SEPT - 2023 - RRR: project - NEWSLETTER -

How can AI help physicians improve the screening of an eye disease?

RRR

A reminder on the Retina Read Risk project!

A few months ago, we told you about the latest updates of the Retina Read Risk project, which aims to provide a solution for physicians who monitor diabetic patients, with a device that enables them to better assess the risk of developing an ophthalmic disease known as diabetic retinopathy. Artificial intelligence is the central technology in this project, and it offers multiple advantages for screening and combatting this disease. As part of the project, we had the chance to meet with Dr Julián Cristiano from the Institut d'Investigació Sanitària Pere Virgili (IISPV), one of the partners in the European consortium developing the project, who gave us an insight on how AI works, and how it is employed in the Retina Read Risk solution.

Focus on the Artificial Intelligence developed for the Retina Read Risk project

Dr Cristiano, thank you very much for agreeing to this interview. You are an electronical engineer from the Universidad Industrial de Santander (Colombia) and a Doctor of Philosophy (PhD) in Computer Science from the Universitat Rovira i Virgili (Spain). Besides this, you are a senior researcher from the Institut d'Investigació Sanitària Pere Virgili (IISPV). Can you tell us in detail how you came to work in this field?

Doctor Julián Cristiano: *I have always been fascinated by mathematics, statistics, physics, system modeling, programming, and problem solving using intelligent algorithms. Thanks to my interest in these fields, I have studied and worked on several projects for many years developing applications that use Artificial Intelligence (IA) strategies to solve real problems in various fields, such as the health care sector.*

So, you have always been interested in problem solving and writing a logical system to achieve that goal. For those of us who are not familiar, can you remind us what an IA is? Can you explain how AI can be used in health research?

Dr Cristiano: *AI is a set of computational algorithms that allow a large amount of data to be analyzed in depth, to extract and model its most important characteristics in order to solve a real problem. In health research, AI can be used to analyze any type of data that can be digitalized, such as medical images and quantitative [e.g. visual acuity, blood sugar level] or qualitative [e.g. pain, subjective feelings] variables from the patient's electronical health reports. AI systems could have the ability of self-learning if they have been designed to initially identify and then automatically extract the most relevant features from the data. The objective is the development of tools that improve medical decision-making regarding the early diagnosis of patients' diseases.*

Thank you. If I understood correctly, by computational algorithm you mean that AI is a composition of ordered sequences of operations, that are aimed to identify, in large set of data, different patterns to solve a specific problem. If we return to the Retina Read Risk topic: Can you explain what we expect from AI?

Dr Cristiano: *In the Retina Read Risk project, AI is used for the development of two complementary systems that help ophthalmologists with the early detection of diabetic retinopathy (DR). One of them is called the MIRA system: it automatically analyzes fundus images obtained with a portable retinograph to determine if a patient has some level of DR. The MIRA system uses an AI technique called convolutional neural networks[1]. The other system is called RETIPROGRAM and it is used to analyze patient's electronic health reports to automatically determine if a patient is at negative or positive risk of developing DR. The latter uses an AI technique called random fuzzy forest[2] to analyze the data*

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[1] AI architecture that is specifically designed to interpret images. It is ordering calculation to transform the image part by part to highlight essential characteristics to recognize elements on it.

[2] AI architecture based on decision trees (hence 'forest') to group together to enable the calculation of a statistic space from a template. 'Fuzzy' means it is not required to have all the data map in the decision trees to get a result. It is generally used to characterize set of data.

and model the risk prediction system. These two systems are expected to improve the patient's early detection of diabetic retinopathy.

"Convolutional neural networks", "random fuzzy forest", I am afraid I am confused by these terms…

Dr Cristiano: *You just need to understand that the two AI systems differ in the types of data they analyze. The MIRA system is used to classify a patient's fundus image into four levels of DR and the other system, RETIPROGRAM, is used for computing the risk that a person has of developing DR. Both systems use different AI strategies that were selected according to the type of input data, as well as taking into account the expected response of the system.*

Thank you for this explanation, could you also tell us how they interact with each other?

Dr Cristiano: *They interact by being tools that provide complementary information of great value to help the final patient's diagnostic, that always must be given by a health professional. The patient's risk of developing DR is computed by the RETIPROGRAM system, and the MIRA system calculates the stage of the DR disease from the analysis of the patient's fundus image in four possible levels (No DR, mild DR, moderate DR and severe DR).*

Great, but if the physician will use it as a base for their diagnosis, the tool needs to be dependable. Can you tell us how the reliability of the AIs used for RRR is evaluated?

Dr Cristiano: *Systems reliability is assessed using standard metrics such as sensitivity, specificity, and accuracy. These indicators allow to evaluate the times that the AI system is giving a wrong result compared to the medical criteria when its performance is evaluated using a dataset unknown by the system.*

In addition to the previous metrics, the characteristics of the input data used by the algorithms to compute their response are also studied. For example, in the case of the MIRA system, it is verified whether the system correctly uses eye lesions, such as microaneurysms or hemorrhages, to classify the level of retinopathy. In the case of the RETIPROGRAM system, the idea is to find out which variables within the patient's clinical health record have influenced more the response computed by the system for predicting the patient's risk of developing the disease. It is very important that the results computed by AI systems can be explained to verify that they are correctly aligned with medical criteria, in order to guarantee their reliability.

If I understood correctly, a part of the work consists in two strategies: the first one is focused on challenging the AI and describing its capability to give a correct, incorrect, other assessment. … The other part aims at understanding how the two AIs work to generate this assessment. Based on your experience, how do healthcare professionals generally react when they discover the capabilities of the AIs developed by RRR?

Dr Cristiano: *Healthcare professionals really like the systems developed within the framework of the RRR project. They find these systems very useful and deem them to be complementary tools that will allow them to reduce the time they spend reading fundus images and analyzing electronic health records. They consider these AI systems will also enable massive screenings in urban and rural areas which will foster early detection of patients at high risk of developing the disease.*

Thank you so much for your very clear explanations. Do you have a word to conclude this interview?

Dr Cristiano: *I believe that RRR will positively impact the patients' life quality. I also faithfully believe that AI will greatly benefit the healthcare field by detecting diseases at very early stages, assuring a better disease prognosis. These AI systems will make possible to improve people's quality of life by increasing the early detection of DR, relieve health personnel workload and decrease high treatment costs by reducing the number of patients with advanced stages of the disease.*

To stay in touch with the Retina Read Risk project, please subscribe to the newsletter.

The Consortium of Retina Read Risk project

About RetinaReadRisk

RetinaReadRisk is the spin-off created within the framework of the European project Retina Read Risk, and founded by Institut d'Investigació Sanitària Pere Virgili (IISPV), GENESIS Biomed, UP2Smart and Grupo TRC last February, it aims to bring a solution to facilitate screening of diabetic retinopathy. The creation of the company emerged from a project supported by EIT Health, an aspect that also gives it an international projection. The new spin-off RetinaReadRisk benefits from more than 10 years of work from researchers and hopes to attract private and public funding in the next 2-3 years to be able to finalize the development of the product and commercialize the solution developed during Retina Read Risk project.

For more information visit: https://retinareadrisk.eu/

About the Institut d'Investigació Sanitària Pere Virgili (IISPV)

The IISPV is a biomedical research institute placed in the province of Tarragona (Catalonia, Spain) that combines clinical and basic research in order to accelerate the translation of knowledge to the benefit of patients. Founded in 2005, the institute integrates the Hospital Universitari de Tarragona Joan XIII, the Hospital de Tortosa Verge de la Cinta, the Hospital Universitari Sant Joan de Reus, the Hospital Universitari Institut Pere Mata and the Universitat Rovira i Virgili, in order to bring together and manage biomedical research and innovation in the territory. The IISPV aims to be a national and international reference centre in biomedical research and translation, at the service of the population, linking the health centres to the community.

For more information visit: https://www.iispv.cat/en/

About the Institut Català de la Salut (ICS)

The Catalan Institute of Health (ICS) is the largest public health services company of Catalonia with a staff of over 51,700 professionals, that provides health care to nearly six million people across the country. As a reference entity of the public health system, the aim of ICS is to improve people's health and quality of live, through the provision of innovative and excellent health services, regarding both the promotion of health and the treatment of diseases, from the most prevalent to the most complex ones. ICS structure includes 949 primary care centers and local consultancy, 8 Hospitals and 7 research institutes, including IISPV as a one of them. Our organization mission states to be a model that, through its structure and participants, responds to projects of strategic relevance to the ICS, guaranteeing the capacity and sufficient knowledge to execute them in short terms and obtaining fast returns in the form of results and value for the organization. ICS' vision would become a reference and reliable model for all management structures, corporate and territorial, and ICS professionals to promote innovative projects, advise on their approach and relate, if necessary, external agents that collaborate in its deployment and / or provide resources. Since mid-2021, Mr Francesc Iglesias, currently

responsible of the Research and Innovation support office of ICS, is the chairman of the Governing Board of EIT Health Spain.

For more information visit: http://ics.gencat.cat/es/inici/index.htm

About Telefonica

Telefónica is one of the world leaders integrated operator in the telecommunication sector, providing communication, information and entertainment solutions, with operations in 12 countries in Europe and Latin American. As of the end of 2021, Telefónica's total number of customers amounted more than 369 million and 103,000 professionals. Telefónica spends more 4,600 million euros each year on technological innovation, including more than 950 million euros on R&D of new products, services and management systems and improvement of existing ones. In the health sector, Telefonica is working in several areas like Telemedicine, geo-localised transport of living tissue between hospitals, assisted surgery operations with 5G and VR, etc.

For more information visit: https://www.telefonica.com/en/

About the Grupo TRC

Grupo TRC has over 30 years of experience working hand in hand with groups of hospitals, developing applications to optimize and integrate all activities and processes of a health center in a unified platform.

The experience in the integration of advanced telecommunications systems, in the deployment of voice operator and connectivity services and in the development of customized software, both public and private sectors, national and international, are the guarantee of the commitment to the quality of our deployments, solutions and services.

For more information visit: https://www.grupotrc.com/

About GENESIS Biomed

GENESIS Biomed is a consultancy firm in the biomedical healthcare sector specialized in providing consulting services in the genesis and first phases of lifecycle of biomedical spin-off and start-up companies, entrepreneurs, and research centers.
Based in its expertise GENESIS Biomed helps entrepreneurs and researchers to shape their business plan and supports them in the private fundraising process. GENESIS Biomed has raised >67,5 M€ in the last years in 19 rounds.
GENESIS Biomed expertise domains are biopharmaceutical, biotechnological, medical devices, in vitro diagnostic, nutraceutical and cosmetic. With more than 20 years of expertise in the healthcare sector, GENESIS Biomed is born in May 2017, and it is located in the Barcelona Science Park, and also with company sites in Madrid center and at La Marina in Valencia.

For more information visit: https://genesis-biomed.com/

About E-seniors

E-Seniors is a French non-profit association, founded in 2004 by Monique EPSTEIN. E-Seniors aims at fighting against e-exclusion by providing access to and training in ICT to seniors and/or disabled

people. Its main objectives are bridging and shrinking the digital gap between generations, caring for elders by fighting against senior isolation, and opening new horizons for efficient use of free time. Besides teaching "basic computer skills", E-Seniors has opened more thematically oriented workshops for "advanced" students, dealing with, for example, digital images and sounds, interactive messaging and chat, "writing memories", and meetings dealing with the fight against e-exclusion. Through its work for elderly people and with them, the association tries as well to enhance awareness of the importance of ICT solutions in everyday life.

For more information visit: https://www.e-seniors.asso.fr/en_main.htm

About Fondation de l'Avenir

The Fondation de l'Avenir aims to support and promote applied medical research for the benefit of patients. Created in 1987 by the Mutualité, it has been recognized as a public utility since 1988. Today, the Foundation is the link between the mutualist movement and public health actors. The Fondation de l'Avenir can count on more than 43,000 donors and 40 partners from the social and solidarity economy, all of whom are mobilized to advance medical progress. The Foundation has financed more than 1,300 projects since its creation, including many world firsts. It is managed by an Executive Board, chaired by Marion LELOUVIER, under the control of a Supervisory Board, chaired by Daniel HAVIS.

For more information visit: https://www.fondationdelavenir.org/

About EIT Health

EIT Health is a network of best-in-class health innovators with approximately 130 partners and is supported by the European Institute of Innovation and Technology (EIT), a body of the European Union. We collaborate across borders to deliver new solutions that can enable European citizens to live longer, healthier lives.
As Europeans tackle the challenge of increasing chronic diseases and multi-morbidity, and seek to realise the opportunities that technology offers to move beyond conventional approaches to treatment, prevention and healthy lifestyles, we need thought leaders, innovators and efficient ways to bring innovative healthcare solutions to market. EIT Health addresses these needs. We connect all relevant healthcare players across European borders – making sure to include all sides of the "knowledge triangle", so that innovation can happen at the intersection of research, education and business for the benefit of citizens.

EIT Health: Together for healthy lives in Europe.
For more information visit: www.eithealth.eu.

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