Type Done – Determining Appropriate Diabetic Care with Personalized AI Methods

Introduction

Over seven million Americans require daily insulin injections to survive. Many of these insulin dependents receive wrong information regarding their unit dosages, blood sugar levels, and carbohydrate ratios. Appropriate diabetic care is unique to each individual. Artificial intelligence can help those with diabetes better understand their condition and make more informed decisions about the specific plan they need. The data collected by these methods could be more accurate than human calculations, and possibly detect hidden trends and genetic information that will better assist personalized plan creation.

Why is this topic data science?

Diabetes is a condition that requires constant self-awareness. Managing this condition consists of finger pricks, insulin dosage calculations, figuring out carb ratios, reading A1C levels, and reading blood sugar levels. All of this is data. Data science comes into play when the record of this information is extracted and analyzed to make decisions. Trends can be observed and forecasted with the data. Technology can be developed for better accuracy in readings and more advanced monitoring systems with the use of data gathered from the diabetics. Data science is relatively new to this topic, but it is crucial in understanding the disease and making more informed decisions for those affected.

What is the deliverable?

The goal of this project is to analyze a variety of AI methods for diabetic care while simultaneously designing a new method that is more personable to each individual.

Acknowledgements

I would like to thank my fiancé, Kaitlyn, for educating me on type one diabetes and teaching me to become more patient and understanding. Thank you to the brilliant researchers at the University of Toronto for discovering insulin and humbly selling the patent for three dollars. Lastly, a great big no thanks to Eli Lilly, Novo Nordisk, and Sanofi for the skyrocketing insulin prices that are literally killing people.

Literature

Li, Yukai, et al. "Analysis and Study of Diabetes Follow-Up Data Using a Data-Mining-Based Approach in New Urban Area of Urumqi, Xinjiang, China, 2016-2017." *Computational and Mathematical Methods in Medicine*, Hindawi, 10 July 2018, www.ncbi.nlm.nih.gov/pmc/articles/PMC6077367/.

Conclusion

You may not have a family member with diabetes, let alone know someone who struggles with it. It is safe to say, however, that we have a friend or loved one that has dealt with some medical condition in their lifetime. Whether it was serious or not, did they deserve care that was catered to their needs? Are all cancers the same? Illnesses? Diabetes is no different. Even more so, the wildly different levels and readings throughout each individual require precise calculations and detailed research to determine the necessary care for them. Artificial intelligence has the capacity to make this happen.

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Abstract

Type one and type two diabetics do not always share similar readings in their every day health monitoring. Many individuals experience very different blood glucose levels, blood sugar spikes throughout the day, and A1C levels. These discrepancies make it difficult to provide a universal type of care to diabetic patients. It is often suggested by physicians to create a personalized approach for treatment, but these methods are often subject to human error. Artificial intelligence could potentially improve this process. Specific information extracted from individual readings could be used to create more effective treatments plans and limit the errors associated with human calculations. Intelligent analytics may be key in determining hidden trends and genetic information that can properly fit a

plan to the needs of each patient, whether they are insulin dependent or insulin resistant. Additionally, these results can be used to improve future computation and give medical professionals more tools to properly address their patients' needs.

Author Keywords

Accessibility; research; diabetes; data; artificial; intelligence

ACM Classification Keywords

Life and medical sciences-Health; Artificial intelligence-General; Data structures; Tables

Introduction

Over seven million Americans require daily insulin injections to survive. Many of these insulin dependents receive wrong information regarding their unit dosages, blood sugar levels, and carbohydrate ratios. Appropriate diabetic care is unique to each individual. Artificial intelligence can help those with diabetes better understand their condition and make more informed decisions about the specific plan they need. The data collected by these methods could be more accurate than human calculations, and possibly detect hidden trends and genetic information that will better assist personalized plan creation.

The Need for Data

Diabetes is a condition that requires constant self-awareness. Managing this condition consists of finger pricks, insulin dosage calculations, figuring out carb ratios, reading A1C levels, and reading blood sugar levels. All of this is data. Data science comes into play when the record of this information is extracted and analyzed to make decisions. Trends can be observed and forecasted with the data. Technology can be developed for better accuracy in readings and more advanced monitoring systems with the use of data gathered from the diabetics. Data science is relatively new to this topic, but it is crucial in understanding the disease and making more informed decisions for those affected.

Research Outcomes

The goal of this project is to analyze a variety of AI methods for diabetic care while simultaneously designing a new method that is more personable to each individual.

Current Methods

There have been numerous projects to address the need for more advanced diabetic care. IBM Watson Health, led by researcher Lisa Latts, developed the Sugar.IQ diabetes assistant, which immediately became a leading-edge app in the field of medical artificial technology. The application uses a combination of artificial intelligence, digital analytics, and diabetes specific technology to constantly monitor all levels of their condition. In the analysis of current methods, this option quickly became a frontrunner for AI ability, and

set the standard for future improvements and the basis of this research.

Recognition of Limitations

The AI algorithm for diabetic behavior can recognize trends in non-glucose related activities. These trends are learned from repetitive behaviors that are mapped and labeled with preferences for those specific activities. Current limitations lie in the scope of non-food intake, more specifically the recognition of stress, depression, physical activity, weather, and other environmental conditions. The surface of these factors has been skimmed, with research finding correlations between heart rates and activities that the user logs and is kept up with for a specific time period. Improvement exists in expanding these parameters to include additional mental health analysis, as well as geographical indicators and relationships. The limits of its current state are not hindering proper readings, but instead hindering the understanding of the diabetic condition and why such readings are received.

Solution Development

Solutions for improving the limitations of current research will be developed by analyzing current methods and expanding on the services they offer. This project will develop a personalized mental health database that is connected to the individual's glucose readings. Instead of relying solely on trends that involve performing a task and monitoring heart rate alongside glucose levels, the user will be directly responsible for inputting their current state as it feels with their mental health situation. This feeds into the factor of geography, additionally, by prompting the user for active feelings about the weather, physical properties associated with being in such weather, and their emotions towards work, school, relationships, and hobbies or interests. The AI methods implemented would be responsible for notating the user's descriptions and providing more detailed results based upon those findings. The question at this point would lie in how weighted mental health, geography, or relationships are in the overall condition for a diabetic. This method would be responsible for assigning these weights as well. This option may be achieved by a type of survey of the user when using the technology. They would enter initial scores based on overall feelings, which would return separate weighted scores for different aspects of their lives. While these scores may differ based on the day, as would be the case in depression, the user would have the option of re-entering their feelings if they are more affected by a particular stimulus on that given day. With these weights in hand, a score would be attributable to those factors and the user would be given the opportunity to monitor glucose readings and examine which personal factor is most obvious in the manipulation of their state.

Conclusion

You may not have a family member with diabetes, let alone know someone who struggles with it. It is safe to say, however, that we have a friend or loved one that has dealt with some medical condition in their lifetime. Whether it was serious or not, did they deserve care that was catered to their needs? Are all cancers the same? Illnesses? Diabetes is no different. Even more so, the wildly different levels and readings throughout everyone require precise calculations and detailed

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References

1. Kerr, D. and Klonoff, D. (2018). Digital Diabetes Data and Artificial Intelligence: A Time for Humility Not Hubris. *Journal of Diabetes Science and Technology*, 13(1), pp.123-127.
2. Li, Yukai, et al. "Analysis and Study of Diabetes Follow-Up Data Using a Data-Mining-Based Approach in New Urban Area of Urumqi, Xinjiang, China, 2016-2017." *Computational and Mathematical Methods in Medicine*, Hindawi, 10 July 2018, www.ncbi.nlm.nih.gov/pmc/articles/PMC6077367/.
3. "Machine Learning and Data Mining Methods in Diabetes Research." *Computational and Structural Biotechnology Journal*, Elsevier, 8 Jan. 2017, www.sciencedirect.com/science/article/pii/S2001037016300733.
4. "Data-Driven Blood Glucose Pattern Classification and Anomalies Detection: Machine-Learning Applications in Type 1 Diabetes." *Journal of Medical Internet Research*, JMIR Publications Inc., Toronto, Canada, www.jmir.org/2019/5/e11030/.
5. Dankwa Mullen, Irene. "Transforming Diabetes Care Through Artificial Intelligence: The Future Is Here." *Mary Ann Liebert, Inc., Publishers*, www.liebertpub.com/doi/10.1089/pop.2018.0129.
6. Makino, Masaki, et al. "Artificial Intelligence Predicts Progress of Diabetic Kidney Disease-Novel Prediction Model Construction with Big Data Machine Learning." *Diabetes*, American Diabetes Association, 1 July 2018, diabetes.diabetesjournals.org/content/67/Supplement_1/539-P.
7. Fagherazzi, G. "Digital Diabetes: Perspectives for Diabetes Prevention, Management and Research." *Diabetes & Metabolism*, Elsevier Masson, 19 Sept. 2018, www.sciencedirect.com/science/article/pii/S126236361830171X.
8. Buch, V., et al. "Artificial Intelligence in Diabetes Care - Buch - 2018 - Diabetic Medicine - Wiley Online Library." *Diabetic Medicine*, John Wiley & Sons, Ltd (10.1111), 14 Mar. 2018, onlinelibrary.wiley.com/doi/full/10.1111/dme.13587.
9. Bennet, Casey C. *Artificial Intelligence for Diabetes Case Management*.
10. Takahashi, Hidenori, et al. "Applying Artificial Intelligence to Disease Staging: Deep Learning for Improved Staging of Diabetic Retinopathy." *PLOS ONE*, Public Library of Science, journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0179790.
11. Latts, Lisa. "Diabetes Care Gets a Boost with Artificial Intelligence Technology." *EndocrineWeb*, www.endocrineweb.com/professional/meetings/diabetes-care-gets-boost-artificial-intelligence-technology.