Frequency Radiation Characteristic Around the Human Body

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***Abstract* — This paper discusses an analysis of human radiation frequency and classify the characteristic of human body radiation based on gender. The frequency radiation of the human body is experimentally studied from 33 healthy subjects on 23 points around the body. The characteristic difference of human radiation is evaluated using statistical analysis of multivariate analysis of variance. Then, kNN classifier is employed for classification of gender. The number of training to testing ratio is evaluated at 50 to 50, 60 to 40 and 70 to 30, to determine best classification accuracy. The data is analyzed separately of raw dataset and post-processing dataset to compare the classification results. At first, the data was classified using raw dataset and followed by the post-processing data to the classifier. It is found that the classification accuracy yields the perfect classification on k = 5, 7, 11 and 13 to 15 in post-processing data.**

Keywords – Frequency, human radiation wave, multivariate analysis, gender classification, kNN

I. Introduction

The concern about scientific investigations of the endogenous electromagnetic field (EM) generated by the human body have receive much attention in recent decades. The human body is believed to having their own radiation which emits into space on their surrounding body. With the advancement of science and technology, the existence of human radiation is identified as electromagnetic field generated by and contained within the biological system of body [1, 2]. The vibration of electromagnetic field generated by human body is referred as frequency radiation of human body, which emits their radiation around the body due to electromagnetic activities of the human body.

The radiation of the human body encircles the physical body as a sphere of radiation and vibrates at their own characteristic of frequencies [3, 4]. In this paper, the EM vibration is studied to classify the characteristic of frequency radiation particularly in gender. For the purpose of pattern recognition, the k-nearest neighbor (kNN) rule is used for classification.

II. Literature Survey

The electromagnetic radiation is described as self propagating wave consisted of electric and magnetic components. The wave oscillates in a periodic fashion exhibiting a characteristic amplitude, wavelength, and frequency. In wave motion, frequency is defined as the number of waves that pass through a given point per second. The EM radiation of the human body is generated associated with electrical properties in the human body [5, 6]. The human body is a biological system that consists of solid properties such as bones, muscles and organs, where they are all linked together by blood vessels, nervous tissue, connective tissue and muscle tissue. Every activity of living tissue is correlated with an electrical change [5]. As the flow of electrical current creates a magnetic field in the surrounding space, the electrical current within the human body also creates electromagnetic field surround the body. Since the human body is a biological system, the electromagnetic field will vary with activity and health of the body [7]. Therefore, the human radiation wave is a collection of electromagnetic waves of varying intensities flowing in and around the body, which vibrates a on their own characteristics radiation of frequency [3, 4]. This radiation namely aura, emits their radiation around the body into surrounding space [8].

In this study, the unique characteristics of body radiation frequency are detected at a distance, as non-invasive technique using a body radiation wave detector. The frequency of human radiation wave is captured on 23 points radiation in the human body included chakra, and layer encloses the body, namely left-side and right-side. The word chakra is derived from the Sanskrit word and literally meaning wheel [9]. A chakra is described as energy center in human being and it also defined as focal points for the reception, absorption and transmission of radiation wave to and from the human body. A chakra exists in the subtle body, a nonphysical body that is superimposed on the physical body and does a similar function within the human body. In general, there are seven major chakra points in the human body that are located along a central axis from the base of the spine to the top of the head [3]. Each chakra is believed to having specific function related to certain organs and glands that are usually associated with their position.

Previously, much research work in genders classification has been discussed based on face images and gait appearances [10, 11]. Additionally, some other techniques in gender identification systems have been done based on voice of speaker [12]. In pattern recognition methods, the k-nearest neighbor (kNN) rule is frequently used for classification because it is simple and robust. KNN classifier has been employed for gender classification from human face images and gaits [13, 14]. Nazir *et. al.* [13] used kNN classifier which the data splitting of training to testing ratio of 50 to 50 and yields classification rate of 99.3%. Hu and Wang [14] achieved 92.33% of classification accuracy with the used of gait principal component image (GCPI) as the gait appearance feature with kNN classifier.

However, some of other researchers have described the problem of classifying gender in image recognition techniques. Indeed, the problem that based on hand shape and facial images was discussed in [15] and [16], respectively. Moreover, other approach based on gait also discussed the challenge of classifying gender [17]. Therefore, search to improved gender classification is still going on.

III. Motivation

This paper proposes a new system that can distinguish between males and females subject using frequency radiation of human body. The frequency radiation of human has become an attractive biometric feature that is based on holistic body information. The radiation frequency is analyzed using statistical technique of multivariate analysis of variance and the characteristic of frequency radiation is classified into genders. The gender classification from human radiation frequency is examined using kNN classifier.

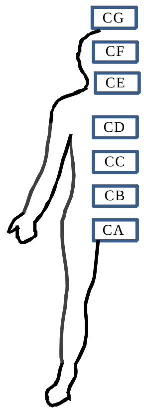
IV. Methodology

A. Apparatus

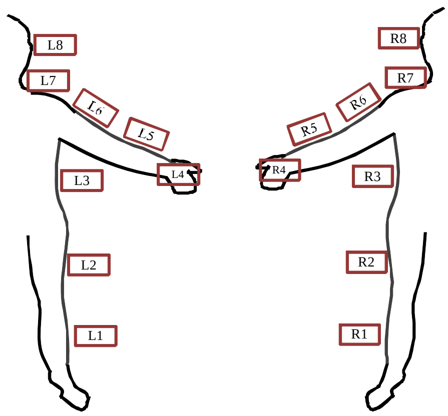
The human radiation frequency is captured through body radiation wave detector on Mega Hertz range. Body radiation wave detector is a hand-held frequency meter. The detector has telescopic whip antenna which can detect a broad range of electromagnetic waves of human radiation fields. Moreover, the frequency meter comes equipped with a filter unit and ultra sensitive synchronous detector. The filter unit will scrutinize the interference that presents in order to prevent display of random noise, while the ultra sensitive synchronous detector on the other hand, indicate the relative field strength of electromagnetic waves or field interacting with the antenna in order to check some form of interference.

B. Subjects

The frequencies of human body radiation are taken from 33 healthy subjects in a group of 17 males and 16 females, between the ages of 19 – 26 years. The frequency radiation obtained from human on 23 points throughout the body. It included 7 points of chakra located along the central axis of body, and 16 points for layer encloses the body, namely left-side and right-side. In particular, 8 points is represents for each part of left-side and right-side, giving a total of 16 points for layer encloses the human body. 16 point of the human body included 4 points in the feet, 4 points on the hand, 2 points on the palms, 2 points in the trunk and 4 points of the head. The arrangement of these 23 points is illustrated in Fig. 1 [18].



(a) 7 points of Chakra



(b) 8 points of Left-side (c) 8 points of Right-side

Figure 1. 23 points of the human body

C. Measurement Configuration & Procedures

The frequency measurements of the human body are conducted in controlled environment to allow similar comfort to all subjects. All measurements are performed in an anechoic chamber with the temperature of the chamber is maintained at 23 ± 2°C. The subject must stand on a ferrite floor at fixed position and relax during measurement. The subjects are also notified to limit their body part movement during measurement to diminish variation of reading frequency. Besides, the ambient frequencies for background conditions are measured immediately before and after the experiment [1], and to establish reliable data for all the subjects are measured at the same location.

In all measurements, the antenna is placed parallel to the

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ground on horizontal position to the human body. The procedure of the experiment involved in capturing frequencies of all 23 points on human subjects is shown in Fig. 2. The antenna is set on the 6^{th} segment length of the frequency meter. The frequencies are remotely detected at a distances of 1 to 5 cm from body to antenna [19]. All frequencies are then transferred to a computer and analyzed as off-line processing.

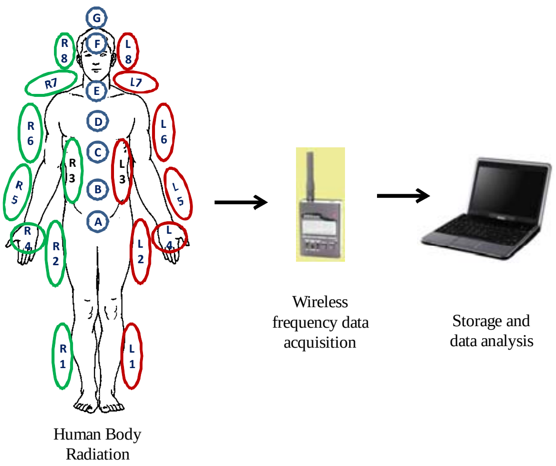

Figure 2. Frequency data acquisition procedure

D. Data Analysis

Fig. 3 shows a flow diagram of the experimental studies. Data are presented as the mean frequency for each particular point of body radiation. The characteristic differences of human frequency radiation in gender are explored by performing multivariate analysis of variance in data processing phase. For classification purposes, the raw dataset that consists of 23 points of frequency data are initially fed directly to the classifier. Then, the post-processing dataset of multivariate analysis is used as the input of the classifier.

The statistical technique of univariate and multivariate analysis of variance (MANOVA) has been employed to identify the characteristic differences of human frequency radiation in gender and minimize the variables for classification analysis [20]. MANOVA is an extension of analysis of variance and basically used to establish statistical significance of group differences among variables and provides the univariate results for each variable individually. As a result, the number of variables is reduced to retain only the variables that will contribute more for the classification.

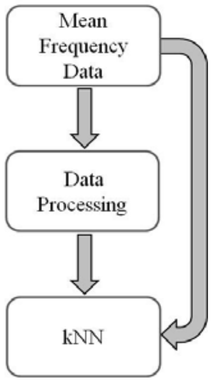

Figure 3. Experiment flow diagram

E. kNN Classification

The kNN classifier was employed for classification. In kNN, an object is classified according to the space distance where k parameter is number of neighbors. Typically, the closest neighbor is labeled when k=1. In this experiment, the default neighborhood setting of euclidean distance in Equation (1) is used to find closest neighbors.

$$d(x, y) = \sum_{k=1}^{n} \sqrt{(x_k - y_k)^2} \qquad (1)$$

The distance between two scenarios is compute using some distance function d(x,y), where x, y are scenarios composed of n features, such that $x = \{x_1, \dots, x_n\}$, and $y = \{y_1, \dots, y_n\}$. Here, the value of k is varied from 1 to 15 in order find the match class between training and testing data.

V. Results

A one-way multivariate analysis of variance was conducted to investigate the differences of frequency characteristic of human body radiation in gender. In this analysis, the 23 points of human radiation frequencies were analyzed separately into three groups: chakra, left-side and right-side. Several preliminary assumptions were performed prior to MANOVA analysis. This included testing of normality, outliers, linearity, multicollinearity, and homogeneity of variance-covariance matrices.

MANOVA is relatively sensitive with the outliers. For that reason, it is necessary for MANOVA analysis to come together with the test for outliers. There are univariate and multivariate engaged in this analysis. Basically, univariate outliers are determined separately for each dependent variable, while multivariate outliers will be determined by checking multivariate normality. Fig. 4 (a) – (c) shows the boxplot analysis for each group of chakra, left-side and right-side, respectively. In these figures, the frequencies data of body radiation were split by gender of males and females in order to separately analyze their characteristic differences. The univariate outliers were displayed as little circles in the plot while the extreme point indicated with an asterisk, *. Refering to Fig. 4, there are 8 outliers at high

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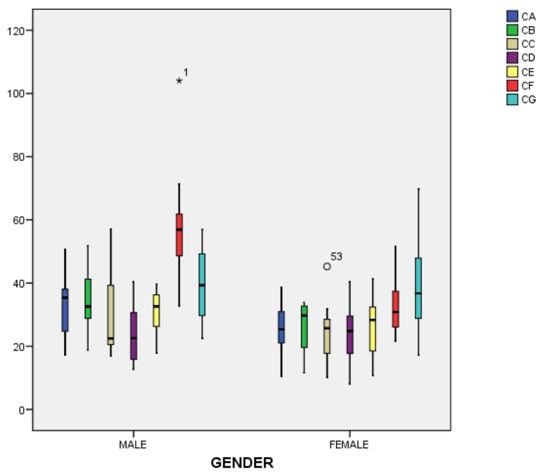
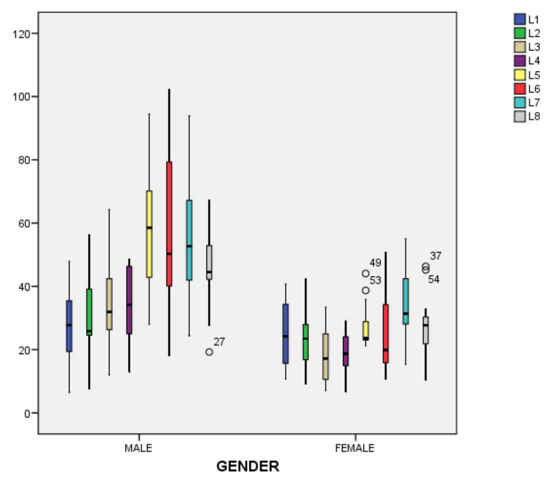
frequencies, 3 outliers at low frequencies and one extreme high frequency exists in the data as a total for both males and females.

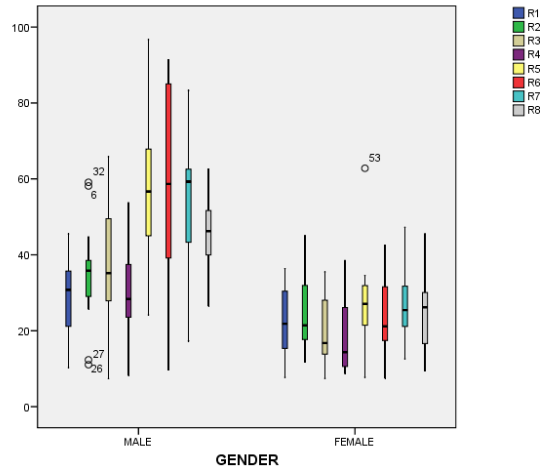
Since significance tests for MANOVA are based on multivariate normal distribution, the multivariate normality was performed by calculating Mahalanobis distance to determine the existence of multivariate outliers. With a criterion $\alpha = 0.001$ of chi Square table, the maximum value of Mahalanobis distance was observed less than critical value for each group as shown in Table I, thus denied the existence of multivariate outlier in the data.



(a) Chakra



(b) Left-Side



(c) Right-Side

Figure 4. Boxplot analysis for detection of univariate outliers

Additionally, the multicollinearity of the variables is determined by checking of high relationship for dependent variables. MANOVA works well if dependent variables have only moderate correlation to each other. From the correlation analysis performed for each group, the strength of correlations among dependent variables were found not more than 0.9, thus, multicollinerity is absence in the results. Furthermore, the assumption of homogeneity of variance-covariance matrices is examined by using the Box's M test of equality of covariance matrices. The significant ρ value was found greater than 0.001 in all groups, thus reject violation for the assumption of homogeneity of variance-covariance matrices.

TABLE I. MAHALANOBIS DISTANCE VALUES FOR ASSESSING MULTIVARIATE OUTLIER

Group	Number of variables	Critical χ^2 [a]	Maximum Mahal. Distance
Chakra	7	24.32	16.20
Left-Side	8	26.13	14.43
Right-Side	8	26.13	18.20

a. Extracted from a table in Tabachnick and Fidell [21]; originally from E. S. Pearson and H. O. Hartley (New York: Cambridge University Press, 1958).

The multivariate test of MANOVA for all groups of chakra, left-side and right-side indicates there are statistically significant differences among gender of males and females on a linear combination of frequencies, which the Pillai's trace obtained the significant value of ρ not more than 0.05 as shown in Table II. The average power to detect the effect in all three groups is 99 percent. Therefore, the difference among gender of males and females in human radiation frequencies is confirmed.

TABLE II. MULTIVARIATE TESTS[C]

PILLAI'S TRACE	GROUP		
	CHAKRA	LEFT-SIDE	RIGHT-SIDE
Value	0.595	0.726	0.621
F	5.250[b]	7.937[b]	4.908[b]
Sig.	0.001	0.000	0.001
Observed Power[a]	0.986	1.000	0.986

a. Computed using alpha = 0.05

b. Exact Statistic

c. Design: Intercept+GENDER

Further investigation on individual characteristic of dependent variable in gender differences was examined from univariate analysis. New alpha levels of Bonferroni adjusted were calculated to determine statistical significance of gender differences in univariate test. The result shows that the number of dependent variables was reduced to 13 points, which represents as post-processing data. Particularly, it included 1 point of chakra (CF), and 6 points for each left-side and right-side on L3 to L8 and R3 to R8.

For kNN analysis, the raw data and post-processing datasets were evaluated into three ratios varies in size of training set to testing set from 50 to 50, 60 to 40 and 70 to 30. The results for these experiments are given in Fig. 5 and Fig. 6. As shown in the graph in Fig. 5, the raw data input is correctly classified at k = 3, 4 and 10 to 15. In this experiment we suggested that the kNN classifier of 70 to 30 training to testing ratio of dataset is suitable.

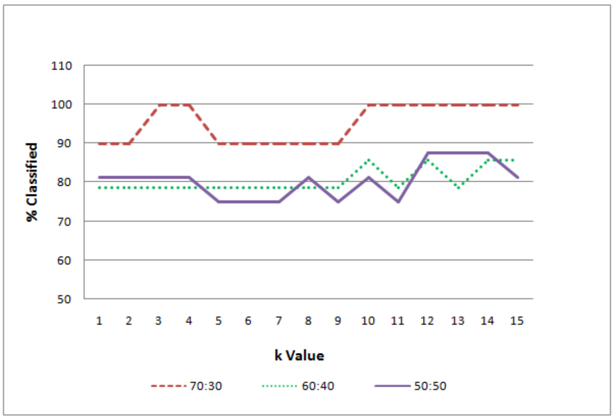


Figure 5. kNN classifier fed with raw data

Meanwhile, for the classifier fed with post-processing data as shown in the graph in Fig. 6, a perfect classification is found in classifier with training to testing ratio of 70 to 30. The highest classification was obtained at k = 5, 7, 11 and 13 to15.

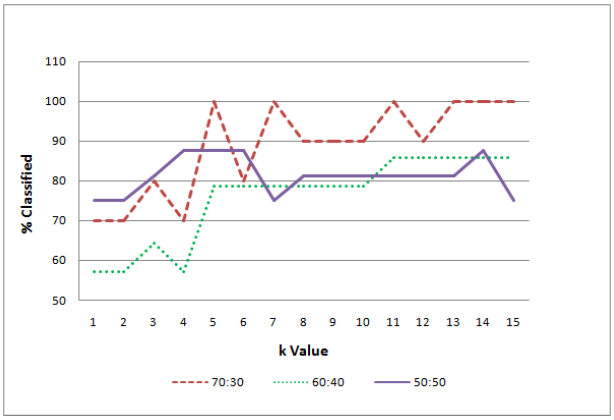


Figure 6. kNN classifier fed with post-processing data

VI. DISCUSSION

The frequencies of human radiation are studied on 23 points around the human body. All frequencies were obtained in the anechoic chamber to establish reliable data. The ambient frequencies before and after measurement were observed constant, which confirmed the stability of the detecting system.

A one-way between-group MANOVA analysis was performed to compare the frequency characteristic of human body. Prior to MANOVA analysis, preliminary assumptions testing of normality, linearity, multicollinearity, homogeneity of variance-covariance matrices, and univariate and multivariate outliers were examined. No serious violations noted in the tests.

The multivariate F value of Pillai's trace is the sum of explained variances on the discriminant variates, which the variables are computed based on the canonical coefficients for a given root. Although there are other statistics involved including Hotelling's trace and Wilks' lambda, the preferred statistic in this study is Pillai's trace, a more robust test for small sample and unequal sample size. The results obtained the significant value of ρ lower than 0.05 for all three groups, therefore, confirmed the difference among gender of males and females in human radiation frequencies.

In the univariate test, the Bonferroni adjustment is used in multiple-comparison procedures to calculate an adjusted probability. It is commonly used when several dependent or independent statistical tests are being performed simultaneously, where a given alpha level may be appropriate for each individual comparison, but it is not for the set of all comparisons. Therefore, the alpha level is lowered to account for the number of comparisons being performed. The new alpha levels of Bonferroni coefficient was 0.0071 for chakra and 0.0063 for both left-side and right-side.

For the classification results using kNN, the data used to train the classifier, and the classifier setting for training to testing data size plays important role in deciding the k of nearest neighbor. Besides, the classification algorithm is strongly affected by the size and the quality of the training data as well.

VII. Conclusions

The experiments described above have shown that the characteristic of human body radiation frequency can be used to classify the gender. Particularly, frequency measurements were carried out from 23 points around the human body, involving 33 healthy human subjects. The classification of difference vibration of body radiation on gender dependency found that 13 points of human body are significant to differentiate males and females.

The kNN analysis was used to classify gender using training to testing ratio of 50 to 50, 60 to 40 and 70 to 30. The data was analyzed separately of raw data and post-processing data. The results show that kNN is able to classify human radiation frequency. The success rate was improved to perfect classification when varying the training to testing ratio to 70 to 30. The selection of splitting data of training to testing ratio depends upon the resultant accuracy.

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