nature portfolio

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Reporting Summary

Nature Portfolio 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 Portfolio 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	No software was used.
Data analysis	The open-sourced library TensorFlow was used to develop the models, and the statsmodels library and custom Python code were used for statistical analysis.

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 Portfolio 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 description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our policy

The main data supporting the results in this study are available within the paper and its Supplementary Information. This study used de-identified data from EyePACS Inc. and the teleretinal diabetes screening program at the Atlanta Veterans Affairs. Interested researchers should contact J.C. (jcuadros@eyepacs.com) to inquire about access to EyePACS data and approach the Office of Research and Development at https://www.research.va.gov/resources/ORD_Admin/ord_contacts.cfm to inquire about access to VA data.

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

Life sciences study design

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

Sample size	Explicit sample-size calculations were not done; instead, we aimed at having geographically separate regions for broad external validation (that is, if the model was trained on California data, it was evaluated on non-California data).
Data exclusions	The images and baseline characteristics needed to be available. In addition, Los Angeles county was excluded from the training data because it was held out for other projects.
Replication	Broad geographical validation across 4 validation sets spanning 198 sites in 18 other US states.
Randomization	Randomization was not applicable, because this study was not interventional. However, a negative control prediction (cataract) was used for the saliency experiments.
Blinding	All grading or labelling were done blinded to model predictions.

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	Details are provided in Table 1. Briefly, the EyePACS datasets and validation set C correspond to patients with diabetes, whereas validation set D also includes patients without diabetes who presented to eye care at the VA.
Recruitment	This was a retrospective study involving de-identified data, and hence there was no explicit enrollment. Please see Methods for details.
Ethics oversight	Ethics review and Institutional Review Board exemptions for this retrospective study on de-identified data were obtained via the Advarra Review Institutional Review Board.

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

Clinical data

Policy information about clinical studies

All manuscripts should comply with the ICMJE guidelines for publication of clinical research and a completed CONSORT checklist must be included with all submissions.

Clinical trial registration	Not applicable, because this study was not prospective nor interventional.
Study protocol	Not applicable, because this study was not prospective nor interventional.

Data collection	This work used de-identified images and baseline characteristics from 4 teleretinal eye screening datasets in the US. The first two datasets were the California and non-California cohorts from EyePACS, a teleretinal diabetic screening service in the US. The third and fourth datasets were from the Atlanta Veterans Affairs (VA), which served multiple community-based outpatient clinics (CBOCs) in the greater Atlanta area.
Outcomes	HgA1c values were extracted from the relevant records by each site; diabetic retinal diseases were graded by graders blinded to model predictions.