Correlation of air pollutants and prediction of physical fitness index based on wireless sensor network

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Abstract
This paper studies the correlation between different data of urban pollutants. It is pointed out that the identification way of the relationship between the environmental pollutants in the surrounding area and the urban environmental pollutants, the geography of the surrounding area, the location and the corresponding wind direction correspond to each other. In addition, it is judged and studied according to the wireless sensor network and physical indicators, so as to understand the correlation between the environmental pollution sources. The information gathered through fitness trackers assumes a significant job in improving wellbeing and the prosperity of the individuals who wear them. There is additionally a progression of direct correlations of a few wellbeing markers from various wellness trackers. In this investigation, we thought about the quantity of steps, calories consumed, and 3 miles of wellness tracker gathered in a free day to day environment over a time of 14 days. It shows our work that the quantity of steps announced by wearing distinctive specialized gadgets at the same time can vary by as much as 26%. At the same time, the same trend is based on counting steps in the mutants seen at a distance traveled. A small correlation is found between the number of calories burned and the observed change in the number of steps between multiple devices. Our findings show their health indicators as calorie burn reports and miles run and rely heavily on the manufacturer’s proprietary algorithms for the device itself and data such as calculations and inferences.

Keywords Andom flows · Air pollution concentration · Physical activity · Ecological environment

Introduction
Prevention and reduction of pollution is a very complicated process. First, we must investigate the causes of environmental pollutants and their consistency, and then formulate corresponding policies and measures, and apply these policies and measures to practice. With the formation of urban environmental pollution causes more and more complex, not only the pollutants produced by people in the city in production and life, but also the pollutants diffused from the surrounding cities. Therefore, for the analysis and research of pollutants, it will be an important research direction to study the diffusion from the surrounding cities to the cities.

Demographic changes caused by the aging of the growing population are common phenomena in the world. Changes in demographics have raised many concerns about health and social approach. For instance, the administration of constant maladies, the nature of well-being care, and the career of independent living are essential to the well-being of the elderly. However, the struggle between aging and improving the quality of life of the elderly is not easy. Aging is attached to skeletal muscle loss, quality, and function. With age, people who live independently can lose their fantastic ability to compromise musculoskeletal health further. Also, the adaptation of skeletal muscle in many healthy older adults is close to or equal to the boundaries of functionally independent thresholds. This means that they lose high-risk groups to their ability to perform their daily activities. Intervention to improve old skeletal muscle has become essential.

However, there are still questions about the dose-response relationship between health benefits and physical activity. The
portion reaction connection between physical activity level and exercise force is, as of now, measured by inconsistent method and imprint volume and power of physical activity. To achieve an accurate estimate of the level of physical activity, many health professionals have standardized on energy consumption such as operational laboratory monitoring, dual standard water technology, and indirect calorimetry. Depending on the measurement, be that as it may, these techniques for estimating vitality consumption are not sensible by and by, and have been estimated outside the research facility or in typical everyday life.

**Literature survey**

Due to more and more pollutants in the air, relevant experts and scholars point out different ways to predict environmental pollution. At the beginning, linear regression method was used more frequently in the study of air pollution. Later, through neural network data information, cloud computing and Bayer network, we also studied the data of air pollution. Aiming at the main pollution sources in the city, the neural network model is used to judge the air quality, so as to increase the accuracy of weather forecast. In the literature, according to the data analysis of different cities in different years, the BP neural network of time series is created (Ye and Ning 2009). The data collected in different seasons are used as the experimental results of the test. The experimental results show that the artificial neural network model does not need to create a digital model, and can make a better accurate prediction.

It has high vocational education (high vocational education) (Gumma and Pavelic 2013) and widespread communication needs in society. These take vocational, physical training so that their professional students will provide the standard for other higher vocational schools and sports data to be achieved in more future cases. It is to analyze the results of the physical fitness test of high vocational students (VCS) exercise (Abd-El-Al 1953). It uses the command causal test method to analyze physical fitness test data for universities in a particular city. It establishes a custom causal test model for physical activity (average performance) at the gym, not withstanding conventional PA, two-layered psychological structure orders high-impact stationary and free weight exercises, tally redundancy, and set free weight works out and it is suggested that during this period you will measure the number of repeats and set free re-activities. On the first layer, APD (OC-SVM) types are broadly applied to free weight and free activity (Mulligan and Charette 2009).

It proposes to approach a multimodal fitness landscape via multiple objective approaches, thereby providing an estimate of the potential optimal area. Firstly, the multi-peak optimization problem uses the multi-objective evolutionary algorithm to transform the optimization of the multi-objective optimization problem into a second optimization goal, the adaptive diversity indicator, and the approximate training landscape. By adding, it will be transformed into a multi-objective optimization problem. Con et al. (2013). That it proposes to design, implement, work, and low cost, physical exercise, and usability of the FFA platform systems, game development, and evaluation (fitness game) suitable for user’s persistent exercise and effectiveness, is being discussed. FFA is designed for the elderly, distilling literary guidelines and recommendations. In the FFA framework, a standard physical exercise program is adopted in fitness game software engineering to improve the adaptability of physical assessment tests with adjustable training intensity standards (Paoletti et al. 2017).

The current work shows a step in this direction. This work unobtrusively tracks individual physical activity throughout the day by mapping calories spent on the activity, estimating calories burned and assessing fitness levels using wearable sensor heart rate data. Need a way it utilizes supposed continuation to quantitatively appraise pulse cardiorespiratory wellness dependent on an individual parameter (Robinson et al. 2005). It shows a learning model of student physical fitness test weights. An algorithm for this solution is also proposed. At that point, we utilize the proposed technique to dissect the two datasets. The outcomes show that the model proposed in this article has points of interest in examining physical wellness test information for college students.

**Materials and methods**

The diffusion of air pollutants in nature mainly depends on the role of wind. In other words, wind direction and wind speed are the most important factors that affect the air pollutants in one city. Different wind directions will produce different spatial correlation (Shaban 2003). For example, when the south wind blows, the air pollutants...
in the south area have a greater impact on the target city, while the air pollutants in other areas have a smaller impact on the target city. Therefore, the surrounding area of the target city is divided into different areas according to the wind direction in order to discuss the spatial correlation of air pollutants. The simulation of air pollutants is shown in Fig. 1, and the comparison of pollution in different cities is shown in Fig. 2.

Indicators of activity levels in the elderly should reveal a personal relationship between exercise intensity and health status. Indicator promotional activities can suggest improvements in health as a result of increasing levels of physical activity. Proposed block diagram as shown in Fig. 3.

This study explored a convenient quantitative method for assessing the physical fitness of the elderly through rehabilitation training in several homes. These exercises must be done safely by all seniors, and fashionable to produce. The accompanying article is isolated into two subsections (Lonergan and Brooks 1994). The primary passage presents quantitative games markers and the proposed quantitative technique. Also, in the subsequent subsection, it gives a short depiction of home recovery preparing for the individuals who are shooting this work.

**Rehabilitation exercises for the elders in home**

There are two principal worries with having a planned home restoration work out. One is that these activities ought to be essential and safe enough for more seasoned individuals to take an interest; another thought ought to be anything but difficult to screen and measure the activities (Bisson and El-Baz 1991). To meet the above necessities, we call six activities for pneumonic recovery (PR) arranging and select six exercises for the upper and lower extremities, which also meet the criteria of physical therapy. Similarly, the correlation between two new comprehensive variables is

\[
U = \alpha_1 x_1 + \alpha_2 x_2 + \ldots + \alpha_p x_p = ax
\]

\[
V = \beta_1 \beta_1 + \beta_2 \beta_2 + \ldots + \beta_p \beta_p = \beta y
\]

This is especially apparent for older people, where physical activity reduces the risk of chronic illness and lack of exercise typically. As shown, these exercises consist of four standing positions and two sitting positions. The gradient information of diversity indicator is shown in equation

\[
d(x) = \sum_{i=1}^{N} |x_i - x_j|
\]
The fitness landscape value is

\[ \varphi = \left( x_\varphi, y_\varphi \right) \times x_\varphi \leq x \]  

(4)

Where,

- \( x \) is whole feasible decision space

It follows that the key to the success of the quantitation method is the signal pattern of acceleration in these exercises. The most important feature of these general rehab exercises is that they improve the upward head and have the same function of stretching (Chenini et al. 2010). The property is brought about by applying a force that resists gravity. It can have the same “U” shaped signal pattern for each movement acceleration change, as shown in the figure. Therefore, the proposed quantitative method can work well in these six exercises. The proposed quantitative markers and strategies for development will be presented in the following segment (Zhong et al. 2018).

**Method and indicators of exercise quantification**

At the same time, the conditions of the domestic environment and the elders must be carefully considered to monitor their physical fitness through the appropriate sensors. It can be used to monitor the elderly and wear watches to provide a home rehabilitation motion sensor small enough (Sabins 1997). The motion acceleration data can also be deployed in the home environment and sent to the home gateway via the wireless Zigbee WPAN, the weighting coefficient function is shown in equation.

\[ w(x) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left\{ -\frac{(x-\mu)^2}{2\sigma^2} \right\} \]  

(5)

Therefore, home restoration preparing observing can be sued advantageously for the older. What’s more, the quantitative assignment is finished in the home passage. At the point when the home door gets a bundle from the sensor, it questions by the short MAC address of the client’s personality, at that point stores the quickening information using the proposed technique and investigates it quantitatively. The intensity of the triaxial acceleration values preprocessed to the additive vector values to represent body motion from the triaxial accelerometer is called the PFI signal amplitude vector. The calculating formula of PFI is defined as:
Where, $x(t), y(t), z(t)$, is the acceleration triaxial values by a specific sampling setting.

Physical Fitness Index (PFI) provides a measure of the degree of exercise intensity, a description of the PFI mode during a particular exercise. The elder needs to apply the force during each exercise to overcome gravity. Experimental observations reveal the lowest point on the PFI curve when the hand is raised to its highest level during exercise (MoEW 2014). This point is assigned as the base PFI, which implies the base moving quickening that happens during movement. From a movement structure viewpoint, it assumes that each stage of the movement, against gravity, requires more power and spends more minutes from the beginning of the motion when PFI occurs. The force of a specific development is gotten by adding the development changes of the determined worth PFI by the accompanying recipe. The tri pivotal speeding up values are taken straightforwardly from the accelerometer. The third indicator PFI is a compilation of all movement changes, always on the move.

$$PFI(T) = \sqrt{x(t)^2 + y(t)^2 + z(t)^2} \tag{6}$$

$$PFI_{total} = \sum_{i=0}^{n} SVM(t_{i+1}) - PFI(t_i) \tag{7}$$

$$PFI_{start to min} = \sum_{i=0}^{n} SVM(t_{i+1}) - PFI(t_i) \tag{8}$$

Where,

$$0 < t_{i+1} \leq T_{total}$$

To assess the quantitative techniques and markers proposed in this examination, the tests are separated into two gatherings. It enrolled five volunteers in directing a test with three guys and two females. Each volunteer burned through six activities multiple times on the gauge information gathered. For a goal correlation, the benchmark group was approached to play out a weighted 750 g article on the privilege and wear tight skin on the chest for more protection from the barricade works out.

National indicator for physical fitness

The National Fitness Index depends principally on the record utilized for the third public physical wellness observation. It has three primary classes: body shape, physical capacity, and physical wellness. Body shape markers incorporate tallness, weight, chest circuit, midsection outline, hip periphery, upper arm subcutaneous fat thickness, stomach subcutaneous fat thickness, scapula subcutaneous fat thickness, and weight list (BMI). BMI is a significant list that mirrors the state of the body. The performance indicators of peak ratio is shown in equation

| Physical characteristics | Mean | Standard deviation |
|--------------------------|------|--------------------|
| Age (yrs.)               | 22   | 3                  |
| Height (cm)              | 177.6| 4.72               |
| Weight (kg)              | 73.2 | 7.32               |

![Table 1 Physical characteristics](image1)

![Fig. 4 Optimization training process](image2)
\[
PR = \frac{\sum_{n=1}^{NR} NPF}{NKp \times NR}
\]

(9)

And the success rate is

\[
SR = \frac{NSR}{NR}
\]

(10)

Pointers of physical capacity incorporate fundamental limit, beat (pulse), systolic circulatory strain, diastolic circulatory strain, and step testing. Physical wellness measures remembering one foot with eyes, sitting shut with bowing forward, sitting quality, back quality, push-ups (male), stomach muscles (female), and vertical hop in choosing reactions.

Results and discussion

Our rating system was tested and confirmed in five healthy male subjects that the average physical parameters were introduced. Five of the subjects are athletes practicing running and long jumps. Two people like sports and regular practice, but the last two do not like sports and rare practice. Physical characteristics as shown in Table 1. Optimization training process as shown in Fig. 4.

Conclusion

The physical condition of every person is a particularly important factor that requires a high level of physical fitness for a person to participate in a particular task. Therefore, for physical fitness system requirements, this would be able to predict the condition of high accuracy and the safety offered by the measured object. The proposed system provides provider safety as well as high accuracy through the use of the evaluated controller. The proposed system is shown and highly accurate in predicting the suitability of the five subjects who participated in our test. As a result, systems can be developed to predict the use of healthy or unhealthy people, and potentially cardiovascular disease.

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Declarations

Conflict of interest The authors declare that they have no competing interests.

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