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## **Research about acquiring psychological information during studying with PC**

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### **summary**

In recently, development of ICT is changing our daily life. For instance, applying ICT to an educational field is very active in not only personal learning but also school management. Especially, e-learning (applying internet technology to education) is a famous one.

One of the challenges of e-learning is about the motivation of learning. Nowadays, there exist a couple of smartphone apps for education or e-learning. Most of the apps focus on improving learner's motivation based on the forgetting curve theory, gamification technique, and/or habituation system with a notice function of smartphone. We thought that a method which predicts learners' motivation in their learning process makes other research assist about motivation management under a hypothesis that their motivation in learning has a relationship with of their facial expression.

In order to investigate this hypothesis, first, we got a pre-experiment that three staffs attended from outside research institute of psychology as experiments participants. The pre-experiments aimed to confirm how to get accurate data for the main experiment. We did an exam with the questions about shape and regularity from the CAB test and took the videos of facial expression and PC monitor of the participants in solving the questions. After solving all questions or time up, we asked the participants to answer the questionnaire which includes "difficulty," "interest," "fatigue," and "concentration". These learners' viewpoints might reflect on their motivation to each question of the exam. After finishing the pre-experiment, we picked up the time (frame number) of solving each question from the video of their PC monitor and divided the video into a set of still images as an input resource for learner's motivation prediction.

As a result of the pre-experiments, we found a couple of issues such as the definition of the question sentences was sometimes obscurity; the participants could not remember how felt they tried such questions, limitation of the PC spec made mismatch of video frames between facial expression and PC monitor, etc.

Next, we got the main experiment which joined 19 students of JAIST and staffs of the outside research institute of psychology. We fixed the procedure of the experiment based on findings of the pre-experiment but conducted it in

a similar way. We analyzed all still images (around 3,000 images) using face++, and got parameters for each [emotion : sadness, natural, disgust, anger, surprise, fear, happiness ], [right and left eye gaze : position of coordinate - (x, y) , vector component - (x,y,z)], [ head pose : pitch, roll, yaw], [face rectangle : width, top, left, height], [mouse status: open, close, other, mask], [static data: old, gender, glass].

Next, we calculated [average, variance, max, min] for all the parameters in each question and compressed the parameters from 3,000 to 453.

We developed a neural network in which inputs were 453 parameters and outputs were the results of the questionnaire. We divided input data into 423 train-data and 30 test-data randomly. And, we compared the average accuracy of the neural networks which had 2~7 hidden layers with “sigmoid” activation function and an output layer which had “soft-max” activation function in learning only the train-data set. We repeated this procedure 50 times to change test-data and calculated the average accuracy of the prediction.

The results of prediction were [“difficulty” max average accuracy was 0.41 ], [“interest” max average accuracy was 0.55], [“fatigue” max average accuracy was 0.522], [“concentration” max average accuracy was 0.505].

Especially, the max average accuracy of “interest” was 2 hidden layers. This means facial expression and “interest” of the questions had a simple correlation. We can apply other prediction methods such as (RNN, CNN, K-nn, SVM, standard statistical method). We denoted them as future tasks.

In conclusion, these results were better than just random, but needed improvements from the accuracy point of view. In the future, we want to adopt an online experiment system to increase the amount of data for machine learning input.

Keywords: facial expression., motivation, education, neural network, machine learnin