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Application of AI Technology in Online Platforms Based on Cognitive Emotion Regulation

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Abstract. In order to cater to the reform of online platforms and improve online users' learning efficiency, this study conducted a design and readjustment of the function of online platforms through application of AI Technology based on cognitive emotion regulation. The results show that AI Facial Recognition Technology can not only identify and regulate users' emotional states, but also improve the learning states in the online learning process. It is effective in cultivating online users' planning and adjusting the content of online platforms. The research put forward improving strategies of online platforms. The results mark a new direction for the improvement of learning state and lay a theoretical foundation for the design of online platforms.

Keywords. Online platform, AI Facial Recognition Technology, Learning states, Cognitive Emotion Regulation

1. Introduction

Due to the COVID-19 outbreak and the development of era, the number of active users of online platform applications is increasing. More and more users choose to use online platforms to improve themselves and make up for their shortcomings in professional knowledge and skills[1]. Meanwhile, Online platforms hope to take advantage of the period of rapid growth and enhance platform functions[2]. In view of such a market demand, people gradually realize that obvious manifestation of individual differences of user groups in online platforms and the differences in individual users' learning status will lead to inefficient learning and low-quality education[3]. Therefore, how to solve the problems of online learning inefficiency and low education quality has become the core of online platform development[4]. With the continuous development of artificial intelligence, more and more online platforms hope that AI technology can become a dynamic engine to help online education platforms solve the problem of individual learning status differences[5]. The author takes AI Facial Recognition Technology as a technical tool and takes cognitive emotion regulation of cognitive linguistics as the theoretical basis to explore the adjustment of individual learning state, with an aim to improve the learning efficiency and teaching quality of online platform.

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2. Literature Review

2.1. Researches on SRL

It is known that current educational research shows individual cognitive state and learning state become important factors which affect learning. Cognitive state refers to different individual receptivity or understanding of the same knowledge and the same teaching method such as the influence of personal state, education level, learning background and other factors. Studies on self-regulated learning (SRL) show that excellent students can recognize their individual differences in self-regulated learning, and they often use self-regulated learning (SRL), an effective learning method to improve their learning efficiency[6]. Therefore, learners must set goals and make plans before starting to learn. Individuals who involved in certain learning need to monitor and adjust their own cognition, motivation and behavior, and reflect on the learning process, which should be repeated as a cycle. Moreover, learning state is also a very important factor in the teaching process which affects teaching quality and learning efficiency. Professor Wilson, Prosser and Trigwell conducted an empirical analysis of the relationship between learning environment and learning style. Learners have two learning styles: shallow and deep[7]. According to their findings, the better the students' cognitive and perceptual abilities, the more willing the students are to use the deep learning style; Otherwise, students learn at a shallow level. In online platform learning, students' cognitive state may be weakened due to the disappearance of classroom and school. According to the latest research by The National Engineering Research Center for Electronic Learning of Central China Normal University, students' facial expressions identifies students' different cognitive emotions and students' different motions will also have a great positive or negative interference effect on learning cognitive state[8]. Learners learn best when they are focused and in a positive mood. In addition, according to the study, when faced with science or math class, positive emotions can help learners to build confidence and a sense of accomplishment, and too difficult subject can cause the learner to escape because of the psychological fear. These emotions will significantly reduce the learner's cognitive level and learning speed. Therefore, in order to improve the quality and efficiency of the online platform, personalized teaching method must be carried out according to the individual cognition and learning state of different students.

2.2. AI Recognition of Facial Expressions

The study of intelligent perception and identification of facial expressions began in the 19th century. In 1872, Darwin first proposed a theory of the consistency of expressions. He pointed out that the meaning of facial expressions does not change with gender or race. In 1970, Ekman and Friesen made a pioneering and important work in facial expression recognition. They studied and determined seven basic types of human expressions: happy, sad, afraid, disgusted, surprised, angry and neutral. Having developed seven basic expressions, Ekman and Friesen developed a specific Coding System for facial expressions based on human facial features: the Face Action Coding System (FACS) [9]. In this system, a total of 44 independent but related monomers are used to describe human face motion. According to this basic coding system, researchers in various countries have established a number of different facial expression libraries [10]. These libraries provide key resources and important learning

basis for the development of AI facial expression recognition[11]. The commonly used methods of artificial intelligence identification can be roughly divided into feature extraction method and classification of learning. Feature extraction method is to determine individual expression by extracting the available features during recognition. For example, Kunar Chanda in India used optical flow method to extract facial expression features, and applied facial expression recognition to human-computer interaction design[12]. The classification of learning is an intelligent facial expression recognition technology that classifies the facial expressions in the facial expression library and generates deep learning through artificial intelligence[13]. Its recognition rate is relatively high and its application is more extensive. CNN, an artificial neural network for image processing, is composed of different layers, namely convolution layer, convergence layer and complete connection layer. There are many expansion studies on deep learning network expression recognition technology based on CNN, and the recognition rate can be improved[14]. The recognition rate in current studies can reach 93%-95%. In addition, present artificial intelligence is more mature in the recognition of individual attention than facial expression recognition[15]. The main research method is to determine through sight capture. When the user's line of sight deviates from the core target area, the intelligent technology will judge the user as an unfocused state. Facial expression recognition and eye line recognition of integrated artificial intelligence can basically determine individual emotion and attention, and studies showed that the success rate of intelligence recognition was more than 80%. Therefore, it is feasible to apply AI facial recognition technology to online platforms[16].

Artificial intelligence will change future teaching in three aspects: the first is to change the method of online and offline education, embedding artificial intelligence technology into tangible physical spaces and intangible virtual data spaces, thereby filling online education with warmer feeling of knowledge ocean. The second is to change the teaching skills of teachers. Through the intervention of AI recognition technology, the teacher can provide personalized development paths for students in online education applications, and design improvement plans to improve the quality of online education. The third is to change students' ways of learning and provide personalized and customized learning content methods to stimulate their deep-seated learning desire. After AI empowers education, immersive perceptual interaction is designed through scene optimization to improve students' learning enthusiasm, achievement, thereby improving the quality of online products.

Through literature review of online platform application, the author found that most of the former research was focused on specific groups of people who participate in online platform. For example, for primary school and preschool children, and the study often aimed to help students understand the curriculum through game-assisted teaching and narrative role-playing teaching[17]. In addition, research and analysis were mainly conducted from the perspective of teaching methods. Some studies found teaching could be carried out through online platforms for specific courses, such as the education of music courses by using acoustic wave[18]. Therefore, based on the above findings, in the design of online platform, it is necessary to consider the basic needs of users and the nature of the course. These studies demonstrate that there are certain differences among individual learners and courses. The advantage of offline traditional education over online education lies in efficient interaction. To improve the quality and learning efficiency of online platforms, the interaction between teachers and students also needs to be taken into consideration[19].

3. Research Tools

Cognitive psychology has given the basic definition of emotion in related disciplines: emotion is the attitude experience of an organism reflecting the relationship between objective things and subjective needs. According to its definition, when the needs of the individual are satisfied, there will be positive emotions, otherwise there will be negative emotions[20]. The emotional subject at this time not only refers to human beings, but is a common feature of animals. Different objects will have different emotional impact on the same person, and different subjects will have different emotions on the same object[21]. After analyzing and disassembling emotions, researchers evaluated and observed emotions from two perspectives: basic emotions and emotional dimensions. The basic emotion theory orientation is the seven basic human emotion expressions defined by Ekman and Friesen above, which forms all human expressions through the combination of different basic expressions. The orientation of the emotion dimension theory is to form the emotion coordinate system through the three basic dimensions, and carry on the emotion evaluation and evaluation through the coordinate system. The three basic dimensions are valence, dominance and arousal. Valence refers to the positive and negative degree of emotion and experience, arousal refers to the influence of emotion on physical behavior, and dominance refers to the control of individuals emotions. Although facial expression is not only reflected by facial change, facial change is the most important expression of emotion, so it lays a theoretical foundation for artificial intelligence facial recognition to recognize individual emotion[22].

According to the above research, it is known that individual cognition and learning state are affected by objectives, thus arousing certain differences. Firstly, from the study of individual group attributes, it is found that individual cognitive intelligence and cognitive ability are closely related to age group. After analyzing the relationship between age group and cognitive ability, this paper finds that young people aged 18-27 are in a relatively mature state of cognitive ability and have the desire for professional skill improvement and interest in learning, furthermore, this group has the ability of autonomous learning. The research investigates the tendency of individuals to adjust their consciousness when they are affected by negative emotional states. The tendency varies in different age groups. This paper advocates regulating users' emotional states in the online learning process through recognition of individual learning states, formulating emotion regulation strategies according to different learning states, and adjusting the content of online platforms, with an aim to improve the learning efficiency and teaching quality of the platform.

4. Research Design

4.1. AI Attention and Facial Information Recognition

Artificial Intelligence Application is used as a tool in this research. It is found that students' learning state is composed of attention state and emotional state, and the change of learning state will have a significant impact on students' learning efficiency and education quality. The change of learning states has obvious influence on students' learning efficiency and education quality. Although artificial intelligence is poor in direct recognition of learning state, it can help with the recognition of learning state

through recognition of individual attention and recognition of facial expressions and emotions. AI attention recognition can be divided into two parts, head posture recognition and sight recognition respectively. The combination of these two parts together constitutes the body's attention recognition. Head pose recognition is accomplished through a process from face recognition to pose feature recognition and then to pose datum recognition. This technical process is the same as facial expression recognition in the first half of the technical process. Facial expression recognition also determines facial recognition by features first, and then obtains individual facial expressions of users by feature and classification. Therefore, individual head posture recognition and facial expression recognition can be technically combined, and their sensing terminals are similar. At present, users' facial information can also be obtained through camera sensors, and it is feasible to apply it to mobile terminals.

4.2. AI Learning State Recognition

Technically, the AI facial recognition technology can be combined with head posture to speculate the user's attention and estimate the emotional state of the user. The attention state and emotional state can tell the users' learning state. In addition, although eye-motion processing technology cannot be carried out by means of facial recognition yet, its technical feasibility can also help the machine recognize the user's head posture and improve the accuracy of identifying the user's attention state[23].

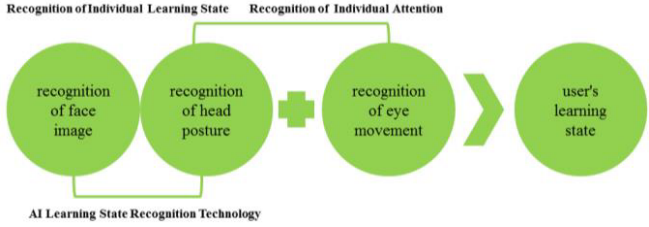

Figure 1. AI Learning State Recognition Technology Diagram

Since the excellent performance of the AlexNet model in image classification competitions, a new convolutional network model is constructed based on the structure of the AlexNet network model and referring to the parameter configuration of the VGG model, and name it the Continuous Net model. At the same time, in order to demonstrate the effectiveness of the improved model, the AlexNet model was compared and modified. The process is as follows: change the single convolutional structure of the first two layers of the AlexNet model to two continuous convolutional structures similar to the VGG model, while keeping the subsequent structure and fully connected layers unchanged, thus forming a new Continuous Net model. Compared with the AlexNet model, the new model has a 10-layer structure and two more convolution operations than the 8-layer AlexNet model, which uses two more nonlinear activation function. The specific network model is shown in Figure 2.

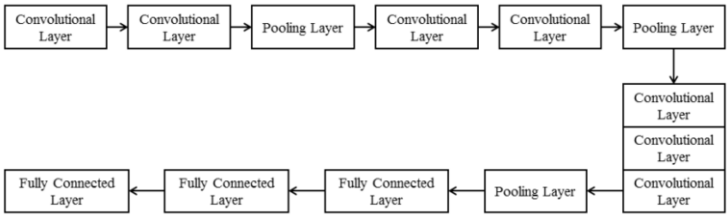

Figure 2. Structure diagram of Continuous Net model

The input data of the improved Continuous Net model are 48*48 black and white emoticon images. The convolutional kernel size of the first convolutional layer is 4*4, the sliding step size is 2, and 64 convolutional kernels are set. Then use the ReLU function as the Activation function, and the size of the pooled operation window is 2*2, with a step size of 2. The second convolutional layer is connected to the first convolutional layer, connecting 4*4 convolutions concatenated together, equivalent to an effect of convolution7*7, but the number of parameters is only half of the previous one. This method of concatenating multiple small convolutions for continuous convolution also increases the usage times of ReLU nonlinear activation, thereby enhancing the model's ability to survey image features.

4.3. The Identification of Three-level Learning States

This study focuses on the research and formulation of adjustment strategy for individual learning state. Therefore, in terms of intelligent recognition of individual learning state, mature research conclusions are used as a technical tool to determine the technical basis, and design practice is completed on this basis. This paper adopts conclusion of individual learning state recognition in the research document *'Towards emotion-sensitive learning cognitive state analysis of big data in education: deep learning based facial expression analysis using ordinal information'* published in 2020 by researchers from The National Engineering Research Center for Electronic Learning of Central China Normal University in Wuhan, China. Through the procedure of AI recognition of face image, head posture and eye movement, the user's learning state is further divided into two aspects, namely, emotional state and learning state. According to the recognition results, the user's learning state is divided into three grades: poor, medium and good. Based on the identification of the three levels, this study puts forward that the formulation and design of AI learning state adjustment can be applied for online platform users to improve their online efficiency.

5. Data Collection and Analysis

The purpose of this experiment is to verify the performance of the improved CNN model - Continuous Net model, and compare it with the Alex Net model. Divide the images from the CK+ emoticon library into training and testing sets in an 8:2 ratio, among which, there are 1084 training images. Set Batch size to 16, requires 68 attempts to complete all training samples. The FER2013 emoticon database training set has 28708 images and among which 64 images are randomly selected with the batch size set or one training batch. Input two types of database images into the above two models for training, and take the first 600 iterations of the training process to obtain the correct

recognition rate change curve images of the two image training sets, as shown in Figure 3.

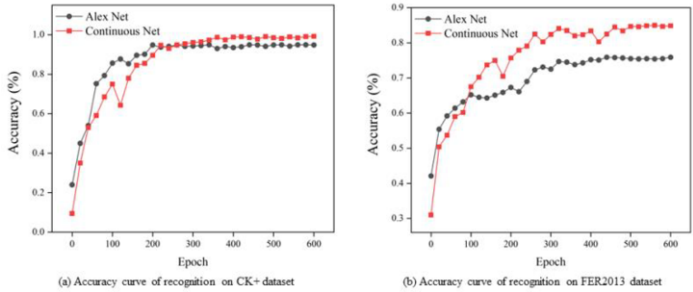

Figure 3. Accuracy curves of recognition of the models on two training datasets

From the accuracy curve of the CK+ training dataset, it can be seen that the recognition rates of both models improve rapidly in the first 200 epochs, while the recognition rate curve of the Alex Net model tends to be stable, but the recognition rate of the Continuous Net model is still increasing, reaching a plateau after 400 epochs. Therefore, the Continuous Net model shows better recognition performance than the Alex Net model on the CK+ training set. On the FER2013 training set, the Continuous Net model also shows better recognition performance compared to the Alex Net model. The Continuous Net model proposed in this study has an accuracy of nearly 100% on the CK+ training set and over 80% on the FER2013 training set. However, because the Continuous Net model is slightly more complex than the Alex Net model, more images are needed to complete the training process of parameter optimization, making the Rate of convergence of the Continuous Net model lower than that of the Alex Net model.

When specific artificial intelligence recognition technology is applied to online education applications, whenever the intelligent technology determines that the user's learning state is low or high, corresponding functions and strategies need to be used to help users adjust their learning state, in order to avoid the low learning efficiency of users affecting the learning of course content. In addition, from the perspective of feedback, real-time recognition of the attention and emotional states of all users of the same course can help evaluate and analyze the structure and state of the course content. Such accurate and efficient feedback can effectively assist teachers or course creators in adjusting and improving course content. From the above, research on the application of AI recognition in online education, there is still relatively wider possibility on the technical feasibility, and lack of specific functional design research in the application.

This study will utilize the specific artificial intelligence recognition technology mentioned earlier to supplement the practical application scenarios of emotion regulation strategies in online education. A cognitive emotion regulation questionnaire was used to conduct a survey on the emotional regulation methods and strategy preferences of users. The survey focused on young users who focus on self-directed learning and career improvement. Research on this group of users can provide more accurate perception of strategic tendencies based on potential users, providing a reference for the practical application of artificial intelligence technology in online education content settings.

The Cognitive Emotional Regulation Questionnaire was designed by N.Garnefski. The revised version of the Cognitive Emotion Regulation Questionnaire (CERQ-C) will be used in this project. The revised CERQ has a total of 32 question options, including 8 dimensions: self-blame, tolerance, contemplation, positive adjustment,

positive imagination, self-comfort, disaster, and blaming others. The questionnaire of this study is distributed to young people aged 18-27, who are in line with online user groups with independent professional skills and knowledge upgrading requirement. The author used the questionnaire as the distribution channel and conducted descriptive statistics on the results to obtain the regulatory strategy preferences of this user group. AI technical methods were used in research to form strategy and help design test. Through questionnaire for the core users of career promotion in online platforms, users' tendency of emotion regulation was found to be 3 aspects, namely, positive assumption, positive adjustment and tolerance. The three tendencies were expanded and transformed into 5 behavior adjustment methods, which are designed into a five sub-scale questionnaire, and the author made these five ways of emotional state regulation in the process of online education into a questionnaire and sent it to the user groups who had participated in the previous questionnaire survey for research.

Questionnaire1 was designed and a survey was conducted on the same experimented users. By comparing the results of consistency and similarity, the recognition degree of cognitive adjustment in the online platform was investigated and the user's demand tendency was obtained. The questionnaire was distributed online with a total of 110 questionnaires, including 2 invalid and 108 valid.

Questionnaire 1

Table 1. Results of the questionnaire on behavioral adjustment of online learning

Adjustment dimension	Subjects	N	M	SD	D (X)
Positive assumption T1/T2/T4/T5	I think we should reduce the difficulty of learning content to improve learning status?	108	3.78	1.213	1.471
Positive assumption T3/T6	I should review the courses I just learned to improve the parts I didn't learn well before?	108	3.21	0.956	0.914
Tolerance	I can't change the emotions I have got. I need to keep learning?	108	2.43	1.103	1.217
Positive adjustment	I think the current state is not suitable for the current study. I should learn other contents to adjust?	108	3.63	1.311	1.719
Positive assumption T7/T8	I want to overcome the negative state and deal with the more difficult content with a positive attitude.	108	3.54	1.323	1.750

From the perspective of design, users need to have a certain degree of cognitive recognition of individual needs in order to have a certain degree of acceptance of the relevant improved functions of mobile applications. Therefore, it is necessary to observe the needs and recognition of users through the investigation of the cognitive degree of the impact of users' learning state and learning efficiency and the recognition degree of adjusting learning state through learning strategies. The author uses the software Questionnaire Star and the main form of the topic is 5-subscale, which is distributed online with a total of 281 valid data. The results are shown below.

Questionnaire 2

Table 2. Research results of the recognition of learning state regulation

Subjects	N	M	SD	D (X)
Do you agree that personal learning efficiency will be affected by emotion or attention?	281	3.87	0.865	0.748
Do you agree that inattention will affect memory, comprehension and learning efficiency?	281	4.21	0.952	0.906
Do you agree that concentration can improve memory, understanding and learning efficiency?	281	4.13	0.803	0.645

Do you agree that negative emotions can make people tired of studying and courses?	281	4.23	0.841	0.707
Do you agree that positive emotions will improve learning efficiency?	281	4.35	0.765	0.585
Do you agree that your attention and mood will be affected by the course content?	281	3.92	0.847	0.717

It shows that emotional state and attention state will affect learning efficiency. In addition, the average score of the questions is 3.87, and its user recognition is relatively high. Therefore, the function of relevant online education applications can be improved through course adjustment.

In the survey of online learning state adjustment, the author also conducted a 5 sub-scale. Questionnaire 3 is based on teachers who have been engaged in education. The main topic is to investigate teachers' recognition of adjusting students' learning state through curriculum content or curriculum process changes, as well as their recognition of strategies to adjust curriculum content through students' learning state feedback. A total of 63 teachers' questionnaires were collected and the results are shown below.

Questionnaire3

Table 3. Research results of teachers' attitude towards learning state adjustment

Subjects	N	M	SD	D (X)
Do you agree that the teacher can adjust the course content or course progress at any time according to the students' state?	63	4.33	0.614	0.377
Do you agree that teachers should adjust the course content according to students' state feedback?	63	4.1	0.781	0.610

Teachers have a supportive attitude towards the adjustment of learning curriculum content through the perception of students' state, and they agree to adjust the curriculum according to the feedback of students' state. Therefore, it is feasible to adjust and improve the online education application function of teachers' direction.

Through market research on online platforms such as Chaoxing, Tencent Conference and other similar products, this paper finds that core users of online platforms for autonomous skills-improving learning is more inclined to regulate emotions by reducing the difficulty of the course, reviewing the course with low emotion and adjusting the content of the online courses. According to the emotion regulation data obtained from the questionnaire survey of cognitive emotion regulation theory, the improvement strategy of online platform is proposed.

6. Conclusion

Based on the application of AI recognition technology and theory of cognitive emotion regulation, this paper explores the functions and strategies for improving learning state in online platforms. In view of the learning tendency of online core users, the emotion regulation strategy is transformed into course regulation. The research was conducted from emotion regulation to individual learning state and to improve learning efficiency. In the research, AI technology such as facial expression, head posture and eye movement state were applied to the study of learning state recognition. The improvement strategy of online platform is put forward. The research results mark a new direction for the improvement of learning state and lay a theoretical foundation for the design of online platforms.

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