Virtual coach

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Motivation

Health and Physical fitness has become the top priority of the current era and with the everyday busy schedule, it has become challenging to be disciplined in our physical activities. Wearable devices solve majority of the challenges, by reminding us to move and sweat everyday. Too much of anything is not good, but how do we know that we are overworking and getting burnt out? Our motivation is to build an intelligence layer on top of the current wearable devices, that leverages the features that are currently collected through wearable devices and provide real time recommendations to the user during the activity.

Context

Every human body is different and Heartrate is a direct measure of the extent to which we are pushing our body. The highest heartrate for a human is approximately (220 bpm - Age of the individual). For someone who is 20 years of age, the maximum heartrate is limited to 200 bpm. The range of 100bpm leading to the maximum limit is the activity zone. For a 20 year old individual, the activity range is between 100 to 200. This range can be split into 5 zones.

EXERCISE ZONES											
		AGE									
		20	25	30	35	40	45	50	55	65	70
100%	VO₂ Max (Maximum effort)	200	195	190	185	180	175	170	165	155	150
90%	Anaerobic (Hardcore training)	180	176	171	167	162	158	153	149	140	135
80%	Aerobix (Cardio training / Endurance)	160	156	152	148	144	140	136	132	124	126
70%	Weight control (Fitness / Fat burn)	140	137	133	130	126	123	119	116	109	105
60%	Moderate activity (Maintenance / Warm up)	120	117	114	111	108	105	102	99	93	90
50%		100	98	95	93	90	88	85	83	78	75

(BEATS PER MINUTE)

- Zone 1: 100 - 120 Easy / Moderate Activity
- Zone 2: 121 - 140 Fat burn / Weight Control
- Zone 3: 141 - 160 Cardio / Aerobic
- Zone 4: 161 - 180 Perform / Anaerobic
- Zone 5: 181 - 200 Peak / Maximum effort / Vo2 Max

Depending on the individual goals, we need to ensure that the user is on the respective zone. For someone who is a beginner, they should reside in Zone 1 / 2, for someone who trains regularly, should reside in Zone 4. For someone who wants to get back to shape should reside in Zone 3.

Objective

To build an intelligence layer on top the wearable devices, that learns the pattern of heartrate across different activities, temperature, altitude, body temperature conditions that guides the user to stay on the aspired zone.

Dataset

An athlete's sports activity data with their consent has been used for this analysis. The dataset captures the information about the athlete every second during an activity. About 36 activity data has been collected, and the features measured were Heartrate, Altitude, Distance covered, Stride count. External environmental variables such as Temperature, Humidity are procured externally for the day of the activity.

- Activity data
  Dataset count: 36
  Features per dataset: 11
  Observations per dataset: 30,000 (Approximately)

- Weather and external variables
  Features per dataset: 4 to 8
  Observations: Day level 365

- Parsing and Importing
  Activity datasets are in csv format, where we need to define custom metrics for prediction based on analysis (summarizing based on time and distance)
  Weather data has to be either pulled from a third party site / an API call will be made (yet to be decided)

- Database, Analysis, Visualization
  The database will have activity, weather information connected based on date field
  Analysis will be done on understanding the heartrate pattern and arriving at minimum time taken to achieve the goal zone
  Visualization will be in Jupyter notebooks, showcasing the zone wise % of activity, fluctuations, relationship between heartrate and activity etc.

Relevance and Impact
- Approximately there are 240 Million runners in the world, 53 Million reside in US
- 34% of the overall population are above the age of 54, that makes it 17 Million people who will need this data driven assistance before involving in any physical activity
- This can also act as a handholding measure, for those with different fitness goals (weight loss, improve, compete etc.)

References
Bpm: beats per minute
Max Heart rate = 220 bpm - age
- The above formulae is widely in practice, here is the source quoted in Runnersworld.com
- American Society of Exercise Physiologists have tried analyzing this formulae and here are the results for the same