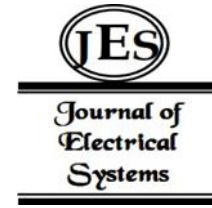


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## Research and Analysis on the Characteristics of College Students' Emotional Face Processing Based on Computer Vision Technology



**Abstract:** - The processing of emotional faces by individuals is an important basis for the perception and understanding of emotions. In accordance with the score of Schutte self-report Emotional Intelligence Scale (SSEIS), students in high and low emotional intelligence groups were screened out. Based on the computer vision technology, four kinds of emotional face pictures, including pleasure, anger, sadness and fear, were randomly presented with the help of the eye tracker, and four interest areas were divided into eyebrows, eyes, nose and mouth. The eye-movement indexes of subjects were recorded, and common characteristics of emotional face processing of college students and differences in gender and emotional intelligence were explored. The results showed that college students had a positive bias to emotional face processing and a certain bias to eye area; the number of fixation points in high emotional intelligence group was more and concentrated, and the processing was more rapid and efficient, while the number of fixation points in low emotional intelligence group was less and scattered, and the processing efficiency was lower; female college students were more detailed in emotional face processing.

**Keywords:** Computer Vision, Eye Tracking, Emotional Face Processing, Emotional Intelligence.

### I. INTRODUCTION

As common nonverbal cues, facial expressions contain rich communication information including emotions, needs, and motivations [1]. In the process of perceiving and judging the facial expressions of others, individuals can obtain relevant emotional information and psychological states of them. Therefore, the correct processing of emotional faces by individuals is an important prerequisite for their effective social and interpersonal communication. Salovey and Mayer proposed that emotional intelligence is a psychological ability to recognize and operate emotions, including the capacity to perceive and comprehend emotions [2]. Daniel Goleman also believed that emotional intelligence includes the capacity of individuals to recognize their own emotions and those of others [3]. Through self-designed emotional intelligence questionnaires, scholars have tested that emotional intelligence indeed includes the ability of individuals to perceive emotions based on their physiological state [4]. Research has shown that the stronger the ability to perceive emotions through nonverbal information such as facial expressions, the greater the level of emotional intelligence, and the better interpersonal cognition [5]. Therefore, it can be inferred that face processing refers to the recognition and judgment of emotional facial information by individuals, and it is the basis for individuals to perceive and understand emotions. As an important component of emotional intelligence, perceiving and understanding emotions is closely related to the processing of emotional faces by individuals and their emotional intelligence.

On the one hand, emotional intelligence of college students is closely related to psychological health, academic pressure, sense of security and satisfaction for life. Research has indicated that college students who possess high levels of emotional intelligence can not only make effective emotional responses to events and have higher levels of mental health [6], but also they have a more positive attitude when dealing with academic challenges, resulting in lower academic pressure [7]. College students with elevated levels of emotional intelligence have stronger perception and judgment abilities towards risk events, and often have a stronger sense of security [8], in addition, they effectively regulate negative emotions, view challenges from a positive perspective, and ultimately have higher life satisfaction [9]. Moreover, some scholars have pointed out that emotional intelligence and cultural intelligence are positively correlated. College students with a high level of emotional intelligence exhibit great emotional stability, stronger interpersonal communication and language expression abilities, and they can actively

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understand cultural differences in new environments, thereby continuously improving their cultural intelligence level [10]. Therefore, these related studies demonstrate the important value and influence of emotional intelligence as a personal trait in the process of individual development.

On the other hand, differences exist in the processing of emotional faces among different groups of college students, such as depressive symptoms, non-suicidal self-injury behavior, autistic traits, self-esteem levels and impulse levels can affect the processing of emotional faces among college students. In terms of pathology, several studies have shown that patients diagnosed with depression exhibit heightened sensitivity to sad facial expressions [11], and have a significant attention bias towards the first appearance of sad face images [12]; college students with high autistic trait show gaze avoidance in the eyes and mouth areas that contain rich social information, resulting in lower discrimination of the facial core area [13]; college students with non-suicidal self-injury behaviors have high emotional sensitivity, and although there is no significant difference in the accuracy of their emotional face valence judgment compared to college students without suicidal self-injury behaviors, their reaction time is shorter and judgment speed is faster [14]. In terms of personal traits, college students with low self-esteem have attention avoidance towards negative emotional images and adopt avoidance strategies to reduce the stimuli that trigger their own negative emotions. On the contrary, college students high self-esteem have attention bias towards negative emotional images [15]; college students with high impulse level tend to pay more attention to happy expressions and have difficulty overcoming them [16]. Due to the limited cognitive resources, individuals will not process all emotional information, so the processing of emotional faces is significantly influenced by individual pathology and personality traits.

To sum up, in relevant researches on college students' emotional intelligence, they mainly discussed the relationship between individual emotional intelligence and other consciousness and ability, and confirmed the significance of emotional intelligence to individual development; in relevant researches of emotional face processing, they mainly focused on the differences in emotional face processing of college students with varying characteristics. However, under the influence of the level of emotional intelligence, there are few researches on how the emotional face processing mechanism of college students and the characteristics of emotional face processing of college students are.

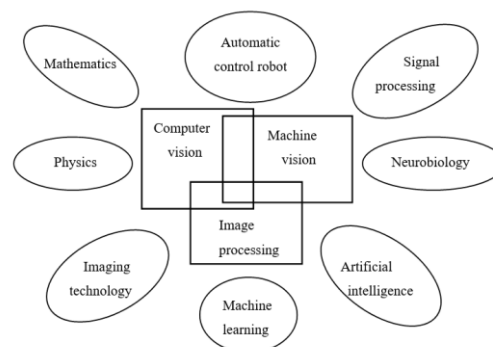


Figure 1: Relationship between Computer Vision and Other Disciplines

Computer vision is not only a technology that uses computers and algorithms to extract effective information from images or videos for data analysis and processing [17], but also a scientific discipline that integrates mathematics, physics, imaging technology and machine learning. Moreover, it has an interdisciplinary relationship with machine vision and image processing, and the specific relationship between computer vision and other disciplinary fields can be seen in Figure 1. Compared with traditional manual observation and recording, computer vision technology features in convenience, speed, and accuracy. Researchers have pointed out that computer vision can effectively optimize the level and efficiency of picking robot operations [18], improve the accuracy of steel bridge bolt loosening detection [19], efficiently analyze and process medical images, and promote the digitization and objectivity of medical images [20]. These researches demonstrated the cutting-edge and efficient nature of computer vision technology in production, construction and healthcare. Eye tracking means tracking and recording the fixation points in an individual's cognitive process based on computer vision technology, facilitating in-depth analysis of the individual's cognitive processing methods. Eye tracking devices can record individual cognitive processing activities in real-time, dynamically, and without interference, so as to obtain direct and continuous eye tracking data, effectively avoiding differences in individual reaction speed, ensuring the authenticity, effectiveness, and ecological validity of the data [21].

Therefore, based on the advanced computer vision technology, this study records the eye movement data of college students during the viewing of emotional facial pictures with the help of eye tracking equipment, and analyzes and discusses the common characteristics of emotional face processing and the differences in gender and emotional intelligence of college students.

## II. OBJECT AND METHOD

### A. Research Object

In this study, 9 classes were randomly sampled from University H of Anhui Province in May 2023, 231 “Chinese Schutte self-report Emotional Intelligence Scale (SSEIS)” were distributed, 51 invalid questionnaires were excluded, and 180 valid questionnaires were finally returned. According to the results of emotional intelligence questionnaire, the total scores were sorted from high to low. The first 10% of the scores were selected as high emotional intelligence group (high EI, total score  $\geq 90$ , 18 students in total), the last 10% of scores were selected as low emotional intelligence group (low EI, total score  $\leq 76$ , 18 students in total), and 36 students from high EI and low EI groups were used as pre-selected subjects for the experiment. There were 18 students with high EI ( $94.56 \pm 2.99$  scores, 9 males and 9 females) and 18 students with low EI (EI scores:  $62.19 \pm 7.37$  scores, 9 males and 9 females). All subjects had no professional background in psychology, were healthy in body and mind, right-handed, had normal vision or reached normal level after correction. All participants provided informed consent prior to the experiment.

### B. Experimental Materials

#### 1) Picture of Emotional Face

Four types of black and white emotional facial pictures including pleasure, anger, sadness and fear were chosen from the Chinese Facial Affective Picture System (CFAPS). 10 emotional face pictures of each type (5 for males and 5 for females), 40 images in total, with an average arousal rate of 7.17.

#### 2) Schutte Self-report Emotional Intelligence Scale (SSEIS)

This study used the “Chinese Schutte self-report Emotional Intelligence Scale” (SSEIS), which was revised by Liu Yanmei [22] on the basis of the Schutte Emotional Intelligence Scale [23], to assess the emotional intelligence of participants. After testing, the scale has demonstrated good reliability and validity. The scale consists of 21 items and five dimensions, namely, emotional regulation to others, emotional evaluation to others, emotional evaluation to oneself, emotional regulation to oneself, and emotional use. A scoring system consisting of five points was adopted, “strongly disagree=1, partial disagree=2, uncertain=3, partial agree=4, and strongly agree=5”. The higher the score, the higher the individual’s emotional intelligence level. The Cronbach’s alpha of this scale in this study is 0.874, indicating good reliability.

### C. Experimental Design

The three-factor mixed experiment design with 2 (gender: male, female)  $\times$  2 (emotional intelligence: high EI, low EI)  $\times$  4 (emotional face type: pleasure, anger, sadness, fear) was adopted. Among them, gender and emotional intelligence are indirect variables, while emotional face type is internal variable.

### D. Experimental Process

The experimental process for this study consists of three steps, as shown in Figure 2.

First, the main test personnel lead the participants to enter the laboratory, get familiar with the laboratory environment, explain the experimental process, precautions and operation methods, and the participants sign the informed consent form.

Second, the participants were seated on a chair positioned approximately 50 cm in front of the eye tracking monitor with both hands on the table to facilitate the operation of keys, and the lower jaw was placed on the U-shaped jaw support to stabilize the head and to calibrate the head and eyes.

Third, show the instructions on the display screen, ask the participants to read them carefully, and start to randomly present the pictures of emotional faces after confirming that the participants are clear about the experimental requirements, each picture presents for 5 seconds, and the participants carefully observe. The eye movement data was collected by the eye tracking equipment, and the experiment ends when the picture presentation ends.

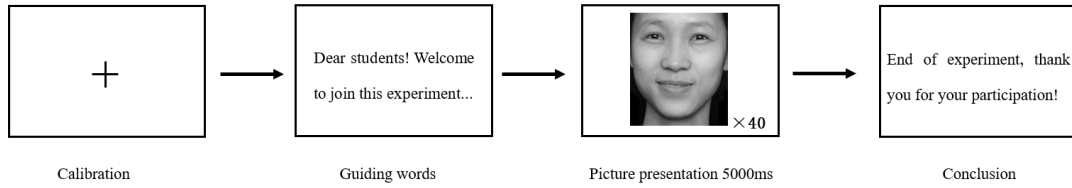


Figure 2: Experimental Process Chart

E. Data Acquisition and Analysis

A computer was used to control the experiment, and a monitor was used to display the stimulation material of emotional face picture, and an eye movement recorder was installed under the monitor. In the experiment, iView X software was used to calibrate the head and eye positions of the subjects, Experiment Center was used to compile and run the experimental materials, BeGaze and SPSS were used to process and analyze the data.

After the eye movement data is collected, the emotional face picture is divided into four interest areas, namely, eyebrows, eyes, nose and mouth by using BeGaze. The data recorded by eye tracker is a physiological index of emotional face processing. This study mainly records and analyzes the number of fixation points, fixation time, fixation hotspot map and scanning path map.

III. RESEARCH RESULTS AND ANALYSIS

A. Number of Fixation Points

1) Total Number of Fixation Points

Table 1: Analysis on the Differences of Total Fixation Points in Gender and Emotional Intelligence (N=36)

Source	SS	df	MS	F	P
Gender	330.028	1	330.028	.251	.620
Emotional intelligence	136038.028	1	136038.028	103.479	.001***
Gender*Emotional intelligence	9248.028	1	9248.028	7.035	.012**

Table 2: Analysis on the Differences of Total Fixation Points in Emotional Intelligence (N=36)

	Emotional intelligence	N	M ± SD	t	P
Total number of fixation points	High	18	340.22 ± 39.242	9.463	.001***
	Low	18	217.28 ± 38.705		

According to the analysis results in Table 1, it can be concluded that there is no significant main effect of gender (F=0.251, P=0.620>0.05), and there is no significant difference in the total number of fixation points between genders, which indicates that gender does not have a differential relationship with the total number of fixation points. The main effect of emotional intelligence is significant (F=103.479, P=0.001<0.05). According to the difference analysis in Table 2, it is evident that college students with high emotional intelligence exhibit a significantly greater number of fixation points compared to those with low emotional intelligence [(340.22±39.242) > (217.28±38.705)], which indicates that the college students in high emotional intelligence group may have made more detailed observation and in-depth thinking on emotional face pictures.

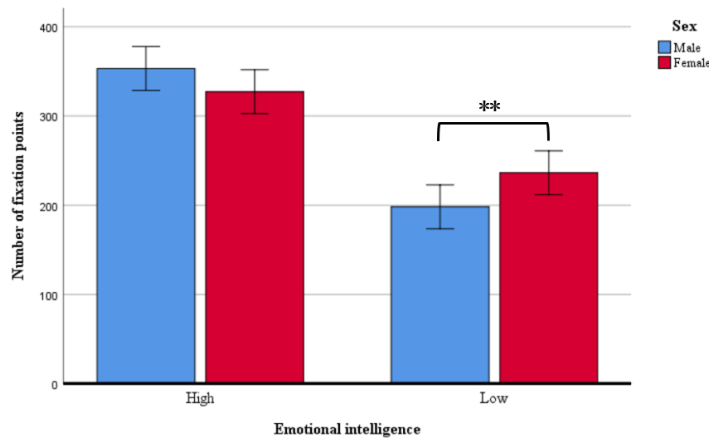


Figure 3: Comparison of Fixation Points of Males and Females in High and Low Emotional Intelligence Groups (Note: \*\*P<0.01)

The interaction between gender and emotional intelligence was significant (F=7.035, P=0.012<0.05). After the simple effect analysis, it was found that there was no significant difference in the number of fixation points between

males and females in the high emotional intelligence group ( $P=0.138>0.05$ ), but there was a notable disparity in the number of fixation points between males and females in the low emotional intelligence group ( $P=0.033<0.05$ ). Specifically, the number of fixation points in females was significantly higher than in males [ $(236.333 \pm 37.908) > (198.222 \pm 30.487)$ ], as shown in Figure 3.

2) *Emotional Face Types*

As shown in Table 3, there were notable variations in the number of fixation points of each emotional face type in terms of emotional intelligence ( $P<0.05$ ). Specifically, college students in the high emotional intelligence group have significantly more fixation points on the four emotional face types of pleasure, anger, sadness, and fear than those in the low emotional intelligence group. Furthermore, there is no notable disparity in the number of fixation points when viewing images of different emotional facial expressions, regardless of gender ( $P>0.05$ ).

Table 3: Analysis on the Differences of the Number of Fixation Points of Emotional Face Types in Emotional Intelligence (N=36)

Emotional face type	Emotional intelligence	N	M±SD	t	P
Pleasure	High	18	103.28±15.866	5.604	.001***
	Low	18	74.89±14.499		
Anger	High	18	78.61±8.576	10.767	.001***
	Low	18	45.78±9.687		
Sadness	High	18	80.11±11.344	9.837	.001***
	Low	18	48.78±7.345		
Fear	High	18	78.22±11.825	7.509	.001***
	Low	18	47.83±12.449		

According to the emotional valence, this study defined pleasure as positive emotion, anger, sadness and fear as negative emotion, and the average value of fixation points of anger, sadness and fear as the fixation number of negative emotion pictures. As demonstrated in Table 4, it is found that there is a significant difference in the number of fixation points among different emotion types after analysis ( $P<0.05$ ). The number of fixation points in the positive emotion picture is significantly greater than that in the negative emotion picture, indicating that the subjects pay more attention to the positive emotion than to the negative emotion. In addition, there was no notable distinction in the number of fixation points between genders and emotional intelligence ( $P>0.05$ ).

Table 4: Analysis on the Differences of the Number of Fixation Points in Emotion Types (N=36)

	Emotion type	N	M±SD	t	P
Number of fixation points	Positive	36	89.08±20.776	5.604	.001***
	Negative	36	63.22±18.304		

3) *Interest Areas*

Table 5: Analysis on the Differences of the Number of Fixation Points on the Interest Area (N=36)

	Interest area	N	M±SD	F	P
Number of fixation points	Eyebrow	36	15.14±23.758	75.447	.001***
	Eyes	36	156.78±64.458		
	Nose	36	70.44±44.773		
	Mouth	36	35.67±27.040		

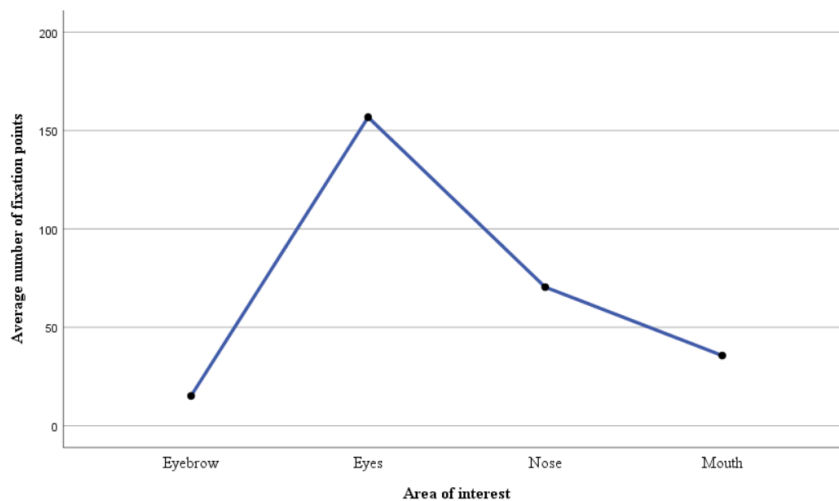


Figure 4: Average Value Chart of the Number of Fixation Points in Each Interest Area

It can be seen from Table 5 and Figure 4 that, on average, the number of fixation points in the interest area of eyes is the largest, while the number of fixation points in the interest area of eyebrows is the least, which indicates that the observation of the facial expression of an individual is mainly focused on the eye area. From the perspective of significance, there were notable variations in the number of fixation points in interest areas ( $P < 0.05$ ), which indicated that there were notable variations in the number of fixation points in different interest areas. Based on the results of the variance homogeneity test, it violates the hypothesis of variance homogeneity, meaning it does not conform to the hypothesis of variance homogeneity, and Dunnett's T3 method shall be used for testing. The specific testing results are presented in Table 6:

Table 6: Multiple Comparisons Afterwards of Dunnett's T3 Method

Dependent variable	(I) Interest area	(J) Interest area	Difference in means (I-J)	Standard error	P
Number of fixation points	Eyebrow	Eyes	-141.639*	11.450	.001***
		Nose	-55.306*	8.448	.001***
		Mouth	-20.528*	5.999	.006**
	Eyes	Eyebrow	141.639*	11.450	.001***
		Nose	86.333*	13.080	.001***
		Mouth	121.111*	11.650	.001***
	Nose	Eyebrow	55.306*	8.448	.001***
		Eyes	-86.333*	13.080	.001***
		Mouth	34.778*	8.717	.001***
	Mouth	Eyebrow	20.528*	5.999	.006**
		Eyes	-121.111*	11.650	.001***
		Nose	-34.778*	8.717	.001***

\*. The significance level for the difference in means is 0.05.

After multiple comparisons afterwards, there were notable variations in the number of fixation points across the four interest areas ( $P < 0.05$ ). There were notable variations in the number of fixation points in each interest area: eyes interest area > nose interest area > mouth interest area > eyebrow interest area. Therefore, in the facial expression, the eye is the important area of information expression and transmission, and the individual will have certain bias when recognizing and processing facial expression.

Table 7: Analysis on the Gender Difference of the Number of Fixation Points in Each Interest Area (N=36)

Interest area	Gender	N	M ±SD	t	P
Eyebrow	Male	18	16.33 ±23.953	.298	.768
	Female	18	13.94 ±24.194		
Eyes	Male	18	170.83 ±70.015	1.322	.195
	Female	18	142.72 ±56.865		
Nose	Male	18	52.50 ±38.405	-2.594	.014*
	Female	18	88.39 ±44.389		
Mouth	Male	18	31.67 ±28.222	-.885	.382
	Female	18	39.67 ±25.980		

It can be seen from Table 7 that there is a significant difference in the number of fixation points in the nose interest area between the genders ( $P = 0.014 < 0.05$ ). Specifically, the number of fixation points in the nose interest area in female is significantly higher than that in the male [(88.39 ±44.389) > (52.50 ±38.405)], and there is no significant difference in the number of fixation points between genders in other areas of interest ( $P > 0.05$ ).

Table 8: Analysis on the Difference of the Number of Fixation Points in Each Interest Area in Emotional Intelligence (N=36)

Interest area	Emotional intelligence	N	M ±SD	t	P
Eyebrow	High	18	6.22 ±5.663	-2.400	.027*
	Low	18	24.06 ±31.011		
Eyes	High	18	186.28 ±64.979	3.056	.004**
	Low	18	127.28 ±49.890		
Nose	High	18	57.72 ±40.226	-1.775	.088
	Low	18	83.17 ±46.544		
Mouth	High	18	23.44 ±23.068	-3.008	.005**
	Low	18	47.89 ±25.628		

Table 8 shows that there is no significant difference in the number of fixation points in the nose interest area ( $P = 0.088 > 0.05$ ), but there is a notable disparity in the number of fixation points in the interest areas of the eyebrows, eyes and mouth ( $P < 0.05$ ). The study results indicate that the low emotional intelligence group had a significantly

higher number of fixation points in the eyebrow and mouth interest areas compared to the high emotional intelligence group [(24.06±31.011)>(6.22±5.663), (47.89±25.628)>(23.44±23.068)]; in the field of eye interest, college students with high emotional intelligence exhibit a significantly greater number of fixation points than those with low emotional intelligence [(186.28±64.979)>(127.28±49.890)]. Furthermore, there was no noteworthy correlation between gender and emotional intelligence in the quantity of fixation points within each area of interest (P<0.05).

**B. Staring Time (Interest Area)**

Because the presentation time of each emotional face picture is 5000ms, this study mainly analyzes the difference of fixation time in interest area, and the difference of fixation time in each interest area in gender and emotional intelligence.

Table 9: Analysis on the Difference of Fixation Time on the Interest Area (N=36)

	Interest area	N	M±SD	F	P
Fixation time	Eyebrow	36	3663.4306±5672.19574	59.133	.001***
	Eyes	36	49852.9222±24857.49083		
	Nose	36	22034.141667±15946.305338		
	Mouth	36	11638.566667±9236.749615		

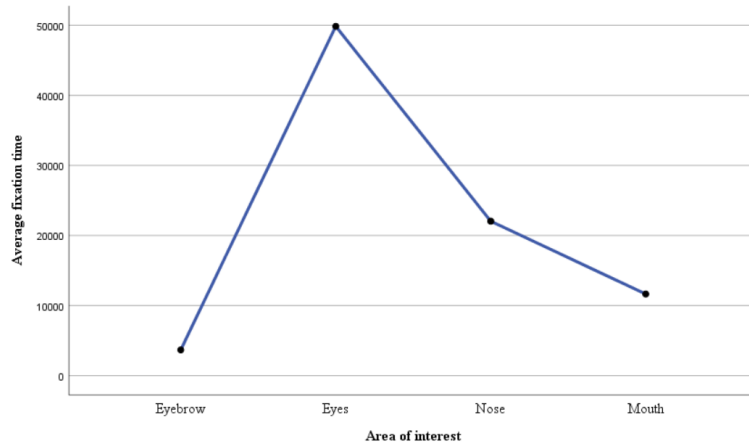


Figure 5: Average Value Chart of Fixation Time of Each Interest Area

From Table 9 and Figure 5, it can be seen from the average that the eye interest area has the longest fixation time, while the eyebrow interest area has the least fixation time, which indicates that the individual has the longest residence time in the eye area when observing the facial expression. From the perspective of significance, there were notable variations in the number of fixation points in interest areas (P<0.05), indicating significant differences in fixation time between different interest areas, and multiple comparisons afterwards are needed to determine which specific interest area has differences. According to the results of variance homogeneity test, it violates the hypothesis of variance homogeneity, meaning it does not conform to the hypothesis of variance homogeneity, and Dunnett’s T3 method shall be used for testing. The specific testing results are shown in Table 10:

Table 10: Multiple Comparison Afterwards of Dunnett’s T3 Method

Dependent variable	(I)Interest area	(J) Interest area	Difference in means (I-J)	Standard error	P
Fixation time	Eyebrow	Eyes	-46189.49167*	4249.40733	.001***
		Nose	-18370.71111*	2820.84728	.001***
		Mouth	-7975.13611*	1806.55710	.001***
	Eyes	Eyebrow	46189.49167*	4249.40733	.001***
		Nose	27818.78056*	4922.11423	.001***
		Mouth	38214.35556*	4419.69203	.001***
	Nose	Eyebrow	18370.71111*	2820.84728	.001***
		Eyes	-27818.78056*	4922.11423	.001***
		Mouth	10395.57500*	3071.38314	.008**
	Mouth	Eyebrow	7975.13611*	1806.55710	.001***
		Eyes	-38214.35556*	4419.69203	.001***
		Nose	-10395.57500*	3071.38314	.008**

\*. The significance level for the difference in means is 0.05.

Through multiple comparison afterwards, we found that there were notable variations in the fixation time of each of the four interest areas. The significant difference of fixation time in each interest area was eye interest area > nose interest area > mouth interest area > eyebrow interest area, which was consistent with the difference of fixation points in each interest area. Therefore, the bias of an individual to the eye area in recognizing and processing facial expressions is further demonstrated.

Table 11: Analysis on the Gender Difference of Fixation Time in Each Interest Area (N=36)

Interest area	Gender	N	M±SD	t	P
Eyebrow	Male	18	4149.694±5801.8239	.509	.614
	Female	18	3177.167±5663.7710		
Eyes	Male	18	56658.306±26917.8215	1.685	.101
	Female	18	43047.539±21201.2321		
Nose	Male	18	16655.011±13147.9967	-2.123	.041*
	Female	18	27413.272±17011.2668		
Mouth	Male	18	11257.850±10704.7120	-.244	.809
	Female	18	12019.283±7794.6113		

Table 11 shows a significant difference in the fixation time in the nose interest area between the genders (P=0.041<0.05). Specifically, the fixation time of the nose interest area in female is significantly longer than that of the male [(27413.272±17011.2668)ms> (16655.011±13147.9967)ms]. There is no significant difference in the fixation time of other interest areas in gender (P>0.05), which is consistent with the analysis result of the disparity in the quantity of fixation points in each interest area in gender.

Table 12: Analysis on the Difference of Fixation Time in Each Interest Area in Emotional Intelligence (N=36)

Interest area	Emotional intelligence	N	M±SD	t	P
Eyebrow	High	18	1551.561±1589.0490	-2.378	.028*
	Low	18	5775.300±7366.8459		
Eyes	High	18	62572.583±25655.8864	3.540	.001***
	Low	18	37133.261±16471.1353		
Nose	High	18	19515.250±17232.1009	-.946	.351
	Low	18	24553.033±14599.5153		
Mouth	High	18	8197.211±8932.3406	-2.380	.023*
	Low	18	15079.922±8413.5554		

Table 12 shows that there is no significant difference in the fixation time in the nose interest area (P=0.351>0.05), but there is a notable difference in the fixation time in the interest areas of the eyebrows, eyes and mouth (P<0.05). In the eyebrow interest area and the mouth interest area, college students with low emotional intelligence had significantly longer fixation times compared to those with high emotional intelligence [(5775.300±7366.8459)ms > (1551.561±1589.0490)ms, (15079.922±8413.5554)ms > (8197.211±8932.3406)ms]; in the eye interest area, the fixation time of college students in the high emotional intelligence group was significantly longer than that in the low emotional intelligence group [(62572.583 ±25655.8864) ms > (37133.261 ±16471.1353) ms], which was consistent with the difference in gender and emotional intelligence. In addition, the interaction between gender and emotional intelligence did not have a significant effect on the fixation time of each region of interest (P<0.05).

Therefore, according to the difference analysis of the number of fixation points and fixation time in each interest area in gender and emotional intelligence, it is evident that the college students in the high emotional intelligence group focus more on the eye area when processing the emotional facial pictures, and mainly extract the relevant information from the eye area, which is more efficient, while the college students in the low emotional intelligence group need to extract relevant information from multiple areas when processing the emotional face picture, and the fixation points are more dispersed.

### C. Fixation Hotspot Map and Scanning Path Map

In order to present the differences of fixation of four emotional face types in terms of emotional intelligence and gender more visually, this study randomly selected one picture of each of four types of emotional faces: pleasure, anger, sadness and fear. One male and one female participant were selected from the high and low emotional intelligence groups, and four participants in total. By using the image processing function of computer vision, the fixation hotspots and scanning paths of the subjects on the four types of emotional face pictures were analyzed. The results are shown in Figure 6 fixation hotspot map and Figure 7 scanning path map respectively.



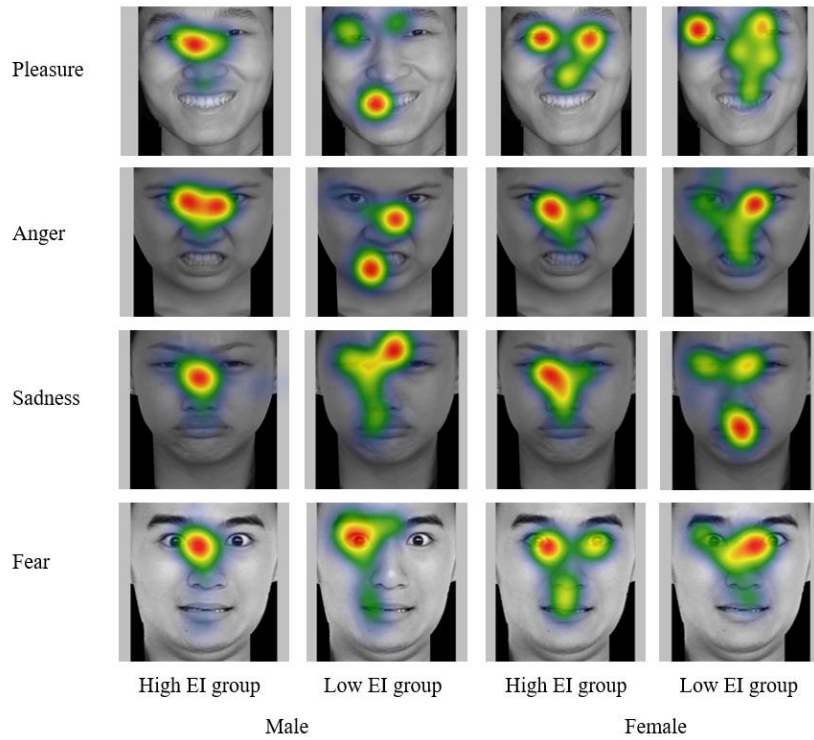


Figure 6: Fixation Hotspots Map of High and Low Emotional Intelligence Groups on Four Emotional Face Pictures

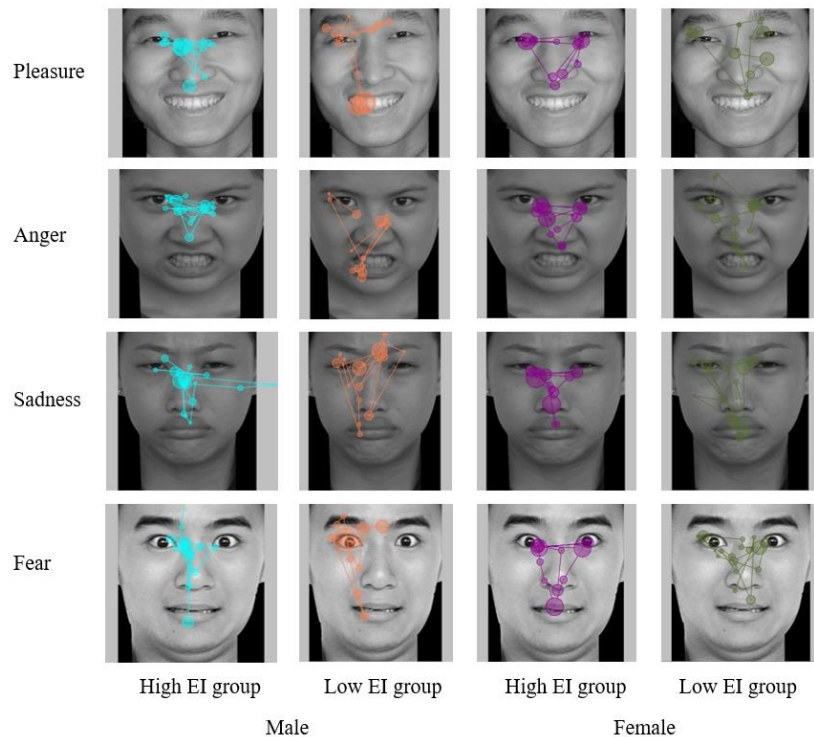


Figure 7: Scanning Path Map of High and Low Emotional Intelligence Group on Four Kinds of Emotional Face Pictures

In terms of emotional intelligence, the fixation points of college students in the high emotional intelligence group are concentrated in the four types of emotional face pictures, mainly in the eye area, while the fixation points in the low emotional intelligence group are scattered, and the fixation range covers the eyes and mouth areas. In terms of gender, compared with male college students, female college students have more scattered fixation points and wider coverage areas on the four emotional face pictures.

#### IV. DISCUSSION

##### A. *College Students Have a Positive Bias to Emotional Face Processing and a Bias to the Eye Area*

In the process of emotional face processing, the eye movement data of face pictures with different emotional valence are different. In this study, there are four types of emotional face pictures with two valences: pleasure, anger, sadness and fear. When analyzing the disparity in the quantity of fixation points of emotional picture types for college students, it is found that compared with negative emotional faces (anger, sadness and fear), the subjects have more fixation points on positive emotional types (pleasure), and gender and emotional intelligence have no significant influence on them, indicating that college students have the same processing bias pattern on emotional faces, i. e. they have higher attention or significant attention bias on positive emotion types, and the processing is deeper and finer.

In addition, this study also divided the areas of emotional face pictures into four interest regions: eyebrows, eyes, nose, and mouth. As the core area of the face, eyes contain rich emotional feature information. Careful observation of the eye area can help individuals to accurately and effectively judge the emotions, states, and intentions of others in social activities by better utilizing this emotional feature information [24]. In this study, both in terms of the number of fixation points in each interest area and the fixation time in each interest area, the number of fixation points and time in the eye area were significantly higher than those in the other three interest areas. Therefore, college students have a general bias towards the eye area when observing and processing emotional faces, which further illustrates that the eye area is a key area for individual expression and extraction of relevant emotional information.

##### B. *Significant Differences Exist in Emotional Intelligence Related to Emotional Face Processing*

Salovey and Mayer believed that emotional intelligence is a comprehensive ability, and high-level emotional intelligence individuals also have a strong ability to perceive and understand various emotional information according to the views of the two scholars. In terms of individual recognition and processing of emotional stimuli, several previous studies have used experimental equipment such as EEG and ERP to conduct brain research on participants have found that there is indeed a significant difference in the response of individuals with high emotional intelligence and those with low emotional intelligence when recognizing emotional stimuli. For example, some scholars have found that individuals with high emotional intelligence tend to concentrate on emotional images and have a more sensitive ability to perceive emotions through EEG experiments, providing an important foundation for their own emotional regulation activities [25]. By analyzing the differences in the number of fixation points in emotional face images among college students with different levels of emotional intelligence, this study found that, within the same fixation time, the high emotional intelligence group had a significantly higher number of fixation points compared to the low emotional intelligence group, which indicates that college students in the high emotional intelligence group are more meticulous in observing emotional face images, so as to obtain more relevant emotional information, and have conducted in-depth thinking.

In addition, when analyzing the number of fixation points in each interest area, it is found that college students with high emotional intelligence have a significantly higher number of fixation points in the eye area compared to those with low emotional intelligence, and college students with low emotional intelligence have more fixation points in the eyebrow, nose, and mouth areas than those with high emotional intelligence, indicating that college students in the high emotional intelligence group are able to quickly and effectively focus their attention on the eye area, which is the main area for transmitting and expressing emotional information, resulting in higher perception and processing efficiency of emotional faces. However, due to the lack of guidance in emotional schema, college students with low emotional intelligence cannot efficiently allocate attention resources. As a result, they need to extract relevant information from multiple facial regions, which leads to lower processing efficiency.

##### C. *College Students in High Emotional Intelligence Group Have Centralized Processing Mode, and Female College Students Have More Detailed Processing Mode*

After analyzing the difference of the number of fixation points in each interest area in emotional intelligence, it is discovered that the number of fixation points in the eye interest area is the most in the high emotional intelligence group compared with the interest areas of eyebrows, nose and mouth; the number of fixation points in the eye area is more in the high emotional intelligence group than that in the low emotional intelligence group, with a significant difference. Both of the two aspects indicate that college students in the high emotional intelligence group mainly focus their attention on the core areas of the face and the eyes when processing emotional face images. In addition, it can be seen from the visual fixation hotspot map and scanning path map that the fixation points of

the high emotional intelligence group are more concentrated than those of the low emotional intelligence group, and the fixation points mainly focus on the eye interest area, which is consistent with the results of data analysis. Therefore, the mode of processing and dealing with emotional faces of college students with high emotional intelligence is more centralized, and college students can devote their attention to effective information quickly and effectively.

In addition, differences in interest areas between males and females in emotional face processing from the perspective of eye movement have also been found. Upon analysis of gender differences in the number of fixation points and fixation time in each area of interest, compared to males, it was discovered that females exhibit more fixation points and longer fixation time in the nose interest area, and there are significant differences. From the intuitive fixation hotspots map and the scanning path map, it can be seen that female college students have a wider distribution and coverage of fixation points on emotional face images compared to male college students. This may be due to the higher sensitivity and emotionalization of women to emotions [26], so they will focus more on some details in emotional faces, so as to collect and process relevant emotional feature information more widely.

## V. RESEARCH CONCLUSION

(I) This study fully exerts the advantages of computer vision technology, tracks the fixation points of college students in real time with eye tracker, records the fixation time and the number of fixation points, and uses the image processing function to draw the visual fixation hotspot map and the scanning path map, so as to provide a convenient path for exploring the processing mechanism of individual emotional faces, and it also shows the validity of the application of computer vision technology in the research of individual cognition.

(II) This study investigates the common characteristics of college students' emotional face processing and their differences in gender and emotional intelligence. The results showed that college students tended to process positive emotional faces, indicating a positive bias, and had a certain bias towards the eye area; the college students in high emotional intelligence group were faster and more efficient in emotional face processing, while those in low emotional intelligence group were less efficient in emotional face processing; female college students were more detailed in emotional face processing.

(III) This study confirms that individual emotional intelligence is strongly associated with the emotional face processing model. Educators should fully recognize the significance of emotional education and explore effective methods to enhance learners' emotional intelligence, and provide crucial support for the development of strong social communication and interpersonal communication.

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