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PREDICTING TIMELINESS OF CORPORATE FINANCIAL REPORTING BASED ON SUPPORT VECTOR MACHINE

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ABSTRACT

The main purpose of this study is to predict the timeliness of the corporate financial reports with Support Vector Machine (SVM) and comparing the performance of SVM with Linear Discriminant Analysis (LDA). 30 samples of Food and Beverages companies on the Indonesia Stock Exchange (IDX) were used in this study. This study concludes that SVM has the best performance in predicting the timeliness of financial reporting compared to LDA. The best variables that can significantly distinguish companies that are on time and not are Return on Assets (ROA) and Debt to Asset Ratio (DAR). Meanwhile, the other two variables, namely Current Ratio (CR) and Company Size, have no significant effect. These results are expected to be a reference for users of financial information in making decisions.

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1. INTRODUCTION

Timeliness of financial reporting of public companies is a very important characteristic for company management. Until the government issued Law No. 8 of 1995 [1] about the capital market and then followed up by Bapepam-LK by issuing an attachment to The Decision of The Chairman of Bapepam-LK Number: KEP-40/BL/2007 [2]about the period for submitting financial reports. Financial reports that are submitted on time are expected to reduce information imbalances and increase the ability of the information to influence decisions. For the company's management, their timeliness in submitting their financial statements will have an impact on increasing their reputation. As for external parties, the financial reports obtained in a timely manner will serve as a reference for them in making decisions. In signaling theory, companies that have good quality will give a signal by submitting their company's financial statements in a timely manner, while companies that have poor quality will tend not to be on time [3]. In addition, according to Agyei-Mensah [4], high financial performance is good news so companies will tend to announce the situation to the public.

Many researchers are interested in examining the factors that affect a company's timely submission of financial statements or not. Various classical statistical methods are used to analyze it. Khasharmeh & Aljifri [5], Imaniar [3], Kristianto & Apriwenni [6], Herninta [7] , and Natikhoh & Samrotun [8] used multiple regression analysis because the dependent variable used was metric data, namely the number of days from closing the book to annual report published. Hilmi et al. [9], Marathani [10], Dewi & Jusia [11], Islam & Fuad [12], Hayati [13], Suryani & Pinem [14], Carolina & Tobing [15], Irmalis & Kariza [16], and Prakoso & Wahyudi [17] chose logistic regression analysis as the method of analysis. This is because they use metric and non-metric independent variables and non-metric dependent variables. Juwitari [18] and Hayati [13] use Linear Discriminant Analysis (LDA) where the dependent variable is non-metric and the

independent variable is metric. In addition, several researchers also tried to use non-parametric statistical methods such as Hayati [13] using the Radial Basis Function Neural Network (RBFNN) and Hayati et al. [19] and Hayati & Muhtarom [20] using the Multivariate Adaptive Regression Spline (MARS). The non-parametric method was chosen because it is considered more flexible and does not require assumptions like the parametric method or the classical method. Hayati [13] even in his research applies parametric and non-parametric methods and compares the two methods. The results of his research show that LDA is better than Logistics Regression and RBFNN in predicting the timeliness of financial reporting of manufacturing companies on the IDX.

Support Vector Machine (SVM) is a machine learning method that was first introduced at the 1992 Annual Workshop on Computational Learning Theory by Boser, Guyon and Vapnik. The SVM concept itself is to find the best hyperplane function to separate two classes in the input space [21]. In the International Conference on Data Mining (ICDM) in Hong Kong in 2006, ICDM identified the 10 best algorithms in data mining. SVM is in third place after C4.5 and K-Means [22]. SVM has been widely applied in various fields including finance. One of the applications of SVM in the financial sector is the classification of companies based on financial distress or bankruptcy. Such as research conducted by Shin et al. [23], Hui & Sun [24], Ding et al. [25], Chen [26], Handayani & Fitriandini [22], Pristiyani et al. [27] and Santoso & Wibowo [28]. Their research resulted in the finding that SVM had higher accuracy than the other methods compared. The application of SVM in the study of the classification of companies based on the timeliness of submission of financial statements has not been carried out.

The main purpose of this study is to apply SVM to predict companies based on the timeliness of submitting financial statements. In addition, SVM will be compared with LDA in order to get the method that has the best performance. This research is expected to help various parties to obtain the best prediction results so that it becomes a reference in making decisions and finding variables that contribute to increasing the timeliness of companies in submitting their financial statements to the public.

2. METHOD

2.1 Type and Data Source

This study uses secondary data in the form of financial statements of companies in the Food and Beverages sector listed on the IDX during the period from 2014 to 2021. A total of 30 companies in the Food and Beverages sector were studied during that period. The predictor variable used in this study refers to the research of Irmalis & Kariza [16]. The predictor variables can be seen in Table 1. These variables were chosen with the consideration that LDA requires that the predictor variables must have an interval or ratio scale (metric data).

Table 1. Predictor Variables

Variable	Proxy
Profitability (X_1)	Return on Asset (ROA)
Liquidity (X_2)	Current Ratio (CR)
Solvency (X_3)	Debt to Asset Ratio (DAR)
Company Size (X_4)	Ln Total Asset

As the dependent variable in this study, namely the timeliness of the submission of financial statements. The timeliness of submitting the company's financial statements in the form of

category data consisting of two categories, namely not on time (0) and on time (1). In accordance with Bapepam-LK Regulation Number X.K.2 [29], companies whose financial statements are reported no later than March 31, are categorized as on time.

2.2 Analysis Method

The data in this study are divided into two, namely training data and testing data. This is done in order to build models and predictions. Data from 2014 to 2019 is set as training data, where with this training data LDA and SVM models will be built. While the data for 2020 and 2021 are used to test the performance of the two models in predicting classification.

The SVM model proposed in this research is formed by pre-determining the kernel function and Gamma and C (cost) parameters. The kernel functions used are Radial Basis Function (RBF), Polynomial and Sigmoid. Parameter C tested is 0,5; 1; 10; and 100. While the Gamma parameters tested are scale; 1; 0.1; 0.01; 0.001. The best kernel functions and parameters are obtained by using the Grid-Search technique.

Standardization of values on predictor variable data needs to be done in this study because the scale of data measurement is different. The last stage in this research is to measure the performance of the two methods using the accuracy value and Area Under the Curve (AUC). AUC is the area under the Receiver Operator Characteristic (ROC) curve. The AUC value is often used to compare the performance of two methods in classifying unbalanced data [30]. In the case of the timeliness of submitting the financial statements of Food and Beverages companies on the IDX, data imbalances were found, where the on-time category had a larger number than the untimely category data. So that AUC is more appropriate to apply in this case.

3. RESULT AND DISCUSSION

3.1 Data Analysis Based on Descriptive Statistics

The compliance of companies listed on the IDX in submitting financial statements has been regulated in Law no. 8 of 1995 concerning the capital market, which is further regulated in OJK Regulation Number 29/POJK.04/2016 concerning reports of issuers or public companies [3]. This study uses a sample of 30 companies in the Food and Beverages sector listed on the IDX. Financial statement data from 30 companies were observed in the period from 2014 to 2021 or for 8 years. To determine the performance of the LDA and SVM methods, the data is divided into two, namely training data and testing data. The training data consists of observation data from 2014 to 2019 with a total of 133 observations, while testing data is selected from data from 2020 to 2021, which is 60 observation data. Training data is used for modeling, while testing data is used to test the performance of the model in predicting.

The training data in this study serves to build a model or equation for LDA and SVM. Therefore, in the following, a description of the training data for each variable will be described. Table 2 shows the distribution of Food and Beverage company data based on timeliness in submitting financial statements. A total of 109 or 82% of the observation data fall into the category of being on time in the submission of financial statements, while as many as 24 or 18% of the observation data fall into the category of not being on time.

Table 2. Percentage of Categories on Time and Not on Time

Categories	Total	Percentages (%)
On time	109	82
Not on time	24	18

To see how far the differences in the characteristics of companies on time and not in submitting financial statements based on the predictor variables, then in Table 3 and Table 4 are presented descriptive statistical values of the variables ROA, CR, DAR and Company Size.

Table 3. Predictor Variable Descriptive Statistics for On Time Category

Variable	Mean	Std. Deviation
Return On Asset (ROA)	0,082595	0,1035033
Current Ratio (CR)	2,369909	2,2780316
Debt to Asset Ratio (DAR)	0,443016	0,1855260
Company Size	28,510748	1,5867368

Table 4. Predictor Variable Descriptive Statistics for Not On Time Category

Variable	Mean	Std. Deviation
Return On Asset (ROA)	-0,053305	0,5681444
Current Ratio (CR)	2,204812	2,524828
Debt to Asset Ratio (DAR)	0,726431	0,7319808
Company Size	28,174595	1,0617431

Companies that are classified as punctual in submitting financial statements, tend to have large profitability ratios (ROA), liquidity ratios (CR) and Company Sizes compared to companies that are not on time. Solvency ratio (DAR) in companies that are on time tend to be smaller than companies that are not on time. This shows that companies that are on time have smaller amounts of assets financed by debt, so the risk of companies to settle long-term obligations is smaller than companies that are not on time. Based on the average value, the ROA and DAR variables are quite significant in distinguishing the categories on time and not on time.

3.2 Prediction Result

In this study, LDA and SVM will be applied to the training data to produce a model, where the model is then used to predict the testing data. This is done with the aim of knowing the performance of the two methods. The predictor variables used in this study have different scales, so it is necessary to standardize their values. In this study, modeling and prediction were carried out twice, namely on data with non-standardized predictor variables and standardized predictor variables.

Tables 5 and 6 show the AUC values and accuracy of LDA and SVM for the non-standardized predictor variables or the original predictor variables and the standardized predictor variables.

Table 5. AUC and Accuracy with Original Predictor Variables

Methods	AUC		Accuray	
	Training	Testing	Training	Testing
LDA	0,65	0,39	78,9%	40%
SVM	0,57	0,53	84%	50%

The best parameters in SVM training data for non-standardized/original predictor variables are kernel polynomial, C = 0.5 and Gamma = 0.1. In Table 5 above, it can be seen that the SVM proposed in this study has a high level of accuracy in predicting the timeliness of submitting financial reports compared to LDA both on training data and testing data. LDA has a higher AUC value in training data, while in testing data, SVM is superior. In general, it can be said that SVM is better than LDA.

Table 6. AUC and Accuracy with Standardized Predictor Variables

Methods	AUC		Accuracy	
	Training	Testing	Training	Testing
LDA	0,65	0,37	78,9%	38%
SVM	0,57	0,50	84%	47%

In training data with standardized predictor variables, the best SVM parameters are polynomial kernel, C = 1 and Gamma = scale. Similar to the results on non-standardized predictor variable data, in general SVM is superior to LDA. The AUC value and accuracy of SVM are higher than LDA both in training and testing, although only on the AUC value of the training data, LDA is superior to SVM.

The results of this study are in line with the research conducted by Pristiyani et al. [27] and Santoso & Wibowo [28]which stated that SVM was better than LDA. Pristiyani et al. [27] and Santoso & Wibowo [28] apply LDA and SVM in cases of Financial Distress. Unbalanced data in this case, where the amount of data that is not on time is less than on time, making the classification results classified as "poor classification". Conditions like this make the minority category will often be misclassified into the majority class.

The predictor variables that are significantly able to distinguish the classification of companies based on the timeliness of financial report submission are ROA and DAR variables. Companies that earn profits tend to be most timely in financial reporting, because profit is an achievement for company management so that companies will not delay the dissemination of this information. Likewise, DAR affects the timeliness of submitting financial reports. The results in this study indicate that companies that are on time tend to have a smaller DAR value than companies that are not timely in financial reporting. Companies with small DAR values have a small risk of financial problems, so this is good news to report. This is consistent with studies conducted by Khasharmeh & Aljifri [5], Dewi & Jusia [11], Marathani [10] , Hayati & Muhtarom [20], Hayati et al. [19], Kristianto & Apriwenni [6] and Herninta [7] that the ratio of profitability (ROA) and solvency (DAR) has a significant effect on the timeliness of submitting the company's financial statements. While the predictor variables that have no significant effect in this study are CR and Company Size. These results are in line with research conducted by Carolina & Tobing [15].

4. CONCLUSION

This study concludes that SVM is better at predicting the timeliness of submitting financial statements of Food and Beverages companies on the IDX compared to LDA. In general, the AUC value and accuracy of SVM are greater than LDA. ROA and DAR variables have a significant effect in distinguishing companies that are not on time and not in financial reporting. While the

variables of CR and Company Size have no significant effect. In this study, the CR and Company Size in companies that are on time and not, have values that are not significantly different. So the CR is not one of the focuses of the good news that will be reported. This also occurs in the Company Size variable. Companies large and small have the same obligation in submitting financial reports in a timely manner.

Studies on the timeliness of submitting company financial statements where data is found that is not balanced between the number of companies that are on time and not on time, becomes a challenge for researchers to find the best method for prediction. Therefore, further research is expected to be able to apply better methods in dealing with this unbalanced data. In addition, it is also expected that the next research will add to the sample data and time span of observation as well as the number of predictor variables such as the addition of variables that describe Good Corporate Governance.

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