

Learning Style Test for Cadets Using Regression K-Nearest Neighbors Classification

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Abstract Learning is a relatively potential behavior as a result of experience or practice. Everyone has a different learning style. A person's learning style is divided into three types, namely visual, auditory, and kinesthetic. Currently there are many types of learning media that can be used for learning. Both for learning in class and for independent study. In the research, the relationship between these variables is functional. In regression analysis, the variables are divided into two parts, namely the response variable (response variable) or commonly called the dependent variable (the dependent variable), and the explanatory variable or commonly called the estimator (predictor variable) or also called the independent variable (independent variable). In regression analysis to determine the key variables that have an influence on a variable, modeling, as well as estimation (estimation) or forecasting (forecasting). By involving visual, auditory, and kinesthetic aspects, it is expected to increase learning activities. The k-Nearest Neighbor algorithm uses the Neighborhood Classification as the predictive value of the new instance value. The training data is presented to a multidimensional space, each dimension describing a feature of the data. This space is divided into sections based on the classification of training data

Keywords. Cadets, Learning Style, Regression, K-Nearest Neighbors Classification, Visual, Auditory, Kinesthetic

Introduction

Everyone has a different learning style. With these different learning references, therefore everyone has a different way of effective learning for each other. Therefore, in order to facilitate the learning process, we must first know what kind of learning style suits us, because this will help us, especially for those who are still confused about the right way to learn. A person's learning style is divided into three types, namely visual, auditory, and kinesthetic. Currently there are many types of learning media that can be used for learning. Both for learning in class and for independent study. The visual learning style focuses on vision. Auditory learning style relies on hearing as a receiver of information and knowledge. This type of learning person does not have a problem with visual appearance when teaching, the important thing is to listen to the teacher's conversation well and clearly. This learning style likes learning that involves movement. Usually, this type of person finds it easier to learn something not just reading a book, but also practicing it. The cadet learning style also

refers to the three audio visual and kinesthetic learning styles and in this study how the cadet learning style can be seen from each cadet character analysis in complete the assigned task

Overview Theory

A branch of science to find out the regularities of nature to master knowledge, both facts, concepts, principles, the discovery process as well as a scientific attitude, and physics is one of the Natural Sciences (Gunawan, 2015). It is not an easy thing to achieve good problem solving skills in students in learning, therefore the application of learning methods using digital simulations is one of the right choices in learning that requires repeated practice. Where we know that all information given repeatedly can increase the deposition of information in memory in the brain, this is in accordance with information processing theory. This study uses the k-Nearest Neighbor Algorithm which is a supervised learning algorithm where the results of the new instance are classified based on the majority of the k-nearest neighbor category. The training data is projected onto a multidimensional space, where each dimension describes a feature of the data. the distance between points in class k is usually calculated using the Euclidean distance. Euclidean distance is a formula for finding the distance between 2 points in two-dimensional space.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Formula to find 2-dimensional distance

Data collection

In the process of finding answers to the problem formulation and research objectives, it is necessary to collect relevant data. These data were collected in various ways, including literature studies, filling out questionnaires with several instruments from audio, visual, kinesthetic variables.

Data analysis

In this study, the relationship between these variables is functional which is realized in a mathematical model. In regression analysis, the variables are divided into two parts, namely the response variable or commonly called the dependent variable, and the explanatory variable or commonly called the predictor variable or also called the independent variable. In regression analysis to determine the key variables that have an influence on a dependent variable, modeling, as well as estimation or forecasting. By involving visual, auditory, and kinesthetic aspects, it is expected to increase learning activities.

RESEARCH METHODOLOGY

In this study using a sample of 24 respondents consisting of 7 female respondents and 17 male respondents with reference to the question items of visual audio kinesthetic potential.

Tabel 1. Descriptive Statistics Respondents

	Visual	Auditorial	Kinesthetic
Valid	24	24	24
Missing	0	0	0
Mean	15.208	11.583	10.708
Std. Deviation	2.843	3.476	3.196
Minimum	10.000	6.000	4.000
Maximum	20.000	17.000	16.000

The value for respondents is Valid = 24 respondents with a value of Missing = 0
The Mean Value of Visual = 15,208 Auditorial = 11,583 Kinesthetic = 10,708
Std. Deviation Visual = 2,843 Auditorial = 3,476 Kinesthetic = 3.196

Tabel 2. Descriptive Statistics Visual Auditorial and Kinesthetic

	Visual		Auditorial		Kinesthetic	
	Female	Male	Female	Male	Female	Male
Valid	7	17	7	17	7	17
Missing	0	0	0	0	0	0
Mean	16.000	14.882	11.714	11.529	10.429	10.824
Std. Error of Mean	0.976	0.717	1.796	0.723	0.869	0.863
Median	17.000	15.000	13.000	12.000	11.000	11.000
Mode	^a 17.000	15.000	6.000	12.000	11.000	10.000
Std. Deviation	2.582	2.956	4.751	2.982	2.299	3.557
Variance	6.667	8.735	22.571	8.890	5.286	12.654
Skewness	-0.732	0.212	-0.182	-0.522	-1.312	-0.459
Std. Error of Skewness	0.794	0.550	0.794	0.550	0.794	0.550
Range	7.000	10.000	11.000	10.000	7.000	12.000
Minimum	12.000	10.000	6.000	6.000	6.000	4.000
Maximum	19.000	20.000	17.000	16.000	13.000	16.000
Sum	112.000	253.000	82.000	196.000	73.000	184.000

^a More than one mode exists, only the first is reported

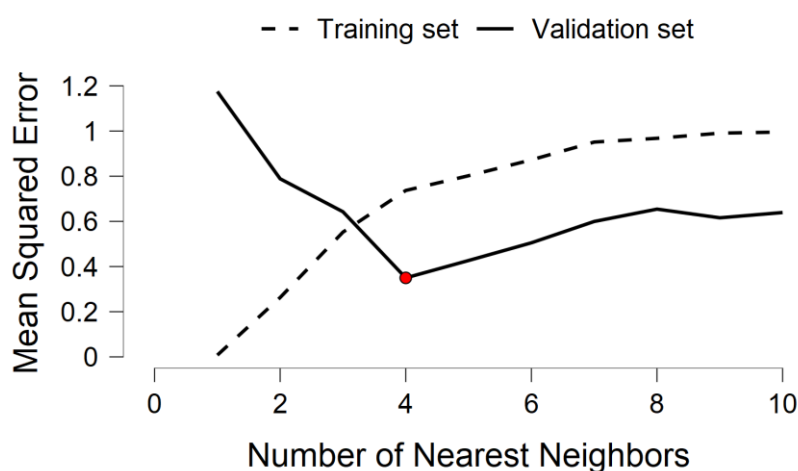


Figure 1. Mean Squared Error Plot

It can be seen in the figure that MSE validation is used to measure the quality of each estimator. Because the results in can be derived from the square of the Euclidean distance from each estimator, the variable is always shown to be positive with each error decreasing and the error result approaching zero for visual, auditory, kinesthetic learning styles.

Result and Discussion

Table 3. K-Nearest Neighbors Classification

Nearest neighbors	Weights	Distance	n(Train)	n(Validation)	n(Test)	Validation Accuracy	Test Accuracy
3	rectangular	Euclidean	16	4	4	1.000	0.500

Note. The model is optimized with respect to the *validation set accuracy*.

By using the K-Nearest Neighbors Classification, it can be seen that there are 3 neighbors between visual audio and kinesthetic with each having a rectangular Euclidean $n(\text{Train}) = 16$ $n(\text{Validator}) = 4$ and $n(\text{Test}) = 4$ with Accuracy value = 1,000 Test Accuracy = 0.500 (Valid)

Tabel 4. Confusion Matrix

		Predicted	
		Female	Male
Observed	Female	0	0.5
	Male	0	0.5

Confusion Matrix to measure the performance of machine learning classification problems where the output can be in the form of two classes observed Female with predicted 0.5 and Male with predicted 0.5 (Valid)

Tabel 5. Class Proportions

	Data Set	Training Set	Validation Set	Test Set
Female	0.292	0.313	0.000	0.500
Male	0.708	0.688	1.000	0.500

Tabel 6. Evaluation Metrics

	Precision	Recall	F1 Score	Support	AUC
Female	NaN	0.000	NaN	2	0.500
Male	0.500	1.000	0.667	2	0.500
Average / Total	0.250	0.500	0.333	4	0.500

Note. Area Under Curve (AUC) is calculated for every class against all other classes.

Table 6 is the evaluation matrices for Area Under Curve (AUC) where AUC female = 0.500
Male = 0.500

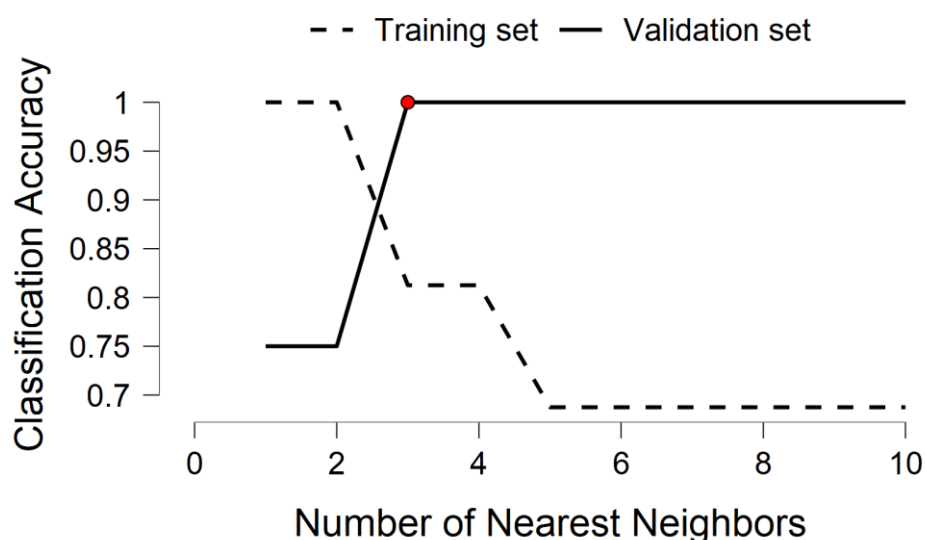


Figure 2. Classification Accuracy Plot

Classification Accuracy Plot The accuracy of the classification metric values assesses the performance of the classification model as the number of correct predictions divided by each total number of predictions. classification can be calculated and is an intuitive result, so it is used to evaluate the classification model in this study

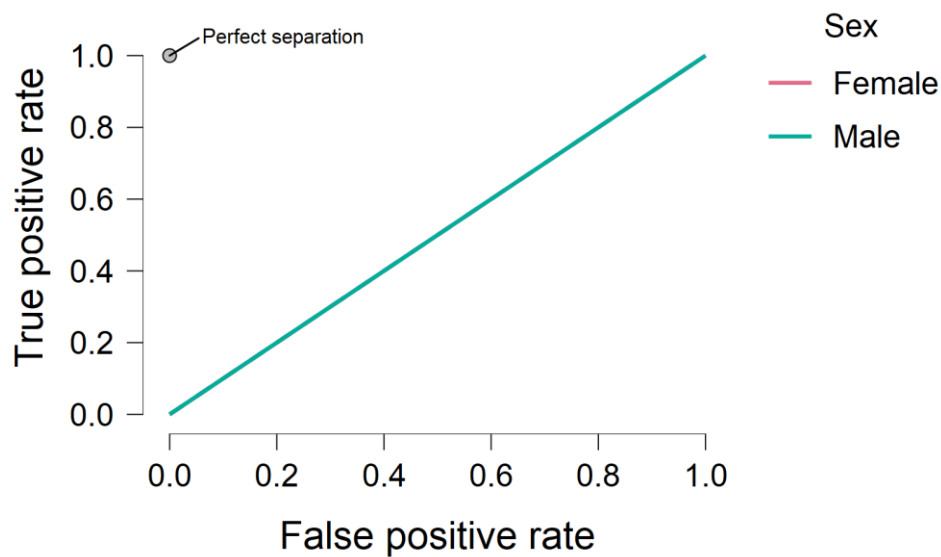


Figure 3. ROC Curves Plot

The ROC curve, is a graphical plot illustrating the diagnostic capability of a binary classifier system as its discrimination threshold varies with perfect separation between Male and Female cluster

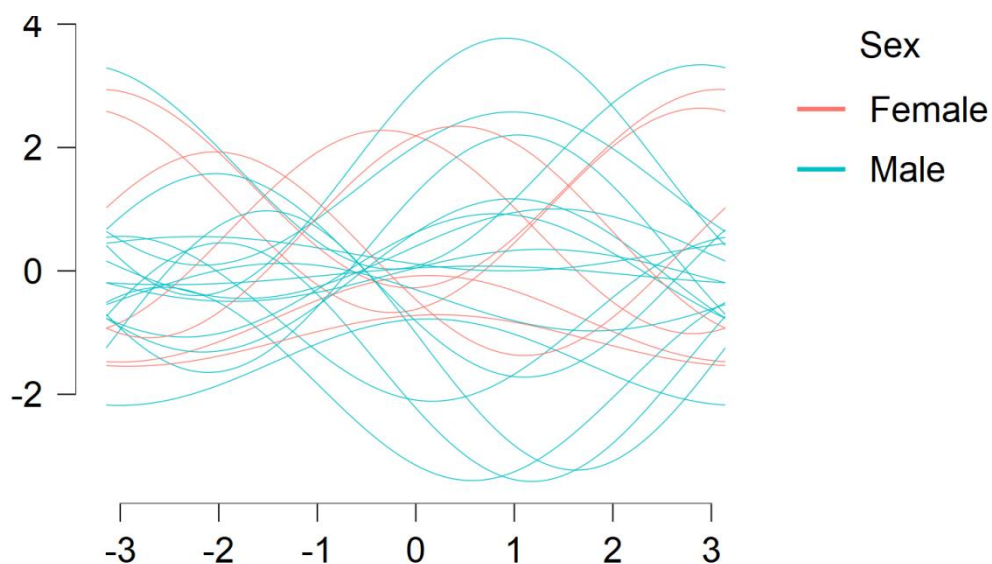


Figure 4. Andrews Curves Plot

The Andrews curve graph in this study is a way to describe the visualization of the cadet learning style structure with high-dimensional data. Andrews curve has a functional form to visualize multivariate data clusters between Male and Female clusters.

Data Split

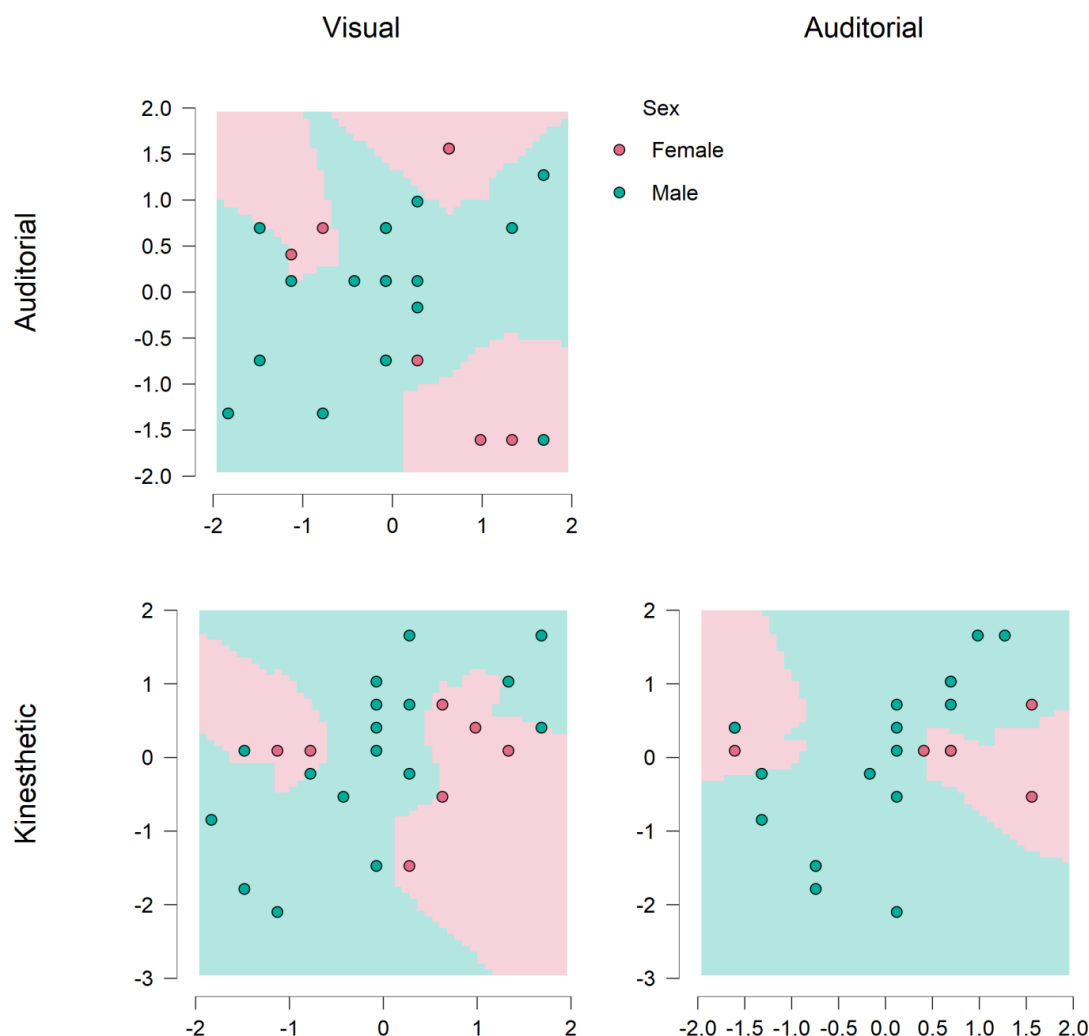


Figure 5. Decision Boundary Matrix

In this figure we can show the closest decision limits for each visual, auditory, kinesthetic learning style variable of cadets in the problem space region where the output of the classifier becomes ambiguous. seen in the figure shows the decision boundary is only the midpoint of the two reconstructed learning styles neighbors between the visual, auditory, kinesthetic learning styles of each cadet

Conclusion

The learning style of each cadet will perceive and process any information from various learning situations. Learning style is one aspect that depends on the situation or learning conditions so that it can be seen the learning style of each cadet and the results of the analysis can be taken using the k-nearest neighbor classification, it can be seen that there are 3 neighbors between visual, audio and kinesthetic with each has a rectangular euclidean $n(\text{train}) = 16$ $n(\text{validator}) = 4$ and $n(\text{test}) = 4$ with an accuracy value = 1000 test accuracy = 0.500

Suggestion

Based on research data, then suggested for future researchers to develop research on the approach contextual through different methods or comparing several methods.

Conflicts of Interest Statement

The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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