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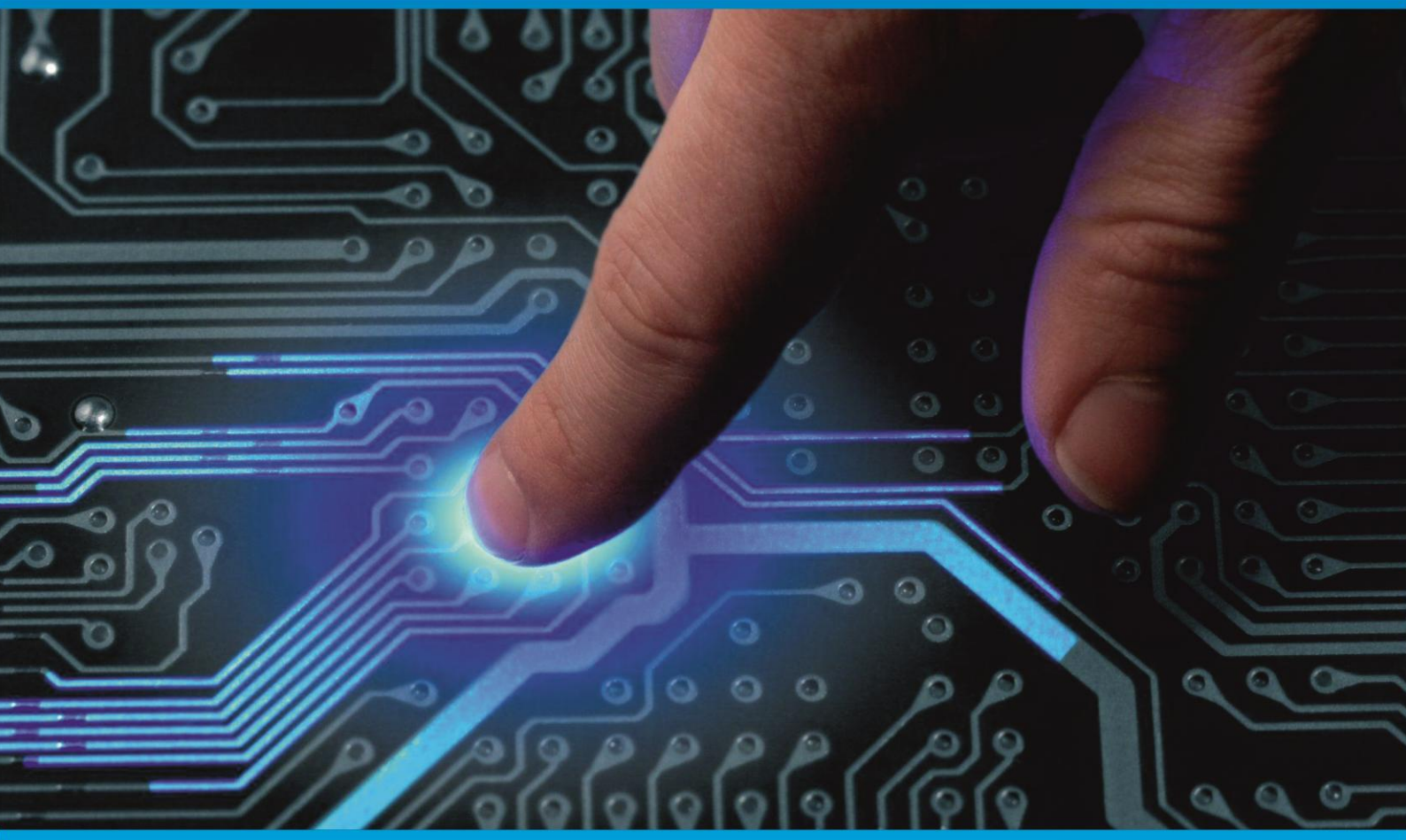

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Artificial Intelligence in Diabetes Care and Management

Siddhant Pravin Jadhav

Research student, Department of Information Technology, B.K. Birla College of Arts, Science and Commerce (Autonomous), Kalyan, India

ABSTRACT: Artificial Intelligence (AI) is a vast and fast-growing field and its applications can be used for diagnosis and management of diabetes. Artificial Intelligence allows a continuous glucose monitoring of the patient's symptoms. Artificial Intelligence applications have the potential to transform diabetes care and can help millions of people with diabetes to achieve better track on glucose in blood and reduce diabetes complications. AI in diabetes care and management can put great amount of effort into developing decision support systems for patients, which can automatically analyse the patient's data collected by Continuous Glucose Monitoring (CGM) sensors and other portable devices. Artificial Intelligence applications offer greater accuracy, efficiency, ease of use, and satisfaction for people with diabetes, their clinicians, and family. Artificial Intelligent (AI) in Diabetes Care and Management can be the most trusted technology and beneficial for all.

KEYWORDS: Artificial intelligence, Diabetic care, glucose monitoring sensor, AI application.

I. INTRODUCTION

Diabetes is a disease suffered by millions of people in the world. So, it becomes difficult to keep monitoring the health of the patients by doctors and caretakers. Artificial Intelligence can help in solving this problem of doctors by using AI applications in various glucose monitoring systems and sensors. By using AI applications in various glucose monitoring sensors, it can keep track of glucose in blood and report it to the doctors and caretakers. Artificial Intelligence based sensors will alert the patient, doctor and family whenever there is high glucose in blood of the patient so that doctors can give treatment in better way.

Artificial Intelligence has vast applications and principles which can change the way of giving treatment to diabetes suffering patients. AI can also give the information of amount of insulin should be given to patient on basis of monitoring the glucose in blood to doctors. Doctors can use AI based monitoring systems and sensors for the treatment of various types of Diabetes i.e in Type 1 diabetes, Type 2 diabetes and Prediabetes.

In addition of Type 1 diabetes, Type 2 diabetes and Prediabetes AI based systems and sensors can also be used in curing Maturity onset diabetes of the young (MODY), Neonatal diabetes, Wolfram Syndrom, Alstrom Syndrome, Latent Autoimmune diabetes in Adults (LADA), Type 3c diabetes, Steroid-induced diabetes, Cystic fibrosis diabetes through giving better treatment and helping doctors.

Artificial Intelligence applications are used in Diabetes care including automated retinal screening, clinical decision support, predictive population risk satisfaction, and patient self-management tools.

II. OBJECTIVES

A. To understand the Artificial Intelligence in Diabetes Care and Management.
B. To understand the applications of AI in Continuous Glucose Monitoring Sensors and other devices used in Diabetes management.

Following Hypothesis are proposed to attain the above objectives using survey analysis: -

1) H1: "The Implementation of Artificial Intelligence in Diabetes Care and Management makes doctors easier to treat the patients."
2) H2: "Implementation of AI applications in Continuous Glucose Monitoring (CGM) sensors and other devices makes the devices to work efficiently."

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III. LITERATURE REVIEW

In [1] Mishra et al. defines the role of Artificial Intelligence in types of Diabetes Mellitus and Artificial Neural Networks and the AI applications used in Diabetes management. [2] Ellahham explained the scope of Artificial Intelligence in Diabetes care and the AI based techniques and applications used in Diabetes management. [3] V. Buch et al. explained that how Machine learning can be used in Diabetes and healthcare system. [4] Dankwa-Mullan et al. explained the categorization of Artificial Intelligence applications and techniques in Diabetes care. [5] Vettoretti et al. explained how Artificial Intelligence can be used in Continuous glucose monitoring sensors and the AI based techniques in Diabetes management.

IV. METHODOLOGY

An online survey is held by using Google Forms. The link of the form was circulated in social media platform for more participation of the participants. The questions in the forms were designed to test the above proposed hypothesis which verified certain parameters.

A. Participants

A total of 57 participants data was collected from different areas of India. Among all the 57 participants 66.7% were male and remaining 33.3% were female.

B. Measures

Participants were asked to distribute their response in two parameters i.e. YES/NO.

Gender	Yes	No	Total
Male	29	9	38
Female	12	7	19
Total	49	8	57

Table.I

There is a simple formula to calculate the expected for any value in the above table.
Formula:
Expected value= (row total) x (column total)/ (grand total)
Expected value:
E_{11}=38x49/57 E_{12}=38x8/57 E_{21}=19x49/57 E_{22}=19x8/57
E_{11}=32.66666 E_{12}=5.333333 E_{21}=16.33333 E_{22}=2.66666

Gender	Yes	No	Total
Male	32.66666	5.333333	38
Female	16.33333	2.66666	19
Total	49	8	57

Table.II

Degree of freedom= (Rows-1) x (Columns-1) = (2-1) x (2-1) = 1.
The formula for Chi-Square is,
$X^2 = \sum (O_i - E_i)^2/E_i$where, O_i=Observed value, E_i=Expected value
$= [(29-32.66666)^2/32.66666 + (9-5.333333)^2/5.333333$
$+ (12-16.33333)^2/16.33333 + (7-2.66666)^2/2.66666]$
$= [0.101626 + 0.260417 + 0.203252 + 0.520833]$
$X^2 = 1.086128$
Thus, A value for x^2 is 1.0861

Gender	Yes	No	Total
Male	34	4	38
Female	15	4	19
Total	49	8	57

Table.III

There is a simple formula to calculate the expected for any value in the above table.
Formula:
Expected Value = (row total) x (column total)/ (grand total)
Expected Value:
E_{11}=32.666666 E_{12}=5.333333 E_{21}=16.33333 E_{22}=2.66666

Gender	Yes	No	Total
Male	32.66666	5.333333	38
Female	16.33333	2.66666	19
Total	49	8	57

Table.IV

Degree of freedom = (Rows-1) x (Columns-1) = (2-1) x (2-1) = 1.
The formula for Chi-Square is,
$X^2 = \sum (O_i - E_i)^2/E_i$ where, O_i=Observed value, E_i=Expected value
$= [0.0544218 + 0.333333 + 0.108843 + 0.666667]$
$X^2 = 1.16327$
Thus, A value for x^2 is 1.16327

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V. EXPERIMENT

The test scores of independent samples were calculated at the confidence level of 95 percent using chi-square test. The participants presented multiple questions to test the parameters in the test. So, the calculated chi value is 1.0861, and the tabulated chi value is 3.84 at significance level 95 percentage with the degree of freedom 1. From the third table, calculated chi value is 1.1633 and tabulated chi value is 3.84 at significance level 95 percentage with the degree of freedom 1.

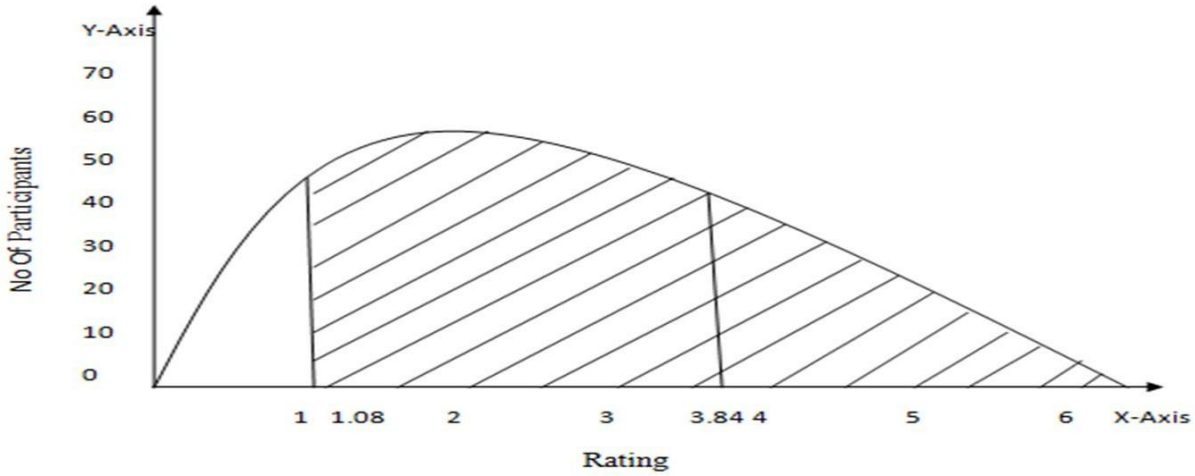

Fig 1. Statistics for chi square for Hypothesis 1

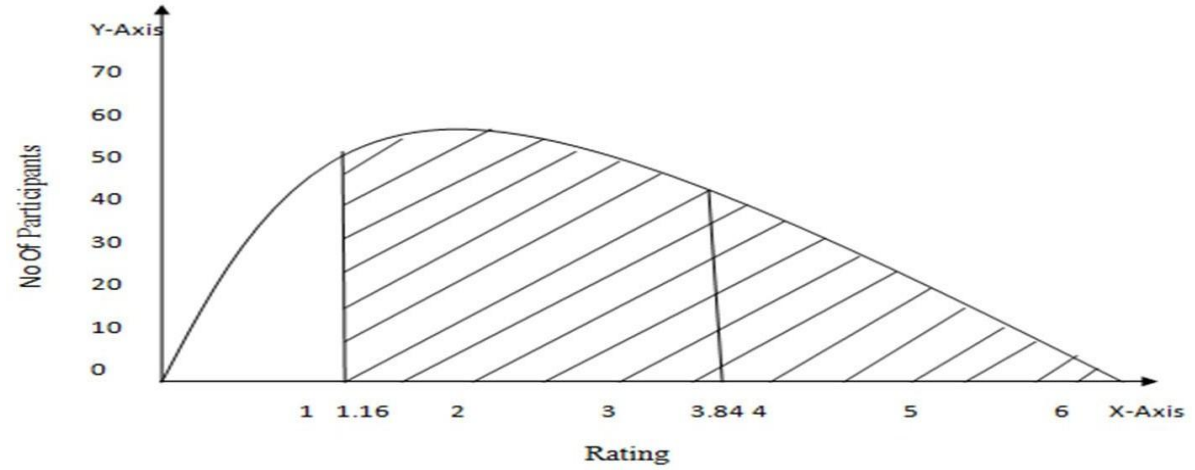

Fig 2. Statistics for chi square for Hypothesis 2

VI. RESULT

The test scores of independent samples calculated using chi-square test using survey analysis resulted that the involvement of Artificial Intelligence in Diabetes Care and Management makes doctors efficient to work. Therefore, The Hypothesis “H1” is accepted. And the AI applications in Continuous Glucose Monitoring sensors and devices can make the devices efficient to work. Thus, The Hypothesis “H2” is accepted.

VII. LIMITATION AND FUTURE SCOPE

The limitation is that the Artificial Intelligence based devices could work sometimes on approximation values of glucose monitoring system. The scope of Artificial Intelligence in future would be that it has vast applications and techniques which can be used in other healthcare systems.

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VIII. CONCLUSION

The implementation of Artificial Intelligence in Diabetes care and management makes the doctors work easier to treat the numerous patients. The involvement of AI based applications and techniques in Continuous Glucose Monitoring sensors and other devices makes the devices to work efficiently.

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