CORONASYS INNOVATION SHEET 44

VIRAL ESCAPE MODELLING

Background

Newly emerged mutations of the coronavirus are causing great concern. Not only do they seem to be more infectious[1][2] and therefore put even more strain on already heavily burdened health systems. Some researchers are also concerned that the new variants (and other mutations of SARS-CoV-2 that may emerge in the future) could temporarily or permanently compromise the effectiveness of some vaccines.

Features

Some viruses, like for example SARS-CoV-2 but also influenza and HIV, can mutate quite quickly, which makes it very difficult to produce effective vaccines against them. The mutation allows them to bypass the antibodies produced by a particular vaccine, through a process known as "viral escape". Researchers from the Massachusetts Institute of Technology[3] have developed an AI (Artificial Intelligence) model that aims at predicting which parts of the viral surface are likely to mutate and which are not[4]. The model is based on models that were originally designed to analyse language[5]. It "identified escape mutations as those that preserve viral infectivity but cause a virus to look different to the immune system, akin to word changes that preserve a sentence's grammaticality but change its meaning" (Hie et al., 2021)[6].

State of information: 01/15/2021

Publication: 01/14/2021

Country: USA

Focus areas: AI, Research, Prediction

Developers: Massachusetts Institute of Technology (MIT)

Beneficiaries:

- Scientists
- Vaccine developers

Potentials

The identification of viral surface structures that are not likely to mutate could help vaccine developers to identify possible targets for new vaccines. The researchers aim to apply their model not only on SARS-CoV-2, HIV, and Influenza but also on the production of the so-called cancer vaccines[7]. The technique also lays the foundation for even more complex modelling[8].

Points to consider

The researchers have also applied their model to the new variants of SARS-CoV-2 that have recently emerged in the UK and South Africa after their paper was accepted for publication. Those results have not been published yet[9].

Conclusion

The model might contribute to future efforts to control viral spread and provide effective vaccines against a variety of different pathogens.

[1] Deutsches Ärzteblatt. "Studie: Neue SARS-CoV-2-Variante Aus England Zu 56 % Ansteckender," December 28, 2020. https://www.aerzteblatt.de/nachrichten/119733/Studie-Neue-SARS-CoV-2-Variante-aus-England-zu-56-ansteckender.

[2] Davies, Nicholas G., Rosanna C. Barnard, Christopher I. Jarvis, Adam J. Kucharski, James Munday, Carl A. B. Pearson, Timothy W. Russell, et al. "Estimated Transmissibility and Severity of Novel SARS-CoV-2 Variant of Concern 202012/01 in England." Preprint. Epidemiology, December 26, 2020. https://doi.org/10.1101/2020.12.24.20248822.

[3] Massachusetts Institute of Technology. "The Massachusetts Institute of Technology (MIT)." Massachusetts Institute of Technology, 21. http://web.mit.edu.

[4] Hie, Brian, Ellen D. Zhong, Bonnie Berger, and Bryan Bryson. "Learning the Language of Viral Evolution and Escape." Science 371, no. 6526 (January 15, 2021): 284–88. https://doi.org/10.1126/science.abd7331.

[5] Massachusetts Institute of Technology. "Model Analyzes How Viruses Escape the Immune System," January 14, 2021. https://phys.org/news/2021-01-viruses-immune.html.

[6] Hie, Brian, Ellen D. Zhong, Bonnie Berger, and Bryan Bryson. "Learning the Language of Viral Evolution and Escape." Science 371, no. 6526 (January 15, 2021): 284–88. https://doi.org/10.1126/science.abd7331.

[7] Massachusetts Institute of Technology. "Model Analyzes How Viruses Escape the Immune System," January 14, 2021. https://phys.org/news/2021-01-viruses-immune.html

[8] Hie, Brian, Ellen D. Zhong, Bonnie Berger, and Bryan Bryson. "Learning the Language of Viral Evolution and Escape." Science 371, no. 6526 (January 15, 2021): 284–88. https://doi.org/10.1126/science.abd7331.

[9] Massachusetts Institute of Technology. "Model Analyzes How Viruses Escape the Immune System," January 14, 2021. https://phys.org/news/2021-01-viruses-immune.html

Background on Innovation Sheet Series

As part of a real-time evaluation of the SARS CoV 2 pandemic (with focus on epidemiological, medical, economical, societal, technical, and cultural developments in Germany and Armenia) the CoronaSys research team, under the leadership of Prof. Dr. Martin Voss, is conducting a continuous monitoring of developments and medical, technical, and social innovations concerning Covid-19.

Multiple national and international media outlets, research platforms, and scientific and organizational guidelines, briefs, and updates are screened to feed into this outlet. The rationale behind this is to support the projects' network partners in Armenia and Germany with short summaries of key developments and promising innovations that are shaping the global, German, and Armenian outbreak response and recovery.

The aim of these short briefs is to give condensed and structured information on selected innovations emerging out of the conducted horizon scanning. This could be mainstream big-ticket items or fringe subjects that are easily overlooked in the global flood of information. Some innovations will be followed through their evolution in time while others may only appear once. While subjectively selected, the briefs are descriptive in nature and leave analysis and critical interpretation to the reader. Network partners in both countries are invited to provide feedback on their interest areas and suggest particularly relevant topics for the CoronaSys Workshop series.

The CoronaSys Innovation Sheet Series is published by the Academy of the Disaster Research Unit, which is, as a non-profit limited liability company, a spin-off of the Disaster Research Unit at the Free University of Berlin. The series is part of the research project "CoronaSys: Addressing the corona pandemic in Armenia through systemic risk management", sponsored by the German Federal Ministry of Education and Research.

If you have any questions, suggestions, or if you wish to be taken on (or off) the project mailing list for CoronaSys updates, innovation sheets, and workshop invitations, please send a message to Janina Schäfer (schaefer@a-kfs.de). For general project inquiries, you may contact the team lead Sara Merkes (merkes@a-kfs.de) or the project lead Martin Voss (voss@a-kfs.de).

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All previous CoronaSys Innovation Sheets are available online:
http://coronasys.a-kfs.de/category/innovation-stream/

Project lead:
Prof. Dr. Martin Voss
Email: voss@a-kfs.de
Phone: +49 30 838 72613
Website: http://coronasys.a-kfs.de

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Akademie der Katastrophenforschungsstelle (AKFS) gGmbH
c/o Katastrophenforschungsstelle
Carl-Heinrich-Becker-Weg 6-10
12165 Berlin