nature research

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Last updated by author(s): Dec 22, 2021

Reporting Summary

Nature Research wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Research policies, see our Editorial Policies and the Editorial Policy Checklist.

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed
☐	☒ The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement
☐	☒ A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☐	☒ The statistical test(s) used AND whether they are one- or two-sided *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
☒	☐ A description of all covariates tested
☐	☒ A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☐	☒ A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☒	☐ For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted *Give P values as exact values whenever suitable.*
☒	☐ For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐ For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☒	☐ Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated

Our web collection on statistics for biologists contains articles on many of the points above.

Software and code

Policy information about availability of computer code

Data collection	The collected neural and behavioral data is a modified version of clinical recordings for purpose of seizure localization and clinical decisions. They will be made available to the lead contact
Data analysis	https://github.com/MBijanzadeh/DecodingAffect

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research guidelines for submitting code & software for further information.

Data

Policy information about availability of data

All manuscripts must include a data availability statement. This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A list of figures that have associated raw data
- A description of any restrictions on data availability

Data used to generate the findings of this study will be available upon request to the Lead Contact.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☐ Life sciences ☒ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

Behavioural & social sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description	We obtained continuous intracranial electroencephalography (iEEG) recordings from the mesolimbic network in 11 patients with epilepsy during multi-day hospitalizations. We have annotated behavioral affective moments using 24/7 audio-video recordings from subjects' hospital rooms that time-locked with the neural data. Using data driven approaches we examined the underlying neural signatures of naturalistic affective behaviors.
Research sample	Subjects included 11 patients (6 females, 5 males, age: 20-43, Table S2), who has been diagnosed with treatment-resistant epilepsy and were undergoing (iEEG) implantation for seizure localization.
Sampling strategy	Subjects that accepted to provide informed consent, or at least had implanted electrodes in 3/5 regions, or the number of behavioral emotional expressions was sufficient enough to train the RF classifiers were included in the study. We assessed the statistical significance of all models by training surrogate random forest models after shuffling the categorical labels within each fold of each dataset (to keep the balance between affective classes). All p-values were computed using non-parametric ranksum test between pairs of distribution for all pairwise statistical test mentioned in the main text or Kruksal-wallis multiple comparison test followed by Bonferroni correction for multiple groups. Please refer to the "methods" section.
Data collection	Over multiple days of monitoring, subjects underwent continuous 24-hour audio, video recording and iEEG monitoring through the Natus clinical recording system as a part of routine clinical care. Electrophysiological data were collected at sampling rates at either 512 Hz or 1024 Hz. All mesolimbic structures were sampled by subdural grid, Ad-Tech 4-contact strip and Ad-Tech 4/10-contact depth electrodes (10mm or 6mm center to center spacing). Trained human raters (11 total) manually annotated these recordings during instances of behavioral and emotional expression. In general, the annotations started two days post-electrode implantation – typically after patients recovered from the implant surgery. As a part of their review, human raters imported the video recordings into ELAN software, a linguistic ethnographic software, and used a custom template to mark individual activities and emotional states the patient engaged in throughout these continuous recordings . For more information please refer to the methods section of the paper.
Timing	The data has been collected over the course of 4 years from epileptic patients. The decoders were trained within each subject. The timing gaps is not a factor in this study.
Data exclusions	Subjects that did not provide informed consent, or at least had implanted electrodes in 3/5 regions, or the number of behavioral emotional expressions were not sufficient enough to train the RF classifiers were excluded in the study.
Non-participation	The nature of the study and patient inclusion was defined after subjects were dispatched from the hospital. Please refer to sampling strategy and Data exclusion. Thus subject drop out was not applicable in this study.
Randomization	We have included 10 and 5 subjects for training within subject positive and negative decoders, because the available number of annotated behaviors were more frequent for positive affective behaviors (e.g. smiling) than negative affective behaviors . Please refer to the method and results section of the study. We have shuffled the labels regarding affective behaviors to generate surrogate models for statistical test. Please refer to the methods section.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology and archaeology
☒	☐ Animals and other organisms
☐	☒ Human research participants
☒	☐ Clinical data
☒	☐ Dual use research of concern

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Human research participants

Policy information about studies involving human research participants

Population characteristics	"See above"
Recruitment	"See above" . Please refer to the sampling Strategy
Ethics oversight	All procedures were approved by the University of California, San Francisco Institutional Review Board. All subjects gave written informed consent to participate in the study prior to surgery.

Note that full information on the approval of the study protocol must also be provided in the manuscript.