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A Deep Learning Tool for Personalized Workout Recommendations from Fitness Tracking Data

Computer scientists at the University of California San Diego have developed FitRec, a recommendation tool powered by deep learning, that is able to better estimate runners' heart rates during a workout and predict and recommend routes. The team frim the Jacobs School of Engineering at UC San Diego will present their work at the World Wide Web 19 conference May 13 to 17 in San Francisco.

Researchers trained FitRec on a dataset of more than 250,000 workout records for more than 1,000 runners. This allowed computer scientists to build a model that analyzed past performance to predict speed and heart rate given specific future workout times and routes.

FitRec also is capable of identifying important features that affect workout performance, such as whether a route has hills and the user's level of fitness. The tool can recommend alternate routes for runners who want to achieve a specific target heart rate. It also is capable of making short-term predictions, such as telling runners when to slow down to avoid exceeding their desired maximum heart rate.

The team was able to develop the tool partially because they were among the first to collect and model a massive fitness dataset for academic research. But developing FitRec was no easy feat as the fitness dataset has a huge number of workout records, but only a small number of data points per individual.

"Personalization is crucial in models of fitness data because individuals vary widely in many areas, including heart rate and ability to adapt to different exercises," said Julian McAuley, a professor in the Department of Computer Science and Engineering at UC San Diego.

“The main challenge in building this type of model is that the dynamics of heart rates as people exercise are incredibly complex, requiring sophisticated techniques to model,” researchers added.

To build an effective model, computer scientists needed a tool that uses all of the data to learn but at the same time can learn personalized dynamics from a small number of data points per user. Enter a deep learning architecture called long short-term memory networks (or LSTM), which the researchers adapted to capture the individual dynamic behaviors of each user in the dataset.

Researchers fed the networks a subset of a public dataset from endomondo.com, an app and website that function as a workout diary. After cleaning up the data, researchers wound up with more than 100,000 workout records to train the networks.

They validated FitRec’s predictions by comparing them with existing workout records that were not part of the training dataset.

In the future, FitRec could be trained to include other data, such as the way users’ fitness levels evolve over time, to make its predictions. The tool could also be applied to more complex recommendation routes, for example safety-aware routes.

But in order for the tool to be used in commercial fitness apps, researchers would need to have access to more detailed fitness tracking data and deal with various data quality issues.

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