論 文 の 内 容 の 要 旨

Thesis Summary

論文題目　Study on Nursing Self Training for Patient Transfer
（看護師による移乗介助動作の自習支援に関する研究）

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Currently, nursing care are becoming more and more complicated since of the development of medical technology and the increase of older patients. Before starting to work in the hospital, nursing students need to master many skills in nursing schools. It is difficult for the nursing students to learn lots of skills during the limited class time. In order to become skilled, nursing students need more training with the instruction of teachers after class. However, since the limitation on manpower and resource of current nursing education, it is difficult to provide such enough training to each nursing student. In view of this, it is important to develop a self-training system to assist the nursing student in improving their skills.

In this study, focused on the patient transfer which is considered as heavy nursing tasks and easy to cause injuries in case of error performances, a self-training system is developed. The problems of constructing a self-training system for patient transfer can be divided in to three aspects which are as follows: (1), automatically evaluating the trainees' skill performance, (2) effectively

instructing the trainees to correct their errors, and (3) enabling the trainees to train themselves without any partners acting as the patient. Therefore, this study is carried out in three stages to solve these three problems respectively.

In the first stage, we focused on developing the methods of automatically evaluating the trainee' skill performance. Patient transfer consists of different steps which involves many different skills. In order to evaluate trainees' skill performance, the methods are proposed which are as follows: Firstly using the features of patient's head's three dimensional trajectories and the fixed order of the steps, the motion sequence is segmented to identify which step the trainees are performing. Subsequently, using two RGB-D sensors and the color markers attached on the body joints, the information of each skill's related postures is measured. The proposed measurement method is able to measure the posture of both trainee and patient who are closely interacting. Finally, according to the contents of the skill, two methods are proposed to classify the trainees' skill performance as correct or incorrect. One is based on the preset searching regions, while the other is based on the quantified threshold. The proposed methods were examined by an experiment. The results revealed that the methods are able to evaluating the trainee's skill performance automatically and the accuracy of the evaluation is up to 80%.

In the second stage, a learning method which is based on the results of the checklist and demonstration videos was proposed to instruct the trainee to correct their errors. The result of the checklist is used to inform the trainee of their error, while the demonstration videos are used to help the trainees to review the teacher's standard performance. Subsequently, using the proposed methods developed in the first stage and the proposed learning method, a skill learning system was designed. In the skill learning system, an operation interface is designed to enable the trainees themselves to manipulate the system. Finally, a control test was carried out to examine the training effectiveness of the skill learning system. The result showed that trainee who used the system to train can improve

more effectively than the trainee who trained without any feedback.

In the third stage, we focus on developing a robot patient to enable the trainees to train themselves without any partner acting as the patient. The robot patient is targeted on reproducing the patient's action and enabling the trainee to perform the skill on it. The robot has 14 joints, including 2 active joints installed with motors, 4 passive joints installed with electromagnetic brakes and 8 passive joint without any actuators. In addition, angle sensors and a voice module are used to sense the joints' rotation angle and trainee's command respectively. The actuators and sensors enable the robot to reproduce the patient's body limbs' action and respond to the trainee's operation during patient transfer. Finally, through the experiment, we proved that the robot is able to reproduce the patient's body limbs' action and it is suitable for skill training of patient transfer.

In this research, the problems of developing a self-training system for patient transfer were solved. The methods of automatic skill evaluation in patient transfer were proposed and the evaluation accuracy achieved to 80%. Combining this method and a newly proposed learning method, we designed a skill learning system. We have proved that, with such evaluation accuracy, the trainee who used the system for training can improve more effectively than the trainees trained without any feedback. Finally a robot patient, which can reproduce the patient's body limbs' action and enable the trainee to perform the skill on it, was designed. Using this robot, the trainee can carry out the training by themselves without any partner acting as the patients.