

ARTIFICIAL INTELLIGENCE/MACHINE LEARNING IN DIABETES CARE

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Abstract: Artificial intelligence/Machine learning (AI/ML) is transforming all spheres of our life, including the healthcare system. Application of AI/ML has a potential to vastly enhance the reach of diabetes care thereby making it more efficient. The huge burden of diabetes cases in India represents a unique set of problems, and provides us with a unique opportunity in terms of potential availability of data. Harnessing this data using electronic medical records, by all physicians, can put India at the forefront of research in this area. Application of AI/ML would provide insights to our problems as well as may help us to devise tailor-made solutions for the same.

Keywords: Artificial intelligence, diabetes care, machine learning.

Artificial intelligence (AI) is a broad term defined as the theory and development of virtual systems which are able to perform tasks normally by utilizing human intelligence such as visual perception, speech recognition, decision-making, and translation between languages.[1] It can be as simple as rule-based or driven by complex statistical methods. Machine learning is a subset of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed.[1,2] Machine learning can be supervised, unsupervised, semi-supervised, or reinforcement based. Through deep learning machine tries to emulate human intelligence by simulating structure of human brain using recurrent neural networks. AI/ML tools are being extensively used in all scientific fields and are responsible for revolutionizing businesses throughout the world. Healthcare systems, on the other hand, have been very slow in adopting these advancements and are lagging far behind in this arena. AI/ML can be useful in the management of chronic diseases, namely, diabetes. In fact, ML/AI is already being used to predict risk of diabetes based on genomic data, diagnosis of diabetes based on EHR data, to predict risk of complications such as nephropathy and retinopathy, and also in diagnosis of diabetic retinopathy [Table 1].[3] There is a paucity of India specific data on all these aspects of AI in the published literature. Google AI research unit in collaboration with few Indian ophthalmology centers has already made great advances in the field of automated diagnosis and grading of diabetic retinopathy based on fundus photographs.[4] Adoption of these technologies can significantly increase detection and early treatment of diabetic complications.[4] However, one area of diabetes care, that has seen very few attempts, is management strategies for diabetes. In type 1 diabetes we are witnessing the advancement of closed-loop insulin delivery system with inbuilt AI/ML algorithms to predict both hypoglycemic and hyperglycemic excursions.[5] These systems are still in infancy and yet to show an impact on long-term outcomes and quality of life. Treating type 2 diabetes is even more complicated than type 1 diabetes as there are multiple treatment options that are to be added sequentially and incrementally. Moreover, the choice of medication and its dosage also depends on a lot of individual factors such as BMI, underlying beta-cell function, and insulin

resistance among others. There are excellent reviews on compiling studies that have used AI/ML approach in diabetes.

A few caveats in these studies need to be noted while planning further research. First, these studies use data generated by multiple practitioners in routine diabetes care. While this may be the best way to get big data for analysis, it would not lead to an improvement in the standards of care. Moreover, at its best, system created from this data would match the outcomes of current practices. Second, due to multiple sources of data, noise level is likely to be very high making it difficult to delineate the most efficient path forward. Third, unless data has records of adherence to lifestyle measures (diet and exercise) and of compliance towards medication, the real-world utility of this AI/ML approach would be limited. Selecting specialist practices with glycemic control better than average would be the first step towards overcoming these problems. Careful prospective data collection by these practices should include records of compliance levels. Using supervised machine learning initially and gradually switching over to unsupervised machine learning would make this data relevant in the real world.

Type 1 Diabetes Management

There is a huge amount of literature on AI/ML approach being used in type 1 diabetes. There are algorithms that have been used to detect composition of food based on images of food thereby helping in carb counting. Prediction of future blood glucose values and anticipating impending hypoglycemic or hyperglycemic event has been the focus of research in numerous publications.[17] Major work is also being done on developing bolus calculators to automate the process of calculating premeal insulin dose prediction.[18] From the perspective of the applicability of these approaches in India, there are two major lacunae. Firstly, most of this research is carried out among people using the insulin pumps and CGMs. As use of these modalities in India is limited due to economic issues, usability of this research in India is also limited. Secondly, different researchers have focused on individual areas of type 1 diabetes management and there is still no single application/technology available that can solve management of type 1 diabetes including carbohydrate counting, calculating insulin-carbohydrate ratios, and also predicting insulin dose for each meal for each patient, especially on multiple subcutaneous daily injections.

Limitations and the way forward

AI/ML is as good as the data used to generate this intelligence. Our country is sometimes called as “country with no records”, however, this may not be exactly true but it does underline the general scenario of lack of record-keeping as an essential part of medical practice in India. A huge burden of disease can be transformed into an opportunity, if entire data is harnessed in a usable form and AI/ML is used to generate insights and solutions specific to our population. A concerted and collective effort is needed by the government and large associations, like, endocrine society of India to initiate data collections and research.

References:

1. Usmonov, M.(2023). PROBLEMS OF FORMING A SPECIAL ANALYTICAL THINKING STYLE AND BUILDING ALGORITHMS FOR SOLVING LOGICAL PROBLEMS. Евразийский журнал технологий и инноваций, 1(1), 39–56. извлечено от <https://www.in-academy.uz/index.php/ejti/article/view/9662>

2. Usmonov, M.(2023). ANTHROPOGENIC ENVIRONMENTAL LOAD ASSESSMENT METHODS USING MODERN INFORMATION TECHNOLOGIES. Евразийский журнал технологий и инноваций, 1(1), 21–38. извлечено от <https://in-academy.uz/index.php/ejti/article/view/9645>
3. Usmonov Maxsud Tulqin o'g'li. DEVELOPMENT OF WEB-APPLICATIONS FOR THE BUREAU FOR THE REPAIR OF APARTMENTS. DEVELOPMENT AND INNOVATIONS IN SCIENCE International scientific-online conference. Том 2 № 1 (2023): Development and innovations in science. <http://www.econferences.ru/index.php/tafps/issue/archive>
4. Usmonov Maxsud Tulqin o'g'li. ROBOTOTEXNIKA MAJMUALARINING AVTOMATLASHTIRILGAN ELEKTR YURITMALARINI QO'LLANILISH SOHALARI. ACADEMIC RESEARCH IN MODERN SCIENCE International scientific-online conference.Том 2 № 2 (2023): Академические исследования в современной науке. <http://www.econferences.ru/index.php/tafps/issue/archive>
5. Usmonov Maxsud Tulqin o'g'li. AXBOROT OQIMINI SHAKLLANTIRISHDA WEB ILOVALARNI YARATISH VA QO'LLASH USULLARI. CURRENT APPROACHES AND NEW RESEARCH IN MODERN SCIENCES International scientific-online conference.Том 2 № 1 (2023): Current approaches and new research in modern sciences. <http://www.econferences.ru/index.php/tafps/issue/archive>