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WRITING A GOOD Ph.D RESEARCH SYNOPSIS

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ABSTRACT

Synopsis is a short summary of your Ph.D thesis work. This paper suggests some ideas to motivate the young researchers for effectively writing the Ph.D synopsis with essential tips and tricks.This can act as a reference and help young researcher to going to write Ph.D synopsis.

Keywords: *Synopsis, Ph.D Synopsis, Literature review, Methodology*

1. INTRODUCTION

Introduction is the first main section in a synopsis. This synopsis is to be considered as a detailed summary of the workwith important resultshighlighting the original contributions in the thesisto be submitted. It should give an outline ofthe thesis. The review of earlier work is to be minimized with just enough to highlight thecontributions in the research work to be reported inthe thesis. It is expected that at the time ofsubmission of the synopsis no work is yet tobe completed except writing the thesis and allother academic requirements such as course work, comprehensive examinations and thesuggestions and directions given by members ofthe Doctoral Committee have been fulfilled.

Standard headings

- Introduction
- Literature review
- Objectives
- Methodology
- Experiments and Results
- Conclusions

The full synopsis should be maximum 2500 to 3000 words, Literature review.

2. TITLE

One of the most important steps in the writing process is coming up with a dissertation title that does justice to your work. The title of the Synopsis and title of the Thesis shall invariably be the same.The title of a thesis or dissertation must do several things in a relatively small number of words.

- First and most importantly, your title must tell readers what you are about to discuss at length.
- Secondly, you title must also include a creative or unique element, something that lets readers know that your personality is present in your work. Classic titles for dissertations or theses typically contain a common punctuation mark used by many academics: the colon.

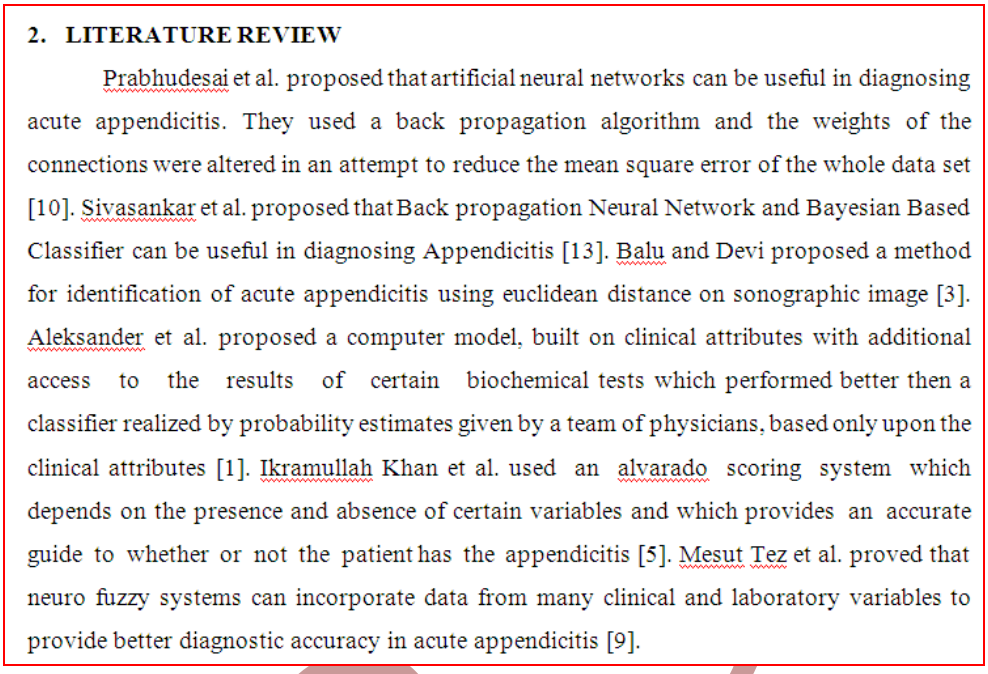
Titles with two phrases separated by a colon allow you to express two sides of your study and to draw readers into your work through information and creativity. The most important thing to consider when writing a dissertation title is your personality. Because the body of your work reveals your writing style, you should remain true to your style in the title. Don't try to write a title that you feel is attractive but that ultimately misleads readers in some way. Most of your colleagues who will be reading your work have professional interests that are similar to your own, so don't worry about what will draw people outside of your academic group because most people who come across your thesis or dissertation will likely be researching a similar topic [1].The synopsis title should be maximum 10 to 15 words. Figure1 shows an example of a title of synopsis.

Fig1. Example of a title

3. LITERATURE REVIEW

Literature review is the second session which is to be carried out in the identified area.The literature review is not just a list of the methods used/conclusions made byprevious studies. Have a look at research papers published in international journals forinspiration - the introductions most often include highly condensed literature reviews. The overall structure of your review will depend largely on your own thesis or research area. What you will need to do is to group together and compare and contrast the varying opinions of different writers on certain topics. What you must not do is just describe what one writer says, and then go on to give a general overview of another writer, and then another, and so on. Your structure should

be dictated instead by topic areas, controversial issues or by questions to which there are varying approaches and theories [2]. Within each of these sections, you would then discuss what the different literature argues, remembering to link this to your own purpose.



2. LITERATURE REVIEW

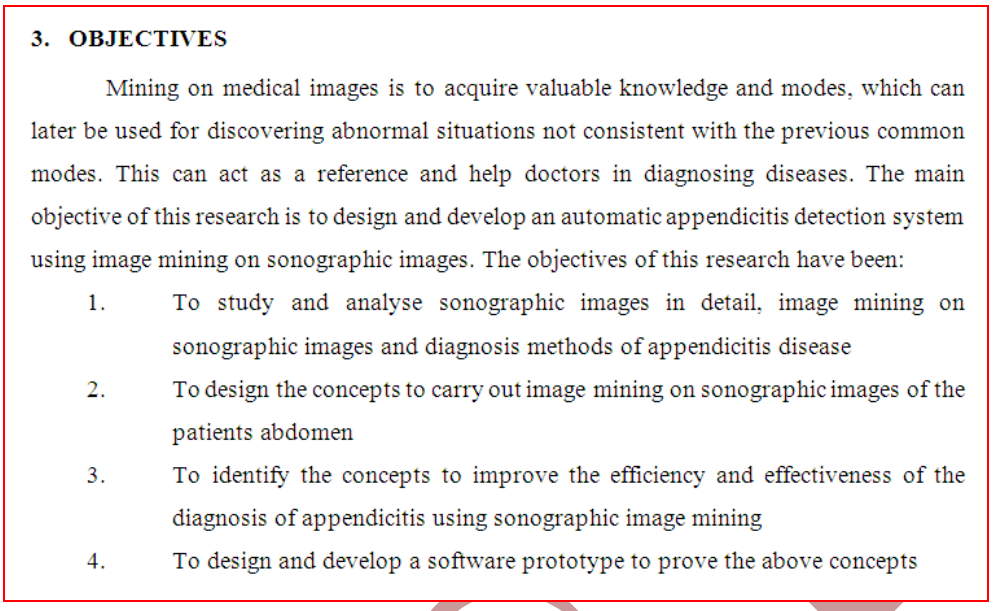
Prabhudesai et al. proposed that artificial neural networks can be useful in diagnosing acute appendicitis. They used a back propagation algorithm and the weights of the connections were altered in an attempt to reduce the mean square error of the whole data set [10]. Sivasankar et al. proposed that Back propagation Neural Network and Bayesian Based Classifier can be useful in diagnosing Appendicitis [13]. Balu and Devi proposed a method for identification of acute appendicitis using euclidean distance on sonographic image [3]. Aleksander et al. proposed a computer model, built on clinical attributes with additional access to the results of certain biochemical tests which performed better then a classifier realized by probability estimates given by a team of physicians, based only upon the clinical attributes [1]. Ikramullah Khan et al. used an alvarado scoring system which depends on the presence and absence of certain variables and which provides an accurate guide to whether or not the patient has the appendicitis [5]. Mesut Tez et al. proved that neuro fuzzy systems can incorporate data from many clinical and laboratory variables to provide better diagnostic accuracy in acute appendicitis [9].

Fig2. Sample of a literature review

3. OBJECTIVES

Objectives should be identified on the basis of the problem analysis. That means, after readingthe problem analysis it should be immediately clear that the choice of objectives is relevant and justified. The objectives should focus on concepts and problems mentioned in theproblem analysis Each research proposal should contain one overall objective describingthe general contribution that the research project makes to the subject area as well as oneor more specific objectives focusing on discrete tasks that will be achieved during theresearch. The overall objective may be something that the study will contribute towards butnot solve/finish; the overall objective should not be a compilation of the specific objectives.

- The objectives are preferred in synopsis and minimum four to five.
  - ✓ To study and analysis….
  - ✓ To design the concepts ….
  - ✓ To identify the concepts to improve….
  - ✓ To design and develop a….



3. OBJECTIVES

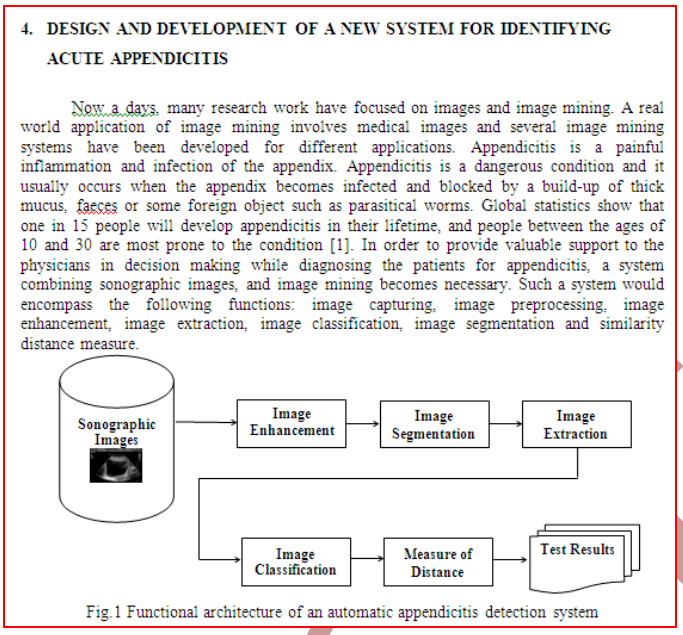
Mining on medical images is to acquire valuable knowledge and modes, which can later be used for discovering abnormal situations not consistent with the previous common modes. This can act as a reference and help doctors in diagnosing diseases. The main objective of this research is to design and develop an automatic appendicitis detection system using image mining on sonographic images. The objectives of this research have been:

1. To study and analyse sonographic images in detail, image mining on sonographic images and diagnosis methods of appendicitis disease
2. To design the concepts to carry out image mining on sonographic images of the patients abdomen
3. To identify the concepts to improve the efficiency and effectiveness of the diagnosis of appendicitis using sonographic image mining
4. To design and develop a software prototype to prove the above concepts

Fig3. Example of objectives

4. METHODOLOGY

Methodology describes a novel method which may be intended for use in your research. A research proposal follows an overall methodology to make conclusions in relation to the overall objective. Some types are experiments, surveys, models and case studies. Within a given research methodology several data collection methods can be relevant, and both quantitative and qualitative methods may be used in the same study. You should specify what research methodology is chosen to fulfil the research objectives. A description of the methodology used does not mean a reproduction of standard textbook definitions, instead, references should be used. For example, it is not necessary to explain that a case study approach 'will allow in-depth analysis of a particular problem and that the limitation is that the results cannot be statistically generalized, but that they could be theoretically generalized for places with similar characteristics'[2]. This is part of the definition of a case study (Yin, 2006), and it would be more informative to explain why a case study approach is suitable in the specific context. Likewise, there is no need to describe in general terms what data will result from an inventory or a semi - structured interview. A reference will be sufficient for commonly used methods, whereas it is relevant to describe the specific data to be collected



4. DESIGN AND DEVELOPMENT OF A NEW SYSTEM FOR IDENTIFYING ACUTE APPENDICITIS

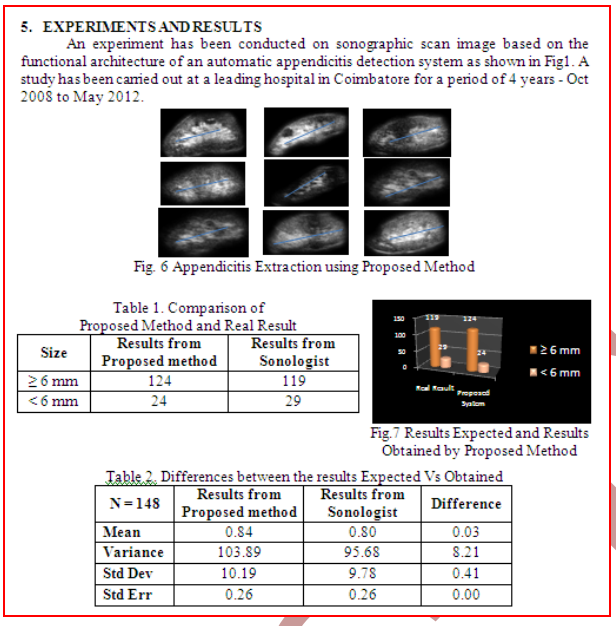
Now a days, many research work have focused on images and image mining. A real world application of image mining involves medical images and several image mining systems have been developed for different applications. Appendicitis is a painful inflammation and infection of the appendix. Appendicitis is a dangerous condition and it usually occurs when the appendix becomes infected and blocked by a build-up of thick mucus, faeces or some foreign object such as parasitical worms. Global statistics show that one in 15 people will develop appendicitis in their lifetime, and people between the ages of 10 and 30 are most prone to the condition [1]. In order to provide valuable support to the physicians in decision making while diagnosing the patients for appendicitis, a system combining sonographic images, and image mining becomes necessary. Such a system would encompass the following functions: image capturing, image preprocessing, image enhancement, image extraction, image classification, image segmentation and similarity distance measure.

Fig.1 Functional architecture of an automatic appendicitis detection system

Fig4. Example of Methodology

5. EXPERIMENTS AND RESULTS

This section is confident about the proposed solution which is simulated, tested and compared [3]. It presents the analysed data, preferably in tables and charts. It is a good idea to organise the results logically, for example by first presenting background information like demographics and then continue with in a sequence reflecting the specific objectives. All tables and figure must be numbered and referred to in the text. Table headings go above the table, figure headings go below the figure.



5. EXPERIMENTS AND RESULTS

An experiment has been conducted on sonographic scan image based on the functional architecture of an automatic appendicitis detection system as shown in Fig1. A study has been carried out at a leading hospital in Coimbatore for a period of 4 years - Oct 2008 to May 2012.

Fig. 6 Appendicitis Extraction using Proposed Method

Table 1. Comparison of Proposed Method and Real Result

Size	Results from Proposed method	Results from Sonologist
≥ 6 mm	124	119
< 6 mm	24	29

Fig.7 Results Expected and Results Obtained by Proposed Method

Table 2. Differences between the results Expected Vs Obtained

N = 148	Results from Proposed method	Results from Sonologist	Difference
Mean	0.84	0.80	0.03
Variance	103.89	95.68	8.21
Std Dev	10.19	9.78	0.41
Std Err	0.26	0.26	0.00

Fig5. Example of Experiments and Results

6. CONCLUSIONS

Conclusion section is somehow the counterpart to the introduction since this section should lead the reader from narrow and/or very specific results to more general conclusions. Start by clearly stating the main finding of the research. Then go on to outline the implications of the findings. How important is your contribution to the understanding that is currently held on the subject area and niche? What future studies could be recommend [4].

7. CONCLUSIONS

This research is concerned with the study and analysis of automatic appendicitis detection system to improve the efficiency and effectiveness of the solution for diagnosing acute appendicitis using image mining on sonographic images. The proposed system offers many advantages including better accuracy, greater noise reduction, faster speed and greater automation. The approach used for designing automatic appendicitis detection system is top-down and the software tool has been developed in windows environment. This system has been implemented using MATLAB. The developed system is expected to provide valuable support to the physicians in decision making at the time of diagnosis. This research work can be further extended in diagnosis of Ureteric Calculus, Cholecystitis, Pancreatitis and Liver Abscess.

Fig6. Example of Conclusions

7. REFERENCE AND PUBLICATIONS

Synopsis should contain at the end a list of references, and a bibliography if required. These should be written on a standard pattern. Therefore, be sure to write the full reference in the reference list, including author,publication year, title,title of journal/series, volume of journal/series contribution, publisher(omitted for journal), location (omitted for journal), page number.Finally listed out your list of publications including journals, conference etc.

8. CONCLUSION

This paper presents the effectively writing the Ph.D synopsis.(Appendix 1 is shown Example of synopsis).

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3. www.dartmouth.edu
4. www.dissertationindia.com

AUTHORS PROFILE

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He received his Doctoral Degree in Computer Science from Bharathiar University (2013) in the area of Image Mining. He obtained his M.Phil degree from Bharathiar University, Coimbatore in 2008, M.Sc Degree in Computer science from Bharathidasan University, Trichy in 2005. He is working as a Faculty in Department of Computer Applications, School of Computer Science and Engineering, Bharathiar University.

He has totally 9 years of experience out ofwhich three years as a system administrator and the remaining in teaching and research. He has contributed more than 15 papers in various National / International conference / journals. He is a member of IEEE, CSS, IET and IAENG.

Appendix 1

DESIGN AND DEVELOPMENT OF AUTOMATIC APPENDICITIS DETECTION SYSTEM USING SONOGRAPHIC IMAGE MINING

Synopsis submitted to Bharathiar University in partial fulfillment of the requirements for the award of the degree of

DOCTOR OF PHILOSOPHY IN COMPUTER SCIENCE

by

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under the guidance and supervision of

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TAMILNADU, INDIA

JULY 2012

CONTENTS

DESIGN AND DEVELOPMENT OF AUTOMATIC APPENDICITIS DETECTION SYSTEM USING SONOGRAPHIC IMAGE MINING

SYNOPSIS

1. INTRODUCTION

This research is concerned with the study and analysis of sonographic images, image mining, appendicitis to improve the efficiency and effectiveness of the diagnosis and detection process of acute appendicitis using image mining on sonographic images. Image mining is more than an extension of data mining to image domain. It is an interdisciplinary endeavor that draws upon expertise from computer vision, image processing, image acquisition, image retrieval, data mining, machine learning, database and artificial intelligence. Advances in image acquisition and storage technology have led to tremendous growth in very large and detailed image databases. Analysis of images will reveal useful information to the human users. Image mining deals with the extraction of implicit knowledge, image data relationship or other patterns not explicitly stored in the images. This process can be done in the mind by a human but implementation of this as a system is very difficult [6].

2. LITERATURE REVIEW

Prabhudesai et al. proposed that artificial neural networks can be useful in diagnosing acute appendicitis. They used a back propagation algorithm and the weights of the connections were altered in an attempt to reduce the mean square error of the whole data set [10]. Sivasankar et al. proposed that Back propagation Neural Network and Bayesian Based Classifier can be useful in diagnosing Appendicitis [13]. Balu and Devi proposed a method for identification of acute appendicitis using euclidean distance on sonographic image [3]. Aleksander et al. proposed a computer model, built on clinical attributes with additional access to the results of certain biochemical tests which performed better then a classifier realized by probability estimates given by a team of physicians, based only upon the clinical attributes [1]. Ikramullah Khan et al. used an alvarado scoring system which depends on the presence and absence of certain variables and which provides an accurate guide to whether or not the patient has the appendicitis [5]. Mesut Tez et al. proved that neuro fuzzy systems can incorporate data from many clinical and laboratory variables to provide better diagnostic accuracy in acute appendicitis [9].

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Now a days, many research work have focused on images and image mining. A real world application of image mining involves medical images and several image mining systems have been developed for different applications. Appendicitis is a painful inflammation and infection of the appendix. Appendicitis is a dangerous condition and it usually occurs when the appendix becomes infected and blocked by a build-up of thick mucus, faeces or some foreign object such as parasitical worms. Global statistics show that one in 15 people will develop appendicitis in their lifetime, and people between the ages of 10 and 30 are most prone to the condition [1]. In order to provide valuable support to the physicians in decision making while diagnosing the patients for appendicitis, a system combining sonographic images, and image mining becomes necessary. Such a system would encompass the following functions: image capturing, image preprocessing, image enhancement, image extraction, image classification, image segmentation and similarity distance measure.

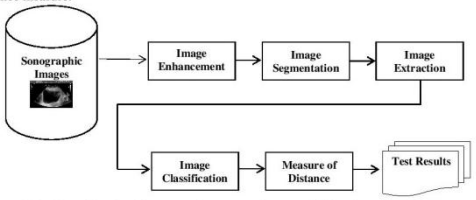

Fig.1 Functional architecture of an automatic appendicitis detection system

Image Capturing is a process to acquire the digital image and the captured image is brought into Matlab. Ultrasound image from the database is obtained through *imread* command in Matlab. Image enhancement techniques are used to improve the intensity of image. Intensity adjustment is an image enhancement technique that maps an images intensity value to a new range. Removing blurring and noise, increasing contrast and revealing details are examples of enhancement operations. Reducing the noise and blurring, and increasing the contrast range could enhance the image [2]. The original image might have areas of very high and very low intensity, which mask details. The *decorrelation stretch* adjusts their operation based on the image information being processed. Image segmentation is an essential step in almost all image analysis systems. There are many applications where on synthesis of the objects or computer graphic images require precise segmentation. Segmentation subdivides an image into its constituent regions or objects [8].

Image extraction extracts characteristics such as size, shape, density and smoothness from the Region of Interest (ROI) and a region of interest is a selected subset of samples within a dataset identified for a particular purpose. This research focuses on region of interests consisting of sub images of different size of thickness. The appendicitis is classified into two different sizes based on the thickness of appendicitis with greater than or equal to 6 mm and less than 6 mm. So, in order to distinguish the thickness, two different rules are engaged. In the first rule, the euclidean distance of the region of interest and in the second rule, the regularity in which the ratio of euclidean distance to thickness of the region of

interest are considered. Classification has a wide spectrum of applications including detecting spam in e-mails, image and pattern recognition, medical diagnosis, detecting credit card fraud, stock market analysis, speech and handwriting recognition, game playing and robot locomotion. The techniques for classification of data and dimensionality reduction are: Principal component Analysis (PCA) and Linear Discriminant Analysis (LDA) [11]. In this research, the appendicitis is detected using the distance measure in order to confirm whether a patient being diagnosed has appendicitis or not in case of appendicitis affected patient, the distance would be predominant in images.

5. EXPERIMENTS AND RESULTS

An experiment has been conducted on sonographic scan image based on the functional architecture of an automatic appendicitis detection system as shown in Fig1. A study has been carried out at a leading hospital in Coimbatore for a period of 4 years - Oct 2008 to May 2012. Ultrasound imaging was done on patients and patients were followed up until the discharge diagnosis was made. In the experimental study, a total number of 148 instances have been studied and the sample data corresponds to patients with their age in the range of 16 – 51 years and it is noted that mean age of these referel instances is 33 – 34. Male and female sex ratio is in the range of 2 : 1.

Fig. 2 Normal Image vs Appendicitis Image

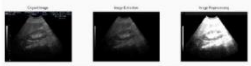

Fig. 3 Image Enhancement

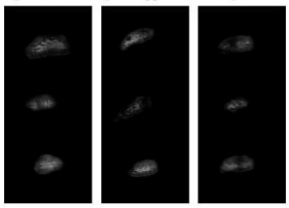

Fig. 4 Image Segmentation

Fig. 5 Image Extraction

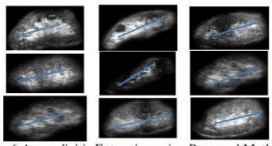

Fig. 6 Appendicitis Extraction using Proposed Method

As per medical research appendicitis is reported when an abnormally thickened appendix with a thickness of above 6 mm is diagnosed [7, 14]. Hence, in this research on image mining of sonographic images, the images are classified in two different sizes based on the thickness of appendicitis with greater than or equal to 6 mm and less than 6 mm. The proposed system is tested with 148 instances and the results obtained are: out of 148 instances, 124 instances show thickness measured as greater than or equal to 6 mm. Table 1 shows the results out of the experimental study conducted for finding acute appendicitis using sonographic images from 148 patients. A sonologist has been consulted and the results obtained from the sonologist on the same 148 samples reveal that 119 patients are affected by appendicitis. A comparison of the results obtained from the proposed system with the results obtained from the sonologist has been done and the results are as shown in Table 1 and the graph corresponding to this is shown in Fig 7.

Table 1. Comparison of Proposed Method and Real Result

Size	Results from Proposed method	Results from Sonologist
≥ 6 mm	124	119
< 6 mm	24	29

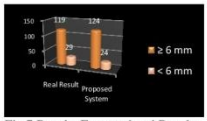

Fig.7 Results Expected and Results Obtained by Proposed Method

The results are validated by calculating the deviation of the results obtained through the proposed method and the real results obtained from the sonologist. The calculations are shown in Table 2.

Table 2. Differences between the results Expected Vs Obtained

N = 148	Results from Proposed method	Results from Sonologist	Difference
Mean	0.84	0.80	0.03
Variance	103.89	95.68	8.21
Std Dev	10.19	9.78	0.41
Std Err	0.26	0.26	0.00

The standard deviation and standard error clearly show that the proposed method yields nearly good results.

6. PERFORMANCE EVALUATION

The confusion matrix determines the performance of the proposed method and is shown in Table 3. This matrix describes all possible outcomes of a prediction results in table structure. The possible outcomes of a two class prediction can be represented as True Positive (TP), True Negative (TN), False Positive (FP) and False Negative (FN). The normal and abnormal images are correctly classified as True Positive and True Negative respectively. A False Positive is incorrectly classified as positive (yes) when it is a negative (no). False Positive is the False alarm in the classification process. A false negative is when the outcome is incorrectly predicted as negative when it should have been infact positive. A confusion matrix contains information about actual and predicted classifications. Performance of such systems is commonly evaluated using the data in the matrix. In the confusion matrix given in Table 3, 'a' is the number of correct predictions that an instance is negative, 'b' is the number of incorrect predictions that an instance is positive, 'c' is the number of incorrect predictions that an instance negative, 'd' is the number of correct predictions that an instance is positive [4]. The recall and precision can be calculated using following equations:

Table 3. Confusion Matrix

		Predicted	
		Negative	Positive
Actual	Negative	a	b
	Positive	c	d

Recall = TP / (TP + FN)

Precision = TP / (TP + FP)

By applying the formulae to the developed system, the recall and precision are 83% and 81% respectively.

Sensitivity and Specificity

Sensitivity and specificity are statistical measures of the performance of a binary classification called classification function. Sensitivity measures the proportion of actual positives and specificity measures the proportion of negatives. Sensitivity relates to the tests ability to identify positive results of the medical test used to identify a disease. The sensitivity is written as [12]: Sensitivity is number of true positives / (number of true positives + number of false negatives). Specificity relates to the ability of the test to identify negative results of the medical test used to identify a disease. The specificity of a test is defined as the proportion of the patients who do not have the disease to who will test negative for it. Specificity is number of true negatives / (number of true negatives + number of false positives). By applying the above formulae to the developed system, the sensitivity and specificity are 83% and 80% respectively.

7. CONCLUSIONS

This research is concerned with the study and analysis of automatic appendicitis detection system to improve the efficiency and effectiveness of the solution for diagnosing acute appendicitis using image mining on sonographic images. The proposed system offers many advantages including better accuracy, greater noise reduction, faster speed and greater automation. The approach used for designing automatic appendicitis detection system is top-down and the software tool has been developed in windows environment. This system has been implemented using MATLAB. The developed system is expected to provide valuable support to the physicians in decision making at the time of diagnosis. This research work can be further extended in diagnosis of Ureteric Calculus, Cholecystitis, Pancreatitis and Liver Abscess.

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