Clinical Feature Extraction of Polycystic Ovaries Syndrome in Ultrasonography Images and Hormonal Data

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ABSTRACT

Ultrasonography imaging of ovaries gives the important information about shape, size, position, number of follicles and the presence of cysts. The features extracted from the segmented image are applied to the K-NN classifier to classify whether the image is normal ovary or cystic ovary. The Statistical Package for Social Sciences (SPSS) tool used to analysis the hormonal data of both Poly cystic ovaries syndrome (PCOS) and control groups. Out Of 100 ultrasonography images 52 patients are diagnosed as PCOS patients 53.6% are have hirsutism, 65.2% are have menstrual disturbance, 32.2% are have normal but irregular cycles and 60.4% have infertility and 48 patients are controls with the normal ovaries on ultrasonography and regular ovulary cycles but they having PCOS. PCOS patients have significantly higher means of FSH, LH, testosterone, androstenedione, prolactin, estradiol and DHEAS levels and higher mean ovarian volume compared to control group. It results 65% of PCOS patients have enlarged ovaries and significantly higher hormonal levels, compared to control group having ovarian volume within normal range.

Keywords**:** *Hormonal Data, K-NN Algorithm, SPSS Tool, Ultrasonography Images.*

I. INTRODUCTION

The polycystic ovary syndrome (PCOS) has irregular menstrual cycle, stress and excess hair growth. The ultrasonography of the ovaries has been a useful tool in confirming a clinical diagnosis of (PCOS).Ovaries is the most common reproductive organ and is responsible for an estimated 70% of infertility. Ultrasonography images have a wide array of clinical applications. In gynaecology medicine frequent observation of ovarian follicles is necessary for the diagnosis of ovarian diseases like cystic ovarian syndrome and infertility treatments etc. The symptoms of infertility are anovulation, improper secretion of FSH (Follicle Stimulating Hormone) and LH (Luteinizing Hormone). The first stage of infertility treatment is to determine the status of ovarian growth. The PCOS also leads to diabetes type II, Cardiovascular disease (5) and endometrial carcinoma. The PCOS and control group, follicle detection and ovarian classification in digital ultrasonography images of ovaries. The experimentation has been done by using ultrasonography images of ovaries.

Proposed computer assisted detection of polycystic ovary morphology image processing yields better classification results in ultrasonography images (2). The method involves three steps are 1). Automatic segmentation of follicles using a mathematical methodology called steriology,(2) Storing the follicle attributes as feature vectors and 3) The classification of the feature vectors into two categories i.e. PCO present/PCO absent. The accuracy of follicle segmentation is measured by

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comparing manual segmentation generated by technicians. It is important to know about the status of the female reproductive system for addressing fertility problems and age related family planning. Now a day's these fertility related incidences in our society is steadily increasing. Monitoring follicles is especially important in human reproduction. The hormonal analysis of the PCOS and control group of patients are useful to know about the important of the hormonal level for the fertility. This work can be very demanding and in accurate.

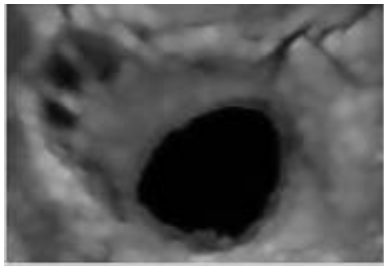
II. MATERIALS AND METHODS

A. Image Classification

The K-NN algorithm is used in MATLAB to classify the normal and PCOS cyst in ultrasonography images of 100 patients (4). The ultrasonography images are given as input images, and they are segmented and denoised by using median and wiener filter, the algorithm is used for the feature extraction and segments the images(2). The K-NN algorithm is the non parametric method used for classification. The input image are consists of K-closest training examples in the feature. In K-NN classification, the output is a class membership. An object is classified by majority vote of neighbours with the object being assigned to the class most common among its K-NN (k is positive integer, typically small) then the object is simply assigned to the class of that single nearest neighbour. The training phase of algorithm consists only storing the feature vectors and class of the training samples. During the classification phase all of the geometric features are extracted, these features are used as a knowledge base for testing phase.


(a)


(b)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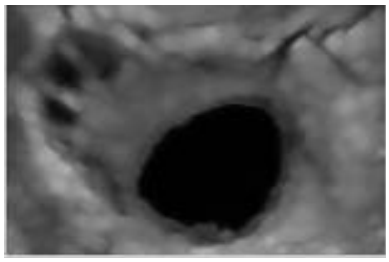
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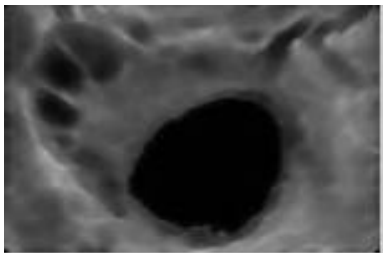
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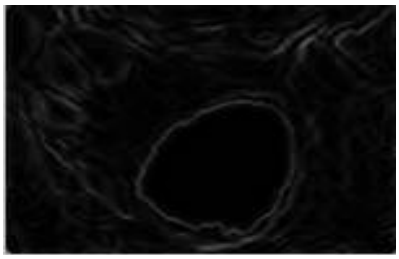
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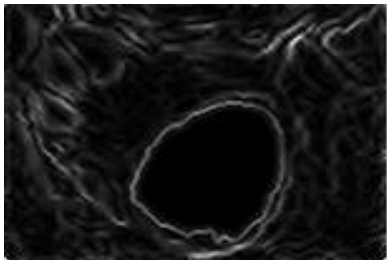
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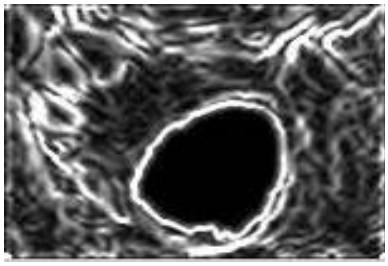
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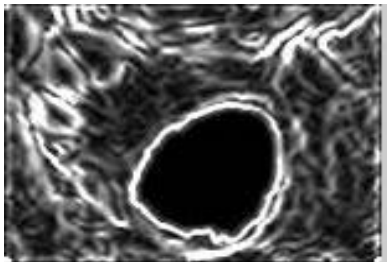
(i)

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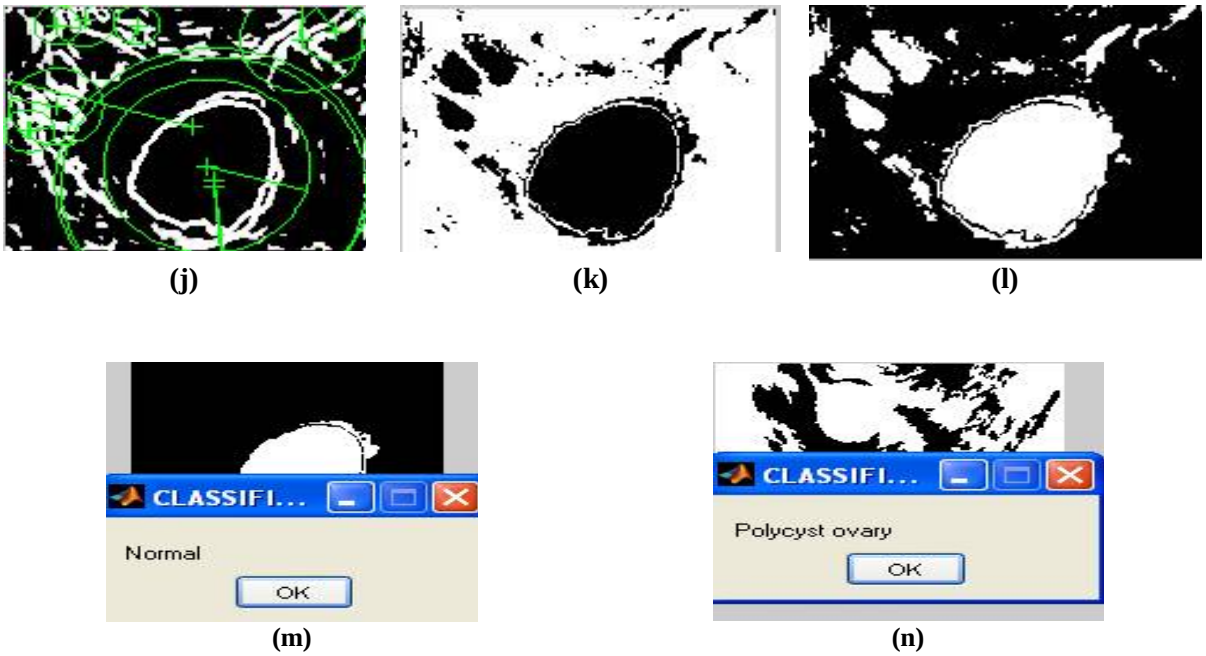

Fig 1.(a). Input Image (b). Gray Scale Images (c). Region Of Interest (d).Wiener Filtered (e).Median Filtered (f).Dilated Image (g).Eroded Images (h).Morphological Gradient For Edge Enhancement (g).Connecting The Class To Double (i). Brightening The Edge (j).Feature Extraction (k). Feature (l).Segmented (m). Normal (n). PCOS.

There is no significant difference in frequency of excess of hair growth , infertility, oligomenorrhea, amenorrhea and irregular menstrual cycles(1). The control group has a normal ovarian volume than the PCOS group of patients shown Table I.

Table I. Increased and Normal Ovarian Volume

	Normal ovarian Volume N=41	**Increase ovarian volume N=59**	**Total %**	**%**
Hirsutism	19 (46.3%)	43 (51.2%)	65	49.6
Oligo menorrhea	18 (43.9%)	40 (47.6%)	58	46.4
Amenorrhea	2 (4.9%)	9 (10.7%)	11	8.8
Irregular cycles	8 (19.5%)	21 (25%)	29	23.2
Infertility	23 (56.1%)	40 (47.6%)	63	50.4

As shown in the Table II the endocrine parameters of PCO patients with normal ovaries and the enlarged ovaries are compared. PCO patients with the enlarged ovaries had significantly higher level of FSH, LH, testosterone, androstenedione and DHEAS levels compared with the control patients(1).

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Table II. PCOS Patients Normal and Increased Ovarian Volume

	NORMAL VOLUME	INCREASED VOLUME
AGE(YEARS)	24.1±0.8	25.3±0.9
BMI	25.2±0.9	27.5±1.6
FSH(IU/L)	5.7±0.4	6.1±0.9
LH(IU/L)	9.4±1.1	16.2±1.4
E2 (pg/ml)	22.6±4.2	28.9±3.1
Testosterone (ng/dl)	73.2±5.1	111.9±8.3
Androstenedione (ng/ml)	1.87±0.05	3.3±0.31
DHEAS	273±22.1	368±30.1

B. Statistical Analysis

The Statistical Package for Social Sciences (SPSS) program, version 16, is used for management and the analyses of the data(3). The statistics is performed by providing the number of percent for C variables and the mean and the standard deviation for continuous variables. The association between PCOS and the control variables were found using the t-test and the Wilcoxon–Mann–Whitney test. For the potential effect of age and the BMI, are carried out the multivariate linear regression analyses for the association between each of the reproductive hormones and PCOS (3). The results are represented by providing of the regression coefficient and 93% of the confidence interval (CI). The P value was calculated and was considered significant if <0.09.

III. RESULTS

The PCOS and controls group are present in Table III. In LH, and total testosterone were significantly increased in PCOS, whereas FSH and progesterone were decreased in PCOS compared to the control group. The remaining measured hormones, i.e., LH, E2, DHEA, prolactin, and estrodiol were not different between the PCOS and control group.

Table III. Comparison of the Characteristics of PCOS and Controls

VARIABLE	PCOS	CONTROLS	P VALUE
Age(years) mean(SD) BMI mean(SD) <25%	35.9 (5.0) 31.9 (6.4) 7(11.3)	38.4(5.5) 29.1(5.5) 12(26.1)	0.01 0.02 0.05
>25%SBP (mm hg) Mean(SD) <140%	55 (88.7) 113.0 (16.1)	34(73.9) 111.7 (13.1)	0.66 0.61
>140%DBP (mm hg) Mean(SD) <90%	2(3.3) 71.8 (10.0) 54 (88.5)	1(2.2) 70.1(8.6) 44(97.8)	0.38 0.08
>90% Presences of acne N0(%)	7 (11.5) 38 (61.3)	1(2.2) 43(93.5)	< 0.0001
.>7% Peripheral cyst localization No%	12(20) 4(6.6)	0(0) 34(91.9)	< 0.0001
YES (%) Presence of oligo menorrhea NO (%)	57 (93.4) 14 (22.6)	3(8.1) 43(93.5)	< 0.0001
YES(%)	48 (77.4)	3(6.5)	

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Table IV. Age and BMI Adjusted Comparison of Reproductive Hormones

Variable	Regression Co Efficient	95%	P Value
LH	0.04	-0.007, 0.05	0.17
FSH	-0.032	-0.05, 0.001	0.06
LH/FSH	0.17	0.03, 0.35	0.03
E2	0.003	-0.02, 0.02	0.71
DHEA	-0.001	-0.04, 0.04	0.94
Total Testosterone	-0.10	0.18, -0.03	0.006
Prolactin	0.003	-0.004, 0.008	0.41
Progesterone	-0.10	-0.16, -0.04	0.006

In this, we have measured the level of reproductive hormones of the women diagnosed as PCOS. In our studied population, patients were younger than the controls group patients, and this age difference is sometimes un avoidable in the observational studies. In addition to the both PCOS and controls have higher than normal BMI which reflects the fact of the obesity is the common finding in PCOS. The patients have significantly higher BMI compared to the controls group patients. The PCOS have the higher risk of overweight compared to the control group patients. We find a significantly lower level of the FSH, and progesterone, and testosterone. The following hormones did not show the significant difference between the PCOS and controls group of patients LH, E2, DHEA-SO4, prolactin, and estrodiol. In the comparison between the PCOS and controls group patients, we were able to confirm the results. The results of the multivariate regression analyses confirmed the regardless of the age and the weight factor, control have the higher levels of the FSH and total testosterone, and PCOS have the lower level of FSH, and progesterone. In conclusion, our study suggests the regardless of the age and weight factor, PCOS patients have the higher levels of the LH/FSH and total testosterone, but lower levels of FSH, and progesterone. The levels of LH and testosterone and reduced FSH, and progesterone were the predictors of PCOS.

This was independent of the BMI or the age. Future studies with larger sample size and data on insulin levels are needed for greater understanding of the manifestation of PCOS.

IV. CONCLUSION

A method is proposed for the classification of normal ovary and cystic ovary in ultrasonography image of the ovaries. The K-NN classifier is used to classify the image as normal or cystic ovary. Within a small period of time the proposed method detects the cysts and reduces the burden of the medical experts. This result shows the PCOS patients are having the higher level of hormonal imbalances and irregular menstrual cycle. They are having more possible of diabetes mellitus, cardiovascular diseases and the heart rate variability problem.

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