

MINISTRY OF EDUCATION AND TRAINING
DUY TAN UNIVERSITY

**RESEARCH SOME TECHNIQUES PROCESSING OBJECT
AND APPLICATION SIMULATION IN MEDICAL**

Majors : Computer science

Code : 9480101

THESIS INFORMATION PAGE

DA NANG – 2022

DOCTORAL THESIS INFORMATION PAGE

Thesis topic: RESEARCH SOME TECHNIQUES PROCESSING
OBJECT AND APPLICATION SIMULATION IN MEDICAL

Majors: Computer science

Code: 9480101

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Place of birth: Da Nang

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2. Dr. Jolanda G. Tromp

Training facilities: Duy Tan University

1. The main contribution of the thesis is as follow:

Each chapter of the thesis contains research findings that are supported and verified by studies that have been published at eminent national and international conferences and journals. The contributions that stand out most are:

(1) Propose an effective RGB color selection technique for complex 3D object structures based on a combination of tagging and marking methods by selecting an RGB color area on the object structure. From the RGB color, codes proceed with ID tagging and the creation of relational tables that store relevant information about specific areas of the anatomy. Using the entire set of color values (R, G, B) to define a set of anatomical regions helps to define multiple overlapping areas of an object for efficient representation of complex objects, and more clearly.

(2) Technical proposal to improve the efficiency of multi-user interaction in augmented reality with scenarios where users have the same geospatial and different geospatial. The solution is to identify and mark the pins and interactive positions on 3D objects to set the color area and interactive position under different views of multiple users on the same object. The proposed technique allows multiple interactions to be performed simultaneously on many different devices with multiple users at the same time with low latency and accurate visualization of the virtual reality model location..

(3) Propose a Memetic algorithm to enhance encryption of medical data in transit in IoT-based distributed systems using a Memetic algorithm combined with DWT transformation. The results of the proposed algorithm are evaluated using performance metrics such as PSNR, MSE, SSIM, correlation, SC, and BER which show the efficiency of the proposed algorithm compared to existing methods. When comparing the histogram of the covered messages and the original message both in color and grayscale images, there is not much deviation in the PSNR values, which indicates that the proposed algorithm works well. in the encoding and decoding process. Therefore, security concerns in the healthcare system through IoT are highly secure and safe.

(4) Applying the above techniques to build a simulation system of the human body. The system provides an interface that allows the user to manipulate to observe the images of the parts that can be searched and looked up information through the sample information.

2. Possibility of reality application

In the context of the "content-oriented" education and training becoming inadequate and having many shortcomings, schools are clearly seeing the importance of a training model that goes hand in hand with practice to help students develop comprehensive capacity after graduation. In order to serve teaching, learning, and research well, schools need to carry out training associated with practice through practice models. This is extremely important for medical students related to anatomy because there are no human corpses to practice with.

The goal of the simulation system is built toward the application of virtual reality 3D technology to simulate the Vietnamese human body intuitively, and accurately with a 1:1 ratio with a full range of organ systems allowing the ability to interact directly in 3D space. Support system, serving teaching, learning, and research in the field of health sciences to reach career goals, able to work in a dynamic and fast-changing new world.

3. Further research directions:

The concerns raised in the thesis span a wide range of topics, making it feasible to identify issues that might be utilized to suggest topics as a study direction for the next projects for each topic given in each chapter. That

demonstrates the concerns raised by the Ph.D. student in the thesis are open-ended. Following up on some of the thesis' unexplored directions:

- Research efficient algorithms for surface smoothing of complex 3D objects based on optimal compression of model meshes. Especially the shading algorithms based on unreliable input data.
- Research algorithms to optimize multi-view navigation from multi-users in a 3D environment. Optimizing techniques for sharing multi-user models on the same space and different geospatial.
- Research effective 3D object encryption algorithms to compress data and increase security when transferring data between devices.

Author's list of publications

- [1] Chung Van Le, Trinh Hiep Hoa, Nguyen Minh Duc, Vikram Puri, Nguyen Tung Sanh, Dac-Nhuong Le (2021), Design and Development of Collaborative AR System for Anatomy Training, *Intelligent Automation & Soft Computing*, vol. 27, no. 3, pp.853-871, ISSN 1079-8587 (SCIE IF 1.647). DOI: 10.32604/iasc.2021.013732
- [2] Srinath Doss, Jothi Paranthaman, Suseendran G, Akila D, Souvik Pal, Balaganesh. D, Chung Le Van, Dac-Nhuong Le (2021), Memetic Optimization with Cryptographic Encryption for Secure Medical Data Transmission in IoT-based Distributed Systems, *Computers, Materials & Continua*, vol. 66, no. 2, pp. 1577-1594, ISSN: 1546-2218 (SCIE IF 3.772). (Corresponding author) DOI:10.32604/cmc.2020.012379
- [3] Chung Le Van, Gia Nhu Nguyen, Tri Huu Nguyen, Tung Sanh Nguyen, DacNhuong Le (2020), An Effective RGB Color Selection for Complex 3D Object Structure in Scene Graph Systems, *International Journal of Electrical and Computer Engineering*, vol.10, no. 6, pp. 5951-5964. ISSN 088-8708. (Scopus Q2). DOI:10.11591/ijece.v10i6.pp5951-5964.
- [4] Chung Van Le, Gia Nhu Nguyen, Tung Sanh Nguyen, Tri Huu Nguyen, DacNhuong Le (2020), Applying 3D VR Technology for Human Body Simulation to Teaching, Learning and Studying, *Emerging Extended Reality Technologies for Industry 4.0: Early Experiences with Conception, Design,*

Implementation, Evaluation and Deployment, pp.17-28. John Wiley & Sons. ISBN 978-1119654636. (Book Chapter) (Scopus) DOI:10.1002/9781119654674.ch2

- [5] Chung Van Le, Jolanda G. Tromp, Vikram Puri (2018), Using 3D Simulation in Medical Education: A Comparative Test of Teaching Anatomy Using Virtual Reality, *Emerging Technologies for Health and Medicine: Virtual Reality, Augmented Reality, Artificial Intelligence, Internet of Things, Robotics, Industry 4.0*, pp.12-21. John Wiley & Sons. ISBN: 978-1-119-50981-3. (Book Chapter) (Scopus) DOI:10.1002/9781119509875.ch2
- [6] Jolanda G. Tromp, Chung Van Le, Le Nguyen Bao, Dac-Nhuong Le (2018). *Massively Multi-User Online Social Virtual Reality Systems: Ethical Issues and Risks for Long-Term Use*. In *Social Networks Science: Design, Implementation, Security, and Challenges*, pp. 131-149. Springer. (Scopus) DOI: 10.1007/978-3-319-90059-9_7

Some other research publications

- [1] Chung Van Le, Vikram Puri, Nguyen Thanh Thao, Dac-Nhuong Le (2021), Detecting Lumbar implant and Diagnosing Scoliosis from Vietnamese X-Ray Imaging using the Pre-Trained API Models and Transfer Learning, *Computers, Materials & Continua*, vol. 66, no. 1, pp. 17-33, ISSN: 1546-2218 (SCIE IF 3.772). DOI:10.32604/cmc.2020.013125
- [2] Jolanda G. Tromp, Dac-Nhuong Le, Chung Van Le (2020). *Emerging Extended Reality Technologies for Industry 4.0: Early Experiences with Conception, Design, Implementation, Evaluation and Deployment*. John Wiley & Sons. ISBN 978-1119654636. (Book Editor) (Scopus) DOI:10.1002/9781119654674
- [3] Dac-Nhuong Le, Chung Van Le, Jolanda G. Tromp, Nguyen Gia Nhu (2018). *Emerging Technologies for Health and Medicine: Virtual Reality, Augmented Reality, Artificial Intelligence, Internet of Things, Robotics, Industry 4.0*. John Wiley & Sons. ISBN: 978-1-119-50987-5. (Book Editor) (Scopus) DOI: 10.1002/9781119509875

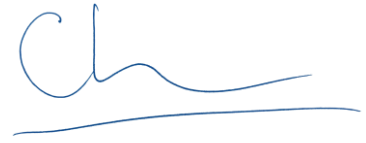
Da Nang, September , 2022

Representative of scientific guide staff

PhD student

A handwritten signature in blue ink, appearing to read 'Hnhuong', with a long horizontal flourish extending to the right.

Assoc. Prof. Dr. Le Dac Nhung

A handwritten signature in blue ink, appearing to read 'Chung', with a long horizontal flourish extending to the right.

Le Van Chung