International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 6 Issue 10 Series I ǁ 2018 ǁ PP. 23-29

Improved Accuracy in Determining Elderly Nutritional Status Using Support Vector Machine Method

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ABSTRACT: *Current method used to determine nutritional status of elderly is by measuring and categorizing with Body Mass Index (BMI) Indicator. Problem of Cadres is difficulty in determining nutritional status of elderly every month and difficulty in documenting data of elderly medical records. If elderly document is lost, development graph of elderly nutritional status can not be traced. The aim of research is to develop intelligent software to detect nutritional status of elderly. Software developed includes the recording of elderly medical record data, detection of elderly nutritional status automatically, and graphic development of elderly weight, height, blood pressure, and hemoglobin,*cholesterol, gout and blood sugar.*. This research consists of two main points. First is the development of intelligent software to detect the elderly's nutritional status using support vector machine (SVM) and data processing of elderly medical records. Output of intelligent system developed is Elderly Good Nutrition Status, Malnutrition, More Nutritional Status.*

KEYWORDS:*Body Mass Index, Cadre, Elderly, Elderly Nutritional Status, SVM.*

Date of Submission: 16-01-2019 Date of acceptance: 28-01-2019

I. INTRODUCTION

Our society views older people as less productive, less attractive, less energetic, easy to forget, perhaps less valuable than those who are still in prime condition [1], for which in national development the government has succeeded realizing positive results in various fields, namely economic progress, environmental improvement, advancement of science and technology, especially in the medical or medical fields, so as to improve the quality of people's health and increase the life expectancy of humans [2]. As a result, the elderly population increases and increases tends to be faster or often referred to as Booming Elderly [3]. One of the Indonesia government's efforts to provide health facilities and implement health efforts for the elderly is by holding a Posyandu. Posyandu is one approach to community participation in the health sector. Posyandu is managed by posyandu cadres who have received training, from midwife. Posyandu cadres are health providers who are near target activities of Posyandu. The frequency of posyandu cadres face to face is more frequent than other health workers. Task of posyandu cadres is not just taking care of toddlers, but has been increased to take care of elderly [4-7], included is monitoring nutritional status of elderly.

The Elderly Integrated Service Center is a health service facility located in villages that aims to improve public health, especially for elderly residents whose implementation is carried out by posyandu cadres. Posyandu cadres are realization of active participation of community in integrated services [8].Current method used by Posyandu Cadres to find out the nutritional status of elderly is to use Elderly Health Card. Namely by measuring and categorizing the Indicator Body Mass Index (BMI). The problem faced by Posyandu Cadres in filling elderly manual is difficulty in determining nutritional status of elderly each month. This is because the work is usually carried out by midwife. In addition, determination of elderly nutritional status manually is not accurate, this is because determination is based on only one indicator, it cannot be several indicators at once. Another problem is difficulty in documenting elderly medical record data. If elderly document is missing, graph from development of nutritional status of elderly it cannot be traced. The research aimed at developing intelligent software to detect nutritional status of elderly, which includes recording elderly medical record data, detecting nutritional status of the elderly automatically, and displaying charts of body weight, height, blood pressure, and hemoglobin levels. The research was conducted covering 2 (two) main points. First is software development to detect elderly nutritional status using support vector machine (SVM) and processing of elderly medical record data. By using the software developed is expectedto increase role of Posyandu cadres, especially in detecting the nutritional status of elderly, so that every examination of elderly can be immediately known for their nutritional status and medical record data can be continuous.

II. MATERIAL

Data used in this study can be divided into two. First is data that is used as training data. The data is data that will be used in the classification process. The data is taken from elderly examination which includes data on body weight, height, blood pressure, and hemoglobin levels, cholesterol, gout and blood sugar. Second is data used in the testing process. The data is the data from the examination of the elderly every month. Data collection was conducted at Sejahtera 2 Posyandu, Ponowaren, Tawangsari, Sukoharjo, Middle of Java, Indonesia. Data taken includes elderly medical record data and anthropometric data of the elderly including: body weight, height, blood pressure, and hemoglobin levels, cholesterol, gout and blood sugar.

III. METHOD

Programming language used in developing software to detect nutritional status of elderly is Matlab programming language [9]. There are stages in developing software to detect nutritional status of elderly people can be described as follows:

a. Create User Interface
   User Interface developed is designed as simply [10] as possible so that Posyandu Cadres can easily operate the program.
b. Management of Elderly Medical Record Data
   Database development for management of continuous elderly medical record data, so that the data of the elderly medical record of the examination results per month can be well documented, including the status of the development of elderly health. To facilitate monitoring the health of the elderly, data is also presented in graphical form, which includes a graph of the development of body weight, height, blood pressure, and hemoglobin levels.
c. Detection of Elderly Nutritional Status Using Intelligent Sistem.
   Method used to developt elderly nutritional status and anemia detection is detection of nutritional based on Body Mass Index (BMI) indicator and Hemoglobin levels using Support Vector Machine method. The stages of detection Nutrition status and anemia using intelligent systems can be explained as in Figure 1.

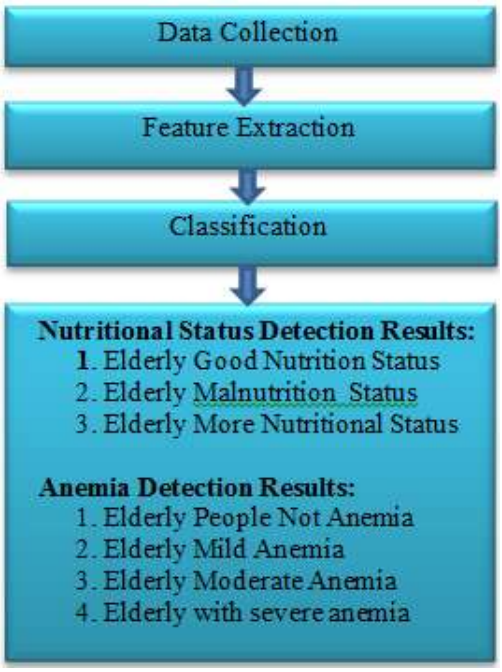

Figure 1. Stages of Methods for Detecting Elderly Nutritional Status

Stages of elderly nutritional status detection can be explained as follows:

a. Data Collection from the Posyandu
   Data collection is carried out in two Posyandu. Data taken includes data from the elderly examination in the form of medical record data which includes name, age, address, gender, occupation, weight, height, blood pressure, and hemoglobin, cholesterol, gout and blood sugar.
b. Feature Extraction
   Feature extraction is the process of getting accurate information so that the identification process can be carried out [11-13]. The features used to detect the nutritional status of elderly include: Body Mass Index

(BMI) feature. While for anemia detection using hemoglobin level (HB) features. The selected features will later be used for the classification of nutritional status and anemia which include: Elderly Normal Nutrition Status, Elderly Poor Nutrition Status, Elderly More Nutritional status, Elderly No Anemia, Elderly Mild Anemia, Elderly Moderate Anemia and Elderly Severe Anemia.

c. Nutritional Status Detection Using Support Vector Machine (SVM)

Detection of nutritional status of elderly is done by carrying out classification process. One classification method is Support Vector Machine (SVM) [14]. Support Vector Machine (SVM) developed by Boser, Guyon, and Vapnik, was first presented in 1992 at the Annual Workshop on Computational Learning Theory. The basic concept of SVM is actually a harmonious combination of computational theories that have existed decades before, such as hyperplane margins (Duda& Hart in 1973, Cover in 1965, Vapnik 1964, etc.), the kernel was introduced by Aronszajn in 1950, as well as other supporting concepts. But until 1992, there had never been an attempt to assemble these components. Unlike the neural network strategy that seeks to find a dividing hyperplane between classes, SVM tries to find the best hyperplane in input space. The basic principle of SVM is a linear classifier, and then developed so that it can work on non-linear problems by incorporating the kernel trick concept in high-dimensional workspaces. These developments provide stimulation of research interest in the area of pattern recognition to investigate potential SVM capabilities theoretically and in terms of applications. At present SVM has been successfully applied in real-world problems, and generally provides better solutions than conventional methods such as artificial neural networks [14]. The program used is MATLAB, which is a language that is highly capable of computational techniques. Matlab combines computing, visualization and programming in a single environment (MathWork). The Software Module used is the Image Processing Toolbox. Toolbox is a compilation of functions given by matlab with the implementation of special image processing algorithms[9].

IV. RESULTS

Application to detect nutritional status of elderly is designed to facilitate posyandu cadres in recording elderly medical record data, automatically detecting nutritional status, and displaying graphs of monitoring nutritional status of elderly. The main menu of application developed can be seen in figure 2.

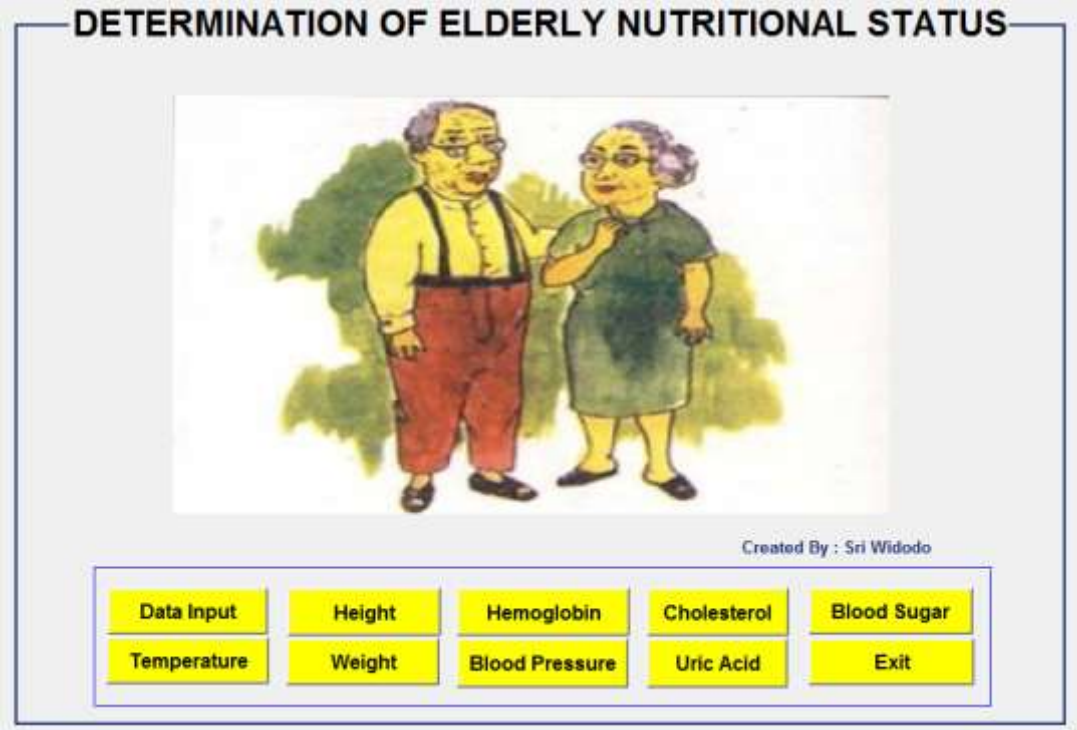

Figure 2. Main Menu

Form for inputting elderly data is shown in Figure 3.

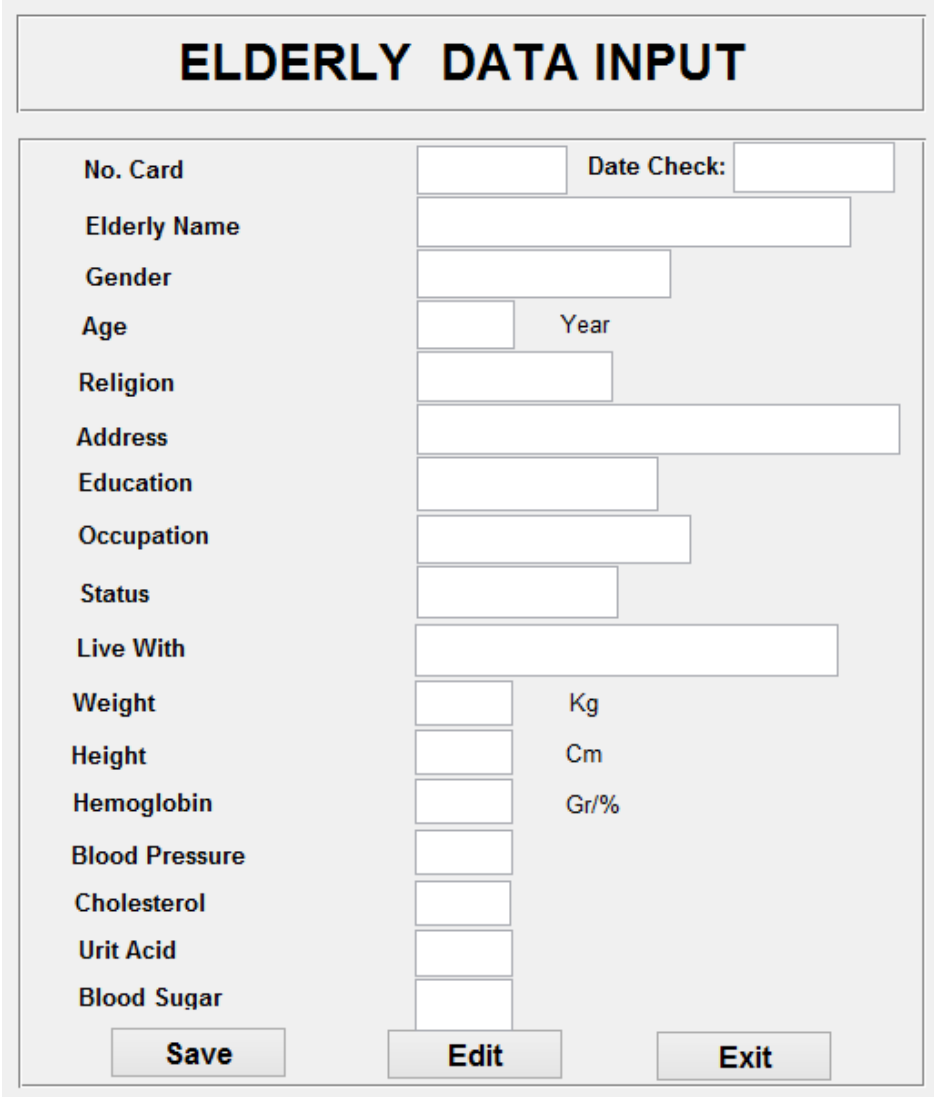

Figure 3. Form for Elderly Medical Record Data Input

After entering elderly examination data every month, system will display detection results of elderly nutritional status which includes normal nutrition elderly, malnourished and excess nutrition. Results of elderly nutritional status detection are shown in figure 4.

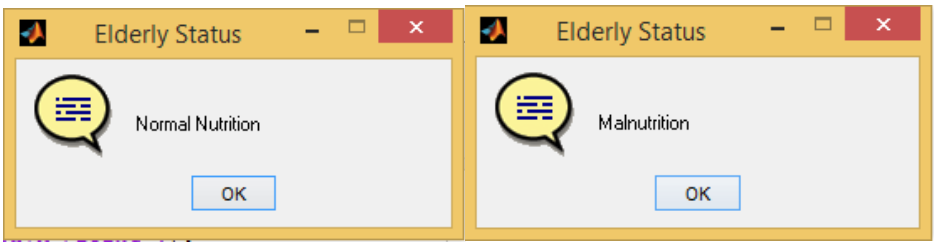

Figure 4. Display of Detection Results of Elderly Nutritional Status

The system can also detect hemoglobin (HB) from the inspection data every month. Results of hemoglobin detection can be shown in figure 5

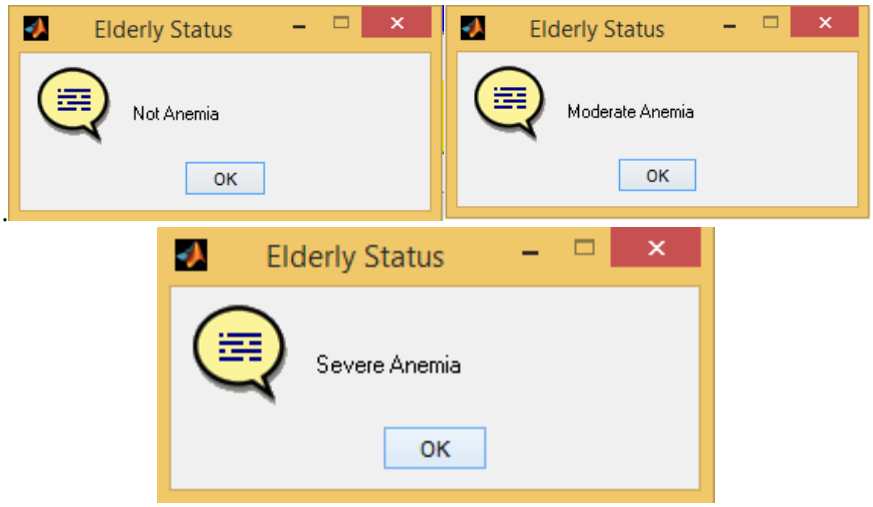

Figure 5. Display Results Detection of Elderly Anemia Status

In this study also included a graph to monitor progress of data on elderly health. The chart includes graphs of temperature development, height, weight, hemoglobin, blood pressure, cholesterol, gout and blood sugar levels. Examples of charts to monitor progress of elderly health are shown in figures 6 and 7.

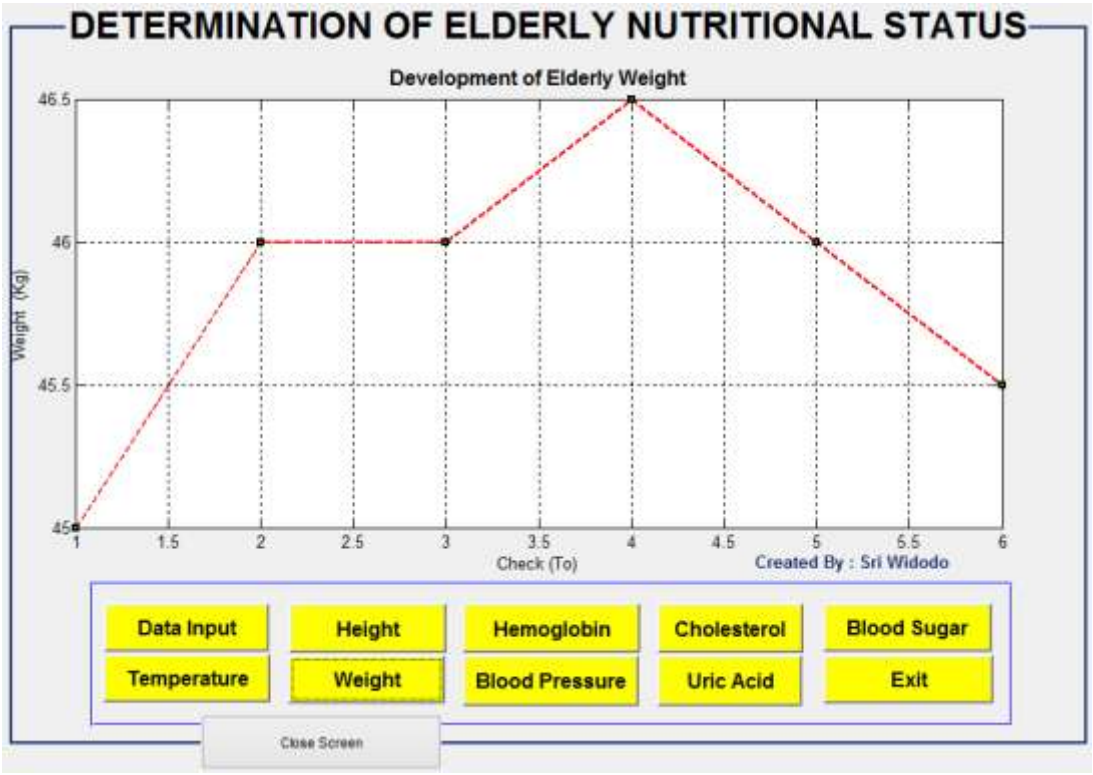

Figure 6 Display Graph of Elderly Body Weight Development

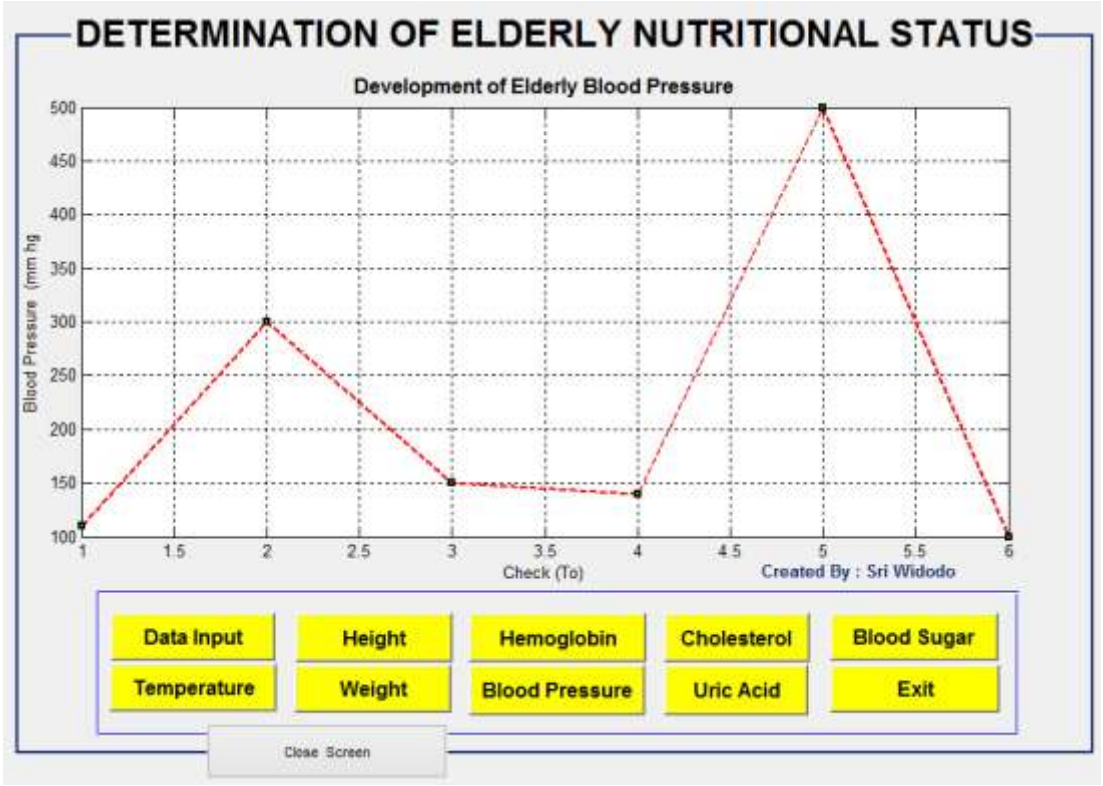

Figure 7 Display Chart of Elderly Blood Pressure Development

To find out accuracy of system being developed, it was tested seven times. The first is a system based on temperature, second is based on body weight, third is based on blood pressure, fourth is based on cholesterol, fifth is based on blood sugar, six is based on hemoglobin and seventh is based on all. Results of tests are shown in table 1.

Table 1. Data Testing Results

No	Number of Test Data	Test Result						
		Test 1 (temperature)	**Test 2** (weight)	**Test 3** (blood presure)	**Test 4** (cholesterol)	**Test 5** (blood sugar)	**Test 6** (Hemoglobin)	**Test 7** (temperature, weight, blood presure, cholesterol, blood sugar, Hemoglobin)
1	20	100%	100%	100%	100%	100%	98.2%	94.6%

The training data used in the system developed were 300 data. The data consists of data from 0 to 100 are data on elderly normal nutritional status, 101 to 200 data on elderly malnutrition status and 201 to 300 are data on elderly normal more nutritional status. The features used to detect the nutritional status of the elderly are weight, height and blood pressure. Training data used to detect anemia in elderly as many as 160 data. The feature used is the hemoglobin level of the elderly. The test is done using 20 testing data. The test results based on temperature, height, weight, cholesterol and blood sugar were 100%. While the results of anemia testing based on hemoglobin were 98.2%. Results of testing nutritional status of elderly based on all features showed an accuracy 94.6%.

V. CONCLUSION

Based on the results of trials that have been carried out, it can be concluded that detection software for nutritional status and anemia in the elderly using the Support Vector Machine (SVM) method is proven to be used as a model for detecting nutritional status and anemia in the elderly. This is indicated by the average accuracy value of 94.6% for nutritional status and 98.2% for elderly anemia.

ACKNOWLEDGEMENT

We would like to express our heartfelt thanks to the Ministry of Research and Technology of Higher Education for supporting my research through the 2018 Community Partnership Program Grant Program.

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Sri Widodo" Improved Accuracy in Determining Elderly Nutritional Status Using Support Vector Machine Method " International Journal of Research in Engineering and Science (IJRES), vol. 06, no. 10, 2018, pp. 23-29