**CSIS 735**

**Machine Learning**

**Deliverable 3**

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I) **Abstract**

Diabetes is a chronic disease that affects how the body turns food into energy. Diabetes makes blood sugar levels very high. Glucose comes from the food that we eat. Insulin is the hormone that helps the glucose reach into the cells to give them energy. There are different types of Diabetes, type 1, and type 2 are the two most popular. With type 1 diabetes, the body doesn’t make insulin. With type 2 diabetes, the body doesn’t make or use insulin very well. Prediabetes means that the blood sugar is higher than the normal level, but not high enough to reach the diabetes level. Over time, high glucose in the blood can causesome complications, such as kidneys, eye, and nerve damage [3].

Predicting diabetes at an early stage can lead to improved treatment and will save lives. This paper predicts early-stage diabetes risk and will be using machine learning techniques such as linear regression. It will cover a dataset which contains the sign and symptoms of a newly diabetic patient. According to UC Irvine, the dataset is collected using direct questionnaires from new diabetic patients. The ages of the patients are from 20 to 65. The data set is characterized as multivariate. It has columns and 520 rows or instances. Machine learning techniques such as classification, decision tree, regression, and other data mining techniques will lead to a good understanding of how early-stage diabetes risk starts and therefore, reduce medical costs in the long run. The result will have a significant improvement in diabetes treatment and save lives [5].

**II) Introduction**

Diabetes is one of the most serious chronic illnesses in the world. It impacts how the body turns food into energy. With type 1 diabetes, the body can’t produce insulin. With type 2 diabetes the body doesn’t produce enough insulin or does not use insulin sufficiently. This paper attempts to predict early-stage diabetes risk and will be using machine learning techniques such as linear regression. It will cover a dataset which contains the sign and symptoms of a newly diabetic patient.

**III**) **What is diabetes?**

**a.** **Definition of diabetes**

According to the Centers for Disease Control and Prevention (CDC), diabetes is a chronic (long-lasting) health condition that affects how the body turns food into energy. It is a disease that causes blood glucose or blood sugar to be too high. Glucose comes from the food we eat. When the blood sugar goes up, it signals your pancreas to release insulin. Insulin is the hormone that helps the glucose get in the cells to give them energy. When someone gets diabetes, the person’s body doesn’t make enough insulin, or the body can’t use the insulin it makes [1].

**b.** **Prediabetes**

Prediabetes happens when the blood sugar is higher than the normal level but not too high to reach the diabetes level. Prediabetes can put the patient at a higher risk of getting type II diabetes. Prediabetes also can raise the risk of heart disease, and stroke [1].

**c.** **Risk Factors**

Type I diabetes risk factors are not known or clear as type II diabetes. It could be family history, for instance having a parent or a sibling with type 1 diabetes. Some of the risk factors for type II diabetes are:

* Having prediabetes
* Being overweight
* Being 45 or older
* Inactivity
* Type II diabetes running in the family
* Have had gestational diabetes or giving birth to a baby who weighed more than 9 pounds [1]

**d.** **Symptoms and causes**

Some of the general symptoms of diabetes are:

· Urinating a lot

· Increased thirsty

· Fatigue

· Losing weight without trying

· Having a blurry vision

· Having numb or tingling hands or feet

· Feeling very tired

· Having very dry skin

· Having sores that heal slowly

· Having more infections than usual [1]

**e.** **Diagnosis**

According to the Mayo Clinic, there are several blood tests for prediabetes. Some of the blood tests are:

· Glycated hemoglobin (A1C) test: An A1C level of 6.5% or higher on two separate tests indicates type 2 diabetes

· Fasting blood sugar test: 126 mg/dl (7.0 mmol/L) or higher indicates type 2 diabetes [2]

f. **Prevention**

Type II diabetes can be prevented or delayed with lifestyle changes such as losing a small amount of weight and getting more physically active. Type II diabetes starts with prediabetes. Most people don’t know if they are prediabetic unless they check their blood sugar. Prediabetes is common in the US. Some of the prevention tips are:

* Make lifestyle changes such as getting more physically active
* Eating healthy foods
* Managing stress, and staying motivated

Diabetes can be prevented by eating healthy foods such as vegetables, whole grains, and fruits. Also, getting at least 150 minutes of moderate aerobic physical activity a week helps prevent diabetes [1].

g. **Complications**

Diabetes complication develops gradually; the longer diabetes in the body - the less controlled blood sugar, the higher the risk of complications. Some of the complications of diabetes are:

* Nerve damage
* Kidney damage
* Eye damage
* Cardiovascular disease
* Foot damage
* Depression

These and more are the complications of having diabetes. Diabetes increases the risk of various cardiovascular issues, including chest pain, heart attack, and stroke. Diabetes also damages many organs in the body such as kidney damage. Diabetes can damage the kidneys, which can lead to kidney failure and might require dialysis or a kidney transplant [1].

IV. **Types of Diabetes**

There are many types of diabetes; the most well-known diabetic types are type 1, type 2, and gestational diabetes.

**a.** **Type 1 causes**

With Type 1 Diabetes the pancreas doesn’t make insulin or makes very little insulin. Insulin is the hormone that helps the blood sugar to enter the cells in the body where the body uses it for energy. Without insulin, the blood sugar cannot get into the cells and therefore builds up in the bloodstream. Type 1 is usually diagnosed in children, but it can develop at any age.

Type 1 is caused by an autoimmune reaction that destroys the cells in the pancreas that makes insulin. It can also be caused by genetics [1].

**b.** **Type 2 causes**

Type 2 diabetes is the most well-known diabetes. In the US there are more than 34 million people with type 2 diabetes. It is caused when the cells don’t respond normally to insulin. The pancreas makes more insulin to try to get cells to respond. Eventually, the pancreas can’t keep up, and the blood sugar rises [1].

c. **Gestational diabetes:**

According to the CDC, Gestational diabetes is a type of diabetes that can develop during pregnancy in women who don’t already have diabetes. It can occur when the body can’t make enough insulin during pregnancy. All pregnant women have some insulin resistance during late pregnancy. Some women start pregnancy with an increased need for insulin and are more likely to have gestational diabetes [1].

**V. Predicting diabetes at an early stage**

Predicting diabetes at an early stage can help the patient and the doctor by leading to improved treatment or lifestyle changes in the case of prediabetes or type II diabetes. Chronic diseases such as diabetes are associated with higher costs in healthcare. Predicting diabetes at an early stage will have significant cost savings for governments and private health insurance. Machine learning can help predict diabetes at an early stage.

UCI( University of California Irvine) early-stage diabetes risk prediction dataset will be used to predict through diagnosis whether the patient has diabetes based on certain diagnostic measurements included in the dataset. There are many limitations in predicting and diagnosing diabetes [5].

This paper predicts early-stage diabetes risk and will be using machine learning techniques such as linear regression. It will cover a dataset which contains the sign and symptoms of a newly diabetic patient. According to UC Irvine, the dataset is collected using direct questionnaires from new diabetic patients. The ages of the patients are from 20 to 65. The data set is characterized as multivariate. It has columns and 520 rows or instances. Machine learning techniques such as classification, decision tree, regression, and other data mining techniques will lead to a good understanding of how early-stage diabetes risk starts and therefore, reduce medical costs in the long run. The result will have a significant improvement in diabetes treatment and might save lives [5].

**VI.** **Treatment for prediabetes**

Treating diabetes is very difficult, but making healthy lifestyle choices can help bring the blood sugar level back to normal, or keep it from rising. Here are some of the tips to prevent prediabetes from progressing to type 2 diabetes:

* Eat healthy food such as low fat and calories and high in fiber
* Be more active every day or get 150 minutes of moderate or 75 minutes of vigorous aerobic activity a week
* Lose excess weight
* Stop smoking: smoking can risk developing type 2 diabetes
* Take medication as needed: the doctor may prescribe medications to control cholesterol and high blood pressure

**VII.** **Living with Diabetes**

Living with diabetes is hard and takes a lot of energy and dedication. To live with diabetes the patient should learn more about diabetes by taking classes, joining support groups in person, or online. The patient should also be active physically and eat healthy food. Keeping diabetes under control is one of the tips given to diabetic patients because diabetes can cause complications including heart disease, stroke, and kidney or nerve damage [1].

**VIII. Conclusion**

Diabetes is a chronic (long-lasting) health condition that affects how the body turns food into energy. The two well-known types of diabetes are type 1 and type 2. With type 1 diabetes, the body doesn’t make insulin. With type 2 diabetes, the body doesn’t make or use insulin very well. Diabetes can cause complications such as nerve damage, and kidney damage. Some of the symptoms of diabetes are fatigue, losing weight without trying and having blurry vision.

Chronic diseases such as diabetes have significant costs for both the government and private health insurance. Predicting diabetes at an early stage can save millions of dollars in healthcare and can lead to improved treatment. Machine learning can be used to predict diabetes at an early stage.

Diabetes doesn’t have a cure, but it can be managed by eating healthy and being physically active. Keeping diabetes under control is the first tip given to patients because diabetes can cause complications such as kidney and nerve damage.

IX**. References**

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