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SUPPORT VECTOR MACHINE ALGORITHM FOR EARLY DETECTION SYSTEM FOR MENTAL EMOTIONAL DISORDERS IN ADOLESCENTS

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Abstract

A mental-emotional disorder is a condition characterized by emotional fluctuations that, if left untreated, might progress into an abnormal state. In Indonesia, the treatment of mental problems is infrequently conducted due to a scarcity of psychiatric personnel and the high expenses associated with comprehensive mental health therapy and treatment. An early detection system for mental-emotional illnesses in teenagers was developed by implementing the Support Vector Machine (SVM) algorithm as a solution to this issue. The Support Vector Machine algorithm is a very accurate classification approach. This study utilizes data that is categorized into two distinct groups: anxiety and depression. The data is partitioned in an 80:20 ratio, with 80% allocated for training data and 20% for test data. The research findings indicate that the testing accuracy levels yielded a value of 85%. The value is derived using the RBF kernel with a gamma value of 0.1 and a C value 10. The Support Vector Machine model is implemented within the Graphical User Interface (GUI). The user experience questionnaire was assessed on the Graphical User Interface, resulting in a user experience score within the "good" category.

Keywords: *Early detection system for mental-emotional disorders, Emotional fluctuations, Classification, Support Vector Machine (SVM), User Experience Questionnaire (UEQ)*

PENDAHULUAN

Emotional mental diseases are characterized by a person undergoing emotional fluctuations. Uninterrupted fluctuations in emotions might progress into a pathological condition (Mubasyiroh et al., 2017). In 2015, the Ministry of Health of the Republic of Indonesia conducted a survey at middle school and high school levels. The report identified ten habits that can potentially harm the health of adolescents (Kementrian Kesehatan Indonesia, 2020). Based on the results of the 2022 Indonesia-National Adolescent Mental Health Survey (I-NAMHS) study, one in three adolescents (34.9%) or 15.5 million Indonesian adolescents, have one mental health problem in the last 12 months and one in twenty adolescents (5.5%) or 2.45 million Indonesian adolescents, have one mental disorder in the last 12 months (Mawaddah & Prastya, 2023).

Based on the latest data released by the Mental Health Care Community Caucus in collaboration with the Faculty of Social and Political Sciences (FISIP) of the University of Indonesia on July 9, 2024, the number of psychiatrists and psychologists in Indonesia is still relatively small, namely 1,053 people and 2,917 clinical psychologists (Triana, 2024). The majority of these mental health specialists are concentrated on the island of Java. This data demonstrates that the responsibility of treating 300,000 to 400,000

individuals, or less than 10% of the population suffering from mental problems, falls on a single psychiatrist or mental health professional who may provide treatment services (Mulya & Malik, 2020). Furthermore, the provision of mental health services, including medicines, incurs a substantial financial burden (Khoirunissa & Sukartini, 2020).

conditions. One such method involves establishing an early detection system specifically designed for detecting emotional mental disorders in adolescents. By implementing this early detection system, it is anticipated that it will aid in identifying and providing information regarding the emotional and mental well-being of teenagers, enabling prompt intervention and treatment.

Emotional mental health disorders are typically identified by the existence of atypical symptoms in emotions, thoughts, interactions with others, and conduct (Khoiriyah & Handayani, 2020). The Self Reporting Questionnaire (SRQ) can be utilized to evaluate an individual's emotional and mental illnesses. The World Health Organization (WHO) has designed this questionnaire as a comprehensive screening tool for mental disorders in underdeveloped nations (Beusenberg et al., 1994). These 20 questions pertain to indicators of mental and emotional illnesses, and they offer "yes" and "no" response alternatives. The 20 questions pertain to indicators of emotional mental problems and offer response choices of "yes" and "no" (Idaiani, 2009; Iskandar & Istiqomah, 2015; L, n.d.). The self-reporting questionnaire is a cost-effective, user-friendly, and efficient instrument for assessing emotional mental health (Renaldo & Suryani, 2020).

Prior studies employed the Support Vector Machine (SVM) technique to classify the diagnosis of Schizophrenia Mental Disorders in various scenarios (Kurniawaty et al., 2018). Kurniawaty utilized a dataset consisting of 75 instances of schizophrenia mental diseases, which were categorized into two distinct disorders: paranoid and simplex. The study (Rizkiah et al., 2020) employed the Forward Chaining technique to identify emotional mental health issues in children aged 4-17 years. The Strength and Difficulties Questionnaire (SDQ) was utilized for this purpose. The study assessed five dimensions of behavior to identify emotional mental health issues at an early stage. These dimensions include behavioral difficulties, emotional symptoms, peer problems, hyperactivity, and prosocial behavior. This study proposes an early detection approach for identifying emotional mental diseases in teenagers, which is capable of categorizing various emotional mental health issues. This program was developed utilizing data obtained from the outcomes of the Self Reporting Questionnaire, which was disseminated through online platforms. The factors employed are indicators that identify individuals undergoing an emotional mental disorder, which are more prone to manifest symptoms of anxiety or signs of depression. The collected data is transformed into a dataset. The classification process was performed using the Support Vector Machine approach. The SVM algorithm is used because of its superior accuracy compared to other classification algorithms (Ahujaa & Banga, 2019).

During the application development process, data is collected from teenagers aged 12-24 years through an online Self Reporting Questionnaire. This data is then merged into a dataset. The dataset consists of 100 rows of data, which have been split into training data and testing data in an 80:20 ratio. The output consists of the outcomes of categorizing emotional mental disorders, which are classified into two categories: experiencing symptoms of anxiety disorders and experiencing symptoms of depression disorders. The system was constructed with the Python programming language

METODE PENELITIAN

1. Support Vector Machine

The classification concept uses the SVM algorithm to find the best hyperplane with the largest margin value, which acts as a separator between two data classes (Hasibuan et al., 2017; Hilmiyah, 2017). Hyperplanes can be found by measuring the margin, the closest point in each class, and then looking for the maximum point. The closest pattern is a support vector (Nugroho et al., 2003) (Jakkula, 2006).

To find the hyperplane of two groups or the positive class and the negative class, the following function can be formulated:

$$f(w,b) = x_i.w + b.$$

$$x_i.w + b \geq 1 \; for \; y_i \; positive \; class \quad (1)$$

$$x_i.w + b \leq 1 \; for \; y_i \; negative \; class \quad (2)$$

Description:

x_i = i's data; w = vector weight; b = bias; y_i = ith data class which has the same value as the equation or f(x).

The vector weight value can be calculated using equation 3 and the bias value can be found using equation 4.

$$b = -\left(\frac{(w.x^{+}+w.x^{-})}{2}\right) \quad (3)$$

$$w = \sum_{i=1}^{n} \alpha_i \, y_i x_i \quad (4)$$

Description:

$w.x^{+}$ = positive data class weight; $w.x^{-}$ = negative data class weight; α_i = weight of the ith data.

a. Kernel Functions

In some cases there is data that cannot be grouped linearly, in SVM non-linear data can be mapped to vector space with higher dimensions using the kernel function. The commonly used kernel function is the Gaussian Radial Basic Function (RBF)

$$K(x,y) = exp\left(-\frac{\|x-y\|^2}{2\sigma^2}\right) \quad (5)$$

And Polynomials

$$K(x,y) = \left((x.y) + c\right)^d \quad (6)$$

Description:

K(x,y) = kernel function ; x = data; y = data class; c = constant C; σ = sigma; d = constant d.

b. SVM Training

The training calculation used is the Sequential Training method, along with the stages of the Sequential Training method (Kurniawaty et al., 2018) (Roy & Chakraborty, 2023).

c. Initiation stage values $\alpha_1, \gamma, C, \varepsilon$.

α_1 = alpha, used to find the support vector value

γ = gamma to control spread

C = cost, used to control the trade off between margin and classification error

ε = to find the error value

d. Calculating the Hessian matrix (Amir & Amine, 2021; Yu et al., 2023) the following equation is used:

$$D_{ij} = y_i y_j\left(K(x_i x_j) + \boldsymbol{\lambda^2}\right) \quad (7)$$

With i,j = 1,…,…,n; y_i = ith data class; y_j = jth data class; x_i = i-th data; x_j = j-th data; $K(x_i x_j)$ = kernel function ; $\boldsymbol{\lambda}$ = lambda; n = number of data

e. Next, to find the alpha value, it can be calculated using the following equation:

$$E_i = \sum_{j=1}^{n} \alpha_j D_{ij} \quad (8)$$

$$\delta a_i = \min\left(\left(\max[\gamma(1-E_i), a]\right), C - a_i\right) \quad (9)$$

$$a_i = a_i + \delta a_i \quad (10)$$

E_i = Error rate ; α_j = jth alpha; D_{ij} = Hessian Matrix; δa_i = delta alpha i

f. Repeat in step 3 until you get the maximum iteration or reach the value $\delta a_i \leq \varepsilon$.

g. After reaching the maximum iteration, the hyperplane or a_i value will be obtained (Amir & Amine, 2021; Yu et al., 2023).

h. Testing Support Vector Machine

Testing on the Support Vector Machine is carried out in steps,

First, calculate the value of f(x), with the formula

$$f(x) = \sum_{i=1}^{m} \alpha_i \, y_i K(x_i, x) + b \quad (11)$$

α_i = i-th alpha ; y_i = ith data class; m = amount of data that constitutes SV; $K(x_i, x)$ = kernel function used; b = bias value

The bias value can be found using the formula,

$$b = -\frac{1}{2}\left(\sum_{i=1}^{m} \alpha_i \, y_i K(x_i, x^{+}) + \sum_{i=1}^{m} \alpha_i \, y_i K(x_i, x^{-})\right) \quad (12)$$

$K(x_i, x^{+})$ = kernel function on positive class data

$K(x_i, x^{+})$ = kernel function on negative class data

i. User Experience Questionnaire (UEQ)

One method for evaluating system design is the UEQ method (Dewi et al., 2020; Laksono et al., 2020; Zhu et al., 2022). The UEQ method is very easy to apply, efficient, and has the advantage of having Data Analysis Tools that can easily compare the level of experience of each respondent (Juniantari & Putra, 2021; Schrepp, 2017). UEQ can be used to determine pragmatic quality and hedonic quality. Pragmatic qualities are

clarity, efficiency, and accuracy, while qualities are stimulation and novelty.

2. Data Collection

The research data used is original data obtained based on the results of interviews with expert psychologists, and the results of the Self Reporting Questionnaire (SRQ) distribution (SRQ) (Beusenberg et al., 1994) which was filled in by teenagers aged 12-24 years via Google form.

Table 1. Self-Reporting Questionnaire Weighting Value

Code	Question	Option	Grade
G01	Have you had frequent headaches lately?	Yes	1
		No	0
G02	Have you had any appetite lately?	Yes	1
		No	0
G03	Have you had trouble sleeping lately?	Yes	1
		No	0
G04	Have you been easily afraid of anything lately?	Yes	1
		No	0
G05	Have you been feeling tense, anxious or worried about many things lately?	Yes	1
		No	0
G06	Have your hands been shaking for no reason lately?	Yes	1
		No	0
G07	Has your digestion felt disturbed lately?	Yes	1
		No	0
G08	Has it been difficult for you to think clearly lately?	Yes	1
		No	0
G09	Do you feel unhappy lately?	Yes	1
		No	0
G10	Have you been crying a lot lately?	Yes	1
		No	0
G11	Has it become difficult for you to enjoy daily activities lately?	Yes	1
		No	0
G12	Have you found it difficult to make any decisions, even simple ones, lately?	Yes	1
		No	0
G13	Does your daily work become disturbed because of your thoughts?	Yes	1
		No	0
G14	Do you feel like you are not doing anything useful?	Yes	1
		No	0
G15	Have you lost interest in things lately?	Yes	1
		No	0
G16	Have you felt worthless about yourself lately?	Yes	1
		No	0
G17	Have you ever thought about ending your life lately?	Yes	1
		No	0
G18	Do you feel tired all the time?	Yes	1
		No	0
G19	Has your stomach been feeling bad lately?	Yes	1
		No	0
G20	Have you felt tired easily lately?	Yes	1
		No	0

These twenty questions represent symptoms that identify emotional mental disorders and are used as variables that are classified in the system using the SVM method. Pairs of symptoms of mental emotional disorders and their clarified types can be seen in Table 2.

Table 2. Paired Symptoms and Names of Emotional Mental Health Disorders

Key Symptom Pairs	Disorder Name
G01, G02, G03, G04, G05, G06, G08, G12, G13, G18, G20	Anxiety Disorders
G01, G06, G07, G09, G10, G11, G13, G14, G15, G16, G17, G19	Depressive Disorders

These early detection options and assessments come from the Description of Mental Emotional Disorders in Cancer Patients During Chemotherapy at Tangerang Regency General Hospital (Dinuriah, 2015). These options and assessments include:

a. Yes has a value of 1, indicating that the symptom appeared in the last 30 days.

b. Not worth 0, indicating that these symptoms have not appeared in the last 30 days.

c. Respondents are said to be experiencing symptoms of emotional mental disorders or distress if they experience six or more symptoms.

d. The results tend to be anxiety disorders based on the respondents' answers, which lead more to symptoms of anxiety disorders.

The results tend to be depressive disorders based on whether the respondent's answers lead more to symptoms of depressive disorders.

3. System Design

The system design process (Figure 1) begins with the data preprocessing stage. This stage aims to make raw data into data that the system can process. The next stage is data processing using the Support Vector Machine (SVM) algorithm. The data will be split into training and testing data with a comparison of 80:20. The data is then processed in the classification modeling process using the SVM algorithm or a training process to obtain hyperplane values.

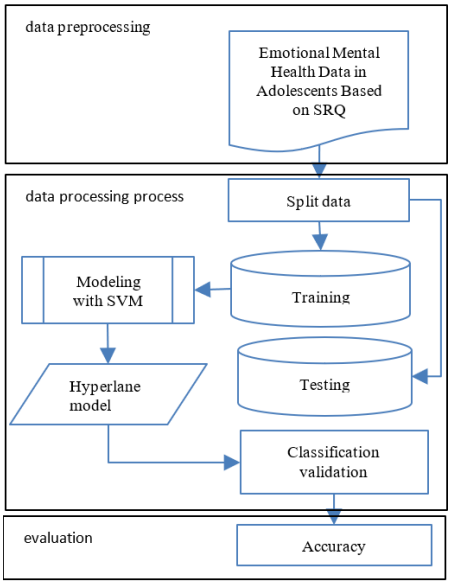

Figure 1. Classification System Process Flowchart

The SVM model that has been obtained is in the form of a hyperplane, then classification validation is carried out. The SVM model, which has been validated and evaluated using accuracy level measurements, is then implemented in the form of a GUI. In Figure 2, a flow diagram of model design is shown to be applied to an early detection system for emotional mental disorders using the SVM algorithm.

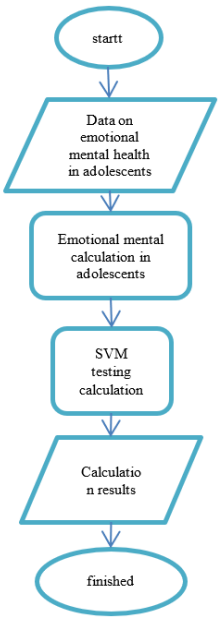

Figure 2. System Flow Diagram

After the dataset is entered, the next step is calculating the training SVM and testing SVM. SVM training, calculated using the sequential training method. The results of this calculation are in the form of predicted classes from test data. This SVM training calculation is carried out to obtain the optimal hyperplane. The SVM sequential training calculation process is explained in Figure 3.

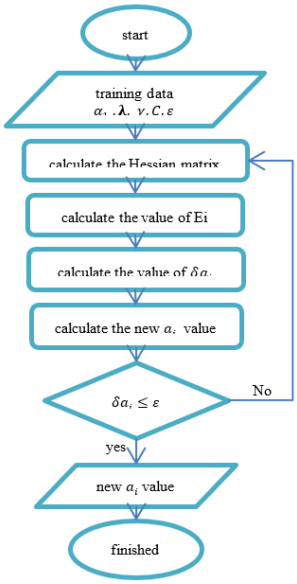

Figure 3. Sequential Training SVM Calculation

The steps, initialize α_1 , $\boldsymbol{\lambda}$, γ, C, ε and the kernel function used. Then calculate the Hessian Matrix, Ei, a_i , a_i value. Then iterates until the value $\delta a_i \leq \varepsilon$, or has reached the specified maximum number of iterations. The output at this stage is the optimal a_i or hyperplane value, to be used for the SVM testing process.

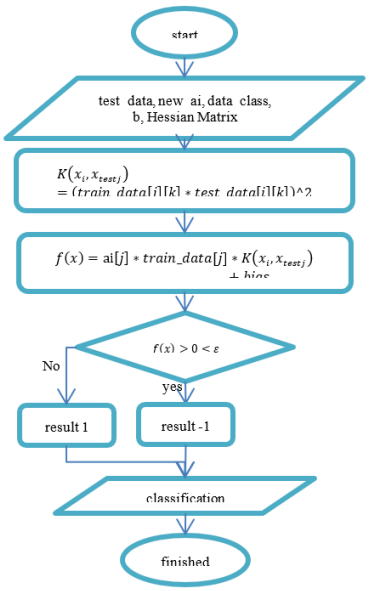

Figure 4. SVM Testing Calculation Process

SVM Testing calculations (figure 4), are carried out by entering test data, αi, b, and Hessian values. Then the kernel value of the test data and the function value are calculated. The output are classification results

RESULT AND DISCUSSION

1. Manual *C*alculations with the Support Vector Machine Algorithm

Manual calculations use part of the dataset that has been collected, with an initial value of 1 meaning yes, value 0 meaning no. The number of training data used was five, and two test data. The measurement parameters used only contain 4 parameters, namely G01 is a symptom of headache, G03 is a symptom of difficulty sleeping, G06 is a symptom of shaking hands and G08 is a symptom of difficulty thinking clearly. Initialize the Anxiety class with a value of 1 and then for the Depression class with a value of -1. Data is presented in Table 3.

Table 3. Training Data and Test Data Table

No	G01	G03	G06	G08	Y	Kelas
1	0	1	0	1	1	Worried
2	0	1	0	1	1	Worried
3	1	0	0	0	-1	Depression
4	1	0	0	0	-1	Depression
5	1	0	0	0	-1	Depression
6	0	1	0	1	1	Worried
7	1	0	1	1	-1	Depression

a. Manual Training SVM Calculations
The manual calculation stage with the SVM algorithm is carried out using the sequential training method to find the hyperplane or dividing plane between two objects from two classes with the maximum margin value.

1) Initiation αi=0, γ=0,01, C=1, ε=0,0004, d=2, λ=0,5, In determining the initiation value the variables used are based on previous research, namely research (Kurniawaty et al., 2018).
2) The Hessian matrix value is calculated using Equation 7. The kernel function used is the polynomial kernel in equation 6. The results of the Hessian matrix for the training data are in Table 4.
3) The a_i value is found using equation 8 to equation 10.

Table 4. Hessian Matrix

D_{ij}	1	2	3	4	5
1	9.25	9.25	-1.25	-1.25	-1.25
2	9.25	9.25	-1.25	-1.25	-1.25
3	-1.25	-1.25	4.25	4.25	4.25
4	-1.25	-1.25	4.25	4.25	4.25
5	-1.25	-1.25	4.25	4.25	4.25

The first step to find the value of ai is to find the value of E_i with initial initiation α_i=0. The results of Ei, $\delta\alpha_i$, and α_i calculations after calculating all training data are presented in Table 5.

Table 5. Calculation of Ei, $\delta\alpha_i$, and α_i values in the 1st iteration

I	E_i	δa_i	α_i
1	0	0,01	0,01
2	0	0,01	0,01
3	0	0,01	0,01
4	0	0,01	0,01
5	0	0,01	0,01

4) Because the value of δa_i is not less than the error value, the second iteration of the calculation is carried out. The iteration stage begins by calculating the error value.

Calculate the Ei, δαi, and α_i value with the new αi value from 1st iteration. The training data calculations in the 2nd iteration can be seen in Table 6.

Table 6. E_i , $\delta\alpha_i$, and α_i calculation results in the 2nd iteration

I	E_i	δαi	αi
1	0,1475	0,008525	0,018525
2	0,1475	0,008525	0,018525
3	0,1025	0,008975	0,018975
4	0,1025	0,008975	0,018975
5	0,1025	0,008975	0,018975

b. Manual SVM Testing Calculations
The next stage is the testing process to obtain the *f(x)* value using equation 11.

Before looking for the value of *f(x)*, it is necessary to search to find out the support vector value and bias value. The value $K(x_i, x^+)$ is the largest support vector value, while $K(x_i, x^-)$ is the smallest support vector value. The manual calculation of $K(x_i, x^+)$ is based on the largest αi value from the positive class, namely 0.018525. Meanwhile, the value of $K(x_i, x^-)$ is based on the largest αi value, from the negative class, namely 0.018975. Based on this value, the Hessian matrix columns 1 and 3 in Table 7 are used.

Table 7. Hessian Matrix Values

D_{ij}	1	3
1	9,25	-1,25
2	9,25	-1,25
3	-1,25	4,25
4	-1,25	4,25
5	-1,25	4,25

First, the bias value is found by calculating the Kernel value in the positive class and negative class.

$$K(x_i, x^+) = \sum_{i=1}^{5} \alpha_i y_i K(x_i, x^+)$$

$$K(x_i, x^-) = \sum_{i=1}^{5} \alpha_i y_i K(x_i, x^-)$$

Then, the bias value is calculated using Equation 12.

$$b = -\frac{1}{2}\left(\sum_{i=1}^{m} \alpha_i\, y_i K(x_i, x^+) + \sum_{i=1}^{m} \alpha_i\, y_i K(x_i, x^-)\right)$$

Next, calculate the value of f(x), by calculating the kernel value for the test data. The values of K(x_i,x_test1) and K(x_i,x_test2) for all test data can be seen in table 8.

Table 8. Calculation of $\boldsymbol{K(x_i, x_{testj})}$ values

$K(x_i, x_{testj})$	x_{test1}	x_{test2}
1	9	4
2	9	4
3	1	4
4	1	4
5	1	4

The next step is to find the value of $f(x)$. From the f(x) value, it can be classified as; for a value >0, the data is included in the class 1 category, namely anxiety. While the value is <0, the data is included in category -1, namely depression. The results of the test data classification can be seen in table 9.

Table 9. Classification results

	Results	Predicted class	Actual class
$f(xtext1)$	0,2137125	1	1
$f(xtext2)$	-0,0795	-1	-1

2. Algorithm Implementation

a. Datasets

In the initial stages of implementation, dataset separation was carried out. Training data is used at the model training stage for classification and test data is used at the model testing stage to assess the performance of the model created. The dataset collected 100 data consisting of 56 anxiety data and 44 depression data.

b. SVM Training

The SVM training process uses a function in the Sklearn Python library, namely GridSearchCV, to find the best parameters. The search process uses previously determined parameter values. Determination of the variables C (cost) and γ (gamma) is based on previous research, namely in Laili's research using C = {0.1, 1, 10, 100, 1000, 10000} and γ = {1, 0.1, 0.01, 0.0001, 2, 0.2, 0.02, 0.0002 (Laili, 2020). The best model for classifying emotional mental health data is with the RBF kernel, C = 10 dan γ = 0,1.

Parameter C is used to control decisions during training to reduce the amount of misclassified data. The gamma parameter can be assumed to be the 'spread' of the dataset used in the training process (figure 5).

```
SVC(C=10, break_ties=False, cache_size=200, class_weight=None, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma=0.1, kernel='rbf',
    max_iter=-1, probability=False, random_state=None, shrinking=True,
    tol=0.001, verbose=False)
```

Figure 5. The output is the best parameters

c. SVM Testing

The next process is to carry out testing with test data. The testing process is carried out by providing input values directly from the data in Figure 6.

Type	G01	G02	G03	G04	G05	G06	G07	G08	G09	G10	G11	G12	G13	G14	G15	G16	G17	G18	G19	G20
Cemas	1	1	0	0	1	0	1	1	1	0	1	1	1	0	1	0	0	1	1	1
Depresi	0	0	0	0	1	0	1	0	0	0	0	0	1	1	1	0	1	1	0	0

Figure 6. Manual test data

Source code for manual testing in Figure 7.

```
[38]  1  grid.predict([[1,1,0,0,1,0,1,1,1,0,1,1,1,0,1,0,0,1,1,1]])
      array(['Cemas'], dtype=object)

[47]  1  grid.predict([[0,0,0,0,1,0,1,0,0,0,0,0,1,1,1,0,1,1,0,0]])
      array(['Depresi'], dtype=object)
```

Figure 7. Manual testing

From the output results shown in Figure 6, the system built was successful in carrying out classification according to existing data.

d. Evaluation of SVM models

The prediction results will be presented using a confusion matrix and the accuracy value will be calculated. Figure 8 shows the results of test data classification presented with a confusion matrix.

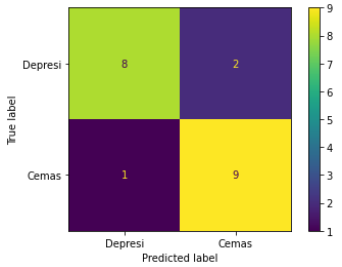

Figure 8. Confusion Matrix Results

The classification results of the SVM model that was applied succeeded in classifying 17 anxiety and depression test data based on their class and 3 anxiety and depression test data were classified as not according to their class. Based on the results shown, it can be seen that the accuracy level of this model is 0.85 or 85% (figure 9).

```
1  from sklearn.metrics import accuracy_score
2
3  y_pred = grid.predict(X_test)
4  accuracy_score(y_test, y_pred)
```

```
0.85
```

Figure 9. Accuracy measurement

3. GUI Implementation

a. Import Library

GUI implementation uses visual studio code and uses several libraries (figure 10).

```
1  import pandas as pd
2  from pandas import DataFrame
3  from sklearn import svm
4  import tkinter as tk
```

Figure 10. GUI implementation library

b. Support Vector Machine Algorithm Process

From the SVM modeling carried out previously, the best parameter values were obtained which were implemented in the GUI. Figure 11, training process on data to be implemented in the GUI.

```
#######################################################
mental = pd.read_csv("datasetseratus.csv")
mental_x = DataFrame(mental,columns=['G01','G02','G03','G04','G05',
'G06','G07','G08','G09','G10','G11','G12','G13','G14','G15','G16',
'G17','G18','G19','G20' ])
mental_y = DataFrame(mental,columns=['Type'])

classifier = svm.SVC(C=10, degree=3, gamma=0.1, kernel='rbf')
classifier.fit(mental_x, mental_y)
```

Figure 11. SVM Model Training

When implementing a GUI, the input value obtained from the entry is taken and stored in a function. Figure 12 shows the programming code for retrieving input data.

```
def test_function ():
    G01 = satu.get()
    G02 = dua.get()
    G03 = tiga.get()
    G04 = empat.get()
    G05 = lima.get()
    G06 = enam.get()
    G07 = tujuh.get()
    G08 = delapan.get()
    G09 = sembilan.get()
    G10 = sepuluh.get()
    G11 = sebelas.get()
    G12 = duabelas.get()
    G13 = tigabelas.get()
    G14 = empatbelas.get()
    G15 = limabelas.get()
    G16 = enambelas.get()
    G17 = tujuhbelas.get()
    G18 = delapanbelas.get()
    G19 = sembilanbelas.get()
    G20 = duapuluh.get()
```

Figure 12. Retrieval of data input

The data that has been inputted and stored in the 'data' variable is carried out in a prediction process. The prediction or testing process can be seen in Figure 13.

```
    mental_x_test_custom= DataFrame(data)
    df2 = classifier.predict(mental_x_test_custom);
```

Figure 13. Prediction Process

From the prediction results, if the result shows 1 it is classified as anxious, and if not, it is classified as depressed (figure 14).

```
If (df==1):
    Label1 = tk.Label(root, text="""based on the answers that the results
    show that you are experiencing some symptoms of ANXIETY. The
    results of this system do not mean that you have an anxiety disorder,
    but you can start to care about yourself and find someone to talk to or
    if you feel in a difficult situation you can go to a psychologist or
    psychiatrist.
    Canvas1.create_window(50, 640=label1, anchor=W)
```

Figure 14. Prediction Result Function

c. GUI display

The GUI (Graphical User Interface) of this early detection system for emotional mental disorders is very simple, just input data according to the question. Users are asked to fill in number 0 if the answer is no and the number 1 if the answer is yes, for each question asked. The result button is used to display classification results. Figure 15 shows the GUI of the early detection system for emotional mental disorders. Figure 16 is the output of the system, namely the results of early detection classification.

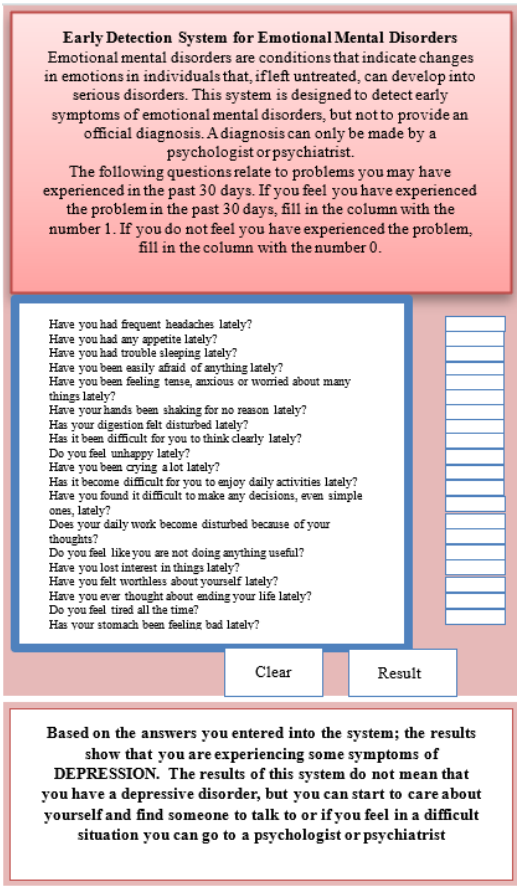

Figure 15. System GUI and Prediction Results Output

4. Evaluation of GUI

Evaluation, using the User Experience Questionnaire (UEQ) method for teenage respondents. Table 10 shows the points tested.

Table 10. User Experience Questionnaires

Obstructive	° ° ° ° ° ° °	Supportive
Complicated	° ° ° ° ° ° °	Easy
Inefficient	° ° ° ° ° ° °	Efficient
Confusing	° ° ° ° ° ° °	Clear
Boring	° ° ° ° ° ° °	exciting
Not interesting	° ° ° ° ° ° °	Interesting
Conventional	° ° ° ° ° ° °	Intentive
Usual	° ° ° ° ° ° °	Leading-edge

UEQ analysis shows that the average value of each variable is between -3 and +3. A mean value of -3 indicates a very negative evaluation and a mean value of +3 indicates a very positive evaluation. Average values between -0.8 and +0.8 describe neutral evaluation results. Negative evaluation results are represented by an average value lower than -0.8, and positive evaluation results are represented by a value higher than +0.8. The average of this variable is the result of the respondent's evaluation. Table 11 shows the average results of respondents' assessments and Table 12 shows the average based on the quality scale measured.

Table 11. UEQ results based on each test point

Item	Mean	Negative	Positive	Scale
1	2.2	obstructive	supportive	Pragmatic Quality
2	1.8	complicated	easy	Pragmatic Quality
3	0.8	inefficient	efficient	Pragmatic Quality
4	1.4	confusing	clear	Pragmatic Quality
5	1.4	boring	exciting	Hedonic Quality
6	1.0	not interesting	interesting	Hedonic Quality
7	2.0	conventional	inventive	Hedonic Quality
8	1.6	usual	leading edge	Hedonic Quality

The test results on the user experience when using the early detection system application for emotional mental disorders show that; Pragmatic quality consisting of clarity, efficiency, and accuracy is included in the Above Average category. Meanwhile,

hedonic qualities which include stimulation and novelty are included in the good category. So, overall, the UEQ results for the GUI of this early detection system for emotional mental disorders are included in the good category (Table 12).

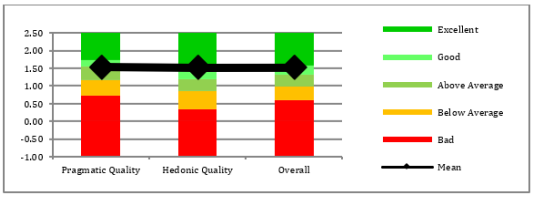

Figure 16. UEQ Results

CONCLUSION

The Support Vector Machine (SVM) algorithm can be applied to an early detection system for emotional mental disorders in adolescents. The data used was 100 data and consisted of 56 anxiety data and 44 depression data. The best SVM model obtained during the training process is used for implementation in the GUI. The results with the User Experience Questionnaire on the GUI of the early detection system for emotional mental disorders by applying the SVM algorithm are included in the good category. The resulting accuracy value for the model created by this research is 85% using the RBF kernel with a value of C = 10 and gamma = 0.1.

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