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Graduate School of Science and Engineering, Aoyama Gakuin University

Title: Study on Over-eating Prevention System Using Satiety Point Detection and Gamification

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Abstract

Originally, human eating behavior is balanced in energy by releasing and excreting energy obtained by feeding. However, this equilibrium collapses by overeating. It is a serious problem that hunger feeling and satisfaction coming from inside the body become difficult to obtain, leading to health damage. On the other hand, it is reported that the activity of the autonomic nervous system related to eating behaviors before meals and after meals changes autonomic nervous system activity, which affects stress and relax states balance. When eating a proper amount of meal, since this is the parasympathetic nervous system that moves digestive organs by eating, the body becomes relaxed.

In contrast, by over-eating, the body turns into a stress state, and the sympathetic nervous system may work strongly. However, when the over-eating state continues, it becomes difficult to feel the stress, and the parasympathetic nervous system becomes significant again when reaching the over-eating limit point. Therefore, in order to prevent over-eating, it is considered effective to change the activity of the autonomic nervous system at an appropriate timing by giving stress during over-eating.

In this study, we focused on the real-time monitoring of the activity of the autonomic nervous system and tried to develop an over-eating prevention system using gamification in order to give stress during over-eating appropriately. The goal is to ascertain the effectiveness of the system.

Most people eat daily, so in order to suppress over-eating, it is necessary to continue using the system during meals. For that reason, by combining various games, it may be possible to promote perseverance. The prototype system adjusts the degree of difficulty of gamification from the movement of the autonomic nervous system during a meal and changes the amount of stress given.

In order to confirm that the prototype system affects over-eating, ten subjects participated in an evaluation experiment. In this experiment, we compare the dietary amount of meal when using or not the prototype system and also conducted a questionnaire survey. As a result, it was possible to reduce the dietary amount of meals for eight out of ten subjects. Moreover, the tendency to decrease the amount of meal by feeling stress was observed.

In this prototype system, the timing to start the game was set manually. Also, an algorithm for automatically estimating satiety point from the obtained autonomic nervous system activity data has been developed. Therefore, in the future, implementing this algorithm to process in real-time would enable to start the game automatically on automatic satiety point detection. Furthermore, we would like to build an overeating system to work as a smartphone application software to be able to use it easily in a meal scene without any time and place constraint.