Glucose Content Analysis using Image Processing and Machine Learning Techniques

Anton Yudhana[1*], Son Ali Akbar[1,2] , Andrio Farezi[1], Kamarul Hawari Ghazali[2], Fatma Nuraisyah[3], Phisca Aditya Rosyady[1]
[1] Department of Electrical Engineering, Faculty of Industrial Technology, Universitas Ahmad Dahlan, Indonesia
[2]Faculty of Electrical and Electronics Engineering Technology, Universiti Malaysia Pahang, Malaysia
[3]Department of Public Health Science, Faculty of Public Health, Universitas Ahmad Dahlan, Indonesia

2022 5th International Conference on Information and Communications Technology (ICOIACT) | 978-1-6654-5140-6/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICOIACT55506.2022.9972142

***Abstract*— Technology is constantly evolving to make it easier for people to work in biomedical research and technology daily. The glucose level checking system can use a urine analyzer detector as a color reader of the urine strip. This work aims to analyse glucose levels based on digital picture identification using the MATLAB application for patient glucose data processing. Injections are joint for diabetic people to control their blood sugar levels. Repeated injections might cause minor physical harm to the body that can hamper the immune system's ability to fight against pathogens. Numerous research has concentrated on non-invasive glucose-based testing, namely using urine. This study was created using image processing to examine the non-invasive glucose testing procedure. The noise is cleaned up using a Gaussian filter and histogram-based feature extraction for picture database extraction. Support vector machines classify data using a 70% training and 30% testing process. The SVM classification results had an accuracy of 85% and time processing of 0.5 seconds. In making medical decisions, it is possible to consider the effects of diabetes, pre-diabetes, and non-diabetes.**

Keywords*— *glucose, gaussian filter, histogram feature, support vector machine.

I. INTRODUCTION

One of the essential nutrients is glucose, which the body needs as an energy source. On the other hand, it is critical to emphasize the risk of diabetes from ingesting too much glucose[1].]. Diabetes, because of its prevalence in children and adults, has become one of the world's most critical public health challenges. Furthermore, this disease has damaged over 500,000 children and resulted in around 5 million deaths. The projected global economic cost of diabetes in 2015 was roughly USD 673 billion, which is anticipated to exceed USD 802 billion by 2040 [2]. Diabetes is one of the most severe illnesses impacting modern humans in terms of socioeconomic burden [3]. Diabetes is a chronic disease caused by the body's failure to create enough insulin or respond to its release [4].

Diabetes increases the risk of developing other diseases such as heart disease, kidney disease, blood vessel damage, nerve damage, and blindness[5]. A glucometer is now used to collect blood samples for examination. This includes things like probing a fingertip or drawing blood from a vein.

This process hurts and creates discomfort for particular individuals who need to be assessed numerous times each day [6].

As a result, there is a non-invasive method for determining BGL; studies have demonstrated that the quantity of glucose in urine, sweat, saliva, tears, and breath fluctuates with blood glucose levels [7].

Urine testing is required for clinical investigations, and machine education is critical for diabetes diagnosis, prognosis, and assessment. It is expected that digital image-based identification would be capable of accurately and effectively forecasting diabetes. RGB is used in photo processing, analysis, and storage[8].

The Gaussian filter is a low-pass filter used to smooth out pictures in image processing. Zhong et al. demonstrated using a gaussian filter to filter image details successfully while enhancing classification results[9]. In a picture, pixels whose value equals the weighted average of the pixels surrounding them[10]. Nugroho et al. investigated the detection of malaria parasites using a feature extraction approach assessed using the histogram color characteristic extraction technique [11]. Habibullah et al. predicted glucose levels with 77.5% accuracy using NIR spectroscopy and the SVM classification [12]. After determining the ideal value, SVM may produce significant results in class prediction [13].

According to the four studies, each strategy has benefits. As a result, this research emphasizes non-invasively monitoring glucose levels via urine and obtaining the best categorization results possible using support vector machine technology.

II. DATABASE

Patients having a history of diabetes, pre-diabetes, and normal glucose levels were given glucose data collection. Urine strips as a glucose level parameter and detection urine analyzer equipment were used to gather data.

The entire glucose collection has 3600 data points, including 802 for diabetes patients, 998 for pre-diabetic patients, and 1800 for regular glucose patients.

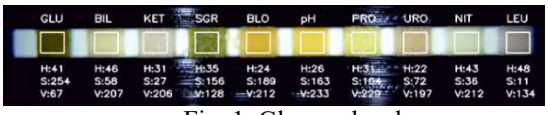

Fig. 1. Glucose level

The sorts of classes based on urine strips in healthy people with a history of diabetes and pre-diabetes are shown in Table 1.

Table. 1. Physical Functional Data

Data	DM type	Diabetes duration	Complication
1	DM	10	Diabetes
2	DM	1-3	Diabetes
3	DM	1-2	Pre-diabetes
4	Nr	Nf	Normal