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Multi-Dimensional Data Collection and Analysis Algorithm of EEG Based on Positive Mental Quality Model

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Abstract:In this paper, the metal electrodes of the brain wave acquisition module are used to sense the bioelectric signals at the forehead and earlobe to analyze the brain waves α, β and other five waves, and then obtain information such as concentration and relaxation. The data is transmitted to the ARMCortex-M4 processor through the wireless Bluetooth module, and the threshold filtering algorithm is used to filter and denoise. Based on the theory of positive psychology, construct a structural model of the positive qualities of college students. In a survey involving 7059 participants, we confirmed 96 positive qualities. On the basis of the above investigation, combined with the existing personality theory, a structural equation model with 13 latent variables was established. Later, based on the established model, various factors of positive quality were explained and possible ways to improve the positive quality of college students were explored.

Keywords: Data Collection, EEG, Positive Mental Quality, Multi-Dimensional

1. INTRODUCTION

Using work analysis method and semi-structured interview method, conduct phenomenological research on athletes' positive psychological quality behavior in training or competition [1]. The biographies of 26 outstanding domestic and foreign athletes were screened, and the works were analyzed through semantic condensing [2]; the positive psychological qualities of the athletes were extracted. Semi-structured interviews were conducted with 44 athletes from Beijing Shichahai and Muxiyuan Sports Schools who had achieved excellent results in group or individual events [3]. Among them, 20 are males and 24 are females. They are between 12 and 18 years old. There are 6 master-level athletes, 17 first-level athletes, and 21 second-level athletes. The sports involved include basketball, volleyball, water polo, badminton, synchronized swimming, martial arts, etc. [4] Through qualitative analysis, construct an athlete's positive psychological quality model. With the continuous improvement of material living standards, the problem of people's psychological state has become more and more prominent [5]. At present, there are major abnormal social psychology such as impetuousness, comparison, servility and rebellion in our country.

Especially for students in school, studies have shown that the ratio of normal to anxious among college students is 3:1, and the mental health of college students is not optimistic, and it shows a gradual decline over time [6]. Serious events, like the "Death of Dr. Hanmen", happen from time to time. It exposes the psychological problems in the society [7], especially the seriousness of the psychological problems of college students, and also exposes the flaws in the related design of the current psychological early warning system in our country [8]. Traditional psychological detection and early warning systems are mainly based on questionnaires and professional measurement equipment, which have problems such as high cost, poor real-time performance, and poor experience of the detected objects [9]. The research of positive psychology started on the basis of critique and remedy to traditional psychology [10]. The article "Introduction to Positive Psychology" published by Seligman and Csikszentmihalyi in "The American Psychologist" in 2000 elaborated on the background [11], research content, research direction, and research purpose of positive psychology. They started the discussion on what is a meaningful life, and proposed that it is equally important to study the response of normal individuals in a frustrated environment. The research goal of positive psychology is to shift from the repair of harmful events in life to the study of the positive qualities of human beings [12].

They also made a clear definition of the research content of positive psychology, which includes three research fields, positive subjective experience, positive personal characteristics, and positive environment [13]. Positive subjective experience involves the study of the subjective level of the individual, such as the individual's subjective well-being, satisfaction [14], and hope for the future. An extremely important form of understanding the information processing process of the human brain [15]. Experts in the field of neuroscience have defined that a person's emotions, mental state, and focus state are all controlled by the cortical area of the forehead of the brain. People can produce specific patterns of brain wave signals (EEG) when they actively think or are stimulated by different feelings [16]. Brain wave signals can be divided into Delta waves, Theta waves, Alpha waves, Beta waves, Gamma waves and other types according to different frequencies [17]. They can reflect the different states of the brain, and can be extracted and classified in real time, and the recording is simple and non-invasive; they are analyzed and interpreted, and further transformed into corresponding actions, which are the basics of controlling objects with "thoughts". Principles have now become a popular research direction [18].

In response to these problems, a lot of work has been done in psychological stress measurement and mental health early warning in recent years [19]: because the changes in human psychology will inevitably cause changes in human physiological indicators [20], based on this document, a psychological stress testing system based on wearable devices has been proposed. However, it requires that the test subject

must wear relevant professional equipment [21], which increases the expenditure and inconvenience of the test subject to a certain extent [22]. With the development of the network and big data technology, it is possible to use social networks to analyze the psychological condition of the test subject. The literature uses deep sparse neural network and convolutional neural network to analyze [23] their mental state based on the microblog data of the detected object. However, for people who don't use social networks often, there will be a problem of lack of detection target data [24].

2. THE PROPOSED METHODOLOGY

2.1 The Positive Mental Quality Model

The positive quality constitutes a positive quality questionnaire for college students. The first part of the questionnaire requires the participants to respond to their basic information. The second part requires a 7-level score of 1-7 on 96 positive qualities. 1 means "most consistent with him/her", and 7 means It is "the most inconsistent with him/her" (see appendix). In this survey, 350 people participated in the self-report questionnaire with 96 virtues and advantages. After screening, 319 valid data were recovered, and the effective recovery rate was 91.1%. The recovered part includes 193 undergraduates and 126 postgraduates. The demographic information of these 319 college students is listed in Table 3-2. According to the data in the table, the gender distribution of the subjects is relatively close, with 152 boys and 167 girls. The constructed model of athlete's positive psychological quality contains two dimensions, namely, 5 first-level dimensions and 12 second-level dimensions.

The five first-level dimensions are: will, wisdom, benevolence, temperance and transcendence. The 12 secondary dimensions are bravery and fearlessness, perseverance, self-control, love of learning, leadership, love and kindness, gratitude, team spirit, modesty and humility, serious and responsible, goal belief, self-confidence and optimism. Among them, bravery, hard work, and self-control in the second dimension belong to the will dimension in the first dimension; love of learning and leadership belong to the wisdom dimension; love and kindness, gratitude, and team spirit belong to the benevolence dimension. Self-confidence is an important quality of the individual. Self-confidence is an important factor in the personality structure and plays an important role in the psychological growth of individuals. Self-confidence is expressed as an individual’s perception and confirmation of his own ability and whether a task can be successfully completed. It is related to self-efficacy. Self-efficacy involves an individual’s evaluation of his or her ability to successfully cope with a specific situation, and the achievement of goals There is a certain correlation between the possibility, and it is also related to the degree of effort, persistence, and completion of an individual in the process of completing an event.

Individuals with self-confident concepts have clear goals, effective and specific goals, and will be firm in their abilities, values, and choices. Be grateful for everything you have, be willing to express gratitude to others through words and deeds, be grateful to teammates, coaches and family members, and be willing to work hard to repay others; 3) Team spirit: have a strong sense of teamwork and be good at cooperating with others , Strive for the maximization of collective interests, such as cooperative behavior in the team, care and encouragement for group members, etc. Temperance-the advantage of an attitude to deal with matters, to ensure that one's feet are down to earth, away from arrogance and sloppy.

2.2 EEG Multi-Dimensional Data Acquisition

The EEG signal collection equipment uses NuAmps 40-lead EEG amplifier. NuAmps is a portable 40-lead DC amplifier. It can be used in a fixed or mobile system with the SCAN software used for EEG/ERP research. In addition to its size and weight the same as a notebook, NuAmps also has performance that some large devices that it is proud of do not have. It has a 22-bit A/D data conversion function, and can be used in conjunction with other stimulation systems for complex ERP experiments. The brain-computer interface (BCI) is a communication system established between the human brain and a computer or external equipment without relying on the peripheral nerve and muscle system of the brain. This article uses the brain-computer interface to realize brain wave data collection and transmission.

The data is processed and analyzed by the filtering algorithm through the single-chip microcomputer, and the control of the drawing robot is realized. Participants were selected in accordance with the standards of psychological experiments, physical and mental health, right-handedness, etc. Participants read the informed consent form before the experiment, and all participating experimenters participated voluntarily. Before the experiment, the participants should be informed of some precautions, such as turning off the mobile phone or turning it into a silent state. During the experiment, try to avoid distractions or other actions that are not related to the experiment, and inform the subject if they feel unwell at any time. try. The brainwave chip (ThinkGear AM, TGAM) is a brainwave acquisition and processing module developed by NeuroSky. Select "Constat" in the Type type in Baseline/Bad Blocks to perform baseline correction of brain waves, that is, the baseline of the waveform coincides with the "X axis" corresponding to the label; if the acquisition mode is "DC" mode, DC can be removed drift.

2.3 EEG Multi-dimensional Data Collection and Analysis of Positive Psychological Quality

The value of concentration and meditation is from 1 to 100, and the value from small to large is the degree of relative concentration (meditation). In the case of concentration, the degree of concentration above 70-80 accounts for 50%; in the case of relaxation, the degree of concentration above 35-50 accounts for 50%; under normal circumstances, the degree of concentration above 50-60 accounts for 50%. Through these data, we can know the status of each person's work. If the concentration is very high in the working state, the work efficiency must be good; similarly, in the normal state, the higher the concentration, the easier it is to enter the working state; and the lower the concentration when the person is tired, the better the rest state, and can recover quickly.

Strict in the meaning of the word means, the attitude is serious and cautious, and the work is meticulous, thorough and perfect. Rigor is related to the individual's diligence, goal orientation and organization, and reflects the individual's degree of self-control over discipline and the ability to delay gratification. Rigor is related to time efficiency, organizational ability, proactive problem solving ability, and stress susceptibility. People with different rigor have differences in the speed and accuracy of cognitive operations. The secondary dimensions included: 1) Modesty: not

boasting, accepting suggestions humbly, making continuous progress, not being proud of winning, continuing to work hard, accepting suggestions from others; 2) being serious and responsible: treating training or competitions carefully and seriously, with due diligence. Such as the handling of training equipment, the wrong commitment to oneself, etc.

Transcendence-the advantage of self-realization, seeking status or permanent meaning in life, including the secondary dimensions. In the first experiment, participants first select the numbers in the uncolored boxes. Click the left mouse button to select the left number, and click the right mouse button to select the right number. One second after making the choice, the color of the box will change. The green represents the gain, and the red represents the loss. For example, if you click the left mouse button to represent the number selected as the left box, the color of the left box becomes green It means that the total income has increased by 25. If it turns red, it means that the total income is subtracted by 25.

3. CONCLUSIONS

This article uses embedded microprocessors and brainwave modules to design data acquisition and control systems for brainwave mapping robots, and conducts research on control algorithms. The system obtains brainwave signals through the TGAM brainwave module, and realizes data transmission through the Bluetooth module. With the guidance of positive psychological concepts, the effect of psychological counseling in the positive quality training of college students is brought into play. As an important mode of psychological assistance in colleges and universities, psychological counseling has achieved remarkable results since its inception. And through the single-chip microcomputer program to detect human concentration and blinking motion, precise control of the three stepper motors of the drawing robot.

4. ACKNOWLEDGEMENT

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