provided in the section IV. Finally, the conclusion and future dimensioned have been discussed.

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II. Properties of the Dataset

We recorded dataset with varying pose and distance in order to cover multiple changing aspects. The detail of recording aspects is coming in the next sections.

Pose Variation

Recognition when pose variation occurs has always been a challenging task in computer vision. In order to cover different pose variation, we decided to record prayer postures with varying pose. We draw a circle on floor and draw radius after every 15 degree angle. It helped us to position the person on the floor after each 15 degree. The sketch of circle drawn on the floor is shown in Figure 1.

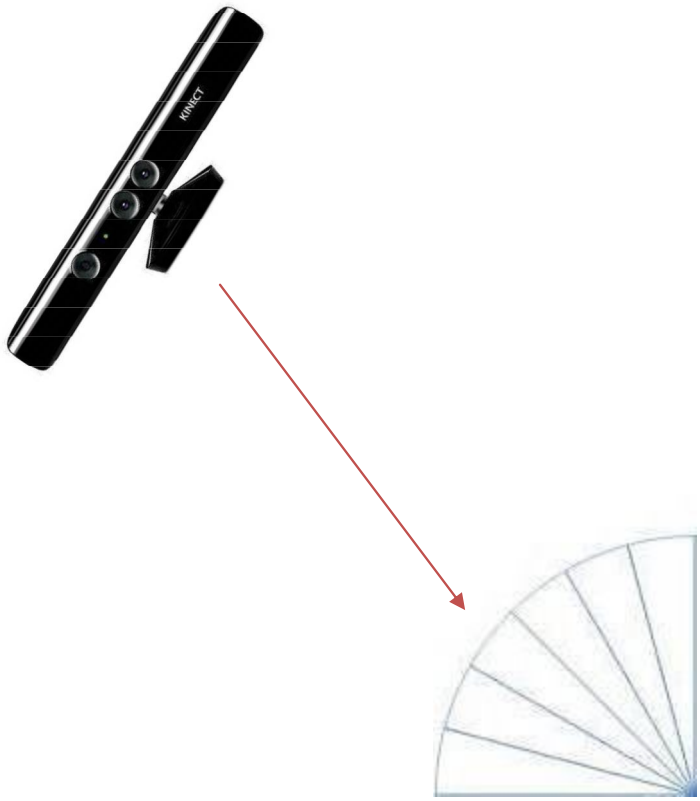


Figure 1: Sketch of Circle Drawn for Pose Variation

Change in Distance

We also want to check the impact of varying distance of the person on the dataset recorded from the camera. We did this in two ways. First, we fixed the camera and decreased the distance of object from camera with a step of 12 inch. We decreased the distance 4 times. The same experiment, we performed by moving the camera towards object. The sketch of this type of variation is shown in the Figure 2.

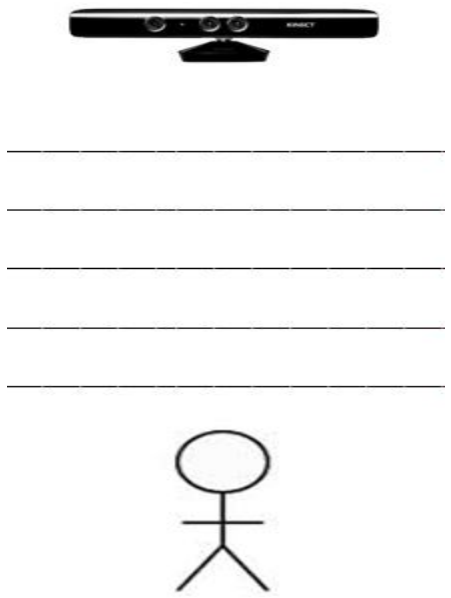


Figure 2: Sketch of Change in Distance

III. Our Dataset

A complete Two-Rakat for 24 people is recorded by us. The negative postures are also been recorded. The negative examples are from various exercises and daily life activities which are closer to the prayer postures. The sample images are shown in the next sections.

A Complete Two-Rakat Prayer Session with Varying Pose

The samples of this type of recording are shown below in Figures from 3-7.

Figure 3: Takbeer (15 Degree)

Figure 4: Coupled Hands (30 Degree)

Figure 5: Ruku (45 Degree)

Figure 6: Sujud (60 Degree)

Figure 7: Slam (75 Degree)

Distance Variation

Is any change occurs in X and Y values, if the Z value changes. First the object was moved towards static camera. Next time the camera was moved towards static object. The session was recorded at 4 different distance variation in both of the cases. The images in Figures from 8-11 presents the recorded samples.

Figure 8: Posture: Jalsa from Ruku

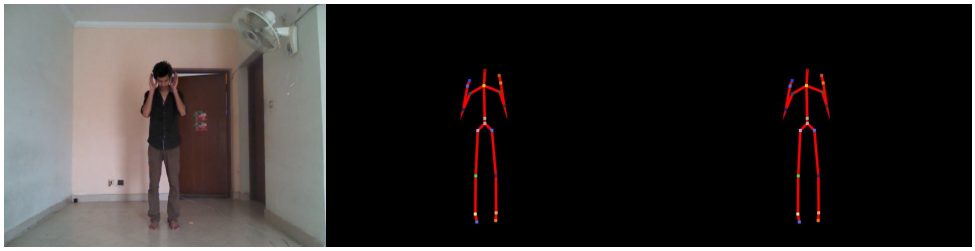


Figure 9: Posture: Takbeer

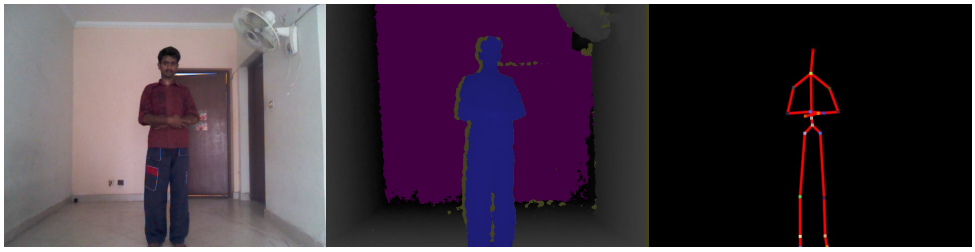


Figure 10: Posture: Coupled Hands

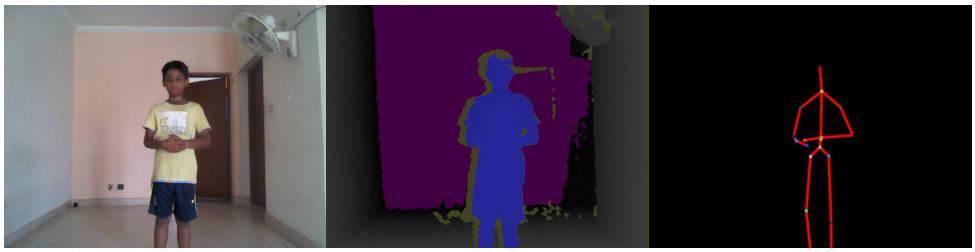


Figure 11: Posture: Coupled Hands

Decrease in Distance

Normalization in data for the verification of results is an important experiment. This time, we fixed human object at a location and moved camera towards human object. The images from 12-15 are presents the idea.

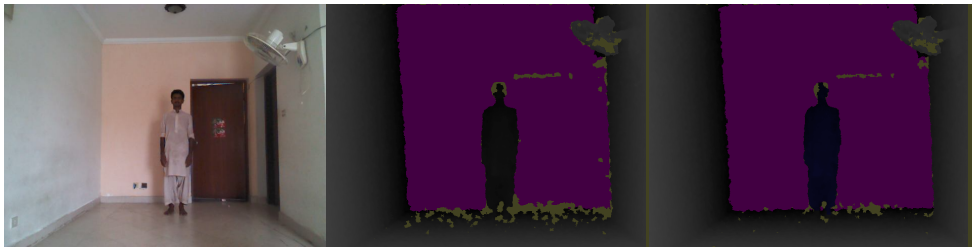


Figure 12: Standing: 4.5 ft

Figure 13: Standing: 3.5 ft

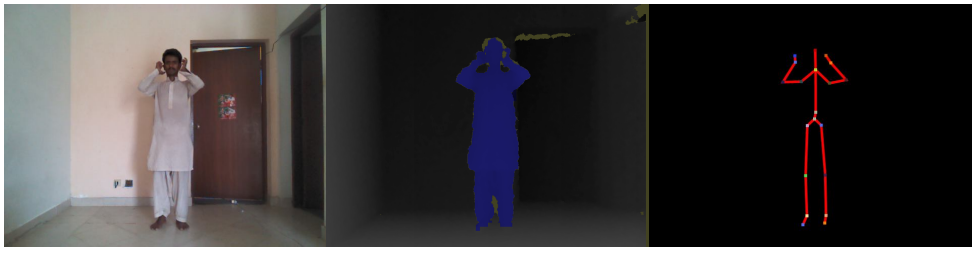


Figure 14: Takbeer: 2.5 ft

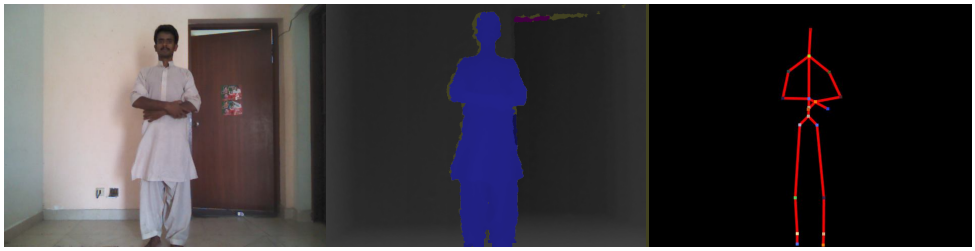


Figure 15: Coupled Hands: 1.5 ft

Negative Postures

Along with recording postures of prayer, we also recorded examples which are not prayer postures but they are similar to prayer postures. We labeled them as negative postures. Again these negative postures cover distance and pose variations in them. These are somehow daily life activities/exercises. The images in figures from 16 – 17 are shown.

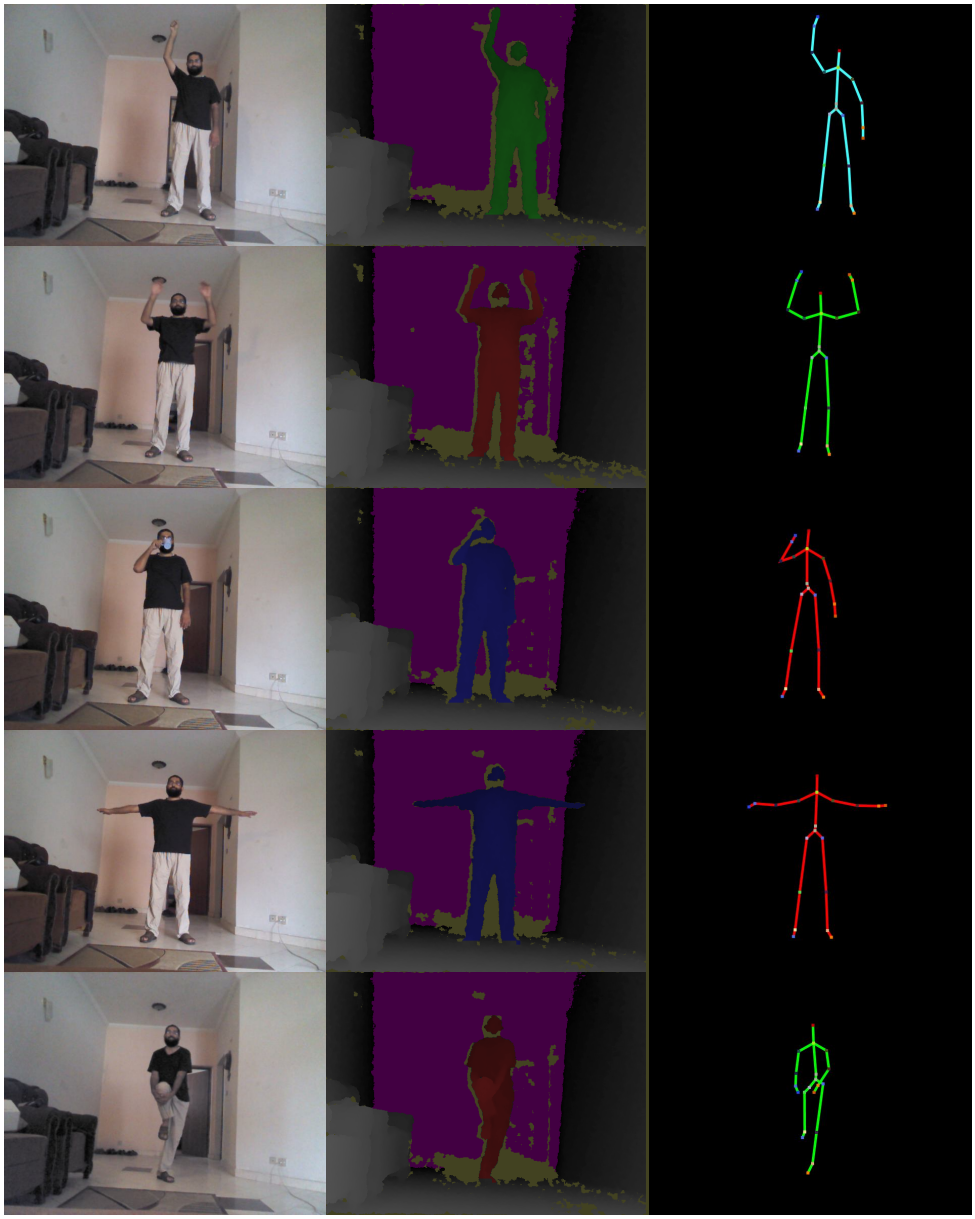
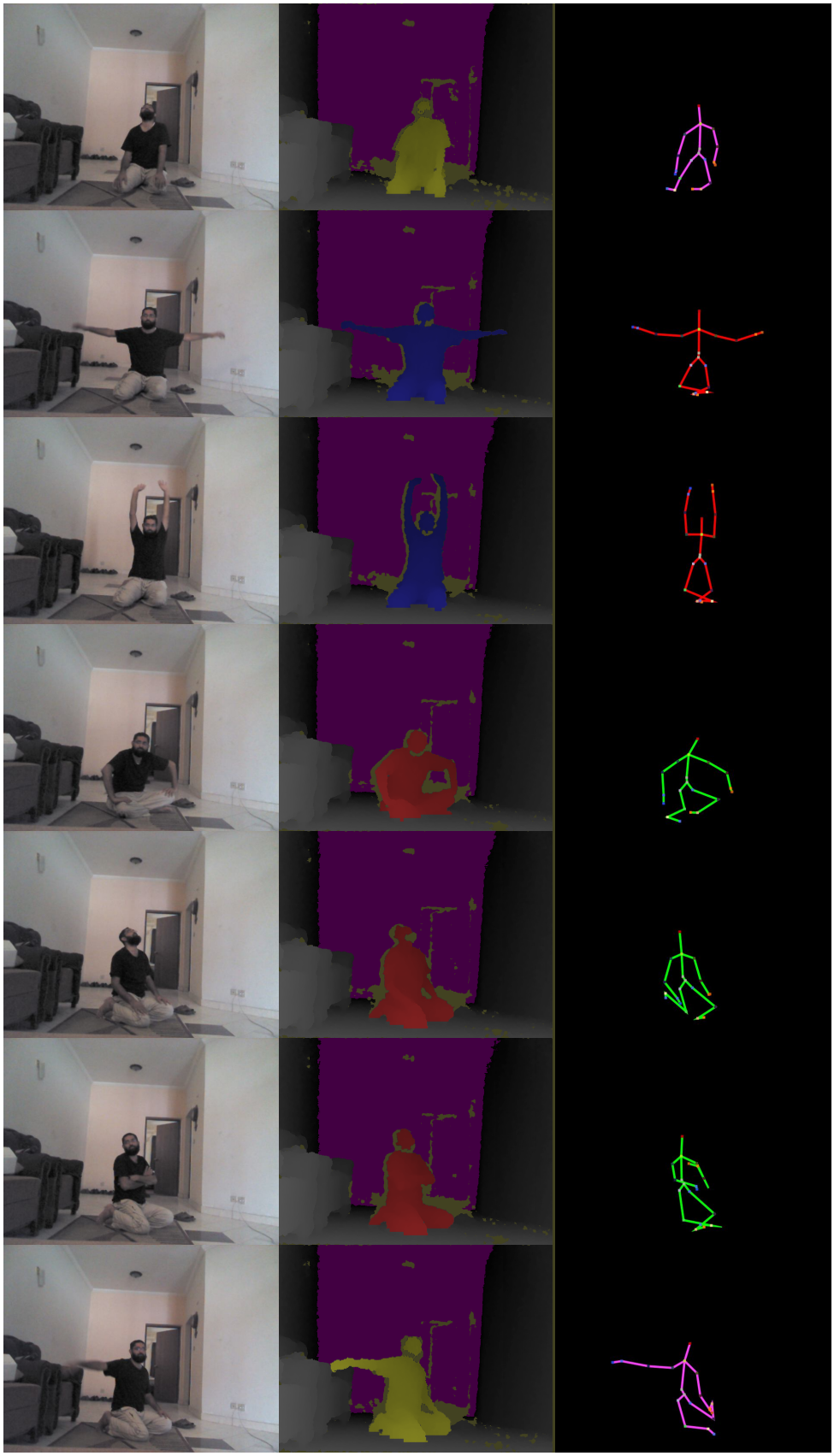


Figure 16: Standing: Negative Postures



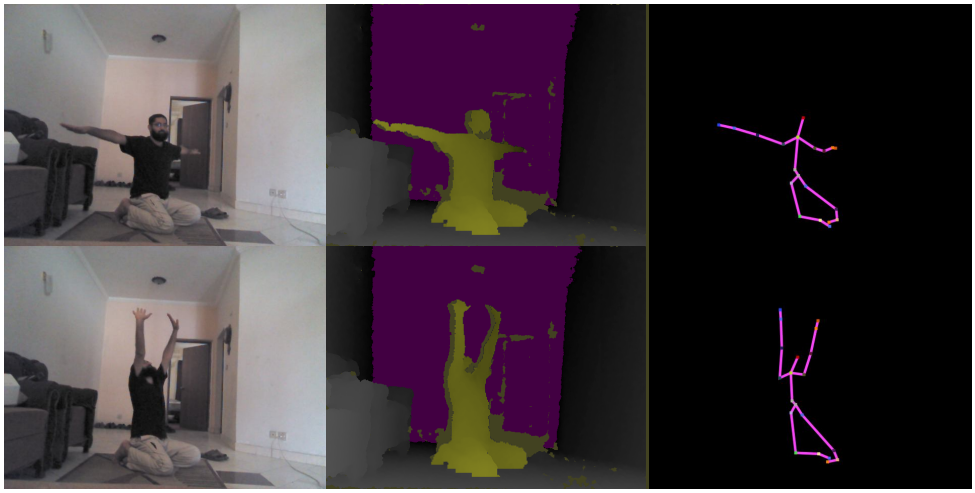


Figure 17: Sitting: Negative Postures

I. Data Files and their Properties

Beside recording dataset, we have also developed an application which can extract information from RGB, Depth and Skeleton data and store into .mat file format. The .mat file can easily be converted into spreadsheet and CSV data file. We have converted this data file into .arff file as well. We have done this for skeleton values of the input frame. However, anyone can easily extract other type of information by following the same principle. The detail of skeleton information is coming in the next sections.

Kinect Skeleton Information

Microsoft Kinect provides skeleton values of 20 joints of human body. The order in which each joint is numbered is provided in Table 1 below.

Joint Name	Joint Number
Hip Center	1
Spine	2
Shoulder Center	3
Head	4
Shoulder Left	5
Elbow Left	6
Wrist Left	7
Hand Left	8
Shoulder Right	9
Elbow Right	10
Wrist Right	11
Hand Right	12
Hip Left	13
Knee Left	14
Ankle Left	15
Foot Left	16
Hip Right	17
Knee Right	18
Ankle Right	19
Foot Right	20

Table 1: Kinect Skeleton Information

Spreadsheet Organization

We have exported the information of 20 joints of human body each of which contain X, Y and Z value for each joint into excel file format. We have placed each frame in one row which actually acquires 60 columns. The column 61 is manually labeled by class label while column 62 is kept empty for the classifier. The high level arrangement of file is shown in the Table 2 below.

Joint Frame	1	2	3	…….....	60	Actual Class Label	Predicted Class Label
1	Skeleton Values					12	Kept Blank
2						3	
3						6	
.						.	
.						.	
.						.	
.						.	
						.	
1740						14	

Table 2: Data File Arrangement

Class Labels

This is very much important here to provide the information about the actual classes present in the data file. There are 10 classes whose skeleton values are provided in the dataset. The detail of classes with their classification label is provided in the Table 3 below.

Class Name	Class Label
Negative One (includes standing/sitting other than prayer)	3
Takbeer	7
Coupled Hands	8
Straight Hands	9
Negative Two (includes standing other than prayer posture)	10
Ruku	11
Negative Three (includes bending other than prayer)	12
Sit	13
Sujud	14
Negative Four (includes sitting other than prayer)	15

Table 3: Class Labels

We have also provided frequency of each type of frame in the data. The Table below will provide a thorough understanding about each type of class present in the data.

Class Label	No of Frames
3	40
7	180
8	360
9	300
10	40
11	270
12	20
13	300
14	190
15	40

Table 4: No of Frames for each Class

Conclusion & Future Work

In this paper, we have presented our dataset of prayer postures with varying pose and distance along with negative examples recorded using Microsoft Kinect for Windows. We have provided labeled data set in various file formats like Matlab, excel and attribute relation file format along with RGB, Depth and Skelton information. Anyone, interested in our dataset can easily contact us by just sending an email to the corresponding author. In future, we have plans to extend our dataset by recording actions for the prayer, for female individual. We have also plans to record actions and postures for azan.

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