www.nature.com/eye

The ROYAL COLLEGE of OPHTHALMOLOGISTS

CORRESPONDENCE

Check for updates

Advances in machine learning to detect preventable causes of blindness

Eye (2023) 37:2582–2583; https://doi.org/10.1038/s41433-022-02354-2

We read with interest Dewing et al.'s paper on the disparity between funding for eye research versus the significant cost of sight-loss in the UK [1]. This article highlights the comparatively low level of ophthalmic research funding in the UK, when compared to cardiovascular disease and cancer research, despite the significant economic impacts of visual impairment [1]. Preventable vision loss imposes significant costs on health, public and private funds, with the economic impact of blindness and visual impairment in the United Kingdom estimated to be over £15.8 billion in 2013 [2]. With aging populations, the prevention of avoidable blindness will become an even greater challenge and novel, more efficient methods of vision screening need to be implemented.

The advent of machine learning, particularly deep learning, has revolutionized the field of medicine. The integration of machine learning with visual assessment technology is an emerging method to reduce preventable blindness and ophthalmic care inequalities. Further research into improving vision screening is essential, as even in England, a significant proportion of cases of treatable disorders including age-related macular degeneration remain unreported [3]. Current home screening for neovascular AMD involves traditional paper based Amsler grids which involves subjective evaluation of vision combined with serial clinic follow-up. With increasing aging populations worldwide, screening populations for preventable causes of blindness will become even more challenging. Although our current research centers on the development of a visual assessment system with machine learning algorithms to assess subtle changes in astronaut vision during spaceflight, we believe that the technology has potential terrestrial applications as well [4, 5]. This technology aims to detect and more objectively quantify, using a single device, the many parameters of subjective visual function (e.g., visual acuity, color vision, contrast sensitivity, visual field testing, and assessment for metamorphopsia).

Low-cost visual assessment with VR headsets combined with AI may be able to provide new possibilities for ophthalmic screening in these underserved areas. These headsets could be made available to communities for synchronous or asynchronous evaluations to improve screening. We believe that both machine learning and VR visual assessment technology are promising methods to help reduce preventable blindness worldwide in the coming future.

Ethan Waisberg [1], Joshua Ong [2], Phani Paladugu [3], Sharif Amit Kamran [4], Nasif Zaman [4], Alireza Tavakkoli [4] and Andrew G. Lee [5,6,7,8,9,10,11,12]✉
[1]*University College Dublin School of Medicine, Belfield, Dublin, Ireland.* [2]*Michigan Medicine, University of Michigan, Ann Arbor, MI, USA.* [3]*Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA, USA.* [4]*Human-Machine Perception Laboratory, Department of Computer Science and Engineering, University of Nevada, Reno, Reno, NV, USA.* [5]*Center for Space Medicine, Baylor College of Medicine, Houston, TX, USA.* [6]*Department of Ophthalmology, Blanton Eye Institute, Houston Methodist Hospital, Houston, TX, USA.* [7]*The Houston Methodist Research Institute, Houston Methodist Hospital, Houston, TX, USA.* [8]*Department of Ophthalmology, Neurology, and Neurosurgery, Weill Cornell Medicine, New York, NY, USA.* [9]*Department of Ophthalmology, University of Texas Medical Branch, Galveston, TX, USA.* [10]*University of Texas MD Anderson Cancer Center, Houston, TX, USA.* [11]*Texas A&M College of Medicine, Bryan, TX, USA.* [12]*Department of Ophthalmology, The University of Iowa Hospitals and Clinics, Iowa City, IA, USA.* ✉*email: aglee@houstonmethodist.org*

REFERENCES

1. Dewing JM, Lotery AJ, Ratnayaka JA. The disparity between funding for eye research vs. the high cost of sight-loss in the UK. *Eye*. Published online September, 2022. https://doi.org/10.1038/s41433-022-02228-7
2. Pezzullo L, Streatfeild J, Simkiss P, Shickle D. The economic impact of sight loss and blindness in the UK adult population. BMC Health Serv Res. 2018;18:63. https://doi.org/10.1186/s12913-018-2836-0
3. Brown K, Bunce C, Onabanjo O, Strong SA, Patel PJ. Is preventable sight loss truly preventable? An exploration of a public health indicator for sight loss due to age-related macular degeneration in England. Eye. Published online February, 2022. https://doi.org/10.1038/s41433-022-01933-7
4. Ong J, Tavakkoli A, Zaman N, et al. Terrestrial health applications of visual assessment technology and machine learning in spaceflight associated neuro-ocular syndrome. npj Microgravity. 2022;8:37. https://doi.org/10.1038/s41526-022-00222-7
5. Ong J, Zaman N, Kamran SA, et al. A multi-modal visual assessment system for monitoring Spaceflight Associated Neuro-Ocular Syndrome (SANS) during long duration spaceflight. J Vis. 2022;22:6. https://doi.org/10.1167/jov.22.3.6

AUTHOR CONTRIBUTIONS

EW—Conceptualization, Writing. JO—Conceptualization, Writing. PP—Review, Intellectual Support. SK—Review, Intellectual Support. NZ—Review, Intellectual Support. AT—Review, Intellectual Support. AGL—Review, Intellectual Support.

Received: 25 October 2022 Revised: 7 November 2022 Accepted: 2 December 2022
Published online: 10 December 2022

FUNDING
NASA Grant [80NSSC20K183]: A Non-intrusive Ocular Monitoring Framework to Model Ocular Structure and Functional Changes due to Long-term Spaceflight.

COMPETING INTERESTS
The authors declare no competing interests.

ADDITIONAL INFORMATION
Correspondence and requests for materials should be addressed to Andrew G. Lee.

Reprints and permission information is available at http://www.nature.com/reprints

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.