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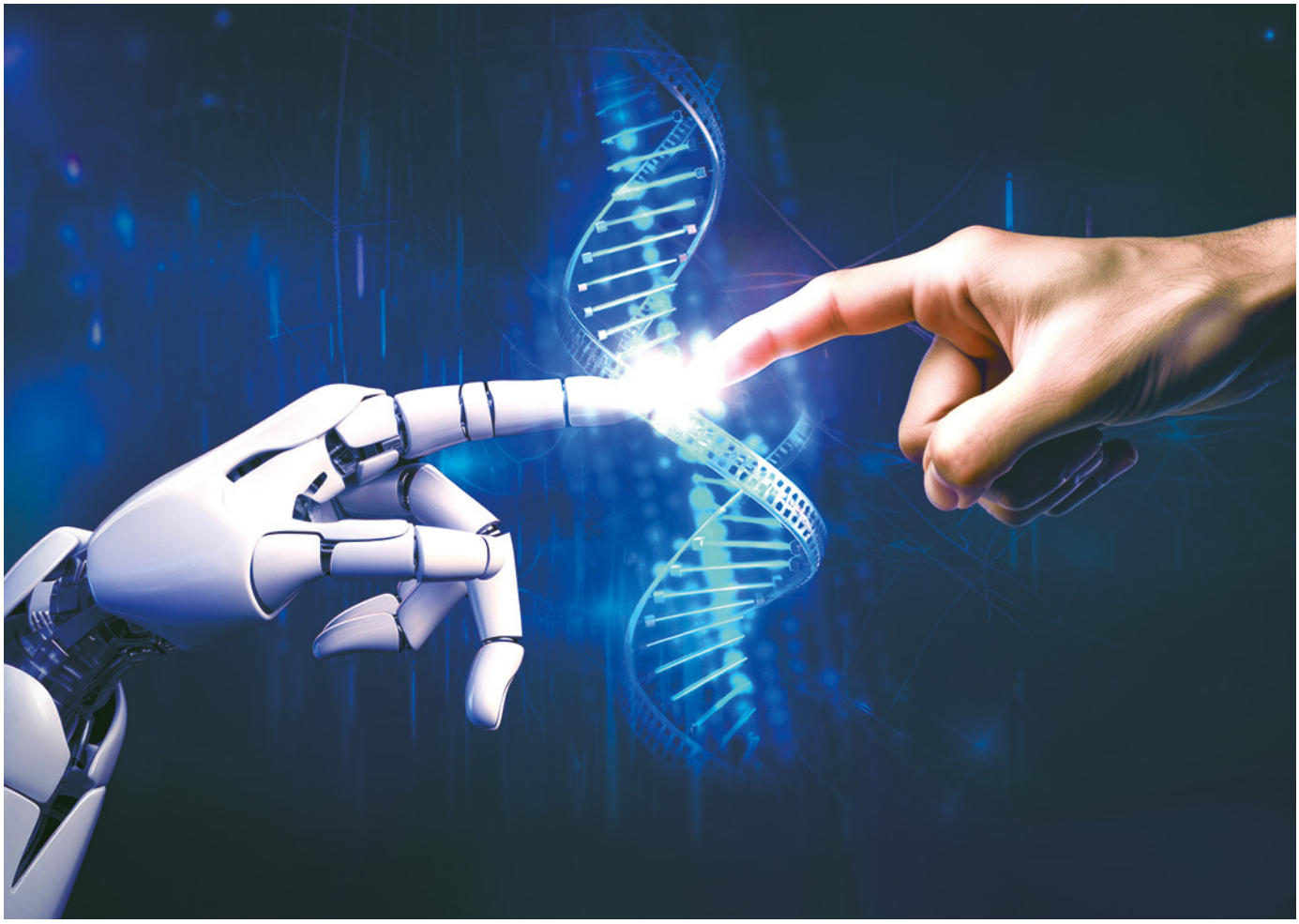

Applications of AI in Diabetes Management

Amid the technological revolution in diabetes over recent years, artificial intelligence (AI) has emerged forcefully as a rapidly growing technology with the potential to help analyse complex data, interpret images, and provide personalised interventions for patients.

AI has been defined by Baker and Smith as "machines or computers that perform cognitive tasks, typically associated with the human mind, particularly learning and problem-solving." Within AI subtypes applied to health we find: Machine Learning (ML), which can be described as an AI algorithm that extracts patterns from raw data to make data-driven decisions; Deep Learning (DL), a subfield of ML based on brain-inspired algorithms; Generative AI, which creates new content (text, images, etc.); Natural Language Processing (NLP), which enables analysis of medical texts (records, articles, etc.); and Dashboards, tools that allow analysis of aggregated data.

The possibilities AI can offer—setting aside those related to diabetes education, already covered in a previous article in this journal (https://www.revistadiabetes.org/tecnologia/que-papel-tiene-o-jugara-la-inteligencia-artificial-en-la-educacion-terapeutica-en-diabetes/)—are numerous, and some are already part of routine practice. Below are several applications of AI in diabetes according to the AI subtype used.

MACHINE LEARNING

Because these algorithms learn from data to make predictions or decisions, ML applications in diabetes range from predicting hypo- and hyperglycaemia, through insulin dose calculation, to identifying patient profiles and planning personalised treatments.

Examples of prediction include the Accu-Chek SmartGuide® sensor (https://www.accu-chek.es/productos/smart-guide-mcg), which, in addition to standard alerts, can predict glucose levels over the next two hours and the probability of nocturnal hypoglycaemia, enabling the person with diabetes to act in advance; and Medtronic's SmartMDI® system, which combines data from a smart pen and a glucose sensor to issue alerts for hyperglycaemia due to missed or insufficient doses, together with a recommended user action (https://www.medtronic-diabetes.com/es-ES/SmartMDI).

Several studies have been published on the use of ML for early detection of diabetes (1), prediction of pancreatic cancer risk in this population (2), cardiovascular risk prediction, and even identification of patient profiles with potential response to a drug (3), and, more recently, prediction of retinopathy in type 2 diabetes mellitus (4).

DEEP LEARNING

The clearest example of DL in diabetes is in diagnosing retinopathy, where commercial software already exists, but there is growing research into its potential for event prediction—such as estimating cardiovascular risk in people with type 2 diabetes via retinal images themselves, or identifying autonomic neuropathy by analysing electrocardiograms (5–7).

There are also DL-based apps we can use day-to-day for detecting nutritional composition—highly useful for the arduous task of carbohydrate counting. Examples include LogMeal® and goFOOD®, compatible with Android and iOS.

GENERATIVE AI

Generative AI is a language model approach that can create text, images, etc., by analysing large datasets. Increasing numbers of health professionals use Generative AI tools (ChatGPT, Gemini, Perplexity, Copilot, Gamma-app, DeepSeek, etc.) as day-to-day professional support for literature searches, data analysis, texts and images—as well as creating them—preparing presentations, generating tailored content, assisting with drafting, and much more. People with diabetes likewise increasingly use tools such as ChatGPT to answer questions about handling different situations or as an information source, further displacing the famous "Dr Google," which has now incorporated AI to provide responses to searches.

Other examples of generative AI are digital or virtual twins: virtual models that replicate real-world objects, systems, or processes, using real-time data to simulate behaviour and support decision-making. They can be used to optimise processes, predict problems, and improve performance of products, systems, or even cities. Simulators let us, for example, model what would happen to a patient if a particular treatment or regimen were prescribed, avoiding trial-and-error.

NATURAL LANGUAGE PROCESSING

A clear example of NLP is health chatbots: »

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PEOPLE WITH DIABETES ARE INCREASINGLY USING TOOLS SUCH AS CHATGPT TO RESOLVE QUESTIONS ABOUT HANDLING DIFFERENT SITUATIONS OR AS AN INFORMATION SOURCE, GRADUALLY DISPLACING THE FAMOUS "DR GOOGLE"

» AI-based virtual assistants designed specifically to interact with patients, health professionals, or family members to provide information, answer questions, and support processes related to health care. In diabetes, besides resolving doubts, they can summarise an Ambulatory Glucose Profile (AGP), answer direct questions about displayed data, assess adherence to prescriptions, compliance, insulin dose titration, therapeutic education, and more.

DASHBOARDS

Finally, dashboards—by analysing aggregated data—provide an overall view that enables grouping patients by level of control, complexity, and complications, thereby allowing prioritisation for individualising care and even incorporating decision-support systems or personalised therapeutic education programmes. D

CONCLUSIONS

Adopting AI in health care raises several ethical and regulatory concerns we must consider, such as data privacy and bias, safety, regulation and legal responsibility for actions, as well as potential inequalities in access that could lead to an inequitable system. Its integration into clinical practice should therefore be carefully monitored to ensure, above all, patient safety and benefit.

Setting these considerations aside, AI stands out as a powerful aid for diagnosis, care, and management, with the potential to transform the current unsustainable health-care model into a more proactive and efficient one—where patients, health professionals, engineers, and legal experts clearly need to work as a team to ensure success.

In conclusion, when used correctly, AI is a strong ally in numerous day-to-day activities for health professionals—ranging from research to precision medicine—through diagnosis, therapeutic education, prediction, automation, and treatment personalisation.

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