要旨

起床動作検知システムにおける
撮像画像内の濃淡むらに対する濃淡正規化

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現在，日本国内において人口に占める高齢者数の割合が増加の傾向にある．それに伴い，病院や福祉施設内で高齢者がベッドから転落する事故が増加している．このような事故を未然に防ぐためには，介護師が 24 時間付ききりで介護をする必要があるが，介護士の負担が大きいため困難である．そこで現在，介護福祉士の負担軽減を目的とした赤外線センサを用いた起き上がり検知や感圧マットを用いた転落検知などのシステムが用いられている．しかしながら，赤外線センサを用いた起き上がり検知では，高齢者の寝返りなどの僅かな動作も検知してしまうことから，精度が期待出来ない．また，感圧マットを用いた転落検知では，高齢者が転落した後に検知を行うことから，転落事故の防止にはならない．そこで本研究では，カメラによる撮像画像を用いて高齢者のベッド上から落下に至る可能性の高い行動を検知することで，高齢者のベッドからの転落事故の防止を目的とした起床動作検知システムの研究を行っている．本システムには，人の個人差に対応するために，検知に非線形識別能力を有する Neural Network を用いている．また本システムは実際の臨床現場で 24 時間運用することを考慮し，撮像環境の明るさが異なる場合でも，安定した撮像画像を得る必要がある．これまでに部屋の照明による均一な濃淡変動の生じる環境への対応手法として，濃淡正規化を提案し，これにより均一な濃淡の変動に対応できることが分かった．しかし，外来光や不均一な照明により撮像画像に濃淡のむらが生じる場合には対応できていない．そこで本論文では，従来

の濃淡正規化を濃淡にむらの生じた場合にも適応可能な方法を提案する．

キーワード：ニューラルネットワーク，介護，撮像画像，輝度，濃淡正規化，適応

Abstract

Normalization of the Gray Levels for the Shading Fluctuation of the Captured Image for the Awakening Behavior Detection System

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Recently, accidents such that seniors fall down from the bed in care facilities or hospitals are increased. To prevent these accidents, caregivers or nurses have to always observe them. However, it is difficult for caregivers or nurses to keep observing them all time. To aid caregivers or nurses, there are some detecting systems in the field. One is the detection system using pressure sensing mat. Another is the detection system using an infrared sensor. However, these systems have some problems. First, the previous system detects senior's behavior when the senior have just fallen. Second, the system detects senior's behavior when they only sit up on the bed. To solve the problem, we propose an awakening detection system using Neural Network in hospital use. The purpose of this research is detecting the objective person's behavior such as falling down from the bed. In this research, the system classifies the objective person's behavior into two states namely, safety action and dangerous action. First of all, the image of the objective person in the bed is captured by the Web camera. Then, the captured images are detected into two states using the NN, respectively. Until now, the captured image in the laboratory is used for the experiment. (The captured image in the laboratory is abbreviated to a lab image.) In addition, we executed using the awakening behavior detection system in the clinical site. So, the detection capability of the awakening behavior detection system using the captured image in the clinical site for the detection was verified. (The captured image in the clinical site is abbreviated to a clinical image.) From the result of the experiment using the clinical image, it shows that the detection success rate of the system is not enough. As a cause, it is considered that this reason is fluctuation of the brightness quantity in the captured image according to the capturing environment. For this reason, the histogram of the captured image such as the lab image and the clinical one is analyzed. From the result of histogram analysis, it is proved that the brightness distribution is different, respectively. To solve the problem, the histogram of the captured image should be equalized. Then, the effectiveness of the new feature extractive method such as the histogram equalization for fluctuation of brightness quantity is proposed.

In this paper, to verify effectiveness of the histogram equalization, the experimental verification is executed. Next, it is considered that the histogram equalization is not able to be satisfied with the shading fluctuation in image. Then, it is need that the effectiveness of the histogram equalization for the shading fluctuation in image should be shown. Adaptive histogram equalization method is proposed, newly in this paper. First, image is divided several area according to the shading fluctuation in image. Second, each divided image is equalized, respectively. Finally, they are unified to one whole image. At the last, the effectiveness of the adaptive histogram equalization is shown with checking manually using real image.

Keywords: Neural Network, Nursing, Captured Image, Brightness Quantity, Histogram Equalization, Shading Fluctuation