A Database with face video images of patients with schizophrenic disorders and control healthy group

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Introduction

Schizophrenia is characterized by various negative and positive symptoms and specific incremental changes in personality. Negative symptoms are manifested in behavior, especially in facial expressions. Actual problems today are predicting disease course, evaluation of the effectiveness of treatment, and diagnosis of schizophrenia in preclinical stage of the disease. Development of the automated system of analysis will allow us to study flat affect – one of the negative symptoms of schizophrenia. Consequently, automated facial expressions analysis will make progress in addressing actual problems.

In recent works are reported about using an automated approach to the assessment of facial movements by images for tracking disease course and treatment effectiveness [1, 2, 3]. However, most studies aimed at identifying the differences between healthy group and patients.

The result of different studies (in Canada, India, European countries, Iran) was the discovery of specific anomalies of facial expressions in schizophrenia. Interest in such studies has grown significantly during the last 5 years. In Russia, such studies are still very few.

Patients with schizophrenia have specific anomalies such as a low frequency of positive emotions on certain stimuli and typical movements [4, 5].

Materials and Methods

A database of video images of patients with schizophrenic disorders and in the psychosis high-risk state [6] has been being collected in Mental Health Research Center. A database of control healthy group has been being collected in Bauman Moscow State Technical University.

Stimulant material for the study of facial expressions were three demonstration videos, intended to product emotions of sadness and joy, duration is about 4-5 minutes, and questions on the subject of videos. The first video is neutral, the second one is sad and the last one comprises two parts: neutral part and subsequent funny part. After video demonstration respondents are also asked to estimate their emotional state. A person can choose one or more of the following emotions: happiness, delight, sorrow, worry, sadness, fear, indifference, shame and disgust, – or propose his own variant of emotion. For chosen emotions a respondent has to estimate intensity in the range from one (the weakest intensity) to five (the strongest intensity).

The respondents with schizophrenic disorders first read the text, then watch the video and estimate their emotional state. Thus, following steps of our study were recorded: reading the text, watching the video 1, discussion of the video 1, watching the video 2, discussion of the video 2.

Respondents with schizophrenic disorders were recorded at two time points: the first point is on hospitalization, the second point is on discharge from the hospital.

Medical advisers of our research group conducted standard procedures for evaluating the mental state of patients with schizophrenic disorders on various scales: Positive and Negative Symptoms Scale (PANSS), The Scale of Prodromal Symptoms (SOPS), The Hamilton Rating Scale for Depression (HDRS), Scale of side effects assessment (Udvald for Kliniske Undersogelser Side-Effect Rating Scale, UKU).

Before the first video a respondent of control healthy group is asked to fill out a questionnaire on trait anxiety from state-trait anxiety inventory (STAI-40). After the last video a respondent is asked to fill out a questionnaire on state anxiety from STAI-40, Toronto alexithymia scale questionnaire (TAS-26) and gelotophobia, gelotophilia and katagelasticism questionnaire (PhoPhiKat<30>).

During demonstration respondent's facial image is recorded. For recording we use Logitech C922 Pro Stream webcam. Recorded videos has full HD resolution (1 920 x 1 080 pixels) at 30 frames per second. For each respondent a video of about 2 GB have been recorded.

Conditions of registration is limited to the hospital environment. The patient sits at the table in front of the window while recording the video. Lighting in the room is top and diffused. The patient's face is illuminated evenly, there are no shadows.

The patient sits in front of the laptop with a webcam attached to the top of the screen. Distance from person to camera is from 30 to 90 cm. Face takes up 60% of the image.

Participants

Medical advisers of our research group separated patients into two groups according to clinical observation: patients with schizophrenia and patients in the psychosis high-risk state. 13 respondents are with schizophrenia in the age from 17 to 25 (the average age 20 years), duration from 1 to 24 months, the mean duration is 9 months with normal

or corrected vision, exclusion criteria: severe somatic and neurological diseases, hearing impairment, alcohol and drug addiction in the anamnesis. 30 patients are in the psychosis high-risk state (age from 16 to 25 years, the average age 20 years, disease duration from 3 to 96 months, mean duration of the disease 33 months).
20 respondents aged 20 to 25 years from control healthy group are recorded. Among them six persons are women and fourteen persons are men.

Results

Primary processing of the video images data was performed manually with facial action coding system (FACS) [7]. We made annotation of two intervals: watching the video 1 and watching the video 2. Motion acts over the FACS (yawning, swallowing, tremor, tears) are included during the annotation.
Annotation include the list of action units and motion acts and the number of the beginning and the end of the act. The beginning and the end of our intervals are also marked in the annotation. Furthermore, there are asymmetrical action units and motion acts in the annotation.
Annotation is made by two authors of the thesis. To verify the homogeneity of the annotations obtained, we tested the hypothesis that distributions of each action unit belong to the same distribution. To test the hypothesis, we use the Kolmogorov-Smirnov test. The null hypothesis is that the data in two vectors are from the same continuous distribution. We performed a test with a 5% significance level.
We used such features:
– frequency of action unit η is the ratio of the number of action unit per interval to the duration of the interval;
– percentage of action unit π is the ratio of the sum of the durations of the action unit during an interval to the duration of the interval.
The analysis showed that there are no differences with the 5% significance level. Features without differences are showed with «+» in the table, e.g. see tab. 1. Features are grouped according to the area of the face. Furthermore, appearance of asymmetric action units is marked with letters «R» and «L» corresponding to right and left action units, «n/a» means the absence of asymmetry in video images.

Conclusions

Our first estimation confirms the possibility of solving different tasks with this database and its annotation:
1. Study differences between groups of healthy persons and patients with schizophrenia.
2. Study differences between groups of patients with schizophrenia and patients in the psychosis high-risk state.
3. Investigation of the dynamics of mimic manifestations at the beginning and at the end of treatment.
4. Identification of the relationship between the results of psychological scaling and the severity of psychopathological disorders of facial expressions.
5. Development of an automated approach to the evaluation of facial movements for the study of changes in various time points of the course of a mental illness.

Table 1: Verified Action Units

Action Unit	η	π	η R	π R	η L	π L
Up Face Action Units						
au01	+	+	+	+	+	+
au02	+	+	+	+	+	+
au04	+	+	+	+	+	+
au05	+	+	n/a	n/a	n/a	n/a
au06	+	+	+	+	+	+
au07	+	+	+	+	+	+
Middle Face Action Units						
au09	+	+	n/a	n/a	n/a	n/a
au10	+	+	+	+	+	+
Down Face Action Units						
au11	+	+	+	+	+	+
au12	+	+	+	+	+	+
au13	+	+	n/a	n/a	n/a	n/a
au14	+	+	+	+	+	+
au15	+	+	+	+	+	+
au16	+	+	+	+	+	+
au17	+	+	+	+	+	+
au18	+	+	n/a	n/a	n/a	n/a
au20	+	+	n/a	n/a	+	+
au24	+	+	n/a	n/a	n/a	n/a
au25	+	+	n/a	n/a	n/a	n/a
au26	+	+	n/a	n/a	n/a	n/a
au28	+	+	n/a	n/a	n/a	n/a
au31	+	+	n/a	n/a	+	+
au35	+	+	n/a	n/a	n/a	n/a

References

[1] Benson P.J. et al. Simple viewing tests can detect eye movement abnormalities that distinguish schizophrenia cases from controls with exceptional accuracy. Biological psychiatry, 72(9):716-724, 2012.
[2] Hamm J. et al. Dimensional information-theoretic measurement of facial emotion expressions in schizophrenia. Schizophrenia research and treatment, 2014.
[3] Tron T. et al. Automated facial expressions analysis in schizophrenia: A continuous dynamic approach. In International Symposium on Pervasive Computing Paradigms for Mental Health, pages 72-81, Springer International Publishing, 2015.
[4] Tron T. et al. Facial expressions and flat affect in schizophrenia, automatic analysis from depth camera data. In IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI), pages 220-223, IEEE, 2016.
[5] Dudek A. et al. Analysis of facial expressions in patients with schizophrenia, in comparison with a healthy control-case study. Psychiatria Danubina, 29(3):584, 2017.
[6] Fusar-Poli P. et al. The psychotic high-risk state. JAMA Psychiatry, 70(1):107-120, 2013.
[7] Ekman P., Friesen W.V. Facial action coding system, 1977.