

## Ubiquitous computing

# Tailoring workout intensity

*Smartphone technology can account for physical differences between individuals during walking to optimize exercise intensity*

**E**ven as fitness programs such as Cross-Fit and Zumba surge in popularity, walking remains one of the most reliable and effective forms of exercise for burning calories and building muscle mass. Walking is free, requires no specialized equipment, and can be done in small time increments. But achieving optimal heart rate is necessary for getting the most out of a walking workout and heart rate targets vary dramatically depending on a person's physical fitness, age, health, and other factors.

Now, researchers at the Nara Institute of Science and Technology have shown that existing smartphone technology has the capacity to account for these individual differences, called 'physical load', to allow walkers to achieve optimal heart rate. Keiichi Yasumoto and colleagues at the NAIST Graduate School of Information Science have proposed a method for estimating physical load and minute-by-minute changes during walking routes, taking into account the individual's physical condition and exertion level.

Walking that is too strenuous can result in heart problems or joint injuries, particularly in the elderly and in people with certain conditions; meanwhile, insufficient exertion yields little benefit. Yet, achieving the optimum exercise intensity is not clear-cut or unambiguous without specialised equipment, such as heart rate monitors. But cost and inconvenience of such equipment can keep some people from taking advantage of walking as an exercise regimen.

**To get a more reliable measure of heart rate, the researchers constructed heart rate prediction models that rely on walking data collected by smartphones and heart rate data obtained by a monitor.**

Existing smartphone applications are able to measure heart rate, but they rely on capturing finger or face images, a system that does not work well during walking. To get a more reliable measure of heart rate, the researchers constructed heart rate prediction models that rely on walking data collected by smartphones and heart rate data obtained by a monitor.

To account for fluctuations in heart rate due to changing exercise intensity during a walk, the NAIST team developed a novel technique to estimate oxygen uptake under varying walking speeds and gradients. Their technique also takes into account the physical condition of individuals. The team tested their method in 18 subjects and five walking routes, and found that they were able to predict heart rate accurately within a mean error of seven heartbeats per minute.

### Reference

1. Sumida, M., Mizumoto, T., Yasumoto, K. Estimating heart rate variation during walking with smartphone. UbiComp 2013, 8-12 September 2013, Zurich, Switzerland.



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NAIST research helps walkers achieve optimal heart rates using smartphone technology.

More information about the group's research can be found at the Ubiquitous Computing Systems Laboratory webpage:  
<http://ubi-lab.naist.jp/>