Abstract

Development of an Engagement Engine to Support Long Term Use of Fitness Trackers and Sustain Physical Activity

Amanda Centi[1], PhD; Ramin Mohammadi[1]; Stephen Agboola[1,2,3], MD, MPH; Mursal Atif[1]; Sagar Kamarthi[1]; Kamal Jethwani[1,2,3], MD, MPH; Joseph C Kvedar[1,2,3], MD

[1]Partners Connected Health, Boston, MA, United States

[2]Massachusetts General Hospital, Boston, MA, United States

[3]Harvard Medical School, Boston, MA, United States

Corresponding Author:
Mursal Atif
Partners Connected Health
Boston, MA,
United States
Phone:
Email: matif1@partners.org

Abstract

Background: Sustained tracking of physical activity can lead to habitual exercise routines and decrease disease risk. However, many new users experience a sharp decrease in tracker use within months of initial use. Users stop using activity trackers for various reasons, including losing interest and lack of support. Innovative personalized approaches that increase continued use could lead to not only acceptance of tracking, but also to more regular engagement in exercise. Here we discuss a multi-phased approach to developing an engagement engine to support long-term use of fitness trackers by adjusting a participant's step goal based on performance and engagement during the previous week and personalized text messaging.

Objective: The objectives of this study are to first identify reasons for non-engagement with activity trackers and then build a machine learning algorithm to support continued use of activity trackers.

Methods: Overweight and obese participants (n=30) were recruited to use activity trackers to record their step counts every day for 9 weeks. Participants completed physical activity behavior-related questionnaires including Proschka's Stage of Change, Barriers to Being Active and Behavioral Regulation of Exercise Questionnaire at 0 and 9 weeks. The questionnaires generated 158 variables which were analyzed to determine their appropriateness for inclusion in the algorithm. Highly correlated and near zero variance variables were eliminated which resulted in 87 variables. To determine the number of factors needed, eigenvalues were calculated and 19 factors were generated with eigenvalues greater than one, which encompassed 98% of the variance. Shannon entropy was used to generate a weekly value, calculated from participants' step counts, that served as an indicator of how likely a participant is to be engaged with their activity tracker. The 19 factors combined with step data and a Shannon entropy value from the past 7 days served as the input to a neural network prediction model. Of the available data, 90% was used as training set for the algorithm while the remaining 10% was used as a test set.

Results: A neural network that predicts a participant's step goal based on their responses to study questionnaires, available step data and Shannon entropy value was developed. The machine learning algorithm's neural network was developed using the backpropagation method, two hidden layers, 20 nodes and learning rate equal to 0.001. Mean squared error of the model was 0.00125.

Conclusions: Artificial intelligence applied to physical activity data combined with behavioral data may be used to increase engagement with activity trackers. A follow-up prospective study is ongoing to determine the performance of the engagement algorithm.

(iproc 2017;3(1):e22) doi: 10.2196/iproc.8461

XSL•FO
RenderX

Edited by T Hale; this is a non–peer-reviewed article. Submitted 13.07.17; accepted 24.08.17; published 22.09.17.

Please cite as:
Centi A, Mohammadi R, Agboola S, Atif M, Kamarthi S, Jethwani K, Kvedar JC
Development of an Engagement Engine to Support Long Term Use of Fitness Trackers and Sustain Physical Activity
iproc 2017;3(1):e22
URL: http://www.iproc.org/2017/1/e22/
doi: 10.2196/iproc.8461
PMID:

©Amanda Centi, Ramin Mohammadi, Stephen Agboola, Mursal Atif, Sagar Kamarthi, Kamal Jethwani, Joseph C. Kvedar. Originally published in Iproceedings (http://www.iproc.org), 22.09.2017. This is an open-access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work, first published in Iproceedings, is properly cited. The complete bibliographic information, a link to the original publication on http://www.iproc.org/, as well as this copyright and license information must be included.

XSL•FO
RenderX