Chapter 1

Introduction

1.1 Background

Type 2 diabetes mellitus (T2DM) is one of the most common metabolic diseases identified by the defect of insulin mechanism including its production and action to metabolize protein, lipid, and glucose. The defect of insulin mechanism leading to massive amounts of glucose present in blood that exceeds the normal level, this condition is associated with organ failures such as kidney, heart, and blood vessels. Among many types of diabetes, T2DM holds 90%-95% in most of the worldwide cases (Kaur et al., 2018). According to the International Diabetes Federation (2021) the projection of diabetes is significantly increasing where in 2021 there are 537 million of diabetes cases, representing 10.5% of the population, and in 2045 it will rise up to 12.2% or 783 millions. This projection indicates poor management of quality of life that is transitioning to a bigger scale of urbanization.

The increasing trend of T2DM prevalence could be more concerning considering the undiagnosed T2DM where about 50% of the people with diabetes are unaware of the T2DM disorder in their body (Kusuma & Syarif, 2023). There are many causes of delay in diagnosis including the time, place, budget, awareness, etc. In terms of medical treatment, T2DM treatment is known for the complexity, effort, and management as it requires multiple pharmacological treatment and currently there is still no treatment that could completely cure T2DM (Khan et al., 2019). From a social point of view this situation could be a huge burden reflecting the economic issue in regards to expensive treatment and poor morbidity of diabetes.

Early detection of prediabetes and undiagnosed diabetes likelihood could be a critical solution to tackle further risk of diabetes complications in terms of medical and socioeconomic as well as to increasing the health lifestyle awareness. In the last 20 years researchers have been trying to identify the triggered factors of T2DM which reveal the obesity, calorie diet, demographic variables, and

socioeconomic status (Indrahadi et al., 2021). These factors could be considered for early detection that give a prediction limited on diabetes likelihood.

The sub domains of Machine Learning, deep learning have become a new approach of improvement in clinical transformation due to a better precision, data driven decision, and promote early detection. The computational execution to recognize the meaningful pattern on medical data has shown digital evidence for healthcare improvement (Shah et al., 2019). One of the most used deep learning frameworks for building AI models is TensorFlow where the model computations are built as deep neural networks structures (Zaccone & karim, 2018). Beside its uses in AI modelling, another version of TensorFlow called TensorFlow Lite allows the integration of the mobile application device with AI model (Lee et al., 2019).

In recent years, the demand for mobile applications has been rising massively and effectively helps people from various backgrounds to use mobile software products. Mobile applications that involve the use of artificial intelligence (AI) are starting to become a new approach for improving user service to meet expectancy and industry standards (Nama, 2023). One of the AI-powered app called on-device inference mobile application offers the serverless uses for AI product by directly integrate the AI model inside the application device, thus no internet connection is needed (lee et al., 2019)

Developing a predictive model using deep learning techniques of deep neural networks on diabetic factors as data and integrating it as a mobile application product can be the solution to reduce the problems caused by undiagnosed T2DM. Therefore this thesis will propose a T2DM predictive model with a deep learning approach that utilizes tensorflow as a deep neural network framework to build the model. The model will be integrated with on-device application for usability and accessible for public users.

1.2 Objective

The objective of this study is to develop a T2DM prediction application with deep learning techniques and obtain a model with a better accuracy performance. The output of prediction will be the direct probability output from 2 classification classes of diabetes and non-diabetes. The output shown to the user will only be the classification probability in percentage. This T2DM Application will only predict the probability of T2DM and not for diagnosis. The expected outcome of this application for the user is to increase their awareness of lifestyle and food choices after self-evaluation of their T2DM likelihood from this application.

1.3 Hypothesis

The expected output of this project is to launch the application with diabetes model prediction that performs accuracy with the best model architect in TensorFlow and Keras.