AUGMENTED VISION FOR ART GALLERIES

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Abstract: Attendance levels at art galleries and other heritage institutions have failed to maintain the same growth rate as the population. Thus, it has become imperative for these institutions to find new ways to improve the guest experience and attract more visitors. The Augmented Vision for Art Galleries system achieves this by providing guests with contextual, visual information through a head-mounted display, while simultaneously collecting information about their interests. The system is comprised of three components: a machine vision module, a user interface, and a curator module. The machine vision module locates and identifies the paintings that are within the guest's field of view. This data is then combined with relevant, visual information and displayed through the user interface. The curator module allows curators to create the desired visual information and view guest behavioural statistics. A functional prototype with sufficient performance for use in an art gallery was developed.

1. INTRODUCTION

Art galleries and other heritage institutions comprise a large industry in Canada, with annual operating revenues of $897 million and an attendance of 30 million for the year 2004 [1]. Unfortunately, recent attendance has failed to maintain the same rate of growth as the population. This decline in popularity, resulting in a reduction in public funding, has made it imperative for these institutions to find new ways to attract guests [2].

One cause for this decline in attendance is increased competition from amusement parks, the Internet, cinemas, and other forms of entertainment [2,3]. In order to compete, heritage institutions are beginning to place an emphasis on making their environments more entertaining, while not sacrificing intellectual integrity [4]. One method to accomplish this is with the addition of interactive systems that use multimedia to improve the learning experience [4]. Additionally, institutions are trying to increase attendance figures by re-evaluating their exhibits to ensure that they match the interests of the public [3]. Thus, systems that provide the curator with details about the behaviour and preferences of guests are becoming an important tool in exhibit design.

2. PROBLEM STATEMENT

There are several devices that attempt to improve the institutional experience using either multimedia or guest feedback; however, there is no one product that combines both of these methods. Therefore, a system is proposed that provides visual information to the guest through a head-mounted display (HMD), while gathering feedback about their art gallery experience. In particular, the system shall be able to identify pieces that a guest is viewing, determine how to display relevant visual information, and develop guest statistics based on the pieces that have been viewed.

3. SYSTEM OVERVIEW

The Augmented Vision for Art Galleries system uses a digital camera, positioned at the guest's head level, to capture images of their field of view. These captured images are analysed to identify the specific paintings being observed by the guest, as well as their relative locations and perspectives. This data is then used to determine the content and position of visual information that is presented to the guest through a HMD. Concurrently, the data is also used to generate statistics about the guest's gallery experience. Examples of such statistics include the duration of time spent looking at each painting and the order in which the paintings are viewed. The system is comprised of three components: a machine vision module, a user interface, and a curator module.

4. MACHINE VISION

The machine vision module is responsible for identifying and determining the locations and perspectives of paintings within the guest's field of view. It is therefore separated into two components: painting identification and location determination.

4.1 Painting Identification

The Speeded-Up Robust Features (SURF) algorithm [5] is used to identify paintings in the captured image. Unfortunately, SURF calculations require a large amount of computation time, resulting in a noticeable lag in the output when performing identification. Thus, an alternate, faster method to identify paintings, using knowledge of the paintings found in previous frames, was developed. This method is combined with the SURF method to create an efficient, yet robust, identification strategy.

4.2 Determining Painting Locations

Since the SURF method is unable to localize and determine the perspectives of paintings, infrared light-emitting diodes (LEDs) are placed in a square around each painting. These LEDs are then located in the captured image and used to extract the required geometric information. However, due to poor lighting conditions and blur from rapid camera motion, these LEDs are not always located. This results in intermittent visual output. Thus, a buffer was developed to allow the system to use information from previous frames to infer the location of any missing paintings.

5. User Interface

The identification and location information provided by the machine vision module is combined with user input to determine what contextual information to display to the guest. Different types of contextual information were developed based on art gallery tours and user interviews.

A basic information option includes the title of the work, the production date, and the artist's name. An art history option provides complementary information about the work, such as its political and cultural importance. Additionally, the interface is able to highlight and provide comments on specific points of interest within the painting. Similar works that may be of interest to the guest may also be displayed.

The user interface is designed to accommodate simultaneous viewing of multiple paintings. In such instances, commentary about similarities between the artwork can be viewed. A screen capture of the user interface is shown in Figure 1.

Figure 1: User interface displaying similar works.

6. Curator Module

Guest statistics and the contextual information displayed by the user interface are stored in a database. This allows multiple curator modules and user interfaces to access the same data. A key feature of the system is its ability to capture guest data for analysis by the curator. This data is comprised of two types: content statistics and painting statistics. Content statistics record the number of times a guest has viewed a type of contextual information. Alternatively, painting statistics track the number of times and the order in which paintings are viewed. The curator module allows curators to view this information, as well as update the information displayed to guests in real-time.

7. Conclusions

The developed system is able to both provide guests with contextual information about exhibits being viewed and track usage statistics for the curator. Using the functional prototype, user testing within art galleries will need to be performed to improve the current interface.

8. Future Work

The functionality of the device can be extended in a number of ways. Audio commentary could be added to supplement the visual information. The system could also be improved by allowing guests to comment and rate paintings, as well as purchase prints of paintings which they have viewed. Finally, the system could be adapted for use in other institutions, such as museums, auction houses, and archaeological sites.

References

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