

Annual Research Symposium - 2012 - 2013 Full Papers

2012 - 2013 වාර්ෂික

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Study of computer assisted teaching & learning tools in the area of Visual Arts

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Abstract

Enhancing Aesthetic Quality of Digital Images: Computational Aesthetic Approach

Measuring aesthetic value of a digital image is a significant task in the field of visual arts. In traditional methods, artists follow manual techniques to balance the visual aesthetic values in products such as an advertisement, a banner, a digital artwork etc. Today, emerging information technology techniques are frequently used for production of art works as well as for operations like judgment and enhancement of the designed product efficiently while the initial artwork is created using traditional methods. Computational aesthetics is the research of computational methods that can make applicable aesthetic decisions in a similar fashion as a human can. Attempts have been made for assessing and computing aesthetic values in the areas of landscape planning and management, computer aided conceptual design, garment and fashion industry, entertainment industry, etc. However, only a little research has been done on evaluating and assessing artworks using IT as it involves three basic concepts namely subjectivity, cultural influence and the qualitative evaluation.

Based on the literature survey, Analytic Hierarchy Process (AHP) which is a multi-criteria decision making method originally developed by Prof. Thomas L. Saaty was selected in this research as the most successful methodology to solve current problem. AHP considers both qualitative & quantitative approaches and combine them into a single empirical inquiry. When dealing with aesthetics in a digital image, user or the evaluator has to give satisfaction feelings using a scale of measurements depending on the physical attributes such as color, contrast, brightness, texture and shape etc.

The major outcome of the research is the suggested framework to characterize a digital image in the area of computational aesthetics. Other outcome of the work is a tool which can be used to rank visual aesthetic quality of a given set of three digital images using a mathematical approach, AHP. Further, it aims to inspire more interests in this new and fundamentally important and challenging research direction. Therefore, this can be the foundation for another researcher to study other related area like dancing or music which is in a same state to express another set of attributes for the aesthetics value of the area concerned.

Key words: computational aesthetics, Analytic Hierarchy Process (AHP), aesthetics quality, aesthetics design, artwork evaluation.

1.0 Introduction

Technology has a significant effect on education for many years. In the classroom, teachers have moved away from the “chalk and talk” days to the use of overhead projectors (OHPs) and lately to multimedia presentation techniques. Computer based technology has opened an avenue to support the individuals learning needs by expanding opportunities for new and improved approaches for delivering courses in schools, institutions and universities. One such approach is Computer Aided Learning (CAL) which is presently receiving much support and attention throughout all levels of education. Rapid improvement in computing and telecommunication technology has enhanced the availabilities and possibilities for CAL [www01].

During the last few years CAL methods have emerged as encouraging tools with computers playing an important role in the education system. There are many Computer Aided Learning Tools that are being introduced to students in schools, institutions

and universities effectively since its inherently flexible features that help to present material for the theory and practical needs of students and the possibility to store information enormously [www02].

2.0 The Evolution of Learning

2.1 The Human Learning

Learning is the process, which begins the instance of our birth and continues until our last breath. While most of our learning is from our day-to-day interaction with our environment, other part of the learning will have to be practiced with the help of different mechanisms dedicated for learning.

The most common form of teaching is the schooling. There are laws internationally making it compulsory for educating of children and it has been recognized in the International Covenant on Economic, Social and Cultural Rights as a human right.

Education is a two way process, between a learner and a teacher. There are several essential requirements for teachers / lectures. They must know what material to be used and how to organize the material in a manner which is understandable to the learner (student).

2.2 The Traditional approach for Teaching /Learning

The traditional approach of teaching is based on the human interaction between the teacher and student. It is a process where

the teacher attempts to create an environment that the student gets individual attention to cater to his or her needs.

In traditional teaching, the learning is the primary focus of attention, and the knowledge imparted would be based on the satisfaction of individual requirements. Some of the traditional teaching methods are given below;

- Lecture Method
- Presentation Method
- Case Studies
- Group Teaching Method
- Assignment Method
- Problem Solving Method
- Role Play
- Tutorial System

Teaching can be done for a group of students or for an individual. Although teaching a group of students can be given inexpensive form of teaching in economic terms, student behavior is generally limited to taking notes. Since there is limited feedback, it may lead to incomplete learning [Boyd-Barrett & Scanlon, 1990].

In a tutorial or an individual class, the student / teacher relationship is of direct interaction. Hence, the performance of the student depends on what the teacher communicates, and what the teacher communicates depends on what the student does.

In traditional teaching it is easy to teach a group of students at the same time than to teach an individual student. Teaching a group of students may lead to a fun filled atmosphere, with a few jokes exchanged between the teacher and students, which may not be the environment in an individual session.

2.3 Learning Model

Learning can be better understood by the following model.

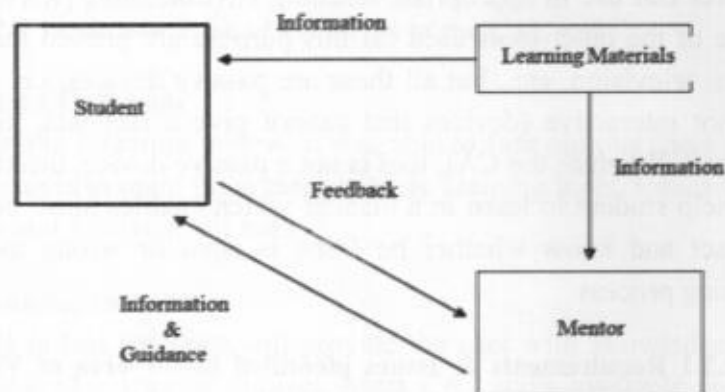


Figure 1: Learning Model

This is a simplified view of the learning process. According to the figure 1, there is a two-way flow of information between the student and his / her learning environment (learning materials and mentor). The learning environment imparts information under the guidance of a mentor (in the traditional method it is the teacher / lecturer). The student responds to what is being taught. As the student accumulates knowledge from the learning process, he / she can use this to retrieve facts, make generalization and carry out inferences in his / her day to day activities.

One must note that the process of learning never ends. The sources available for learning are limitless. Some common examples are: electronic & printed media, Internet etc.

In the case where the computer is being used for learning, it will act as the mentor / mediator of the two-way flow of information.

In many developed countries computers are used widely to teach many areas of study. The CAL package is a tool that the teacher / lecturer can use in appropriate teaching environments [www03]. Some of the other tools used for this purpose are printed media, slides, television, etc., but all these are passive devices, i.e. they are not interactive (devices that cannot give a feedback to the student). Whereas the CAL tool is not a passive device, thereby it can help student to learn in a manner which enables him / her to interact and know whether he / she is right or wrong in the learning process.

2.3.1 Requirements & Issues identified in the area of Visual Arts

Computer Graphics theory deals with fundamental concepts, algorithms and techniques for generating 2D and 3D graphical objects. One important aspect of this subject is experimentation [Donald Hearn & Baker, 1994]. As this is a practical subject, it is essential that students should have hands-on experience. It is a known factor that digital images of paintings or any other form of artworks are used in the developing of computer based art works. In this process, there are some requirements like analysis of

color, identification of the shape (edge) of the objects within the image or the scenery in an effective way.

In case of color analysis, user or the developer needs to segment the color region based on a given set of criteria. For this purpose, author has to find out in the case where the computer is being used for learning, it will act as the mentor / mediator of the two-way flow of information.

2.4 Implementation of Prototype of the CAL tool

2.4.1 CAL tools

In the literature review, it was able to find out that there exist CAL tools in main three categories as Training tools, Educational tools and Edutainment tools.

- **Training tool -**

Tools in this category will provide the user with knowledge and training of a specific subject. Most CAL tools available are for training the user on a computer application or a development language or a platform.

- **Educational tool -**

When a tool is used purely for educational purposes, especially for subjects that are offered in schools and universities for training the user on a computer application, student could get a better exposure to the subject. Further text of better quality may be extracted from different reading material that may be limited in public domain. The tools might consist of examples, drawings of charts and important diagrams. Experiments that are pote

ntially hazardous and expensive to perform by a few inexperienced students can be displayed on video.

• **Edutainment tools -**

This type of tool is very interesting for the younger audiences, since they would like to learn something which is entertaining and in a graphical format (e.g. using cartoon characters). Some of the tools in this category are developed in the form of a game to teach mathematics or any other subject for small children.

2.4.2 Developed Prototype

Author wanted to discover any tool which could cater the requirements and issues identified in the area of visual arts. But, it was unable to discover any user friendly tool for that purpose. Therefore, it was designed and developed a prototype, primarily focusing two main features: the color analysis (color segmentation) and shape detection (edge detection).

2.4.2.1 Features of the Prototype

Following screen shot will show interface of the tool.



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2.4.2.1.1 Color Segmentation

Color segmentation is used to segment an image based on the given set of parameters [www04]. In this operation, user has to specify different set of parameters such as number of clusters, number of iteration etc. which are required for the simulation of the selected algorithm. Final output of the selected algorithm mainly depends on the given number of clusters. If low number of clusters is given, user will get a lower number of color regions by replacing nearby regions with a similar color. Therefore, user will be able to demonstrate the different appearances of the same digital image by changing the number of clusters in the tool. In the above screen shot, the top part will display the difference between a given digital image and the segmented image based on the given values for the parameters. In this prototype, this feature can be used by pressing the “start clustering” button. Accordingly, this will become a teaching / training / learning tool that could be used to demonstrate the effect of color segmentation in the area of digital images.

2.4.2.1.2 Shape Detection

This is a technique that can be used to identify the two dimensional shape of the object. In the area of visual arts, there is a requirement to observe the sketch or the basic shapes of the objects appeared in a digital image for the purpose of training the development procedure of an artwork as a beginner. For that purpose edge detection techniques are used. Out of the available edge detection techniques, Sobel, Laplacian and Successive Difference algorithms have been implemented in this prototype. So, this tool can be used to display the basic shape of an image in the area of computer graphics [www05].

2.5 Discussion & Conclusions

In this research, it was studied the area of CAL in different dimensions and literature survey was done for the purpose of getting a clear understanding about CAL tools and identifying problems existing in the above area of study. Based on the findings and requirements identified, a prototype of a CAL tool that can be used in the area of computer graphics was developed in such a way that graphical visualization of a digital image can be done by changing the parameters and options related to color segmentation and shape detection (edge detection).

2.6 Future Enhancements

This research can be used to study the concept of Computer Aided Learning Tools in another area like entertainment, performing art etc. Further, it can be enhanced by another researcher to study some other graphics concepts which are most critical to understand and training in the area of visual arts.

Key Words: *Computing, Computer Aided Learning (CAL), Computer Graphics*

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