FIGURATION OF DIGITAL ACTOR AND ITS APPLICATION TO DIGITAL CONTENTS

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ABSTRACT

Developments in digital restoration and reproduction technologies accelerate the accompanying growth of industries which utilize contemporary multimedia environment. This is most manifestly witnessed in the application of Digital Actor. Digital Actor, in addition to the realistic description of outer appearance, must enhance user experience by overcoming uncanny valley phenomenon. Recent researches on Digital Actor have focused on the visual reproduction of Digital Actor based on Live Actor. And for priority is given to application of initially planned contents, its utilization to different contents is also inconvenient. This study researches the figuration and application of Digital Actor through Multimedia Data Editing Tool which can process, save and edit the form information, pattern image and action video of real figures of the past and present into 3D Resource & Animation Data through life cycle. In utilization of Digital Actor, this study particularly aims to make Digital Actor feel like a real figure in digital and offline space when it performs its role and to popularize it for expanded performance of Digital Actor

Keywords: *Digital Actor, Live Actor, Figuration, Multimedia Data, Multimedia Data Editing Tool,*

1. INTRODUCTION

The advancement of digital technology has dramatically expanded the expressive style and scope of media and contents; its impact is deeply felt in digital contents. When reproducing Digital Actor (DA) which is used in digital contents such as CG/VFX-based cinema and animation or digital game, verisimilitude is required in addition to realistic description; interaction using Digital Actor must contribute to contents immersion. Assuming the production of Digital Actor with greater visual reality enhances the experiences of digital contents user, [1] the concept of reality associated with Digital Actor goes beyond indexical reality, which Andre Bazin mentioned, to digital realism or Digital Actor realism. [2] Also, Digital Actor production requires efforts to overcome uncanny valley phenomenon in order to facilitate emotive interaction beyond visual reality.

Hence there is a need for research on realizing the form, pattern image and action of Digital Actor using Multimedia Data Editing (MDE) Tool which can fuse Digital Actor Production Digital Actor and process from computer graphic tools like game engine, animation production tool and Autodesk Maya into 3D Resource & Animation Data for application.

2. SYSTEM MODEL AND METHODS

2.1 Related Researches

A study of Digital Actor reproduction using computer graphic tool reveals that the degree of reality has an impact on the user's response. Based on this result, Digital Actor takes on the additional significance as a mean to enhancing reality and as an image component. As for technology and research related to Digital Actor production, one may first turn to modelling and rendering animating for realistic facial expression of Digital Actor. Also, motion capture creates the motion of Live Actor which is required for Digital Actor interaction; performance capture can convert detailed facial interaction of Live Actor into CG; performance EOG (Electrooculogram) capture combines performance capture and scanning;

emotion capture is also well-known for its use if the 3D CG movie Avatar (2009)

Most of these techniques require quite a long time and complex processing. Digital Game Content Beyond Two Souls used motion capture data for every scene in the game. With 88 markers on the Live Actor's face, it took only about 20 minutes of the game per day, and this process lasted for one year. It also took another year to apply motion capture data to the Digital Game content. In the case of movies, the emotion performance capture technique used in 'Avatar' had to last a year in a set where 250 cameras were installed, including the markers and the process of attaching a small camera around the Live Actor's face. [1, 3, 4, 5].

2.1 Enhanced Researches

Most of technologies covered in the existing research address Digital Actor production based on Live Actor in cinema, animation and digital game. Also, most of them are In-house tools used in Hollywood and other film developing studios; thus, developers are difficult to access because of different organizations.

Thus, the present study seeks to expand the scope of Digital Actor production and application beyond the limited scope of Live Actor -based work to real figures of the past or present. In addition, the study aims to produce an editing tool which can process form or action information of Digital Actor by life cycle stage into Database. As not only Digital Actor's outer appearance but emotions expressed through facial expression, motion or gesture serve as an important element in its reproduction, the study attempts to realize an editing tool to classify Digital Actor figuration or motion information into different life cycle stages and save and apply them on Database. This adds a new layer of significance to Digital Actor, as in the deconstruction and reconstruction of image to create new image, while facilitating multifaceted application of Digital Actor in on/off-line display [6, 7]. Digital Actor in this study uses Multimedia Data
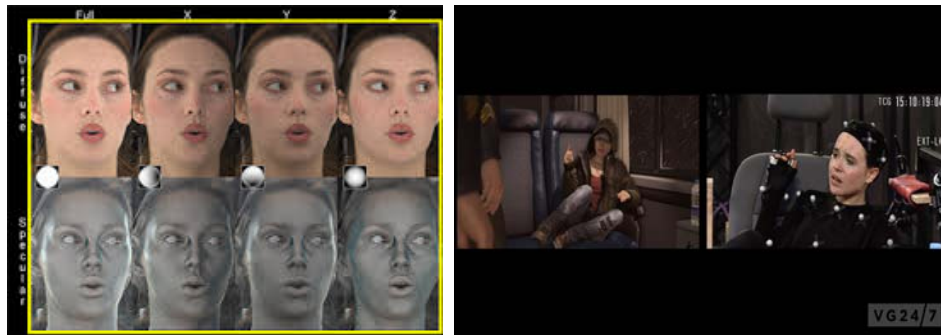

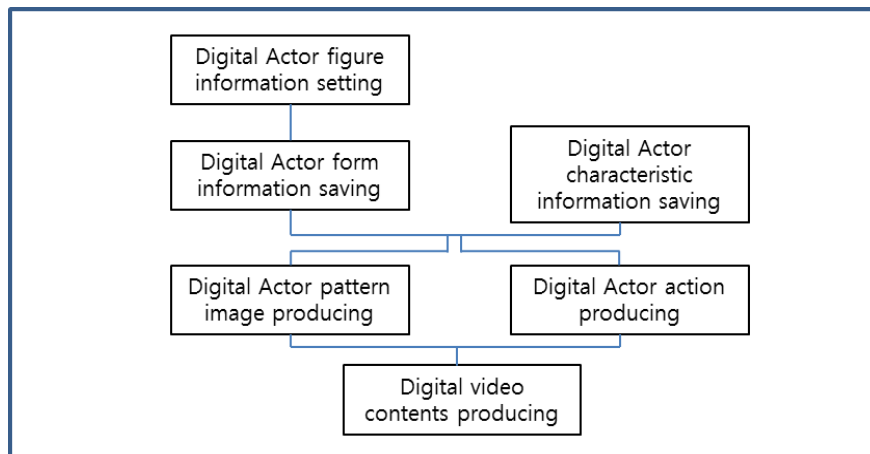*Figure 1 : Achieving a Photo-real Digital Actor: The Digital Emily Project (L), Beyond Two Souls (R)*

Figure 2 : A Diagram of Digital Actor Figuration by Using Multimedia Data Editing Tool

Editing Tool for efficient management and universal application of asset Database; this reduces the time and cost of digital contents production involving Digital Actor figuration and application, improves its productivity and establishes an efficient and stable production structure to contribute to the contents' competitiveness.

3. System Configuration

This study aims to use Multimedia Data Editing Tool to visualize real figures of the past or present into Digital Actor for use in digital contents. By processing the form information, pattern image like facial expression and gesture and action video into digital information and using it for digital contents production, the use of Digital Actor may go beyond conversion of Live Actor into Digital Actor to a much wider scope of expression and production. In addition, as Digital Actor production data is made in digital information, editable in Multimedia Data Editing Tool, digital contents become simpler and easier.

Also, as Multimedia Data Editing Tool can classify, produce and utilize Digital Actor's form information, pattern image and action video by life cycle stage, a particular digital actor can be visualized at different ages. Here, Digital Actor figure information with a life history adds to the reality of figurate description, facilitating multidimensional effect and application.

For Multimedia Data Editing Tool construction and Digital Actor figuration, 'Actor identification information Database' is required to

of the past or present. Basic form information and pattern image of the selected figure are then saved as 'Actor basic form information Database' and 'Actor pattern image Database,' respectively. Here, the pattern image of Digital Actor is produced based on the pre-saved basic form information. The action video of Digital Actor is also based on basic form information and is saved to 'Actor action Database'; this is followed by digital contents production. Each form information, pattern image and action video is produced by stage-specific algorithm and saved into a library for duplex editing. Digital Actor Multimedia Data is thus created and integrated in Multimedia Data Editing Tool for Digital Actor figuration, ready for application in digital contents.

Common to each stage mentioned above is that Digital Actor's form information, pattern image and action video are produced and utilized for different life cycle stages. This enables a particular Digital Actor to be shown in different ages, setting a life history of the Digital Actor [8].

3.1 Digital Actor Selection and Figure Information Setting

To make Digital Actor into a figure, real figures of the past and present or virtual ones to be realized as Digital Actor should be selected and then set on Digital Actor identification information DB. Basic figuration information of a selected figure is saved on actor's basic figuration information of computer equipment; the selected figure's basic figuration information from real figures of the past and of the present is computed by figure figuration attribute Data drawn from
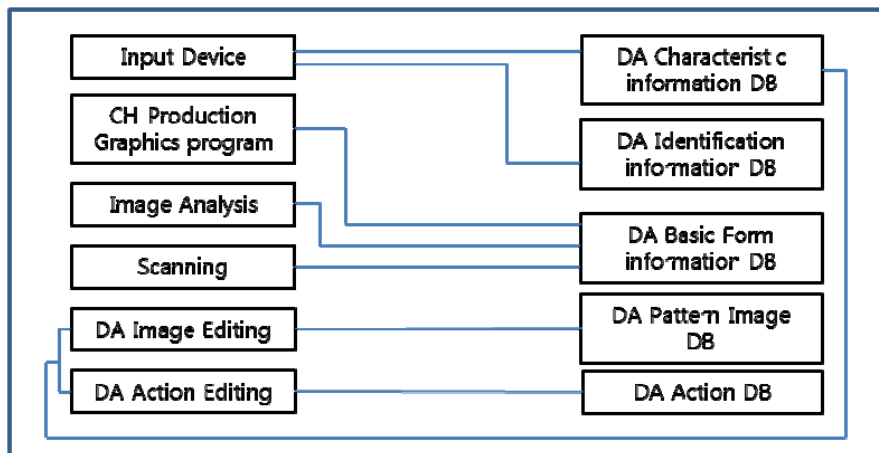

Figure 3 : A Diagram of Digital Actor Figuration System

select and identify information about the real figure   image analyzing equipment that performs image

analysis on the real figure's photos. Basic figuration information of the selected figure from the present real figure can be computed by figure figuration attribute Data drawn by scanner that performs video scanning on its real figure.

And basic figuration information of selected virtual figures that have already been reproduced in contents like myth, religion, literature and movie can be computed by figure figuration attribute Data drawn from image analyzing equipment that performs image analysis on the virtual figure's photos; basic figuration information of a selected figure from a virtual figure which has not been reproduced before can be directly created by character creation graphic program. And by saving behavior characteristic information, language characteristic information and response characteristic information of a figure to be realized as Digital Actor on actor's characteristic information DB (Data Base), Digital Actor reproduction and the level of reality that user experiences can be enhanced.

Characteristic information includes a selected figure's behavior characteristic information, language characteristic information and response characteristic information. On a stage for saving motion pattern based on Digital Actor characteristics, Digital Actor motion pattern information based on behavior characteristics and Digital Actor motion pattern information based on response characteristics are set and then saved on Digital Actor motion pattern information DB based on characteristic information.

To make Digital Actor basic figuration image, a selected figure's basic figuration image should be produced by a computer graphics tool that includes 3D modeling program such as game engine, animation production tool, Maya, etc. The selected figure's basic figuration image is produced by using character modeling process that includes the selected figure's skeleton and joint creating process; polygon object creating process by the created skeleton and; a process to give texture to the created polygon object's surface. The Digital Actor's basic figuration image created as above is upon the premise that it looks like real human's outer appearance and it is also necessary to overcome uncanny valley phenomenon.

Basic figuration image of a selected figure from past ones or real figures and of virtual ones that have already been reproduced in cultural contents such as myth, religion, literature and movie should be computed by figure figuration attribute Data drawn from image analyzing equipment that performs image analysis on the real figure's photos.

The stage for saving Digital Actor basic figuration image is a stage to store a selected figure's basic figuration image and production information included in basic figuration image on Digital Actor basic figuration image DB. Production information included in basic figuration image can contain information on Digital Actor's skeleton, joint, polygon, texture, etc.
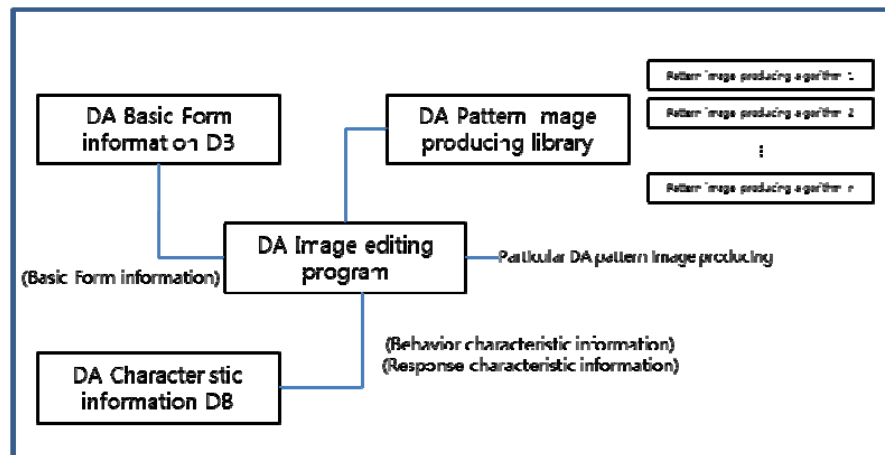

Figure 4 : A Diagram of Digital Actor Pattern Image

3.2 Creation of Digital Actor Shape Image and Motion Video

On the stage of producing Digital Actor shape image, it is created through basic figuration image's editing process by shape image editing program module of computer graphics tool based on a selected figure's shape images like hairstyle, facial expression, gesture, clothes etc. - basic figuration information, behavior characteristic information and response characteristic information.

Creation of Digital Actor's shape image is done by shape image editing program module of computer graphics tool based on basic figuration information, behavior characteristic information and response characteristic information that include the selected figure's hairstyle, facial expression, gesture, clothes, etc. Digital Actor video realization system consists of shape image creation library where shape image creation algorithm to create multiple shape images divided by shape characteristics is set and saved in the form of library. On Digital Actor shape image production stage, program module for editing shape image receives shape image creation algorithm corresponding to a produced shape image from shape image creation library and then activates it; shape image creation algorithm receives basic figuration image of Digital Actor to create shape image from Digital Actor basic figuration image DB and then creates the shape image as needed.
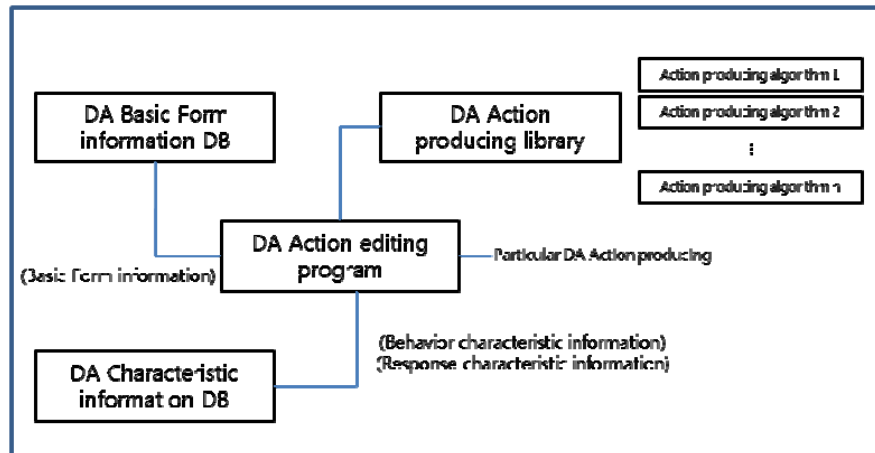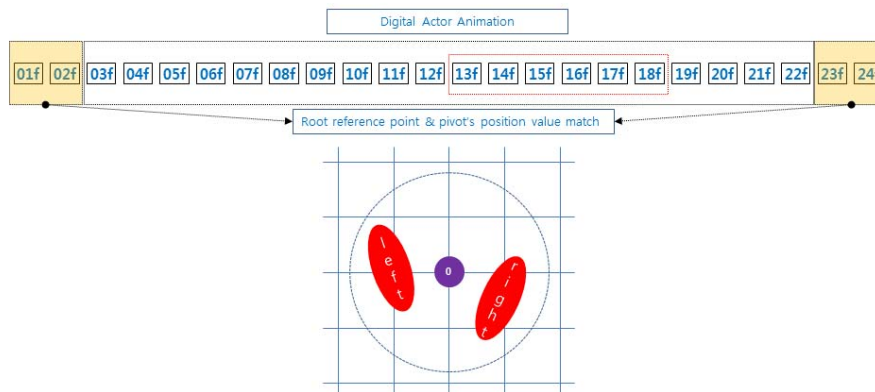

Figure 5 : A Diagram of Digital Actor Action

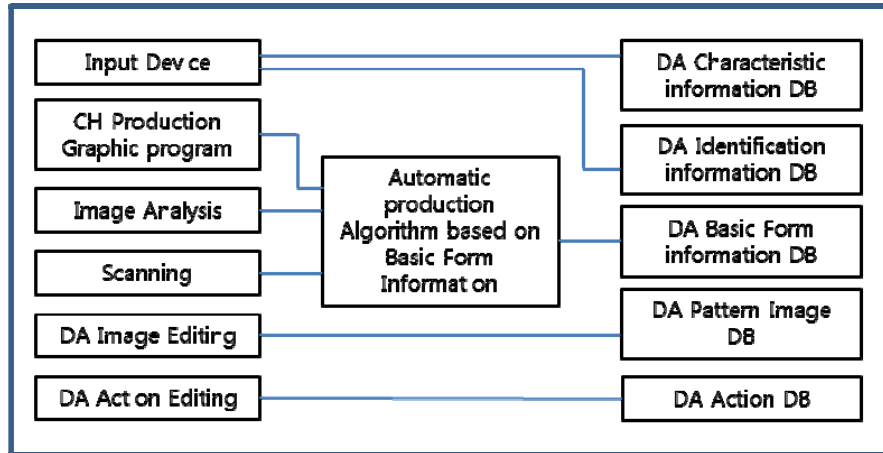*Figure 6 : Digital Actor's position matching on video frame*

Figure 7 : A Diagram of Digital Actor Figuration with Automatic Production Algorithm
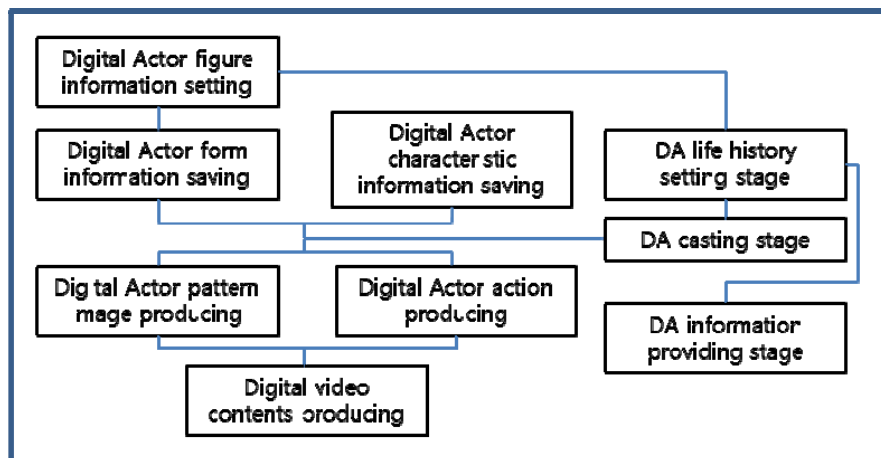

Figure 8 : A Diagram of Digital Actor Figuration & its Application

Figure 9 : Digital Actor Figurations – Jacky Chan

On the stage of saving Digital Actor shape image, a selected figure's shape image and production information included in the shape image are saved on Digital Actor shape image DB in the form of library. On the Digital Actor shape image production stage, animation creating reference video frame where Digital Actor is arranged with preset reference shape image is created on a preset reference position of video frame where motion video is realized and on the Digital Actor shape image saving stage, the created reference video frame for creating animation is saved on Digital Actor shape image DB. Digital Actor's reference shape image refers to a shape image of Digital Actor's standing still while expressing Digital Actor's preset posture, facial expression and gesture. Reference video frame for creating animation sets Digital Actor's root reference point and pivot's position value as (0, 0, 0) on video frame's XYZ relative coordinate.

Digital Actor video realization process sorts Digital Actor's movements selected upon contents production process and performs motion creation library where motion creation algorithm that can create motion is set and saved in the form of library. As on the shape image creating stage, motion video editing program module receives motion creation algorithm corresponding to created motion from motion creation library and then activates it and the module becomes equipped with motion creation algorithm on the Digital Actor motion video production stage.

On the subsequent Digital Actor motion video production stage, Digital Actor's motion video is created by receiving reference video frame for creating animation from Digital Actor shape image DB and the performing rigging work on Digital Actor arranged on the reference video frame for creating animation. A selected figure's motion video and production information included in the motion video are saved on Digital Actor motion video DB in the form of library.

3.3 Automatic Creation Setting for Basic Figuration Information

On the figuration information saving stage for Digital Actor subject to video contents application, when Digital Actor's basic figuration information is saved separately for different life cycle stages, behavior characteristic information, language characteristic information and response characteristic information are distinctively set and saved depending on Digital Actor's life cycle stage on the Digital Actor characteristic information saving stage. Digital Actor shape image creating stage distinctively creates and saves shape image generated from basic figuration information by Digital Actor's life cycle stage and Digital Actor motion creating stage distinctively creates and saves motion video generated from basic figuration information by Digital Actor's life cycle stage.

The stage for setting automatic creation algorithm of basic figuration information automatically creates basic figuration information for Digital Actor's life cycle stage by analyzing human growth pattern and it is performed between the Digital Actor figure information setting stage and Digital Actor figuration information saving stage. The Digital Actor figuration information
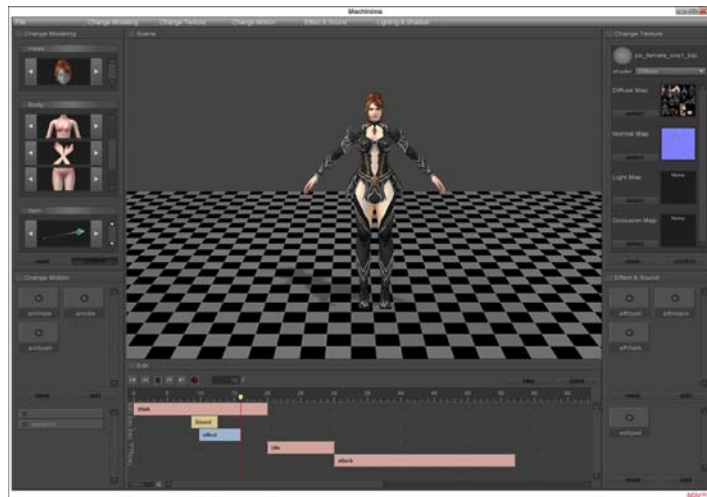

Figure 10 : Multimedia Data Editing Tool

saving stage separately creates basic figuration information for Digital Actor's different life cycle stages from basic figuration information automatic creation algorithm.

4. VIDEO CONTENTS PRODUCTION AND UTILIZATION

Figure 8 is a diagram for how to apply Digital Actor's video contents and construct its operational method. To explain each stage, the Digital Actor's life history setting stage is with a life history scenario set on figure's events which has been selected from the Digital Actor figure information setting stage on each life cycle stage in chronological order to save the scenario on the Digital Actor's life history. Digital Actor casting stage is a stage where Digital Actor provided by actor's identification information is selected for producing video contents and Digital Actor information providing stage is where figure information of Digital Actor cast for producing video contents is computed from Digital Actor's life history.

Utilization of Digital Actor contents includes display and role playing both in online and digital space realized by digital devices with which a video is displayed with examples of multimedia contents that are run by network and application programs. When realizing Digital Actor's behavior, Digital Actor is displayed on process or menu output, selection and execution of operating program on devices that work on operating system, operating program, application, IOT (Internet of Things) environment and plays a role as a kind of UI (User Interface), capable of providing user with information or playing a certain role. In that case, Digital Actor may include motion and voice realization and the Digital Actor can interact with other characters or objects in digital space or with user in offline environment.

When linking Digital Actor to offline events, it can be displayed by virtual video or hologram devices through display equipment in offline space. Behavior conducted by Digital Actor can also interact with and exchange reaction with other people or objects in offline environment. Through this process, Digital Actor can be more expansively utilized.

5. CONCLUSION

The discussion so far concerned the structure, process and methodology of Digital Actor

figuration based on Multimedia Data Editing Tool. The idea is to go beyond the existing Live Actor-based Digital Actor to be able to produce life-cycle Data for each form information, pattern image and action video so as to add to the import of Digital Actor and its application. Future researches will address the integrated use of Multimedia Data Editing Tool in the production of digital contents using Digital Actor as well as Digital Actor operation. Digital Actor's significance and application can be expanded through the process that a Digital Actor is selected from real or virtual figures of the past and present; figuration information, shape images like facial expression or gesture and motion video are created and realized with digital information and made utilizable to produce video contents. In addition, Digital Actor's figuration or motion is realized with digital information, which facilitates video contents' production and further, it promotes production of various video contents. As Digital Actor's figuration information, shape image and motion video are separately created for different life cycle stage, a certain Digital Actor can be realized in various age ranges within video contents and with Digital Actor's life history being set, figure information can be expansively utilized. As aforementioned that could be supplement weak points that existing Digital Actor realizing methods had in creating variations from a single Digital Actor. If there should work again to apply Digital Actor through life cycle created for Digital Games to 3D Animations, the process can be simplified with the proposed MDE Tool. Digital Actor applicated in this study have limitations in performing only the roles assigned to each digital content. To overcome these limitations and to broaden their application, further studies needed. Further studies for additional Digital Actor operation would be conducted as to a system where direct interaction can be made with user by expanding the scope of digital video contents that can utilize Digital Actor to UI (User Interface) format on which AI (Artificial Intelligence) is applied.

REFEERENCES:

[1] U. S. Jeong, and H. J. Suk, "The Human Characters in 3D Animation-Visual Reality and Audience Acceptance", *The Korean Journal of Animation*, Vol. 8, No. 4, 2012, pp. 95-111.

[2] J. H. Ryu, "Beowulf's Digital Actor, Realism, And Cyborg", *Film Studies*, Vol. 35, 2008, pp. 349-377.

[3] O. Alexander, et al., "Digital Ira: Creating a Real-Time Photoreal Digital Actor", in *ACM SIGGRAPH 2013 Realtime Live*, Anaheim: CA, 2013.

[4] N. H. Kim, "A Study of the UV Phenomenon of Digital Actor In Robert Zemeckis films", *Journal of Digital Design*, Vol. 13, No. 1, 2013, pp. 489-498.

[5] I. K. Jeong, H. D. Kim, S. M. Baek, C. W. Chu, and I. H. Lee, "Photo-Realistic Digital Image Content Production Technology", *Electronics and Telecommunications Trends*, Vol. 20, No. 4, 2005, pp. 3-15.

[6] T. S. Jeong, and E. C. Park, "Study on the Basic Design of Digital Actors for Reproduction", *Bulletin of Korean Society of Basic Design & Art*, Vol. 16, No. 1, 2015, pp. 591-601.

[7] D. I. Kim, and J. H. Lim, "Commune with Human and Avatar", *Journal of KSME*, Vol. 11, No. 11, 2012, pp. 48-111.

[8] H. S. Pak, E. J. Chae, H. J. Jeon, and J. H. Ko, "Figuration of Digital Actor by Using Multimedia Data Editing Tool", *ICCCA 2016*, 2016, pp. 21-24.