Gender As A Moderator Between Level of MATLAB Knowledge and MATLAB Features Understanding

Ching Yee Yong, Kim Mey Chew, Nasrul Humaimi Mahmood and Ismail Ariffin

Faculty of Electrical Engineering, Universiti Teknologi Malaysia
Johor, Malaysia
chiyong@fkegraduate.utm.my

Abstract

Around 35 students from the university campus participated in the Development of Biomedical Image Processing Software Package for New Learners Survey investigating does gender will affecting the use of software package for processing and editing image. The survey was available online for six months. Facts and opinions were sought to learn the general information, interactive image processing tool, non-interactive (automatic) tool, current status and future of image processing package tool. Composed of 19 questions, the survey built a comprehensive picture of the software package, programming language, workflow of the tool and captured the attitudes of the respondents. The result of this study shows that the moderating effects of gender explain 37.03% of mean variance in research output. The result is expected to be beneficial and able to assist users on effective image processing and analysis in a newly developed software package.

Keywords: *MATLAB; image processing; moderator; software package*

1. Introduction

This paper details a project jointly funded by the Dana Pembangunan Pengajaran (DPP) and Universiti Teknologi Malaysia (UTM) to produce a survey of computer graphics and visualization tools in use in the medical image processing.

Biomedical Image Processing techniques involve lot of mathematical equations and new learners/ students need to calculate manually in order to analyze such techniques. It is very important to the new learners to understand the fundamentals of Biomedical Image Processing; however, through demonstration the techniques via real application would be extra benefit for new learners to understand such techniques.

This paper is divided into seven sections. The first section mainly introduces the whole study. It provides the general overview of the visualization tools in medical image processing. The second section includes the objectives of this study, which describes the aims that needed to be achieved. The third section discusses the background studies, literature review and the study implementation. A specification list of the research framework and thorough discussion on the developmental tool or processing and analysis on various medical images will be explained in section 4 and 5. Finally, the last two sections contain the results, conclusions, future developments and possible enhancement and improvement on this study.

2. Problem Formulation

The hypothesized function of newly developed image processing software package is to provide the users with information about the ease of image processing of an image in

order to deliver useful information through the analysis with connection to the theory of image information through processing. In this study, the practice item of image processing software package was focused on MATLAB application.

Several imperatives were identified to be addressed by the survey:

- To discover the current visualization practice in biomedical image.
- To discover the affecting factor (gender) in relationship between level of MATLAB knowledge and understanding of MATLAB features.

A wide variety of image processing techniques have been used in medical field for image analysis. This employs a large number of visual and physiological features, a fact which usually impedes the training process [1].

In this paper, an effective of moderator factor impacted between the relationships was presented through survey result. Several aspects for example the number of subjects and ease of use of MATLAB software were considered while the processing was being done. This software package does not process only raw image for analysis, but also important in managing the image data effectively and providing scientific information about image characteristics.

3. Literature Review

Biomedical image processing is any form of biomedical signal processing for which the input is a medical image, such as from various imaging modalities, i.e. MRI, CT Scan, X-Ray and Nuclear Medicine [2, 3]. Most biomedical image processing techniques involve treating the biomedical image as a 2D signal and applying standard signal-processing techniques to it. Although there are also 3D medical images involved for image processing, this project will only concentrate on 2D image processing techniques such as image enhancement, image filtering, image segmentation, thresholding and morphological operation.

The research framework and methodology complies with ADDIE model [4, 5]. ADDIE model is the generic process traditionally used by instructional designers and training developers. The five phases—Analysis, Design, Development, Implementation, and Evaluation—represent a dynamic, flexible guideline for building effective training and performance support tools. Our work starts with conducting a survey to the new learners/students about their understanding on Biomedical Image Processing course to identify any problems or issues of how difficult to them to understand the Biomedical Image Processing course.

In this project, our plan is to investigate does gender will affect the understanding toward a software package and the difference between these two groups.

Digital image processing has become such a broad area and sometimes it is very difficult to distinguish what might be considered as particularly useful to a non-specialist. The boundaries are become blurred and hence in this paper, we emphasize a representatives of digital image processing software packages that capable to embody all the core capabilities in scientific image processing applications.

We have concluded the core capabilities into 5 major sections: image utilities, image filtering and transformation, image compression, image analysis and programming and data analysis environment. The first section includes file conversion, image manipulation and image display. It is an essential that a software package capable to convert an image from one format to another since images comes in such a variety of formats. Filtering and transformation include median filtering, averaging filtering,

convolution, Fourier Transform, scaling, translation, morphological operations and other image functions form. Image compression is a demand for those who works with large image that might require large amount of storage space. A standard image compression utility provides an image database for storing and retrieving compressed images. The main goal for image analysis is to derive some useful information from an image. Simple image analysis tools like segmentation and edge detection are powerful tools for gleaning important and unique information from a visual image. Programming and data analysis environment provides a platform to develop new processing algorithm or interface with other image processing techniques. It is also provides an environment for computation and iteration.

4. Methodologies

A number of steps were taken in order to realize these objectives and these including the design of a questionnaires framework, construction of the project web pages, the use of on-line social activity platform like facebook messaging, e-mail discussion groups, face-to-face interview and the development of a dedicated project discussion list.

In this paper, we proposed a model regarding the effect of gender on the understanding toward MATLAB features through their level of MATLAB knowledge.

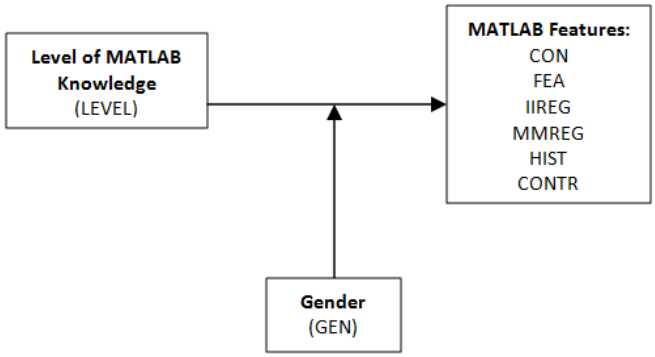

Figure 1. Research Model Overview

In Figure 1, the model is built up with 6 MATLAB features: conversion, feature extraction, image-to-image registration, model-to-model registration, grayscale analysis and contrast adjustment.

4.1. Research Model

The six sections in the model were divided into four Likert scale dimension from 1-4 which represented from never heard before, somewhat, likely until fully understand. Respondents were required to choose among the scale based on their understanding of the features. While the data for the level of MATLAB knowledge was also taken with the same method by dividing the level into 4 categories using Likert scale 1-4 from never used MATLAB before, use MATLAB a little but not comfortable with it, can comfortably use MATLAB but not an expert, until expert user.

All the data were then key into SPSS software for analysis.

4.2. Data Collection Framework

Data for the research are collected through questionnaires distributions, World Wide Web service, mailing list and online activity platform.

Subjects were invited to make general observations and perspectives on the use and potential use of the image processing software tool techniques in their work.

In order to publicise the survey and encourage participation, a World Wide Web service was established. The service included the opportunity to complete the online version questionnaire and the result only can be downloaded in EXCEL format by admin to be printed for analysis. These pages server will remain available on the internet server for at least the next 6 months.

An extensive use was also made of existing e-mail list discussion group in addition by through traditional and conventional means. The details of the project were sent to around 50 receipients together with the relevant URL of the project World Wide Web pages. Receipients in the mailing list were encouraged to visit the homepage of the poject and complete the online version questionnaire and further forward the message to other lists which they might be relevant to the scope of the project.

5. Result

The response rate to the questionnaires is mild and has been limited but not very disappointingly so. We have received over 35 completed questionnaires. Of these, almost 70% were completed the survey. Around 20-25% of the response rate to the questionnaires is considered good by some relevant literature suggestions.

Table 1 shows the model summary of the research. All the Sig. F Change values are less than 0.05 and it complies that gender does exist as a moderator and it affects the relationship between the level of MATLAB knowledge and MATLAB features understanding. This result supports the presence of moderating effect. In other words, the moderating effects of gender explain 37.03% of mean variance in research output.

When the respondents discussed about the use of MATLAB software in image processing, the software was described as being neither particularly easy nor difficult to use and it was viewed in high regard however.

Descriptions were included that the software was specifically used for data analysis with customised procedures, matrix manipulation, data visualization, graphic image production and editing, and customization of statistical data using language script.

Table 2 shows the moderating effect on level of MATLAB knowledge and understanding of MATLAB features and Figure 2 summarized the information from the table using graphical method. From Figure 2, the slopes for six sections of MATLAB features for female were steeper than male, and these implied that female respondents were much more varied among themselves on understanding of MATLAB features. This result can be supported by analysing the level of MATLAB knowledge for male which dropped into a boundary of 1 to 4 while female in a boundary of 0 to 4.

Table 3 shows the mean and standard deviation for LEVEL (level of MATLAB knowledge). The descriptive statistical data was used in the reworking of equations.

6. Discussion

The advantage of the development of image processing package over other is the ability of this processing tool to provide an effective and easy method for user. It is important to consider the processing in all the aspects including speed and quality.

From the supported result, for male category, respondents suggested that users with MATLAB level above 1 can easily cover and implement the features while female suggested that they can start from zero. As short, a good and useful software should be designed around four essential qualities: validity, reliability, impact and practicality. Validity is normally taken to be extent to which a processing can be shown to produce scores which are an accurate reflection of the image taken true level. Reliability concerns the extent to which processing results are stable, consistent and accurate, and therefore the extent to which they can be depended on for making decisions about the image processing. Impact concerns the effects, beneficial or otherwise, which an examination has on the processing using the package. Practically can be defined as the extent to which a processing is practicable in terms of the resources needed to produce and administer it.

7. Conclusion

This survey attempted to raise an interest of gender factor in affecting the level of MATLAB knowledge toward its features application in the medical image processing field. The survey results are fairly depressing and there is plenty of work to be done. In medical image field, not many visualization tools can be used and most of them are not easy being used. Hence, a creation of simple computer graphics such as histograms, bar charts and scatter plots by MATLAB package to manipulate and visualize matrices data is a need.

The project's web pages will continue beyond the completion of the survey, as will visualization tools.

In future, this model will be upgraded and implemented more others affecting moderators to stabilize resources to provide the necessary infrastructure, supplies and materials needed to ensure every processing is achieving the image analysis potential. This is important to increase the reliability and effectiveness of the analyzing steps.

A more detailed concept of model will be more useful in later analyzing stages. As in moderating flow algorithm, all the information is need to be incorporated on the direction of processing. Optimization in realization is very important for a optimize solution from the beginning.

Acknowledgements

A project of this magnitude depends on the hard work and commitment of many professionals, and we are pleased to acknowledge their contributions. The authors are deeply indebted and would like to express our gratitude to the Universiti Teknologi Malaysia and Dana Pembangunan Pengajaran for supporting this study under Vote 08233.

References

[1] L. Alexander, N. Anastasios and K. Smith, "High-Speed Architectures for Morphological Image Processing", Nonlinear Image Processing, **(1990)**, pp. 145-156.
[2] L. P. Jerry and M. L. Jonathan, "Medical Imaging: Signals and Systems", Prentice Hall, **(2006)**.
[3] L. Semmlow John, "Biosignal and Medical Image Processing, Second Edition", CRC press, **(2005)**.
[4] M. Molenda, "In Search of the Elusive ADDIE Model", Performance improvement, vol. 42, no. 5. **(2003)**, pp. 34–37.
[5] W. Dick and L. Carey, "The Systematic Design of Instruction", Allyn & Bacon. 6th ed., **(2004)**.

Table 1. Model Summary

Model	Unstandardized Coefficients								Mean Square		R	R Square	F	Sig.
	B				Std. Error									
	Constant	LEVEL	GEN	LEVEL*GEN	Constant	LEVEL	GEN	LEVEL*GEN	Regression	Residual		Change	Regression	Regression
CON	-2.674	1.878	3.103	-1.033	1.789	0.719	1.282	0.481	3.211	0.727	0.547	0.853	4.416	0.011
FEA	-1.315	1.138	1.743	-0.46	1.888	0.759	1.353	0.508	3.216	0.81	0.527	0.208	3.972	0.017
IIREG	-0.196	0.345	1.911	-0.298	1.732	0.696	1.241	0.466	3.151	0.681	0.556	0.242	0.242	0.009
MMREG	-0.835	0.509	2.121	-0.473	1.547	0.622	1.109	0.416	1.965	0.543	0.509	0.187	0.187	0.024
HIST	-1.301	1.558	2.158	-0.701	1.617	0.65	1.158	0.435	3.257	0.594	0.589	0.284	5.488	0.004
CONTR	-2.065	1.805	2.493	-0.793	1.432	0.575	1.026	0.385	4.752	0.465	0.705	0.448	0.448	0.000

Equations Reworking:
CON = -2.674 + 1.878 LEVEL + 3.103 GEN – 1.033 LEVEL*GEN
FEA = -1.315 + 1.138 LEVEL + 1.743 GEN – 0.460 LEVEL*GEN
IIREG = -0.196 + 0.345 LEVEL + 1.911 GEN – 0.298 LEVEL*GEN
MMREG = -0.835 + 0.509 LEVEL + 2.121 GEN – 0.473 LEVEL*GEN
HIST = -1.301 + 1.558 LEVEL + 2.158 GEN – 0.701 LEVEL*GEN
CONTR = -2.065 + 1.805 LEVEL + 2.493 GEN – 0.793 LEVEL*GEN

Dummy coding for Male = 1
CON = 0.429 + 0.845 LEVEL
FEA = 0.428 + 0.678 LEVEL
IIREG = 1.715 + 0.047 LEVEL
MMREG = 1.286 + 0.036 LEVEL
HIST = 0.857 + 0.857 LEVEL
CONTR = 0.428 + 1.012 LEVEL

Dummy coding for Female = 0
CON = -2.674 + 1.878 LEVEL
FEA = -1.315 + 1.138 LEVEL
IIREG = -0.196 + 0.345 LEVEL
MMREG = -0.835 + 0.509 LEVEL
CONTR = -2.065 + 1.805 LEVEL
HIST = -1.301 + 1.558 LEVEL

Table 2. Moderating Effect on Level of Matlab Knowledge and Matlab Features

	Male		Female	
Model	Low	High	Low	High
CON	2.0683	3.2344	0.96932	3.56096
FEA	1.74332	2.67896	0.89272	2.46316
IIREG	1.80618	1.87104	0.4733	0.9149
MMREG	1.35584	1.40552	0.15246	0.85488
HIST	2.51958	3.70224	1.72152	3.87156
CONTR	2.38828	3.78484	1.4367	3.9276

Table 3. Descriptive Statistic for LEVEL

	N	Minimum	Maximum	Mean	Std. Deviation
LEVEL	35	1	3	2.63	0.690
Valid N (listwise)	35				

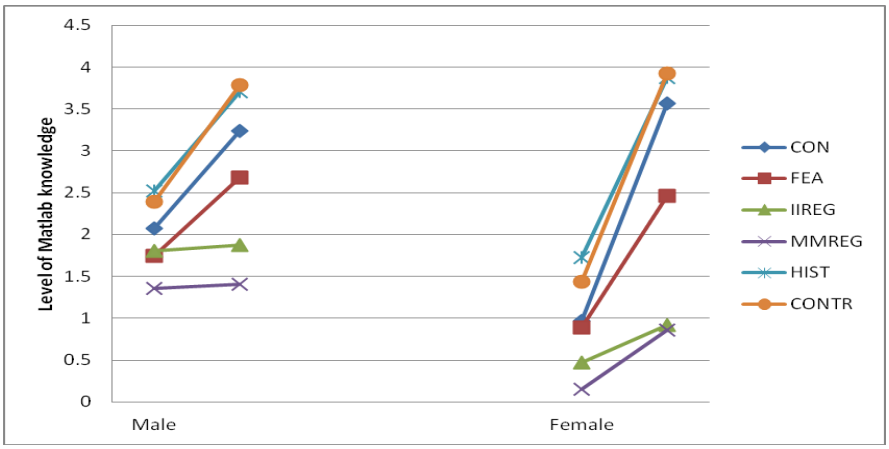

Figure 2. Graphical View for Table 2

CON = Convert between image formats
FEA = Feature extraction
IIREG = Image-to-image registration
MMREG = Model-to-model registration
HIST = Grayscale analysis (Histogram, Average, Min/Max, SD)
CONTR = Brightness or contrast adjustment

Authors

Ching Yee Yong

Ching Yee Yong was born on 11 January in Sandakan, Sabah, Malaysia. She is currently a PhD candidate at Faculty of Electrical Engineering, Universiti Teknologi Malaysia (UTM). She obtained her B.Eng (Hons) in Electrical (Medical Electronics) from UTM.

She has published six journal articles and ten conference papers. Her latest journal article was entitled "Image Processing Tools Package in Medical Imaging in MATLAB" in International Journal of Education and Information Technologies (NAUN). Her research interests are facial and motion detection, medical image processing and signal analysis.

Ms. Yong is currently an IEEE Postgraduate Student Member and member of IEEE Communications Society. She honored with First Class Degree Holder for her B.Eng (Hons) with project title Polygraphic Recorder – Lie Detector V1.0. She was also an invited member for Golden Key International Honor Society of Universiti Teknologi Malaysia.

Kim Mey Chew

Kim Mey Chew was born on 31 January in Sibu, Sarawak, Malaysia. She is currently a PhD candidate at Faculty of Electrical Engineering, Universiti Teknologi Malaysia (UTM). She obtained her B.Sc (Hons) and M.Sc in Computer Science from UTM.

She has published six journal articles and ten conference papers. Her latest journal article was entitled "Image Processing Tools Package in Medical Imaging in MATLAB" in International Journal of Education and Information Technologies (NAUN). Her field of research are software engineering, ontology design, microwave signal tumour detection and signal processing. She has served as a Research Officer at Faculty of Electrical Engineering and Faculty of Health Science & Biomedical Engineering UTM for 2 years. She was experienced with grant managing, seminar and workshop conducting, administrative handling and experiment directing. Ms. Chew is currently an IEEE Postgraduate Student Member and member of IEEE Communications Society.

Nasrul Humaimi Mahmood

Nasrul Humaimi Mahmood is currently a Senior Lecturer at Faculty of Electrical Engineering, Universiti Teknologi Malaysia (UTM). He received his B.Sc. degrees in Electrical Engineering from Universiti Kebangsaan Malaysia (UKM) and M.Sc. degrees in Electrical Engineering from UTM, and Ph.D. degree from the University of Warwick, United Kingdom.

He has published lot of articles related to image processing and image reconstruction.

His latest journal article was entitled "A User Friendly Guide for Spleen Ultrasound Image Enhancement in International Journal of Computational Engineering Research (IJCER). His research areas are biomedical image processing, medical electronics and rehabilitation engineering.

Dr. Mahmood is currently an IEEE Member and Head of Department for Biomedical Instrumentation and Signal Processing. He is also a member of mSET (Malaysian Society for Engineering and Technology) since May 2011.

Ismail Ariffin

Ismail Ariffin was born in Penang, Malaysia, on the 13th September 1962. He received a Bachelor of Science degree in Electronic and Electrical Engineering from University of Miami, USA in 1987 and a master degree in Electrical Engineering (Specialization in Electronic) from Universiti Teknologi Malaysia in 1991. Currently he is a senior lecturer at the Faculty of Electrical Engineering, Universiti Teknologi Malaysia. He joined the Faculty of Electrical Engineering at Universiti Teknologi Malaysia since 1983.

Mr Ariffin is currently a Malaysian Standard (SIRIM) technical committee on Anaesthetic/Respiratory and Electromechanical Devices. His current research interests include medical electronic, medical imaging, digital signal processing and image processing.