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A Study on Human Observer Classification and Ou-Isir Database for Gender and Age Estimation

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Abstract: ***Identifying a person among a group of peoples is very difficult. Forthis, many techniques are introduced. Among which Gait identification is one of the best approaches. Because of its quality against unclear images, for a better data extraction silhouette image is used. This data like step size, foot length, walking hip moment etc., of a particularperson, is stored in the database to match it with obtained image. However, if we don't have particular person data in the database, there is a probability of knowing the gender and age of that person. In this paper, initially, to identify the gender of a person from his silhouette image, the human observer's classification of gender methodis used. This method includes a predictio n preference of some peoples are considered for identifying a person by his hair, chest, hip style, dressing, from a static image. After getting the gender, it is easy to estimate the age from the obtained image using OU-ISIR Database. In this work, we took two different groups of ages as children's and adults.***

Keywords: ***gait analysis, gender classification, human silhouette, CCR, HOG, and CASIA.***

I. INTRODUCTION

Both man and womanplay a significant role in the socialworld. Several social relations depend on these separations. Gender classification is a significant event for grouping similar kind of peoples. If a pc acknowledges gender, it'll be useful in several applications. As an example, gender classification will improve police investigation systemssuch as allowing lady police for females and gent police for men, body check like similar things. By itself,classification is often supported face, voice, or gait. Among these, we tend to contemplate gait that may be a specific method of identifying biometric features from a distance [1] [2] [4] [6] [12]. Someresearch-oriented works are going on in this field. Gait dependent,gender(male and female) classificationremainsundeveloped. Attributable to these distinctive blessingsfor being non-contact, none involving, and merely no inheritable from a far field, it raised great interest among researchers in this field. In previous ways of human sexes (male and female) identification a tracer is placed on every joint or every part of the human and the suspects are even asked to have short costumes.Such techniques are not correct and uncomfortable. Connecting tracer on the whole human body of all the suspects is impractical. Else attempt for having somebody's silhouette from different pictures.

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Anyhow building a body moment of some subjects at a time is very difficult. Gait based on physical appearance options are often simply no inheritable and have a lower process price than the model-based approach. During such correspondence, that tends to initial describe the associate task which requires suspecting bodies to acknowledge different gender (male and female) from moving silhouette images and whole data is gathered for identifying a suspect by physical appearance [9]. Different parameters of the suspected body have beentaken into consideration given by observers, and then a final identification is done. Numbers of observations are done on cross-race Gender identification which has given good analytical results. Similar to gait based identification our human observers based identification also faces some problems such as carrying bags, wearing coat etc. in this paper we also try to solve some problems which are given above. Till today huge amount of work has been doneon gender identification which is totally based on voice or face detection.It addsa gender recognition method to use a neural network based back propagation which is for face-based human classification. Which proved efficient with its error as 8.1% its average rateaccording to the USstandard,has given as11.5% of efficiency rate which means a human can be classified even on PC vision.After someresearch works, researchers have come to know that Gait is very useful and essential for gender classification. In till today work small point lights are used by fixing it to the joints of suspected persons. Depending on that point lights connected to bodies these human observers checka total ofsixty-three different displays accuracy and then classifies the gender [12]. Finally, observers found that lights on several dynamic parts of the body are majorly helpful in gender identification; even static point lights study also has given necessary data for this classification. In other studies also this point light technique is conjointly used. As a result of this study that human observers have been used for differing sexes (male and female) classification. The tactic projected in uses associate for the point light display which can extract gender information is 3 mode PCA; the Correct Classification Rate (CCR) during a forty subject's information (20 females and twenty males) 96% accuracy is obtained. 20 observers are employed conjointly for identifying differences in sexes by seeing on PC images. This CCR is sixty-nine among different variables of normal image. We can't obtain the CCR rate efficiently with these old techniques of human observers if any point lights are missing. In short higher, CCR's can be obtained by observing the waist to hip style and neck to hip style for identifying a walkers gender [13]. In this observation, males use to swing their shoulders a lot than the hip where as females use to swing their hip a lot than their shoulders [5].

It's complicated to have a perfect prediction from these images because men have broad shoulders whereas females have wider hips further there issome parameters which can't predict from images. Some researchers are working on silhouette images for extracting gender identification parameters from these images. These silhouette images are further divided into seven equal regions individually with the relation to all parts of the area of conic. It considers an option that centre of mass, the ratio of the axis of the conic and many other important aspects of conic. The tactic previously usedby L&Gobtained a CCR of 84.5% during information about twenty-four subjects (ten females and fourteen males). Just like L&G technique, H&W conjointly utilized conic options for different sexes (male and female) classification. It's obvious that H&W got 97% efficient than other techniques because they used multiple cameras for movements extraction and used the face recognition technique. For human classification of different male and female,the silhouette image is divided into seven parts of information according to the body parts of the person in silhouette image. The seven parts are the top, arm, trunk, thigh, front leg, back leg, and feet. More than 500 experiments are done on different kind of circumstances, together with totallyseparate strategy such as shoes, bag, coat, etc. every image of these seven parts of silhouetteis thoroughly considered for result efficiency. We can get valuable suggestions from this comprehensive study of human body parts. In keeping with our study, hairstyle, and chest are 2 vital body parts in different sexes (male and female) identification. Anyhow the hair element is separated as skull and neck elements. According to the personality,the chestis also divided into two [6]. One considers as arm element for an obese personandothersconsider as neck part for the thinner persons. It's desirable to mark some parts of the body of both male and female which are variable such as below the neck and hips we also can mark the similarities between both the genders for easy analysis. We elaborate this analysis for better and efficient identification with this segmentation which is affordable. These antecedently presented techniques have helped a lot with dynamic silhouettes and the segmented image is obtained by removing background textures. The advanced silhouette data observations replace full body pictures which are a static image technique of human gender identification. The bar chart, used for homeward-bound Gradients (HOG) due to the SVM/RF as classifiers and 75.0% accuracyachieved for 600 pictures. Most current analyses pay abundant attention to the current question: that contributes a lot of to gender classification: material body form or motion? Motion is a lot of dominant than form data once mistreatment point-light displays, and conversely, the form is a lot of important than motion once mistreated images.

II. HUMAN OBSERVER'S CLASSIFICATION OF GENDER

This classification requires an human observers who decides whether the suspect is male or femaleand they try to convince this depending on number of parameters when silhouette is given then depending on its upper or lower part the accurate data is obtained such as arm size, swing of arms, chest, hip etc. are taken into consideration [13]. As shown in fig.1 one silhouette is divided into upper and lower parts which are seen individually. We take one of the images from the CASIA database of Gait.

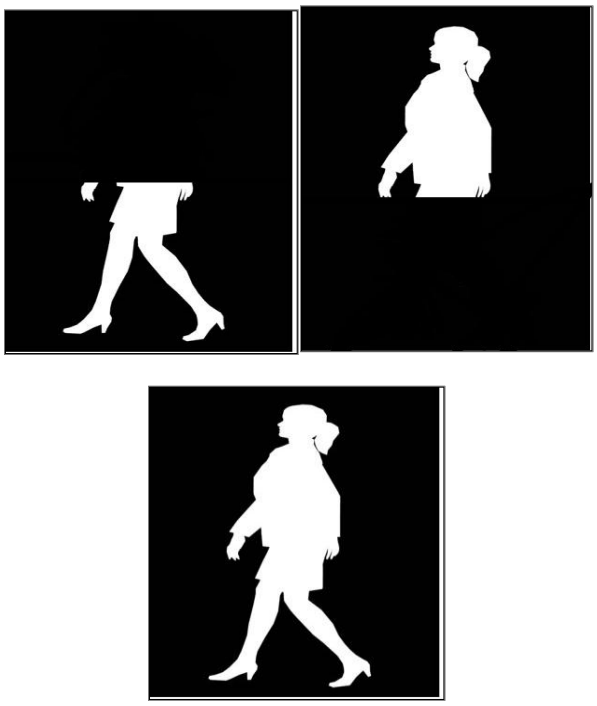

Fig.1: silhouette image.

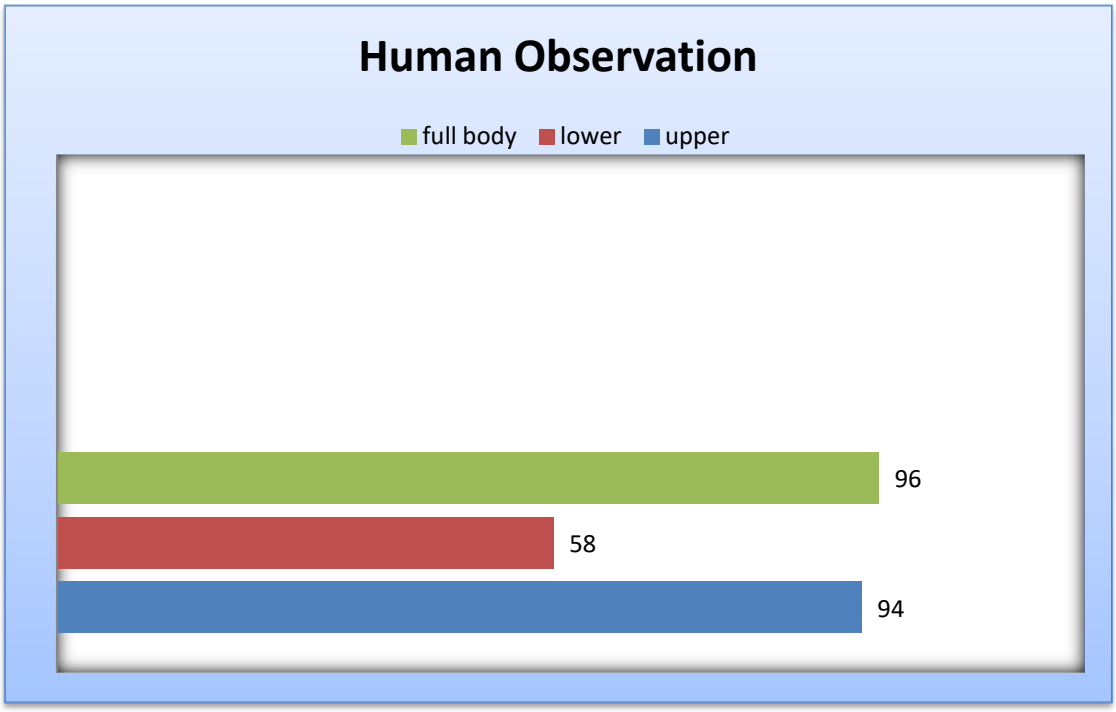

Fig.2: human observation

A moving dynamic picture was presented in the screen with the twenty-five images per second speed to be observed by this new technique. Then persons who were hired for observation have to acknowledge with a keen view in sexes (male or female)and classify it [7]. As we divided our silhouette into up and low parts here up part contains lots of data than the low part. For conveying this classification, we perform a test on this upper and lower parts in which every non-moving and moving information is used.

Total of 54 members haired as voluntaries out of which thirty-six members are male and remaining are females in this experiment.Correct rate got by observation is about 57.86% for low part of silhouettes, 94% is obtained of up part of silhouette,and96% is obtained for normal silhouette observation as shown in (Fig. 2). It's clear that a person can be classified easily form his upper body observation which gives lots of data about gender this can be said by seeing the efficiency of observation, whereas lower body gives required information but not as much than upper body because if both genders wearing pants then it's very difficult to classify it[4]. It appears that humans havea lot of sense to unmoving body form data than the moving data. We tend to conjointly survey the participants to induce many data on the contribution of various body parts. Many choices, specifically, head and hairstyle, neck, legs, walking style etc. are given are said to identify gender using this data, for this marks or rating has been assigned from zero to five points. Where zero marks or rating represents that there is not much data provided for classification or the panel for observation is so week that it can't identify the differences and five marks or rate represents the data efficiency or panel efficiency [8]. The observation marks or rating is as in Table I. in gender identification most useful classification is chest & hip that belongs to both up part, the lower part of human physic. However, more data can be acquired from the unmoving images than the moving images. Human observers initiate this as in fig.2.

Table.1: marks or rate of observation

Option	Average Score
skull	**4.4**
Below neck	**4.8**
hip	**1.4**
Waist	**1.6**
Thickness of Legs	**4.6**
Moment of Legs	**3.9**
Swing of arms	**3.1**
Moment of Body	**2.7**

So, as a result, the obtained parameters shows that given input image is of women and for this image now we estimate the age using static and dynamic responses of silhouette image.

III. AGE ESTIMATION

During this paper, we've got known many gait signatures for the gender identification of a human when his information is missing in the database. We also use these parameters like head length, linear unit, height legsand breadth between steps which was used to identify the exact age of person [2] [5]. The number of alternative steps is utilized for age identification such as the angular bend of the body from hip to head and walking style. Here in this paper, two age groups are taken that is an adult and child. OU-ISIR database is used which is of huge population database from which we identify the suspect age[6] [11].

Till date, we have used a face detection technique most commonly for age detection [1] [2] [10]. This estimation is done basically in 2 different ways one is static and other is dynamic. Here static face detection means having control view over the whole image whereasdynamic means quite the opposite. Normal images don't convey exact information of moving pictures whereasthe silhouetteis used for a high resolution saying that if the picture is not clear even then also we can extract the information. Biological predictions are done to identify the exact age from a human silhouette [11]. This prediction is based on face length, neck size, wrist size etc. these dynamic information's are based on step length and width. It's essential to identify exact information through joint parts of the body in the human silhouette as we marked some parts of the body as in fig.3 where every distinct length is assigned with parameters [8]. Refer to "(1),"The top length l is a parameterfor the upper part of the body in silhouette (xT, yT) to the component close to the subject's chin (xC, yC) by mistreatment,

$$\mathbf{l_h = \sqrt{(x_t - x_c)^2 + (y_t - y_c)^2}} \qquad \textbf{(1)}$$

As shown in fig.3 every part is measured such as l_b for head to chin, l_a for the neck to chest representation and gap among every step wide considered as $s_l$which will be varying for every step of suspects [7]. Calculation of legs moment is very difficult from silhouettes because joint reading is also required. As in fig.3, two vertical lines represent foot width and angle of legs size. One of these lines is from thigh to foot andanother line is from knee to foot if high heel sandals were used then angle will differ between legs. Whatever parameters were applied to the front leg and the same should be applied to back leg [12]. Let a1 and a2 Refer to "(2),"are same leg parameters thigh and foot and b1 and b2 is other leg parameters, lgis calculated as

$$\mathbf{l_g = \frac{(a_1+a_2)+(b_1+b_2)}{2}} \qquad \textbf{(2)}$$

The other measurements of the gait options are often derived from these basic options. Let t, sf, and r refer to "(3)," "(4)," "(5),"denote the stature, stride frequency and head-to-body magnitude relation of the topic. These options are often computed as

$$\mathbf{t = l_h + l_b} \qquad \textbf{(3)}$$

$$\mathbf{sf = \frac{s_l}{N}} \text{ , N is No. of frames /cycle} \qquad \textbf{(4)}$$

(4)

$$\mathbf{r = \frac{l_h}{l_b}, 0 < r < 1} \qquad \textbf{(5)}$$

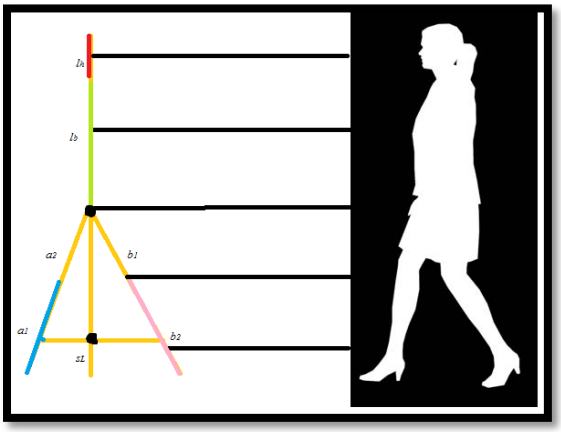

Fig.3: silhouette body parameters

IV. EXPERIMENTAL RESULTS

Here in this experiment, we use Osaka University-Institute of Scientific and Industrial Research (OU-ISIR) database which has done a great work by using a huge population as a subject with accurate silhouette identification ability. This research work recently has gone up to 20,000 peoples approximately on a single platform. This database is the world'slargestinformation-carrying systemabout 4007 subjects, in which 2135 are males and 1872 are females. These subjects are not of similar age group we have taken subjects of different ages of all durations such as one year infant to 95 years adult. Fig.4gives complete data clarity about gender ranging in different ages in which the concentration of males is more than a woman. This data provides nearly approximate data bout subject identification as we view it in different angles as we use more cameras which have 60 fps. As we have different age groups, different parameters are taken into constraint according to age group, such as infants condition. It is very rare due to less requirement, even though they are toddlers.As they use both arms and legs, it is easy to detect. When coming to kids and elders, their heights differ, for elders and old peoples angle of bending their body in degrees is calculated because as age increases older persons can't stand straight as they can.This is why choosing this database in our study of age estimation can provide lots of information about various age groups. As we know this database have copyrights means thoroughly checked in different aspects such as suspect is tested on treadmill speed variation, on different clothes, in different view angles etc. it's mandatory to verify the age of the subject manually which can't be system based.In this experiment, we use two various age groups of child and adult where 10 children's and 10 adults are encompassed as the same set of data acquisition. As we said, different views are used which is of 85 degrees angle as a maximum angle from which whole body moments can be captured. Silhouette image hasa high resolution to capture every single moment. The Experiment is based on gender and age estimation so; we have taken various age ranges and both the genders for experimental proof.

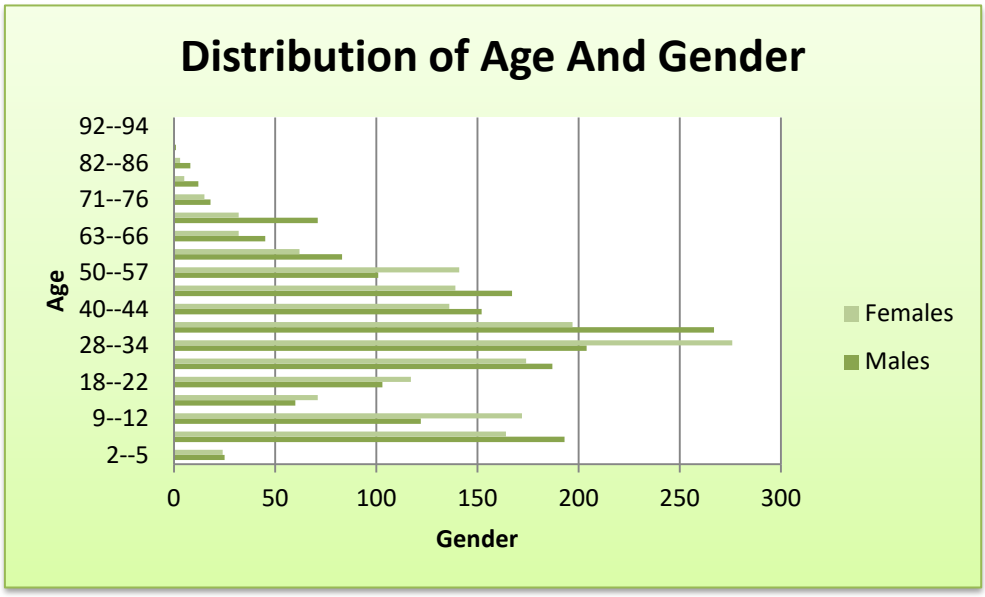

Fig.4:age distribution of both genders according to OU-ISIR database

A. Biological and Kinematic Gait Features investigation

In the experiment, we try to find the difference among child and adult by seeing their head to body and body to foot differences which vary. Fig. 5gives this data bout head to body variations among adult and child from which toddlers are also included for data purpose. Here we understood that adults are 0.19 to 0.26. Whereas adults should have optimized magnitude of 0.16 and for Childs, the magnitude should be 0.20. This fig.5 shows the exact magnitude rate for adults and Childs which can be helpful for age analysis.

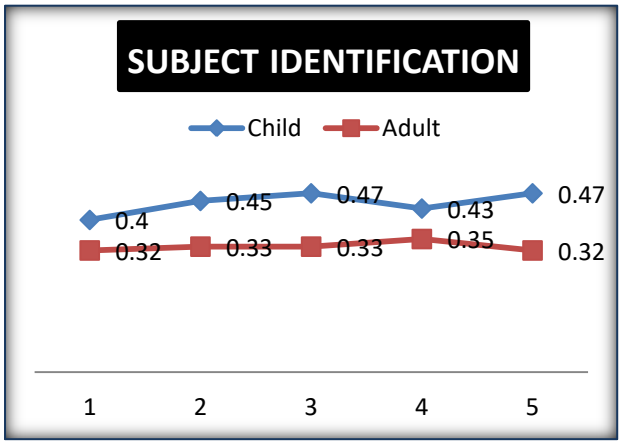

Fig.5: Subject ID

As we can see thatsfis same for all other themes which are due to the short walking distance of suspect as in OU-ISIR database, the subject is walking on a treadmill with different sensors on their body parts [1] [10]. Whereas closing the foot or closing the stride joints are also observed for valuable information and are denoted as, sL. The sfis mainly verified in police research which represents turns taken by a suspect according to their foot style as stride is open. The total height of the upper part of the bodyis considered as t which can't go furtherbecause the silhouette image resolution is about 88x128 pixels which is 127 pixels height.This can be the same for both adults and Childs because picture resolution is the same. Leg length, lg, which definitely varies to adults and Childs as we can see in table.2 the leg height parameter is varying but not much as we theoretically expect. $l_b$represents the base length which is also a great differ in both the age groups. Herelg, l, and r aremajor parameters for identifying age difference. Every parameter in this experiment such as l_b,l_g,l_h, t, r, s_f and $s_l$have contributed their calculation for age estimation. This Table-2 has given the extreme understanding of how an adult and child Gait is varying in both Static and Dynamic aspects with experimental parameters.

Table.2: Subjects Measurement Analysis

	Age Group	l_h	l_b	l_g	t	s_f	s_l	r
1	Adult	19.4	111.32	68.78	127.57	2.00	58	0.12
2	Child	21.3	106.7	62.45	127.34	2.00	57	0.16
3	Adult	18.5	112.34	67.65	126.12	2.00	59	0.14
4	Child	22.8	106.3	61.81	123.21	2.00	46	0.17
5	Adult	17.9	109.11	64.12	127.13	2.00	54	0.13
6	Child	23.1	104.7	61.11	126.76	2.00	49	0.16
7	Adult	18.2	110.23	64.52	126.89	2.00	58	0.13
8	Child	20.8	105.8	61.84	125.11	2.00	51	0.14
9	Adult	19.1	110.12	64.42	127.78	2.00	61	0.12
10	Child	21.7	106.9	59.26	124.16	2.00	52	0.17

V. CONCLUSION

During this paper, someone whose information,not providedin the database, can't be known precisely. However, by applying moving and unmoving image techniques on a presently obtained image, we can specify the gender and age of the specific person who might be useful in filtering the quality of chance. So, this paper uses human observer's classification technique for gender identification within which all the parameters like foot size, waist size, chest, back, a hip moment whereas walking, and hairstyle etc., are thought-about. Whereas for age estimation OU-ISIR giant Population information technology is employed within which 5-90 years gender peoples are subjected among those 2 different age teams are studied as subjects,i.e., adult and kid. This paper clarifies that sensible and actual knowledge of someone isn't abundant similar;thus, accuracy ought to be hyperbolic in actual and sensible knowledge which might be thought-about as a future scope.

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