

Implementation of Support Vector Machine (SVM) for Classification of Heart Failure Patients (Case Study: Prabumulih City Hospital)

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Abstract

The heart is a vital organ that functions as a blood pump to meet the body's oxygen and nutrient needs. Disorders of the heart can result in disruptions to blood circulation, underscoring the importance of maintaining heart health to prevent heart disease. The optimal function of the heart depends on the condition of the cardiac muscles, valves, and proper pumping rhythm. Heart failure, as one of the heart diseases, refers to the heart's inability to meet the body's blood demands. The management of heart disease involves comprehensive medical services provided in hospitals. One effort to improve the quality of healthcare services is to enhance the performance of hospitals. The Regional General Hospital of Kota Prabumulih is one healthcare institution that addresses various diseases, including heart disease. However, the classification process for heart disease at the Regional General Hospital is still conducted manually, consuming time and inefficient. To address this issue, the development of an intelligent system capable of classifying heart failure based on patient symptoms is necessary. This research proposes the implementation of the Support Vector Machine (SVM) method as a classification model, which is a high-dimensional hypothesis learning system. It is hoped that this system can assist medical professionals in determining the initial steps in managing heart failure quickly and effectively.

Keywords: Heart Failure, Hospital, Support Vector Machine (SVM)

1. Introduction

Health is something that must be improved for the welfare of society. Maintaining health is an effort to take care of ourselves, all organs in our bodies are things that must be maintained and cared for. Most people pay little attention to health, especially heart health, people are reluctant to have their hearts checked due to lack of services to patients and lack of medical personnel [1]. One of the diseases related to the heart is heart failure. Heart failure is a major clinical and public health problem with a prevalence of more than 23 million worldwide, associated with significant mortality, morbidity, and health care expenditures; The direct cost of heart failure reaches almost 2% of the total health care budget in many European countries [2].

One effort to improve the quality of service to the community is to improve hospital performance professionally and independently. One of the hospitals in Prabumulih City is the Prabumulih City Regional General Hospital. Prabumulih City Hospital treats patients with various diseases. One of the diseases treated is heart disease. In its handling, the Hospital does not yet have a system that can quickly determine the classification of heart disease.

The determination is still done manually based on the results of the examination analysis. In this study, the Support Vector Machine (SVM) method was used. The Support Vector Machine (SVM) method is a method that can predict and recognize patterns from the results of input or learning provided [3], [4], [5].

2. Research Methods

The methodology used in this study is to implement Support Vector Machine (SVM). The general characteristics of SVM are summarized as follows [6], [7]:

1. In principle, SVM is a linear classifier.

2. Pattern recognition is done by transforming data in the input space to a higher-dimensional space (feature space), and optimization is performed on the new vector space. This distinguishes SVM from general pattern recognition solutions, which optimize parameters on transformation results that are lower in dimension than the input space dimension.
3. Implementing the Structural Risk Minimization (SRM) strategy.
4. The working principle of SVM is basically only able to handle two-class classification, but has been developed for classification of more than two classes with pattern recognition.

This study discusses how to develop a support vector machine application for heart disease to run optimally. How to make the application. First, import the required library, namely pandas. This library will load data in the form of comma separated values (.csv) format, changing the dataset [8], [9].

```
import pandas as pd
dataset = pd.read_csv('heart.csv', delimiter=',')
```

Select the 0th to 8th index attributes as predictor attributes and save them in the Feature modifier.

```
Fitur = dataset.iloc[:,0:8]
Target = dataset.iloc[:,8]
```

Data division into training data and test data. Here will take 70% to be training data and the remaining 30% to be test data.

Then we will input the data into the SVM function to run the svm algorithm. The SVM algorithm uses a set of mathematical functions defined as kernels. The kernel function is to take data as input and transform it into a high-dimensional space called kernel space. Different SVM algorithms use different types of kernel functions.

```
#Kernel Linear
from sklearn import svm
from sklearn import metrics

clf = svm.SVC(kernel='linear')
clf.fit(X_train, y_train)
y_pred = clf.predict(X_test)
```

From this research, it was concluded that:

```
from sklearn.model_selection import train_test_split
from sklearn import metrics
X_train, X_test, y_train, y_test = train_test_split(Fitur, Target, test_size=0.3, random_state=109)
```

3. Interface Implementation

The implementation of the interface is done by creating an interface on this website. Each page that will be created will be formed into a file with the extension.

Home Page



Fig. 1: Home Page

This page displays the main page of the system. On this page, several menus are displayed to go to the intended page. The menus include: home, heart application, profile.

Heart Information Page

(RUMAH SAKIT UMUM DAERAH)

KOTA PRABUMULIH

Home Aplikasi Jantung Profil

Prediksi Potensi terkena serangan jantung

Silahkan masukkan hasil dari pengecekan dari dokter kedalam kolom dibawah ini untuk mengecek

Masukan umur: 0 - +

Masukan Detak Jantung (impulse): 0 - +

Pilih Jenis Kelamin: Laki-Laki

Masukan Tekanan darah bagian atas: 0 - +

Masukan Kadar Gula (Glukosa): 0 - +

Masukan Tekanan darah bagian bawah: 0 - +

Masukan Senyawa Organik / Kreatin Serum (KCM): 0.00 - +

Masukan Protein Darah (troponin): 0.00 - +

Prediksi

Fig. 2: Heart Information Page

This page displays the heart application page that functions to check heart health. To fill in the data refers to the results of the examination to the doctor. The data entered are age, gender, impulse, upper blood pressure, lower blood pressure, sugar levels, serum creatine, and troponin.

Profile Page



Fig.3: Profile Page

This page displays the profile page which functions to display the profile of the Prabumulih City Regional General Hospital.

4. CONCLUSION

The conclusion of this discussion is seen from the development of the running system, then it can be concluded as follows:

1. The application to be developed is in accordance with the needs of heart disease check-up information for the wider community using online channels.
2. Application development using the streamlit method with a UML design model supporting design tools, namely use cases, class diagrams, the programming language used is python and the scv database.
3. The application development created is a website to conduct online checks through the application menu which can save time and with a better and more precise process.

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