

Development of the pole to present the information for improvement of the skill in Nordic walking

Yuta Ogai, Ryota Sugimoto, Yoshiya Mori, and Masahiko Yamamoto

Tokyo Polytechnic University

Keywords: Nordic walking, Accelerometer, Wearable devices

Nordic walking, or walking with poles, is an effective aerobic activity that uses the whole body, including the muscles of the lower body as well as the arms and the upper body. The benefits of Nordic walking are that it can easily be started regardless of the season, and the effect of the exercise is achieved within a short time. Previous studies aimed toward the scientific verification of the benefits of Nordic walking mainly focused on the alleviation of the load on the legs provided by the poles and on the energy consumption. Although a difference in the load on the legs and the energy consumption is expected to occur with technical mastery of the use of the poles, detailed research on this issue has yet to be conducted. Therefore, we analyzed the techniques of both experts and beginners of Nordic walking to gather basic data about their differences.

We developed a system to acquire data by using a three-axis accelerometer attached to the tip and grip of the poles used in Nordic walking. We collected and analyzed the data from both experts and beginners by using this system. One of the results of the analysis indicated that two or more significant peaks existed in the power spectrum of the data of the experts, whereas only one significant peak existed in the power spectrum of the data of the beginners. We expect the features will become useful indexes to differentiate between experts and beginners. Using the results, we developed a program automatically to analyze the data and indicate the features by sounds during the pole work.

Furthermore, in order to miniaturize the system and add other feedback functions like tactile stimulus, we developed another system using Raspberry Pi (a small PC) and Arduino (a microcomputer). Raspberry Pi and Arduino can work with a mobile battery as small wearable devices. The IMU (Inertial Measurement Unit) sensors attached to the poles can measure not only accelerations but angular velocities. The data are saved as CSV files for later analysis. Moreover, the system can provide feedback to the subject via the Arduino using vibrators, LEDs, and speakers. The system was tested by having one of the researchers walk along a mountain road with the equipment attached to the body. We believe that the system contributes to research on the relations between the load and the pole work and the through feedback, improves the pole work of beginners.