



(RESEARCH ARTICLE)

Check for updates

Web-based application of descriptive statistics for data dispersion analysis to support statistic learning

I Gusti Agung Sadnyana Putra ^{1,*}, I Ketut Suja ¹ and I Gusti Agung Ayu Uttami Vishnu Putri ²

¹ Hospitality Study Program, Tourism Department, Politeknik Negeri Bali, Bali, Indonesia.
² System Information Study Program, Stikom Technology and Business Institute, Bali, Indonesia.

World Journal of Advanced Engineering Technology and Sciences, 2024, 12(02), 403–413

Publication history: Received on 09 June 2024; revised on 19 July 2024; accepted on 22 July 2024

Article DOI: https://doi.org/10.30574/wjaets.2024.12.2.0311

Abstract

Statistics is a branch of science that studies ways of collecting, processing, presenting, analyzing, interpreting and drawing conclusions from data. Descriptive Statistics is a part of statistics that carries out the tasks of collecting data, classifying, processing and presenting quantitative data.

Statistics has a very important and necessary role in various areas of life, so that statistics courses are taught in almost all departments, both exact and non-exact, at various educational institutions. A common problem found in studying statistics courses is that students in non-exact majors are less interested in courses involving numerical data processing, so that learning outcomes for this course are generally relatively low.

With advances in information technology, several statistical applications have been developed, but these applications directly present the final results of data processing without displaying the steps to obtain the final results. This is inadequate from a learning perspective, because students do not get a clear picture of the steps for solving problems based on statistics. This research uses the method waterfall [8] [9] or linear sequential, namely a sequential and systematic software development method consist of : Analysis, Design, Coding and Testing. The result of making this application is an analysis of data dispersion measures consisting of Range, Inter Quartile Range, Quartile Deviation, Average Deviation, Standard Deviation, Variance, Coefficient Variation and Coefficient Quartile. This application will show in detail the steps to solve the problem according to theory, formulas and calculation steps to get the final result. These results will make it easier for students to understand and it is hoped that this course will be presented more interestingly and ultimately increase learning outcomes.

Keywords: Web based; Application; Descriptive statistics; Dispersion analysis; Statistics learning

1. Introduction

Statistics is a branch of science that studies ways of collecting, processing, presenting, analyzing, interpreting and drawing conclusions from data. Then statistics can be interpreted as a collection of methods and rules regarding the collection, processing, interpretation and drawing conclusions from data in the form of numbers. [1]

Descriptive Statistics is a part of statistics that carries out the tasks of collecting data, classifying, processing and presenting quantitative data [2]. In other words, descriptive statistics only describe or describe the characteristics or traits possessed by a group of data, without generalizing, namely drawing general conclusions based on sample data applied to the population. Meanwhile, Analytical Statistics is a part of statistics that has the same task as descriptive statistics plus analysis, interpretation and drawing conclusions that apply generally. In the world of economics, statistics has a function as a tool in data analysis, forecasting and decision making, especially for economic actors, businesses and

Copyright © 2024 Author(s) retain the copyright of this article. This article is published under the terms of the Creative Commons Attribution Liscense 4.0.

^{*} Corresponding author: I Gusti Agung Sadnyana Putra

decision makers [1]. Looking at the function of statistics, it can be seen that statistics has a very important and necessary role in various areas of life. Based on this situation, statistics courses are taught in almost all departments, both exact and non-exact, at various educational institutions [3].

A common problem found in studying statistics courses is that students in non-exacts study programs are less interested in courses involving numerical data processing, so that learning outcomes for these courses are generally relatively low [4].

With advances in information technology, several applications have been developed [5], including statistical applications, but these applications directly present the results without displaying the steps to solve the problem (Figure 1). This is inadequate from a learning perspective, because students do not get an idea of the steps to solving problems based on their knowledge of statistics.

Poste	Baskerville Citd Fa + 14 -	A' A' = = = * *	🕞 Wop Test	General •
C17	118 - 4	=MERIAN/CZ-C14)		
1 - 0	8	- D		G H
2	Dota nilai Statistik			
	Kelas II A			
4	Prodi Perhotelan, Iu	rusan Pariwisata, Poli	teknik Negeri Ba	15
	a rout a criticacian, ju	i doni i ni mononia, i on	teraine regen in	Only
6	Nama	Nilai		JOINY
-	Andita	76		5
-	Promudan	83		1.
-	Sigraciai	64		displays the
-	There Wienen	79		and prays the
	Acra Dhacma	96		
12	Firminus	68		final recult
12	Herdiani	85		Innai result
1.4	Violamora			
15	Analisis Statistik			
16	Rata-rata	77.195		
	Median	74.5		
1.6	Look Category			
19				
20				
21				
	Sheetl (+)			

Figure 1 Statistical Applications in Excel

Based on this, we created a web-based application for descriptive statistics for data deviation analysis. In making this application, the steps for solving the problem will be shown in detail according to theory, formulas and calculation steps to get the final result (Figure 2). This will make it easier for students to understand and it is hoped that the presentation of this course will be more interesting and finally increase learning outcomes.

S Untitled Document	× +		
← → C ① File C	:/apache/htdocs/pkl/Conto	oh%20Data%20Penelitian.html	
🔢 Apps M Gmail 🚥 Yo	uTube 🛃 Maps		
Menghitung Median			
Media adalah : data yang ter	letak di tengah setelah da	ta-data diurutkan.	
Data semula : 76 83 64 73 9	6 68 85 72		
Data setelah diurutkan : 64 6	58 72 73 76 83 85 96		
Karena cacah data genap ma	ika, Median berada di tenj	gah = 1/2 x (73 + 76) = 74,5	
Jadi Median data di atas ada	lah = 74, 5		

Figure 2 Examples of Research Results

2. Materials and methods

The research carried out is in the form of designing a system that produces certain software. This research uses the method Waterfall [8] [9] or linear sequential, namely a sequential and systematic software development method consist of :

- Analysis : The process of gathering software requirements, such as information domain, performance and *interface* required. This stage will produce software requirements specifications [10].
- Design : a multi-step process consisting of data design, architectural design, interface design and procedural details/algorithms that will be applied in the next step, namely creating program codes [11].
- Coding : The process of translating a design into program codes that can be read and executed by a computer machine. In this case, coding will be used using the PHP Triad program which consists of the PHP programming language, MySQL database and Apache server [12][13][14][15][16].
- Testing : When the code is created, testing begins, which consists of internal logic testing and external functional testing to eliminate errors and ensure the results are as required. Apart from that, this stage is also intended so that the resulting system can be used easily by future users [8].

3. Results and discussion

3.1. Initial Implementation

The beginning of implementation is a display of the identity of this system and the system can begin to be used by providing pathways for 3 (three) types of facilities provided, namely: Data Concentration Measures, Data Dispersion / Deviation Measures and Other Analysis as shown in Figure 3.

Performered by Image: Constraint of the second se			APLIKASI STATISTIK D MENUNJANG PEMBELAIJ BAGI PRODI NO	ESKRIPTIF UNTUK ARAN MK STATISTIK N EKSAKTA		
Fasilitas : Ukuran Pemusatan Ukuran Dispersi Lainnya	Pom	ered by	Php	En al	12.08	
Ukuran Pemusatan Ukuran Dispersi Lainnya			Fasilitas :		A. Sand	
	u	kuran Pemusatan	Ukuran Dispersi	Lainnya	1000	
	al da	1992		N. S.		

Figure 3 Application initial display

3.2. Application Usage Cycle for Data Dispersion Analysis

The Descriptive Statistics application can be used by general users by utilizing the facilities available in each main form according to the category at the start of the application (figure 3).

The Data Deviation Measure Analysis facility can be used via the main data deviation measure form as shown in Figure 4 which will be explained in the following stages.



Figure 4 Main Form Data Dispersion Analysis

3.2.1. Input New Statistical Data

The new statistical data input facility is used to enter new data that will be analyzed for data centralization measures. This is done by clicking the "Input Data" facility on the main menu. The form and data entered can be seen in Figure 5.

	in	put Data-data		10
Koda Deta	6 72	*). Weight his 20	te dargen Dener	
Barpel Deta	1 19	0.0		
	Data - data (a	gut data tiya (sacio dari)	lizi ka kasiwi).	
10	0	4	4	
111				(X
		_		
-				
	0	mpan Data (Reset		

Figure 5 Input New Statistical Data

3.2.2. View Statistical Data

The statistical data viewing facility is a facility provided for users to see that previously inputted data has been included in the data list, it is also provided for users who wish to obtain information about existing/registered data. A display of the use of the "View Data" facility can be seen in Figure 6.

							Da	ftar	Da	ta T	ersi	mpa	11								
Kode Data	Busyok Data	1	1	6	4	5	6	1	1	0	20	n	12	13	14	15	16	17	11	13	30
A	4	30	5	15	4	0	0	0	0	-	6	10	0	0	0	0	0	-	0	0	0
3	5	26	11	1	26	5	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0
C)6	15	63	27	42	10	26	0	10	0	0	1	0	10	12	9	0	0	0	10	10
D	1	36	27	4	15	27	1	10	18	0	0	0	0	0	0	0	0	9	0	0	0
Ξ	8	10	63	1	42	27	0	0	0.	0	0	0	0	10	0	0	0	0	0	10	0
									K	ribai											

Figure 6 View Statistical Data

3.2.3. Using the Data Deviation Analysis Facility

In data deviation analysis, several facilities are available that can be used according to user needs, namely: Range, Inter Quartile Range (IQR), Quartile Deviation (QD), Average Deviation, Standard Deviation, Variance, Coefficient of Variation and Coefficient of Quartile Variation. The following explains one by one the use of these facilities.

Start Using

- Select/click the analysis menu available from the main menu for data dispersion measures (figure 4).
- Next, a list of existing data will be displayed that will be analyzed. Select the data to be extracted by clicking "Select" on the available data (figure 7).

							1	Daft	ar E)ata	Ters	sim	pan									0
Kode Duts	Basyak Data	1	20	4	+	4	*	7	*	9	10	11	12	13	14	15	16	17	18	19	20	
A	4	10	8	15	4	0	0	10	0	0	1	0	0	0	0	0	0	0	0	10	10	nih
в	5	26	11	1	16	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	(7.1h
C	4	10	63	27	42	10	26.	0	10	0	10	0	0	0	10	0	0	0	10	0	10	Zib
D	1	36	27	4	15	27	<u>a</u> .	10	45	0	0	0	0	0	0	0	0.	0	0	0	0.	200
E	3	10	63	3	42	27	10	9	9	0	1	0	10	0	0	0	0	0	0	20	0	1977
_		_	_	_	-		_		_	Ken	tal I	_	_	_	_	_	_	_	_	_	_	- 11

Figure 7 Selecting Data to Analyze

• The results obtained will be explained in the next stages.

In the results obtained, the following can be seen:

- Title: Name of the analysis carried out
- Theory: is a theory used as a basis for analysis.
- Formula: is the implementation of theory in the form of equations and mathematical operations based on the theory.

- Data and calculations: the data that is analyzed, the steps in the calculation operations that are carried out to obtain the final results of the required analysis.
- Returning to the main analysis form, there is a "Back" menu which can be used to return to the main menu.
- \circ $\,$ $\,$ For other data deviation analysis needs, the sequence of steps above can be reused.

Data Deviation Analysis Results

• Range (R)

Range is a measure commonly called the spread, namely the difference between the largest value and the smallest value in a data series. The results obtained are as shown in Figure 8.

	Range / Rentang / Sebaran (R)	
Teori	Range adalah suatu tikseun yang biasa disebut romang / sobatan, yantu selisih antara mlas yang terbesar dengan mlas yang terkecil dari suatu kelompok data	
Rumus	R = X max - Xmin	1996
Data dan Hitungan	Data: 10 - 63 - 27 - 62 - 10 - 26 - Data: tenberar - X mara - 63 Data: Tenkenil - X min - 10 R - X man - X min - 63 - 10 - 53	
	Rental	

Figure 8 Range Analysis Results

• Inter Quartile Range (IQR) dan Quartile Deviation (QD)

Inter Quartile Range (IQR) / quartile distribution, which is a measure that is the difference between the value of the 3rd quartile (Q3) and the value of the 1st quartile (Q1).

Quartile Deviation is the value that is half the difference between Q_3 with Q_1 . The results obtained are as shown in Figure 9.

Teori	Inter Quartile Range (IQR) adalah suatu ukuran yang disebut sebaran antara quartile, yaitu selisih nilai quartile ke 3 (Q3) dengan nilai quartile ke 1 (Q1). Quartile Deviation (QD) adalah merupakan setengah bagian							
	selisih antara Q3 dengan Q1							
Rumus	IQR = Q3 - Q1 $QD = \frac{1}{2} (Q3 - Q1) = \frac{1}{2} . IQR$							
	Data : 10 - 63 - 27 - 42 - 10 - 26 -							
	Data Terurut : 10 - 10 - 26 - 27 - 42 - 63 -							
	Letak Quartile I= LQ1 = 1/4 * (6+1) = 1.75							
	Quartile I = 10 + 0.75 x (10 - 10) Quartile I = 10							
Data dan	Letak Quartile III= LQ3 = 3/4 * (6 + 1) = 5.25							
Hitungan	Quartile III = 42 + 0.25 x (63 - 42) Quartile III = 47.25							
	IQR = Q3 - Q1 = 47.25 - 10 = 37.25							
	QD = ½ (Q3 - Q1) = ½. IQR = ½. 37.25 = 18.625							

Figure 9 IQR and QD Analysis Results

• Average Deviation (AD)

Average Deviation is the average deviation value. The results obtained are as shown in Figure 10.

			Average Devi	ation (AD)	
Teori	Ave	erag	e Deviation adala	h merupakan nilai rata	-rata deviasi
Rumus	AI	-	∑ Xi −Xr n		
	Dat Xr Xr Xr	a : 1 = (1 = 17 = 29	0 - 63 - 27 - 42 - 10 0 + 63 + 27 + 42 + 1 8 / 6 .666666666666667	- 26 - 10 + 26 +) / 6	
	No	- Xi	Xi - Xr	Xi - Xr	
	1	10	-19.666666666666	19.666666666667	
1910/1920/1920	2	63	33.333333333333333	33.33333333333333	
Data dan	3	27	-2.6666666666666	2.6666666666666	
Hitungan	4	42	12.33333333333333	12.33333333333333	
	5	10	-19.666666666667	19.66666666666	
	6	26	-3.6666666666666	3.6666666666666	
			Jumlah =	91.3333333333333	
		AD -	91.3333333333333 / 6	15.222222222222	
			Kemb	at]	

Figure 10 Average Deviation Analysis Results

• Standard Deviation (S) and Variance (V)

Standard Deviation is a value that shows the average deviation of a value from the average.

Variance is a number or figure that shows the square of the average deviation of a value from the average. The results obtained are as shown in Figure 11.

Teori Standart variance kuadrat d rata-rata S = St Rumus S = St V = SQR	Deviation ac impangan su adalah bilan lari hasil rata ya. Σ (Xu QRT (dalah suatu nilai y uatu nilai terhada agan atau angka yi u-rata penyimpang Xr)2 1 - Xr)2 - Xr)2 - Xr)2 - xr)2 - n ≥ 3	ang menunjukkan rata p rata-ratanya. ang menunjukkan pan suatu nilai terhadap 30						
Rumus S = S V = SQR	Σ (Xi - QRT (Σ (Xi QRT (n	- Xr)2 	30						
	. (S)								
Data : 10 Xr = (10 Xr = 178 Xr = 29.6t	Data: 10 - 63 - 27 - 42 - 10 - 26 - Xr = (10 + 63 + 27 + 42 + 10 + 26 +) / 6 Xr = 178 / 6 Xr = 29.666666666667								
No	Xi	Xi - Xr	(Xi - Xr)2						
1	10	-19.67	386.91						
2	63	33.33	1,110.89						
Data dan 3	27 -2.67 7.13								
Hitungan 4	42	12.33	152.03						
5	10	-19.67	386.91						
6	26	-3.67	13.47						
		Jumlah =	947.45						
	S =	SQRT (947.457 6-1)	13.77						
	V =	SQR(13.77)	189.61						

Figure 11 Results of Standard Deviation and Variance Analysis

• Coefficient of Variation (CV)

Coefficient of Variation (CV), namely: is a number that shows the comparison between the standard deviation and the average value.

The results obtained are as shown in Figure 12.

		efficient o	f Variation (C	:V)
Teori	Coeffic menunji nilai rat	ient of Varia ukkan perban a-ratanya	ation (CV) adalah dingan antara star	suatu bilangan yang idart deviasi terhadap
Rumus	S = 2 Σ Xr = CV =	Σ (Xi SQRT (n-1 Xi S Xr	- Xr)2) n ≤ 100%	30
	Data : 10 Xr = (10 Xr = 178 Xr = 29	0 - 63 - 27 - 42 0 + 63 + 27 + 4 1 / 6 67	- 10 - 26 - 2 + 10 + 26 +) / 6	Canocompanyation [
	No	Xi	Xi - Xr	(Xi - Xr)2
	1	10	-19.67	386.91
	2	63	33.33	1,110.89
Data dan	3	27	-2.67	7.13
Hitungan	4	42	12.33	152.03
	2	10	-19.67	386.91
	0	10	-3.07	13.4/
	-		SOPT (047.45)	947,45
		S =	6-1)	13.77
		and the second s	13.77 / 29.67 x	44.00 %

Figure 12 Coefficient of Variation (CV) Analysis Results

• Coefficient of Quartile Variation (CQV)

Coefficient of Quartile Variation (CQV) is a value obtained from a comparison between the differences in Q_3 with Q_1 to the total value Q_3 and Q_1 .

The results obtained are as shown in Figure 13.



Figure 13 Coefficient of Quartile Variation (CQV) Analysis Results

4. Conclusions

In the data deviation analysis application, several facilities are available that can be used according to user needs, namely: Range, Inter Quartile Range, Quartile Deviation, Average Deviation, Standard Deviation, Variance, Coefficient Variation dan Coefficient Quartile.

Each analysis element is equipped with a title, theory, formula and data along with calculation steps to obtain final results, which are not available in other statistical applications. This is a specialty of this application because it will make it easier to understand and analyze the required statistics.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

- [1] Wirawan, Nata, Easy Ways to Understand Statistics, 4th Edition, 2017, Keraras Emas, Denpasar
- [2] https://ejournal.uin-suka.ac.id/adab/FIHRIS/article/viewFile/1922/916 Descriptive Statistics as a Collection of Information, accessed 12 February 2023
- [3] https://www.globalstatistik.com Statistical Functions
- [4] https://jurnal.ar-raniry.ac.id/index.php/alkhawarizmi/article/view/6949 Analysis of Student Difficulties in Descriptive Statistics Courses
- [5] Kadir, Abdul, 2018, Introduction to Information Systems, Andi Offset, Yogyakarta
- [6] https://salamadian.com/pengertian-aplikasi/ accessed 20 February 2023

- [7] https://idcloudhost.com/pengertian-aplikasi-arti-fungsi-klasifikasi-dan-contoh-aplikasi/ accessed March 10, 2023
- [8] Pressman, 2015, Software Engineering, 7th Edition, McGraw-Hill International Inc.
- [9] Mc.Leod,R,Jr, 2015, Management Information System, 10th Edition, Prentice-Hall International Inc.
- [10] Aragon, G., Escalona, M.J., Lang, M., dan Hilera, J.R.. 2012. An Analysis of Model-Driven Web Engineering Methodologies. International Journal of Innovative Computing, Information and Control 8(12):1-10.
- [11] Wasowski A., Truscan D., Kuzniarz L. 2010. 8th Nordic Workshop on Model Driven Software Engineering (NW-MODE 2010). Proceedings of the Fourth European
- [12] Korth, Silberschatz, 2015, Database Sistem Concept, 6th Edition, McGraw-Hill International Inc.
- [13] Lalang Erawan, Ajib Susanto, Agus Winarno Techno.COM, Vol. 16, No. 2, May 2017: 132-143
- [14] Sutarman, 2010, Building Web Applications with PHP and MySQL, Graha Ilmu, Yogyakarta
- [15] User Guide and Reference. Version 1.9. Programming and Software Engineering ,Unit (PST), Institute for Informatics, Ludwig-MaximiliansUniversity. Munich, Germany.
- [16] William, Hugh E and David, Lane, 2012, Web Database Application with PHP and MySQL, O'Rilly and Associates Inc.Conference on Software Architecture: Companion Volume:243-244.