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Research on Classroom Teaching Behavior Analysis and Evaluation System Based on Deep Learning Face Recognition Technology

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Abstract. With the continuous enrichment of educational resources, how to analyze and evaluate classroom teaching behavior has become one of the important indicators to measure teaching quality. Based on this, this article builds a classroom teaching behavior analysis and evaluation system based on deep learning face recognition technology, and conducts professional course classroom behavior analysis, from three perspectives: the concentration of the student's side face, the concentration of the student's head down, and the concentration of the eyes. Make judgments. The experimental results show that face recognition technology based on deep learning can effectively judge students' classroom behavior and facilitate teaching management and implementation.

Keywords: Deep Learning, Face Recognition, Classroom Behavior Analysis and Evaluation System

1. Introduction

With the continuous enrichment of educational resources, how to analyze and evaluate classroom teaching behavior has become one of the important indicators for measuring teaching quality [1]. The important place for teachers to teach and students to learn is the classroom, and the education and learning activities in the classroom need to be realized through various interactions [2]. Classroom behavior is the social behavior in the classroom situation, and the external manifestation of classroom concentration. Teaching interaction has become one of the most basic characteristics of classroom teaching activities, reflecting the essence of teaching to a certain extent. Regarding the study of classroom behavior, the domestic academic circle focuses more on the study of teacher behavior and teacher-student interaction behavior, while there are relatively few studies on student classroom behavior [3, 4]. With the gradual establishment of the scientific system of classroom interaction research, the evaluation of classroom learning quality has become more diverse [5]. Classroom is the main space for interpersonal interaction in school education. It is a continuous, interactive, and basic organic "ecosystem" unit between teachers, students, teaching materials and the environment [6].

This article relies on deep learning face recognition technology to explore the construction of a classroom behavior analysis and evaluation system for face recognition technology, aiming to better



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serve the teaching field.

2. Teaching interaction in the classroom environment of information technology

2.1. Teaching interaction model in the classroom environment of information technology

The teaching interaction model of the information technology classroom cannot be embodied by one model. Taking into account the diversity and complexity of the elements that affect classroom interaction, the classroom interaction element model is determined from the three aspects of human, technology and environment.

(1) Human elements

Human-human interaction is the main form of interaction in teaching interaction, so the human element in the interaction is also the most important element. Human elements include the person's own knowledge background and cognitive level, as well as the position of people in interactive behavior. Reflected in the verbal and non-verbal communication between teachers and students, students and students: the knowledge and cognitive level of teachers and students themselves can be reflected in language communication, and the position of people in interactive behavior can be in the state of language communication Reflected.

(2) Technical elements

As the teaching interaction in the information technology classroom, the introduction of technology is indispensable. Technology is mainly embodied in the technical support during human-human interaction, the application of technology during human-machine interaction, and the guarantee of interconnection during machine-machine interaction. For example, teachers and students present learning content based on the media, and students use computers to complete tasks.

(3) Environmental elements

Due to the addition of technology, the classroom environment has changed. The hardware and software of the classroom provide support for interaction and create a good interaction atmosphere. Teachers' teaching management, organization, and application of different methods have effectively supported the occurrence of teaching interaction, so that students can form a good physical and mental state, and make psychological and behavioral preparations for interaction. Classroom, as a place for learners to learn and develop, is a place that fully embodies people-oriented, many environmental factors are around whether to promote and ensure teaching interaction, whether it is beneficial to learners' learning and physical and mental development.

Of course, there should be level differences in the teaching interaction behavior in the classroom itself. From the perspective of education and education, interaction should be divided into three levels: behavior interaction, emotional interaction, and cognitive interaction. Thus, the three levels of the general information technology classroom interaction level model are determined: behavioral interaction level, emotional interaction level, and cognitive interaction level.

Behavioral interaction is the most basic classroom interaction behavior is mainly manifested in information interaction, whether it is through language or physical behavior, as long as there is information transfer between the two, it is considered that information interaction has occurred, and we do not need to understand the content of the information. That is to say, any purposeful behavior or language of information transmission that we obtain through the observation system can be used as the behavior of information interaction. Of course, this behavior must be interactive.

2.2. Teaching observation and analysis system in the classroom environment of information technology

The indicator setting characteristics of the three classroom teaching observation and analysis systems. Based on the information technology classroom interaction element model and the information technology classroom interaction level model obtained earlier in this article, a new teaching interaction observation and analysis coding system is derived, which we call human-based A technology-environmental interactive analysis coding system.

Based on the above coding system, I concluded that the index system that mainly affects the teaching interaction has the following parts: teachers, students, technology, and environment.

(1) Teacher

Teachers play a leading role in teaching. Teachers' cognitive level, humanistic quality, and teaching quality determine the effect of teaching, and also directly affect the quality of teacher-student interaction.

(2) Students

In classroom teaching interaction, student-student interaction is also an important link. The influence among classmates often has positive and negative effects. Teenage students are immature in their minds, and their classmates tend to pay attention to what their peers do in the eyes of their peers, instead of paying attention to what their peers actually do or say. Many students have a herd mentality. . Morrishen's research found that students have a set of universally recognized rules in classroom participation: don't ask stupid questions; questions should be meaningful and don't waste teachers' time; don't waste class time: you already have them in your heart Ask the teacher when you answer.

Due to the above reasons, in classroom teaching, teachers need to build a harmonious and interactive activity platform, which can promote students to effectively interact in the classroom. We observe students' interactive behaviors in the classroom. We can also think about students' interactive behaviors from the information, emotion, and cognition levels. From the simple information interaction level, we can observe the behaviors that can generate information interaction, such as discussing with peers and doing things. Practice and response behaviors determine the occurrence of information interaction. At the level of emotional interaction, we can consider the emotional attitude of the interaction, such as whether to actively participate in the classroom and actively help peers. From then on, we can get the emotional level of interaction. In the process of interaction between teachers and classmates, they must feel respected and safe, so that students will actively participate in discussions, explorations or experiences, and devote themselves to learning activities. Cognitive level interaction We consider interaction in terms of cognitive depth. For example, whether the thinking of the problem needs to be obtained through repeated communication, which can reflect the depth of knowledge of the problem. Students' initiative to ask questions and actively provide insights can reflect the initiative of students' cognitive processing. Cognitive communication is closely related to students' active thinking, and we can obtain interactive behaviors at the cognitive level by observing interactive behavior and language analysis.

In the classroom, students are affected by their own cultural background, speech ability, subjective concentration in class, etc., and there will be situations where the participation in classroom teaching activities is not high or low, and it is not conducive to the occurrence of interactive behavior. We obtain the deeper influencing factors of the interaction by observing the cognitive interaction and emotional interaction between teachers and students.

(3) Technology

Teaching interactions are all developed around teaching media. In information technology classroom teaching, teaching media is the carrier of two-way communication between teachers and students, and a tool for information transmission and storage. Teachers transfer learning content to students through various teaching media, and students interact with the teaching content contained in the teaching media by manipulating various teaching media. In the information technology classroom, in addition to being used by teachers to present teaching content, create problem situations, and stimulate students' inquiry thinking, information technology is also used by students as a cognitive tool and resource environment for inquiry designated by teachers. activity. Since teaching activities are based on information technology teaching media, teacher-student interaction or student-student interaction has been reduced. Reasonable and full use of teaching media can promote students' cognitive abilities and promote the two-way interaction between teachers and students, students and students. We can obtain the influential elements of the technical component in the interactive behavior by observing the use of technology in the classroom.

(4) Environment

The environment also affects the factors of interaction behavior. We can also see from the interaction model that interaction not only involves human elements, but also the elements of technology and environment, because it directly or indirectly affects the occurrence and development of interaction behavior. Environmental elements include two aspects: one is the teaching environment created and managed by teachers, and the other is the physical environment of the classroom itself.

The teaching environment created and managed by the teacher includes the teacher's control of the teaching tasks such as start, prompt, and end; the teacher's management of the classroom order, such as the teacher's management of the chaotic and meaningless classroom through language and prompts; the teacher's guidance of the classroom teaching sequence through language Grasp of. The teacher's management behavior of the teaching environment can create a good interactive environment for the classroom, that is, through the observation of the teacher's behavior, we can get the evaluation of the factors affecting the classroom interactive environment. In the information technology classroom environment, the actual situation of the classroom restricts the occurrence of interaction, such as whether there are obstacles in the interaction space between teachers and students, whether the distance between tables and chairs affects the interaction, etc., these all affect the teaching interaction. The classroom hardware environment factors. By observing whether the hardware environment in the interactive process affects a certain interactive behavior, we can have a more comprehensive understanding of the state of classroom teaching interactive behavior.

3. System design based on deep learning face recognition technology

3.1. The overall framework of the classroom behavior analysis and evaluation system

The classroom behavior analysis and evaluation system is mainly divided into five functional modules: image acquisition module, image processing module, face recognition module, eye recognition module, and behavior analysis module. The overall framework is shown in Figure 1.

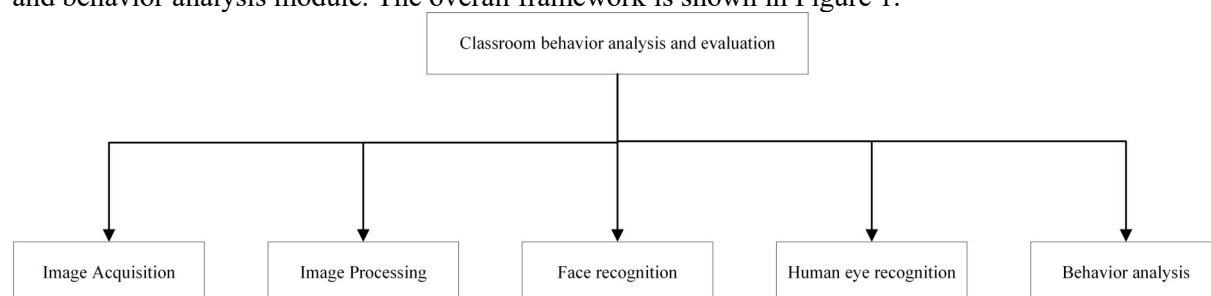


Figure 1. The overall constant channel of the evaluation system.

3.2. System design ideas

In summary, the system is mainly divided into image acquisition module, image processing module, face recognition module, eye recognition module, and behavior analysis module. The overall research and development ideas of this system can be explained as follows.

First, take a picture of each frame of video to determine the degree of focus of the target, and perform related image processing operations.

Then, use the deep learning model to assist offline learning of general image features from the image database, construct a deep feature extractor to extract facial image features, build a supervised deep learning model, and complete the face through online fine-tuning and training of facial images Identify the task.

Finally, detect the facial features of the target person, detect and analyze the characteristics of the eyes, nose, and mouth of the target person, and convert the posture, expression, movement and other characteristics of the target in the classroom into algorithm calculations to quantify the concentration of students in class Evaluation.

3.3. Classroom behavior analysis process

The classroom behavior analysis and evaluation system based on face recognition technology designed in this paper realizes the concentration judgment from three aspects, namely, the judgment of the concentration of the student's side face; the judgment of the concentration of the student's head up and down; the judgment of the opening and closing of the eyes, thus all-round Judging the concentration of students in class, it is used to study the relationship between the concentration behavior of modern apprenticeship students in class and the learning effect, and to provide an objective basis for the evaluation of the classroom learning effect of modern apprenticeship students, and finally make a more realistic and effective teaching evaluation.

For classroom behavior analysis and evaluation object $u'_i, u''_i, (i', i'' \in N, i' \neq i'')$, let $w_j^*(i', i'')$ be a random variable that obeys a certain distribution on the interval $[\min(w_{ij'}, w_{ij'')}, \max(w_{ij'}, w_{ij'})]$, and call $s(u'_i \succ u''_i)$ the superiority of u'_i to u''_i , as shown in formula (1):

$$s(u'_i \succ u''_i) = p(f(u'_i) > f(u''_i)) + 0.5p(f(u'_i) = f(u''_i)) \quad (1)$$

4. System implementation

Design a classroom behavior analysis and evaluation system based on face recognition technology. The implementation steps of the classroom behavior analysis and evaluation system are detailed as follows.

(1) Extract the target face, detect the facial features of the face, and detect the eyes, nose, and mouth of the target person.

(2) The human eye is the main feature to judge the degree of concentration, and the nose is used as an auxiliary reference area for judgment.

(3) Comprehensively judge whether the student is focused on listening from the three aspects of the concentration of the student's side face, the concentration of the student's head up and down, and the concentration of the eye opening and closing.

(4) By transforming the characteristics of the target's posture, expression, movement and other features in the classroom into algorithmic calculations, the students' concentration in class can be determined.

4.1. Database design

Student information form: stuInfo (student number, name, gender, class, photo, preference)

Image collection table (image ID, image name, image size, image type, capture time, storage path, student number, processing mark)

Image recognition table (student number, identification number, image ID, storage path, recognition result)

Judgment process table (student number, identification number, judgment result, start time, end time)

Concentration table (student number, frequency of judgment, start time, end time)

Focus statistics table (student number, time period, judgment result, image ID)

4.2. Experimental environment

The experimental environment for judging the concentration of students in class based on face recognition mainly includes hardware and software. In terms of hardware, it involves video capture, using a high-resolution network video surveillance camera. The software environment is configured as follows: the operating system is Windows7, 64-bit, the CPU is 2.6G, and the memory is 4GB. The specific deep learning experiment environment is as follows: CPU is i7-5830K, memory is 128G, GPU is GTX1080, and deep learning framework uses TensorFlow1.4. Development language: C++, database: Mysql.

4.3. Related code

```
//Align
FaceAlign::Face(const char*model_path){
    faci_detec=new CCFAN();
    if (model_path==NULL)
        model_path=" facesb_fa.bin" :
    faci_detec ->InitModel(model_path);
    float*facial_loc=new float[pts_num*2];
    faci_detec -> FaciPoiLoc(gra_im.data, gra_im.width,gra_im.height,face_info,
    facial_loc);
    for(int i=0;i<pts_num;i++){
        points[i].x=facial_loc[i*2];
        points[i].Y=facial_loc[i*2+1];}
    delete[]facial__lov;
}
//Detect
facesb::FaceDete detec(" F:/faceSB/FaceDete/model/fa,cesb_fd.bin" );
facesb::FaceAligt point_detec(" F:/faceSB/FaceAligt/model/facesb_fa.bin" );
Facelident_recog((MODEL_DIR+" facesb_fr.bin" ).c_str());
std::string test_dir=DATA_DIR+" test face_recog/" ;
cv::Mat galle_img_color=CV::imread(test_dir+" img/testl.jpg" ,1);
CV::Matgalle_img_gra;
cv::cvtColor(galle_img_color,galle_img__gra,CV_BGR29ra);
cv::Mat probe_img_color=CV::imread (test_dir+" img/test2.jpg" ,1);
cv::Mat probe_img__gra;
cv::cvtColor(probe._img_color,probe_img_gra, CV_BGR2gra);
```

4.4. Experimental results

Due to the occlusion of students' faces and the distance, some students did not detect and recognize them. When most students raised their heads, it was judged that raising their heads was a focused behavior, and lowering their heads was an unfocused behavior. Due to the long distance, the face image is blurry. One student can recognize the face but cannot locate the human eye, so it is judged to be inattentive behavior. The remaining 4 students can correctly locate the human face and the human eye. The degree of expansion is large, and it is judged as a focused behavior.

5. Conclusion

Based on deep learning face recognition technology, this paper constructs a classroom teaching behavior analysis and evaluation system, and conducts professional course classroom behavior analysis, judging from three perspectives: the concentration of the student's side face, the concentration of the student's head down, and the concentration of eye opening and closing. The experimental results show that face recognition technology based on deep learning can effectively judge students' classroom behavior and facilitate teaching management and implementation. Instructors can design teaching programs in a targeted manner to effectively improve the quality of classroom teaching, so as to achieve the expected teaching effect.

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