DEPRESSION DETECTION BASED ON REACTION TIME AND EYE MOVEMENT

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Motivation

- **Background**

Depression is a common mental disorder, current depression detection relies almost exclusively on the clinical interview and structured questionnaire, our goal is to achieve a convenient and objective depression detection system, which can assist clinicians in their diagnosis of clinical depression.

- **Contribution**

- Design an experimental paradigm based on image cognition to record the reaction time data and eye movement data.
- Build one of the largest datasets of depression, which includes 214 depressed patients and 493 normal controls.
- Extract the corresponding R-T features and E-M features to classify, which can reflect the participants' attention bias.
- Our method achieves accuracy up to 86%, which outperforms the previous related method.

Pipeline

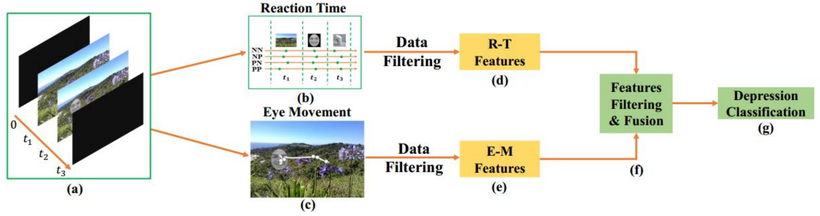

Fig. 1: Pipeline of our method. Through an experimental paradigm based on image cognition(a), we collect participants reaction time data (b) and eye movement data (c), extract R-T features (d) and E-M features (e) after data filtering, finally filter and fuse features (f) to classify depression (g).

Single Test Process

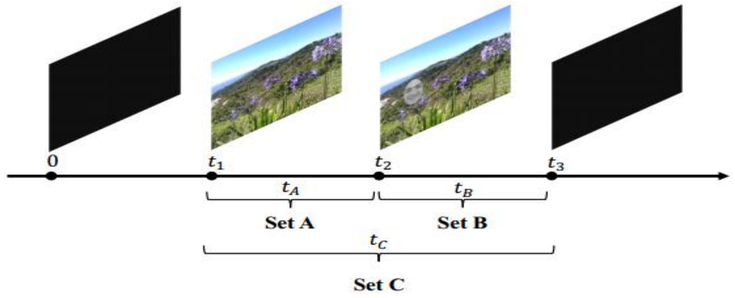

Fig. 2: Single test process of experimental paradigm.

- The entire test contains 80 such processes, including:
- 20 groups of negative image and negative face (NN).
- 20 groups of negative image and positive face (NP).
- 20 groups of positive image and negative face (PN).
- 20 groups of positive image and positive face (PP).

Eye Movement Features

Table 2: E-M features used in our method. The size 4×2 means the feature is extracted for four emotional groups in Set C and Set B.

E-M features		Size
Orientation	Total fixation numbers	4×2
	Fixation numbers in the face area	4×2
Release	First fixation duration	4×2
	Total fixation duration	4×2
	Fixation duration in the face area	4×2
Transfer	Saccade path length	4×2
	Start time of transfer	4×2
	Transfer speed	4×2
Gender and age		2

Reaction Time Features

Table 1: R-T features used in our method. The size 4 means the feature is extracted for four emotional groups.

R-T features	Size
Average reaction time	4
Standard deviation of reaction time	4
The difference of reaction time	6
Gender and age	2

Detection Result

Table 3: Comparison of original depression classification performance.

Classifier	Classification performance			Data
Performance	Sensitivity	Specificity	Accuracy	Valid
W. Li [11]	80%	80%	80%	44
X. Li [12]	81.1%	-	81%	34
C. Le [13]	76%	**91.67%**	83.67%	49
Ours (SVM)	**88%**	84%	**86%**	50

- In large-scale dataset, we also get outstanding classification performance. The F-F classifier means a feature fusion classifier.

Table 4: Comparison of depression classification performance in large-scale dataset.

Classifier	Classification performance			Data
Performance	Sensitivity	Specificity	Accuracy	Valid
R-T classifier	67.74%	68.40%	68.22%	186D+481N
E-M classifier	69.19%	68.87%	68.97%	198D+469N
F-F classifier	**71.51%**	**72.49%**	**72.22%**	172D+458N