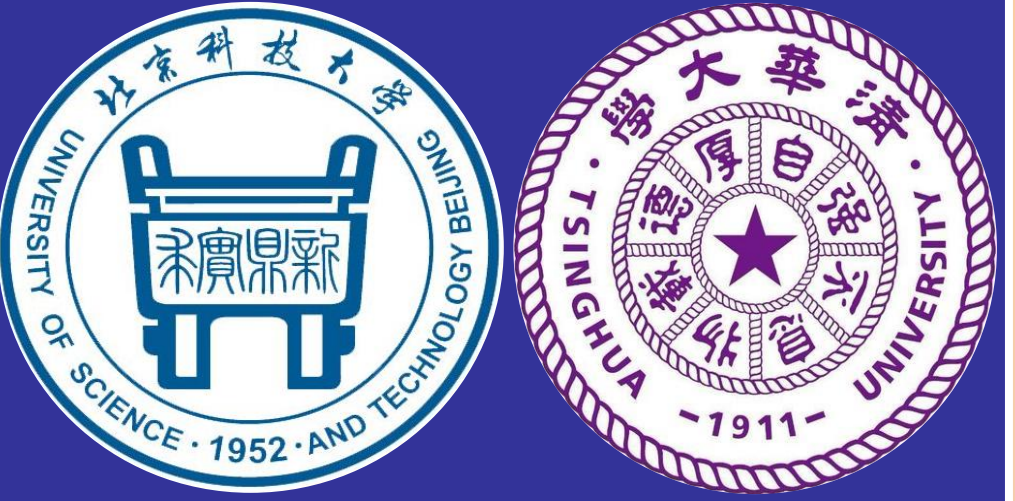


Depression Detection by Combining Eye Movement with Image Semantics

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Motivation

Observation:

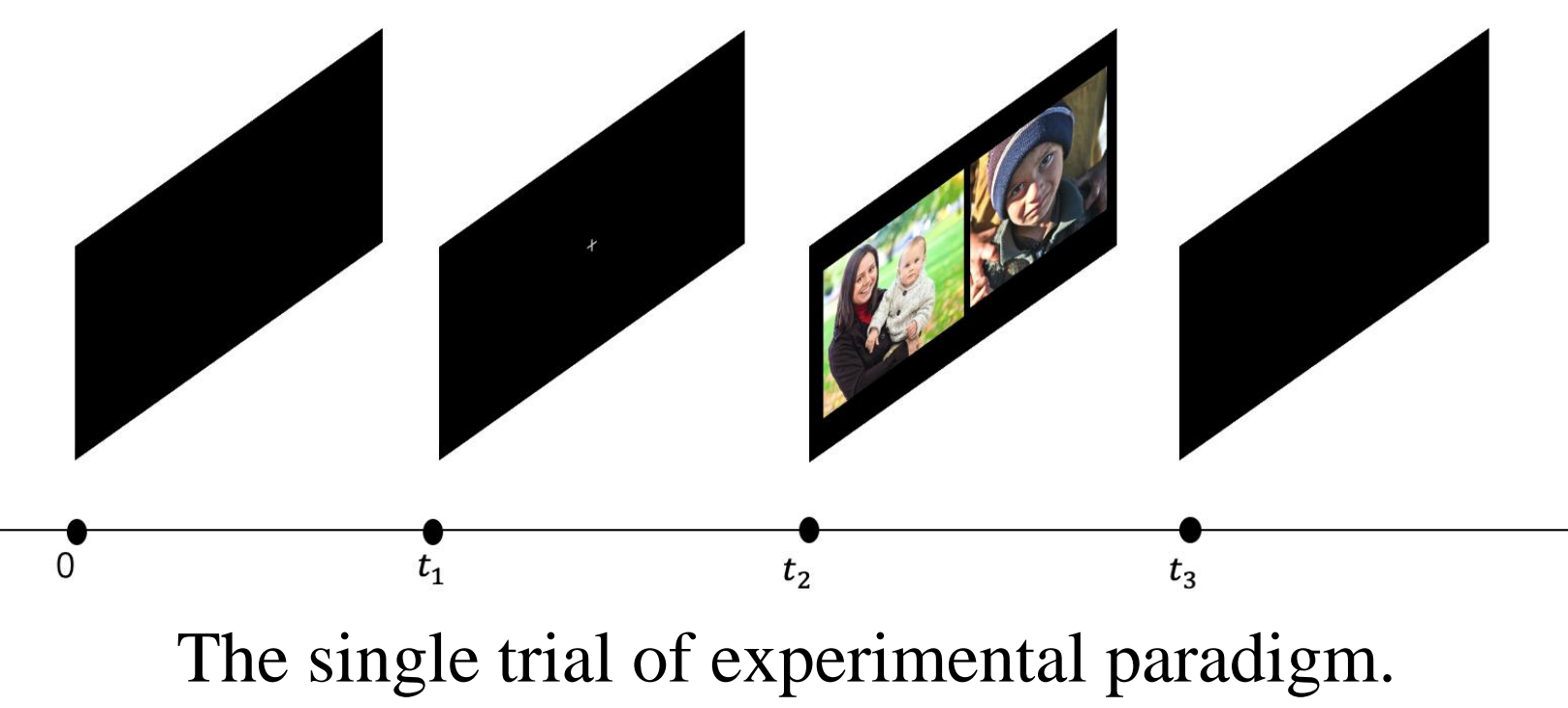
Depression is a common mental disorder that affects patients' daily life. How to detect depression objectively and conveniently is still a challenge.

Contribution:

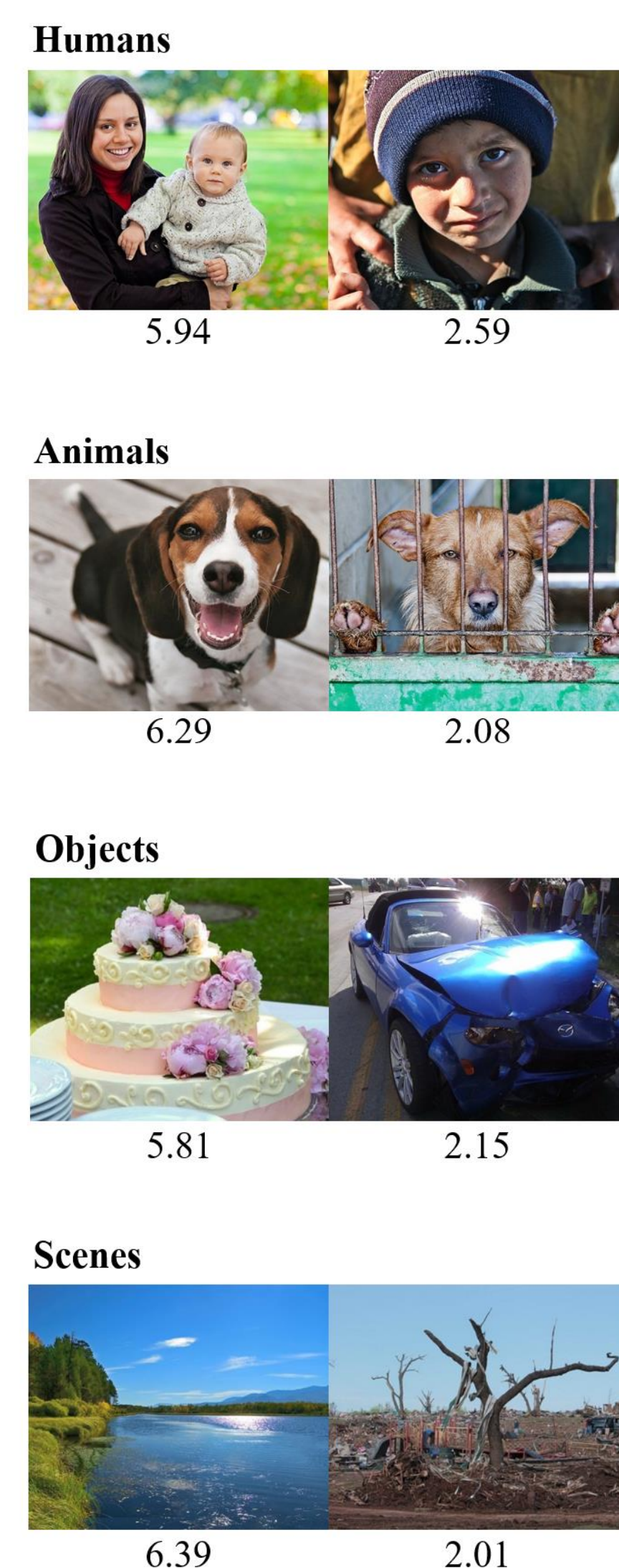
- Design a new depression detection method that presents positive and negative images as stimuli and records the subjects' eye movement data.
- Explore the deep semantics of the images and combine it with the two groups of subjects' gaze patterns for analyzing the subjects' psychological conditions.
- The accuracy of our method is up to 90.06%, which outperforms previous methods and realizes an objective depression detection method based on deep learning.

Method

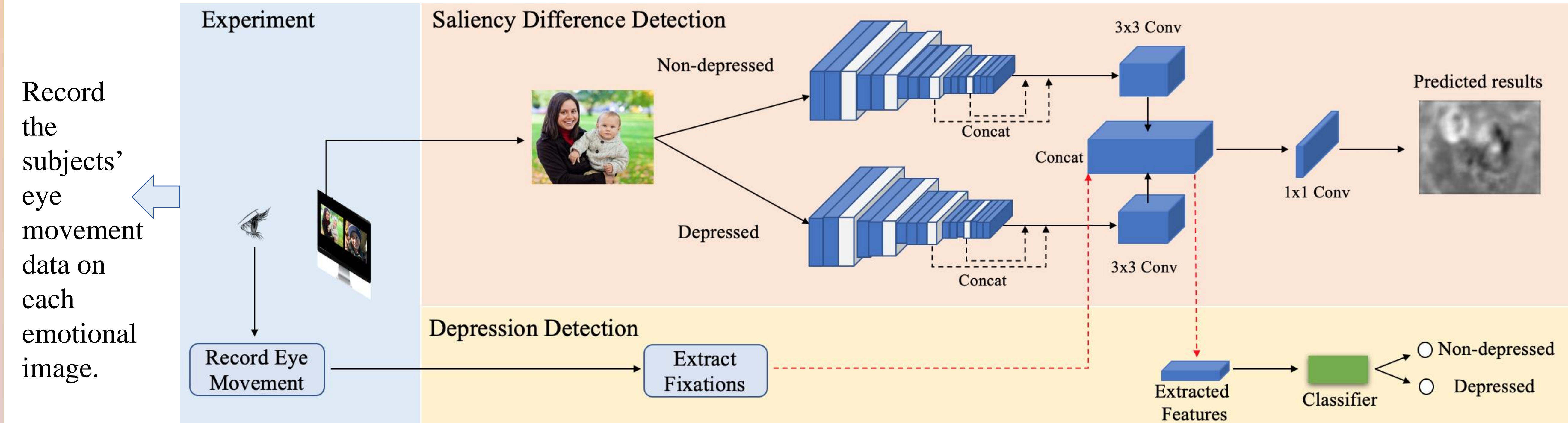
1. Experimental Paradigm and Process



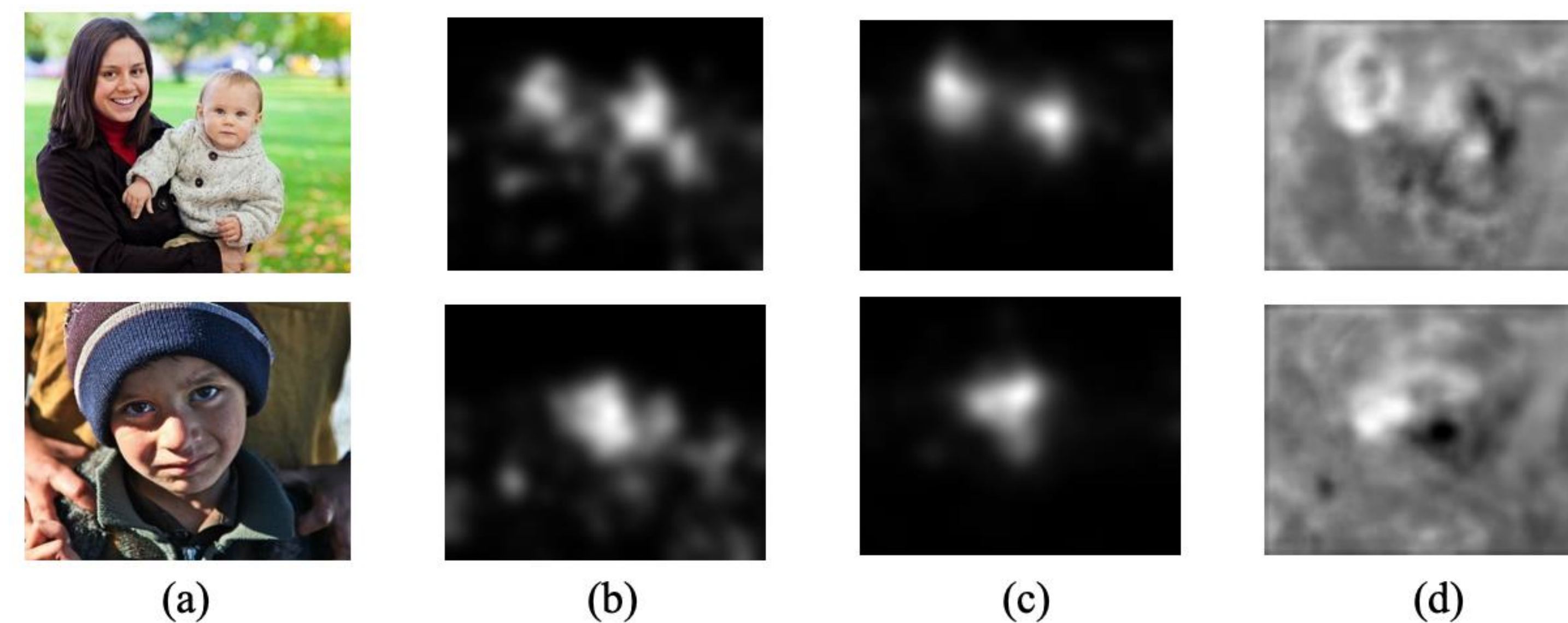
- The entire test contains **80 trials**.
- The emotional images come from OASIS, which covers four categories: **humans, animals, objects, and scenes**.
- Collect eye movement data by Tobii eye tracker.
- Collect **181** subjects' data:
 - 106** depressed subjects
 - 75** non-depressed subjects



2. Attention Analysis Based on Saliency Differences



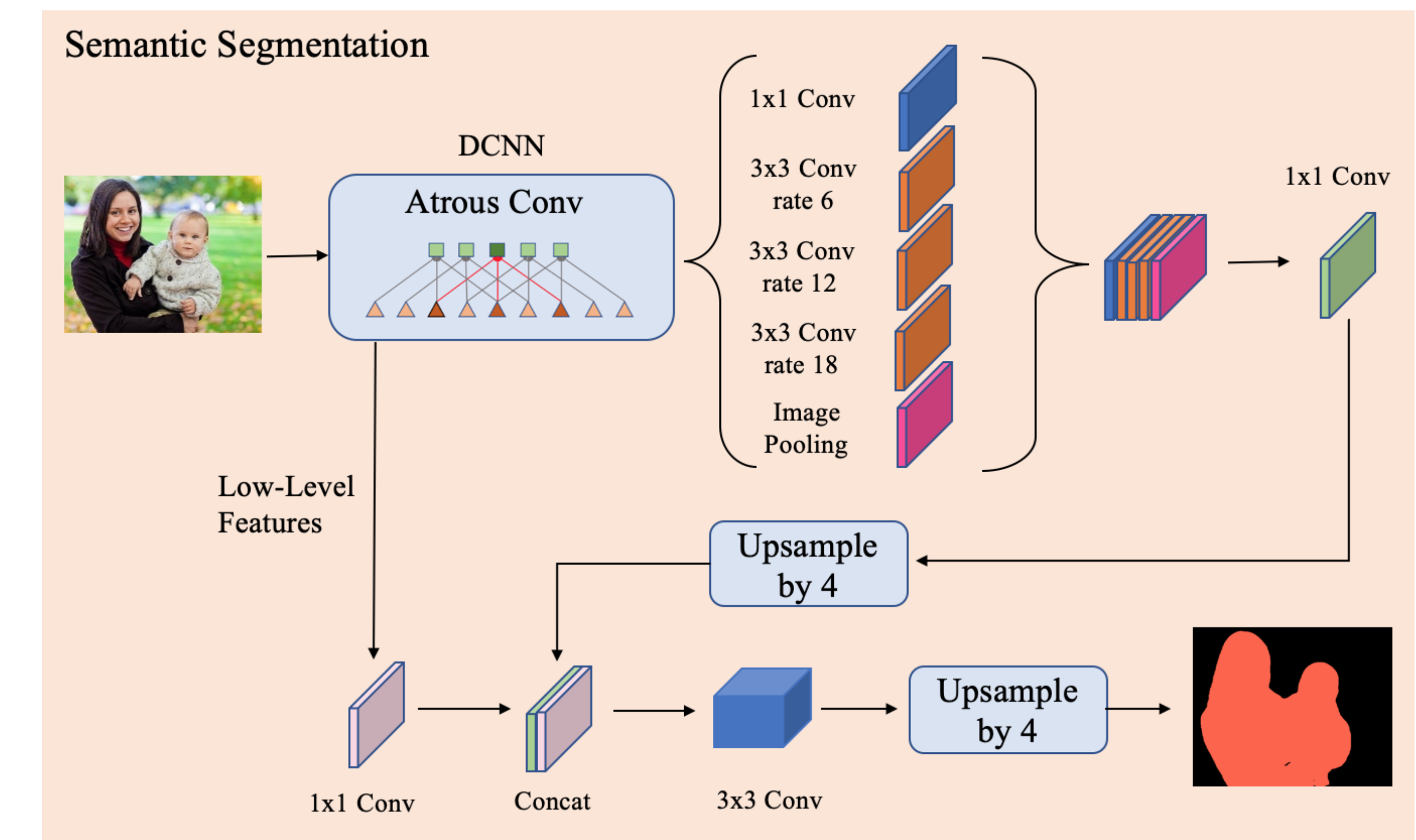
Be trained for predicting the differences of visual saliency on emotional images between depressed and non-depressed subjects.



(a) Emotional images, (b) fixation maps of non-depressed subjects, (c) fixation maps of depressed subjects, (d) predicted results.

- **The dark areas** of the predicted results represent the attentional areas of non-depressed subjects.
- **The light areas** represent the attentional areas of depressed subjects.
- **The gray areas** represent where the differences between the two groups of people are not salient.

3. Attention Analysis Based on Semantic Segmentation



Replace the module of Saliency Difference Detection with the module of Semantic Segmentation to get more image semantics.

Results

Performance	Accuracy	Sensitivity	Specificity
Saliency Differences	83.98%	84.91%	82.67%
Semantic Segmentation	73.48%	73.58%	73.33%
Fusion	90.06%	91.51%	88%

- Use an SVM as the discriminant model.
- Respectively calculate the saliency difference features and semantic segmentation features for depression classification.
- Combine the features based on saliency differences with the features of semantic segmentation for classification and acquire excellent classification performance.