博士論文審査結果の要旨

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氏　　名	Somchanok Tivatansakul
論文題目	Healthcare system focusing on emotional aspect -Using augmented reality, facial expression and ECG-

〔論文審査の要旨〕

論文の概要は以下のとおりである。

To cope with negative emotional health in daily life, she proposed a new healthcare system focusing on emotional aspects. To make the healthcare system more attractive and effective, she proposed and created a breathing control application for a relaxation service using deep breathing techniques and augmented reality to increase user relaxation and decrease their stress. To make the healthcare system more effective and intelligent, she integrated emotion recognition by facial expression and proposed new feature extraction algorithm to recognize emotions to increase the accuracy of existing facial emotion recognition. Furthermore, to increase the accuracy and efficiency of the emotion recognition by facial expression, she integrated emotion recognition from ECG signal. She firstly adapted favorable local pattern description methods for emotion recognition by facial expressions to recognize emotions from ECG signal. To apply the proposed system in real environment, the prototype of emotional healthcare system was built. Moreover, stress detection from ECG signal was integrated in this prototype to recognize stress together with emotion recognition. As the results, the prototype is effective at recognizing negative emotions and stress to provide the relaxation service in real-time process.

最終審査は、1 時間の発表の後、質疑応答を行った。質疑では、感情認識に使用した手法やその理由などについて質問があり、いずれの質問についても的確な回答が示された。またこれらの内容を明確に博士論文に反映することにより、さらに質の高い博士論文になるとの助言を受けた。予備審査の段階から、既に博士論文にふさわしい内容であるとの合意があり、質疑が尽きた時点で、投票を行った結果、全員一致で合格と判断された。

なお本研究および関連研究の成果は、学会誌査読論文 2 件（うち 1 件は筆頭で、3 件目投稿中、4 件目投稿準備中）、国際会議（IEEE CICARE2013, HCII2013 等）13 件（うち筆頭 9 件）、国際会議 workshop（SEATUC2013 workshop）1 件（筆頭）、国内研究会（電子情報通信学会）1 件（筆頭）である。

(Form6)

論　文　要　旨
Thesis Abstract

(yyyy/mm/dd)　2015 年　07　月 01　日

※報告番号	第　　号	氏　名 (Name)	Somchanok Tivatansakul

主論文題名　(Title)

Healthcare system focusing on emotional aspect - using augmented reality, facial expression and ECG signal-

内容の要旨　(Abstract)

In this doctoral dissertation, I proposed a new healthcare system focusing on emotional aspects to cope with negative emotional health in their daily life.
To make the healthcare system more attractive and effective, I proposed a breathing control application for a relaxation service using deep breathing techniques and augmented reality to increase user relaxation and decrease their stress. The evaluation results suggested that the breathing control application for relaxation service was able to decrease their stress and augmented reality helped users decrease stress more quickly than only deep breathing technique.

To make the healthcare system more effective and intelligent, I integrated emotion recognition by facial expression. To increase the accuracy of existing facial emotion recognitions, I proposed Complementary Directional Ternary Pattern (CDTP) algorithm to recognize emotions. CDTP was designed to compress the sparse features of DTP by decreasing size of feature vector and reducing the feature redundancy in pattern representation while maintain the integrity of extracted feature. The evaluation results indicated that CDTP with SVM was able to recognize basic emotions with high accuracy and performance.

However, emotion recognition from facial expression was able to cause the confusion issue. To solve this and to increase the accuracy and the efficiency of the emotion recognition by facial expression, I integrated emotion recognition from ECG signal. To recognize emotions from ECG, I adapted LBP, LTP and CLTP which are the favorable local pattern description methods for emotion recognition by facial expressions. The evaluation results indicated that LBP and LTP effectively extracted ECG feature with high accuracy using k-NN classifier.

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内容の要旨(Abstract

To apply the proposed system in real environment, the prototype of emotional healthcare system was built. The experimental results showed that breathing control application of relaxation service also effectively decreased negative emotions. The emotion recognition by facial expression effectively recognized negative emotions but it had some confusion to correctly recognize emotions. The results also indicated that the integration of emotion recognition by facial expression and ECG signal addressed the confusion issue and increased the accuracy of facial emotion recognition. However, only recognition of negative emotions might not be enough to provide relaxation service. Therefore, stress detection from ECG signal was integrated in this prototype to recognize stress together with emotion recognition. Thus, emotion recognition and stress detection had a potential for emotional healthcare system to provide assistance when users experienced some stress or negative emotions. The efficiency of the prototype was improved and it was more suitable for practical usage.

From the results of this dissertation, I achieved all research goals to construct attractive, effective and intelligent emotional healthcare system using augmented reality, emotion recognition by facial expression and ECG signal, and stress detection from ECG signal. Finally, I obtained a new design of emotional healthcare system, a new relaxation service with augmented reality, a new feature extraction approach (CDTP) for recognizing emotions from facial expression, new feature extraction approaches (LBP and LTP) for emotion recognition from ECG signal, a new real-time emotional healthcare system using real-time emotion recognition by facial expression and ECG signal, and real-time stress detection from ECG signal. The findings from this dissertation such as new feature extraction algorithm (CDTP) for recognizing emotions from facial expression and new feature extraction approaches (LBP and LTP) for emotion recognition from ECG signal were also applicable to any other researches and systems.

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