

Brain activity can reveal the severity of autistic traits

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Credit: National Research University Higher School of Economics

A team of researchers from Russia and Israel applied a new algorithm to classify the severity of autistic personality traits by studying subjects' brain activity.

The article Brief Report: Classification of Autistic Traits According to Brain Activity Recoded by fNIRS Using ϵ -Complexity Coefficients is published in the *Journal of Autism and Developmental Disorders*.

When diagnosing autism and other mental disorders, physicians increasingly use neuroimaging methods in addition to traditional testing and observation. Such diagnostic methods are not only more objective, but also often reveal the presence of a disorder in cases where the doctor has insufficient behavioral data, such as when the patient is young in age.

An important task in the development of diagnostic methods is the selection of an algorithm that can identify certain [brain](#) activity patterns. Since [brain cells](#) generate many electrical impulses per second, the raw data is often insufficient to make any conclusions. The data must first be processed.

A team of researchers from Russia and Israel studied one of these algorithms. The experiment involved 26 healthy subjects, though 5 were excluded from the final sample due to noisy signals. First, the participants completed the Autism Spectrum Quotient, and based on the test result, they were divided into two groups: those with strong autistic traits and those with weak autistic traits.

Then the participants performed an interpersonal synchronized movement task: each subject was asked to move their right hand in synchronization with that of the researcher for several minutes while their brain activity was recorded. Interpersonal synchronization tasks are often used in the diagnosis of autism spectrum disorders because people with ASD have difficulty coordinating joint actions.

Instead of traditional MRI or EEG, the researchers chose functional near infrared spectroscopy (fNIRS) to record subjects' brain activity.

fNIRS technology is based on measuring oxygen levels in the blood vessels of the brain using infrared light. Unlike fMRI, fNIRS is a more affordable and portable technology that does not make noise, so this neuroimaging technique is well suited for studying the brain activity of people with autism.

To analyze the brain activity data, the researchers used ϵ -complexity coefficients. This relatively new mathematical approach allowed the researchers to extract meaningful information from complex and noisy patterns. Based on the data processed in this way, the researchers used classical classification methods to divide the subjects into groups depending on the characteristics of brain activity when performing the synchronization task.

Experimenting with these algorithms, scientists were able to achieve prediction accuracy of more than 90%: in 9 out of 10 cases, the assessment of the severity of autistic traits in subjects using neuroimaging coincided with the results of the questionnaire that the participants filled out at the beginning.

The new technology can be used as a diagnostic tool for autism spectrum disorders, as it is more accessible and convenient when working with people with ASD compared to fMRI.

In addition, this study has successfully applied ϵ -complexity theory for the first time to decode data recorded with fNIRS. This opens up the possibility of using the [new algorithm](#) in other studies with fNIRS technology.

'We used ϵ -complexity methodology, which has been developed over the past few years by dr. Darkhovsky B.S., in our study to develop an algorithm for classifying patients based on fNIRS records of brain activity. The resulting model-free technology for [time series analysis](#) can

be used in cases where the prerequisites of traditional methods of analysis are violated—for example, when working with significantly non-stationary ECG and EEG signals. Therefore, this technology can be used to study other [mental disorders](#) and features, the patterns of which appear in the data," says study co-author Yuri Dubnov, a senior lecturer of computer science at HSE University.

More information: Anat Dahan et al, Brief Report: Classification of Autistic Traits According to Brain Activity Recoded by fNIRS Using ϵ -Complexity Coefficients, *Journal of Autism and Developmental Disorders* (2020). [DOI: 10.1007/s10803-020-04793-w](https://doi.org/10.1007/s10803-020-04793-w)

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