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Digital Marketing Optimization in Artificial Intelligence Era by Applying Consumer Behavior Algorithm

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ABSTRACT

There are matters to pay attention to in running a business, specifically marketing that will determine the right types of consumers. We can determine the right customer segments for a product or service by observing their behavior. If the target consumers are in line with the product or service offered, it make it easier to sell it. However, choosing the right consumer segment is not an easy task. There are aspects need considering to comprehend the behavior of consumers. By benefiting from artificial intelligence and its ability to process multiple factors simultaneously. This study uses a behavioral approach. The three phases conducted in this study are 1) preliminary study and initial data collection, 2) initial data analysis and designing optimization algorithm, and 3) application of optimization algorithm and its resulting behavioral analysis. There are three main results: 1) a 1 click/day increase in the number of clicks (from 7 to 8 clicks/day), 2) a 76 posts/day drop in the number of impressions (from 129 to 53 impressions/day), and 3) a 9.66% increase in the click through ratio (CTR) (from 5.43% to 15.09%). These findings indicate that the optimization algorithm and its application are able to increase digital marketing effectiveness.

SARI PATI

Penentuan konsumen yang tepat dapat dilihat dari perilaku konsumennya. Tetapi untuk menentukan konsumen yang tepat adalah tidak mudah. Dengan memanfaatkan kemampuan artificial intelligence untuk mempelajari beberapa faktor secara bersamaan. Terdapat 3 tahap yang dilakukan dalam penelitian ini. Tahap pertama adalah studi pendahuluan dan pengumpulan data awal. Tahap kedua adalah analisis data awal dan perancangan algoritma optimasi. Tahap ketiga adalah penerapan algoritma optimasi dan analisis hasil penerapan perlakuan. Terdapat 3 hasil dari penelitian ini. Pertama, terjadi peningkatan jumlah klik dari 7 klik/hari menjadi 8 klik/hari. Kedua, terjadi penurunan jumlah tayangan dari 129 tayangan/hari menjadi 53 tayangan/hari. Ketiga, terjadi peningkatan Click Through Rate dari 5,43% menjadi 15,09%. Berdasarkan hasil

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tersebut menyatakan bahwa penerapan algoritma optimasi yang disusun mampu meningkatkan efektivitas pemasaran digital.

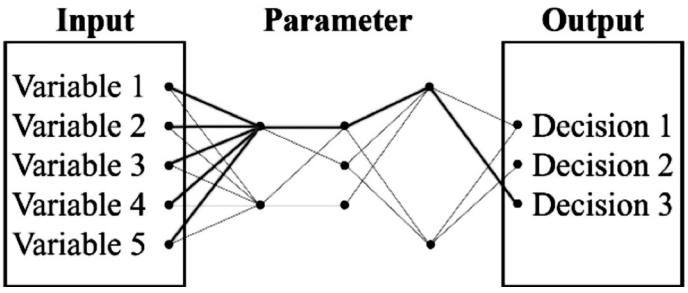
INTRODUCTION

A strong interest in entrepreneurship has now considered a factor that can boost the local economy. The people, especially the youths, are starting to consider starting their own businesses (Aldrich & Cliff, 2003). Such businesses offering products and services fuel the economy, which contributes to the prosperity of the people (Fu, 2016). Even so, there are aspects to pay attention to in running a business, specifically marketing and determining the consumer segments appropriate to the business. We can determine the right customer segments by observing their behavior. If the target consumers are in line with the product or service offered, it make it easier to sell a product or service (Kullgren, et al., 2018). However, choosing the right customer segment is not an easy task. There are aspects to consider to be able to comprehend the behavior of consumers (Desmet, 2018). Choosing the recommended customer segments be simplified by the use of artificial intelligence capable of processing multiple factors simultaneously, and it would require neat understanding of things that influence a decision making by potential customer segments (André, et al., 2018).

The term artificial intelligence involves a piece of technology that mimics and is based on human intelligence to perform a certain task or function. (Lawless & Sofge, 2017). One of the applications of artificial intelligence is neural networks. A neural network is a form of artificial intelligence logical pattern that can factor in a certain condition as an input, and produce a decision as an outcome (Khoshroo, Emrouznejad, Ghaffarizadeh, Kasraei, & Omid, 2018). The illustration of a pattern of neural networks pattern as shown in Diagram 1.

Based on Diagram 1, we can see that neural networks consist of sets of inputs, parameters, and outputs. Each set component play a role in shaping a working logic. A set of inputs are required as the initial data that will be used as a basis of the logic, while a resulting output will serve as the final decision of the logic. In between there is a set of parameters required as conditions that can change the course of a final decision. This set of parameters is the component shaped and finalized by artificial intelligence (Khosrow-Pour, D.B.A., 2018).

Considering the business climate in Indonesia and the benefits that artificial intelligence



technology has to offer, it became important to conduct this study to map out sets of inputs, outputs and parameters of local small and medium-sized enterprises (SMEs). Once the sets are identified, neural networks can be constructed and help strengthen SMEs competitiveness in the industry 4.0 era (artificial intelligence era).

METHODS

This study uses a behavioral approach, meaning that certain behavioral treatments are imposed upon study objects so that their influence or effect can be observed (Achyani, 2018). The three phases conducted in this study are 1) preliminary study and initial data collection, 2) initial data analysis and designing optimization algorithm, and 3) application of optimization algorithm and analysis of the application. The following is a diagram that illustrates the methods used in this study.

The elaboration of the study methods based on Diagram 2 is as follows.

Phase 1 Preliminary Study and Initial Data Collection

Phase 1 consists of a preliminary study and initial data gathering. The preliminary study was focused at finding out the relationships between variables involved in the study as factors to consider when designing the optimization algorithm. Meanwhile, the initial data collection was aimed at gathering historical data or data before treatments are imposed on study objects.

Phase 2 Initial Data Analysis and Designing Optimization Algorithm

Phase 2 consists of initial data analysis and designing the optimization algorithm. The initial data analysis was focused on analyzing the initial data at hand to know which

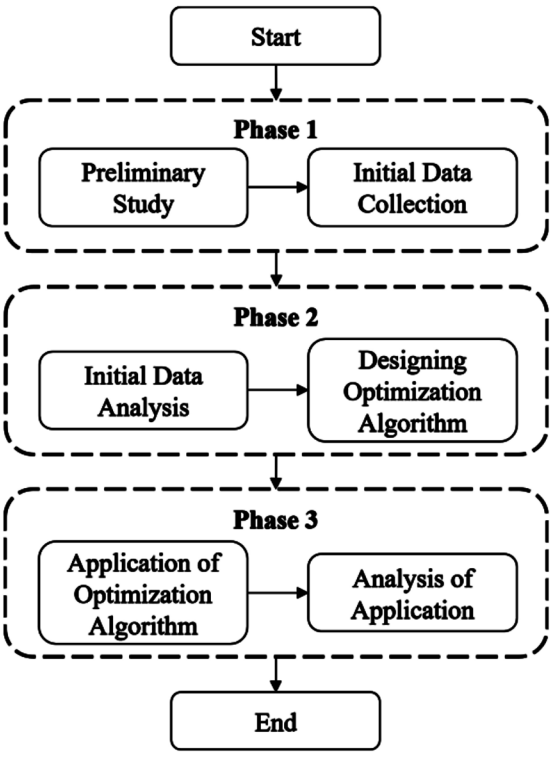


Diagram 2. Study Methods

part should be optimized. In the meantime, designing the optimization algorithm was focused on structuring the steps of optimization based on the resulting initial data analysis.

Phase 3 Application of Optimization Algorithm and Analysis of the Application

Phase 3 consists of application of optimization algorithm and its analysis. The application of optimization algorithm was focused on imposing the optimization algorithm upon study objects. Meanwhile, the analysis was aimed at analyzing the effects or impacts of the application of optimization algorithm on study objects to see whether it managed to serve its purpose.

RESULTS AND DISCUSSION

Results

The results of this study are presented in this section, and are elaborated and be broken down according to the phases in the study methods.

Preliminary Study

There are three (3) variables involved in this study: number of clicks, number of impressions and click through rate (CTW) percentage. These variables serve as a reference point for the optimization carried out (Management Association, 2018).

The first variable, number of clicks, is the number of times the internet users click a digital advertisement (Hurst, 2018). It can be viewed as how many users that are interested in the advertisement. There is a chance that as they see the advertisement, they would click it and then visit our website. Higher number of clicks often indicates higher advertisement attractiveness level to the eyes of audience.

The second variable, number of impressions, is the number of times a digital advertisement is displayed on a search engine page such as Google (Hurst, 2018). It can be deemed as how many advertising keywords we generate that are looked up by users. If the keywords that they type in match ours, then the advertisement will appear more often. Therefore, it is imperative that the chosen keywords are strongly related to the product or service offered.

The third variable, click through rate (CTR), is a ratio in a form of percentage between how many clicks that a digital advertisement is able to generate and how many times the advertisement appears on Google search (Hurst, 2018), or in other words the value of CTR is calculated by dividing number of clicks by number of impressions. Higher CTR percentage indicates higher quality of an advertisement, which substantiates that the advertisement is in sync with the interest of users.

Initial Data Collection

The initial data was collected from the results of digital marketing using Google Ads. The period of initial data collection was referenced from the preceding data before optimization application to be compared with the data after optimization was applied later on.

Table 1. Results of Initial Data Collection

Variable	Initial Data Collection
Click	7 Clicks
Impression	129 Impressions
CTR	5,43%

Based on Table 1, we can see that the initial data consists of 7 clicks and 129 impressions, which lead to a CTR value of 5.43%. This number served as the basis of the next step.

Initial Data Analysis

Based on the initial data collection, it is known that the CTR value is 5.43%, with 7 clicks and 129 impressions, which is is a relatively small. This

proves the significant gap between the number of clicks and the number of impressions.

The gap might have been caused by a large number of times that the appearing advertisement was clicked by users. This might due to the keywords used in the advertisement were too universal that even though users searched those keywords, there was still a mismatch. As an example, the keyword "3D printing" used in this study is similar to "t-shirt printing", "screen printing" and "sublimation printing". Those keywords incorporate a similar keyword "printing", which led to the appearance of any product containing "printing" as search results on Google page. The users would not click the search results because they were not the "3D printing" that was searched for.

Designing Optimization Algorithm

Based on the analysis, it is known that a mismatch between keywords can lead to low performance of an advertisement. Therefore, the optimization was designed for the main purpose of enhancing CTR percentage. By having a higher value of CTR, our advertisement will be found by the appropriate audience of users.

One way to enhance the CTR value is by adjusting keyword suitability of the advertisement or product offered. Keyword adjustment can result in more keywords added or eliminated that are connected to our advertisement. In Google Ads, keyword adjustment can be done by choosing more specific keywords or excluding similar but unsuited keywords. The algorithm for digital marketing optimization is as shown in Diagram 3.

Based on Diagram 3, the optimization algorithm starts with collecting the data that was going to be processed consisting of keywords set initially, CTR percentage and keywords

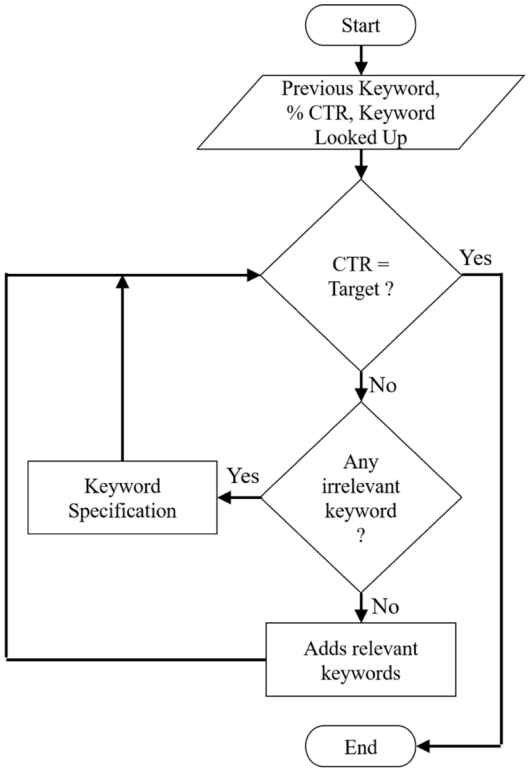


Diagram 3. Optimization Algorithm Design

searched by users. The algorithm will conclude once the CTR percentage has achieved a certain targeted value, otherwise it will continue to next step in the process, which is checking whether the keywords searched by users are not related to our products. When the keywords searched by users match our products, then the next step would be to make the keywords of our products more specific. In contrast, if the keywords searched by users match our products, the next step would be to add keywords relevant or related to our products. This algorithm was run in every optimization application round.

Optimization Algorithm Application

The results of optimization algorithm application can be seen below, which are presented in tables for every application round carried out. In overall, there are two rounds of optimization application conducted in this study.

Table 2. The First Optimization Results

Variable	Initial Data	1st Optimization
Click	7	7
Impression	129	64
CTR	5,43%	10,94%

Table 2 shows the results of the first application of the algorithm. It was known from the initial data that the number of impressions is relatively too high compared to the number of clicks, so the necessary step taken was to examine the keywords searched by users. It was found out that the number of impressions could get as high as 129 impressions despite the number of clicks being only at 7 clicks. This was due to the keywords that were too general, and thus the advertisement would just appear when similar keywords were looked up. Hence, an action taken was to exclude some unsuitable or unrelated keywords. The results of the first optimization application are 7 clicks and 64 impression, leading to a CTR percentage of 10.94%.

Table 3. The Second Optimization Results

Variable	1st Optimization	2nd Optimization
Click	7	8
Impression	64	53
CTR	10,94%	15,09%

Table 3 shows the results of the second application of the algorithm. It was known from the first application round that the number of impressions is still relatively too high compared to the number of clicks, so the necessary step taken was to again examine the keywords searched by users. It was found out that the number of impressions could get as high as 64 impressions despite the number of clicks being only at 7 clicks. This was once more due to the keywords that were still too general, and thus the advertisement would just appear when similar keywords were looked up. Hence, another action taken was to further exclude some unsuitable or unrelated keywords. The results of the second optimization application are 8 clicks and 53 impression, leading to an enhanced CTR percentage of 15.09%

Optimization Application Analysis

The analysis results of optimization application carried out can be seen below, which are presented in a form of percentage highlighting the changes from before and after the optimization algorithm was applied. The analyzed variables are optimized clicks, optimized impressions and optimized CTR.

Table 4. Application Analysis

Variable	Lowest	Highest
Optimized Click	0%	14,29%
Optimized Impression	17,19	50,39
Optimized CTR	4,16%	5,51%

Based on Table 4, it is known that the optimized number of clicks ranges from 0% to 14.29%, the optimized number of impressions ranges from 17.19% to 50.39%, and the optimized CTR percentage ranges from 4.16% to 5.51%. These results show that the optimization algorithm is capable of enhancing advertising performance, which is proven by the increased number of clicks, lower number of impressions, and increased CTR percentage. It shows that improvements in terms of advertising performance have been achieved from its previous state before the optimization algorithm was applied.

Discussion

Based on the above analysis, it is known that

the performance of a digital advertisement is influenced by several factors: number of clicks, number of impressions, and CTR percentage. This finding is consistent with a study by Fuxman stating that the performance of a digital advertisement is influenced by factors related to the interactions between the advertisement and the targeted user audience (Fuxman, Elifoglu, Chao, & Li, 2018).

The performance of an advertisement can be measured by the value of its CTR percentage, which indicates whether the advertisement is on target leading to a better advertising performance. This is also backed by a study by Barker stating that the suitability of a digital advertisement for the targeted users will enhance its advertising performance (Barker, 2018). Hence, the results of this study have been consistent with past research.

CONCLUSION

After analyzing the optimization algorithm designed for this study, some conclusions can be drawn as follows:

1. The optimization algorithm can improve the performance of the advertisement made in this study. The improved performance is indicated by an increase of 14.29% in the number of clicks, a decrease of 50.39% in the number of impressions and an increase of 5.51% in the CTR percentage.

2. Improvements to advertising performance can done in two ways: 1) by adding more relevant keywords if no keywords searched by users are irrelevant, and 2) by changing or adjusting the keywords to the more specific ones if the keywords searched by users are irrelevant.

The mind map generated in this study is as shown in Diagram 4.

Based on Diagram 4, we can see that the scope of the neural networks is aimed at digital marketing and advertising containing several components. The input consists of advertising budget and keyword variables, while the output results in a set of actions consisting of adding keywords or adjusting keywords. The parameter set contains number of clicks, number of impressions and keywords searched by users.

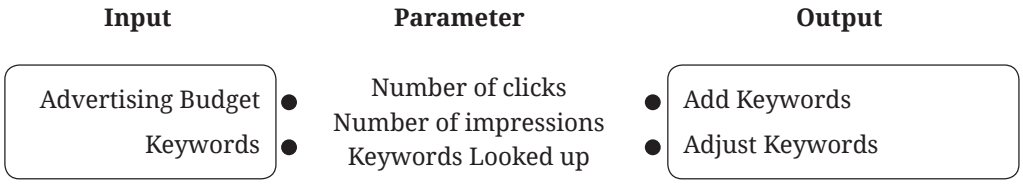


Diagram 4. Digital Marketing Mind Map

REFERENCES

Achyani, Y. E. (2018). *Penerapan Metode Particle Swarm Optimization Pada Optimasi Prediksi Pemasaran Langsung* (Application of Particle Swarm Optimization Method on Prediction Optimization of Direct Marketing). Jurnal Informatika, 5(1), 1–11. https://doi.org/10.31311/ji.v5i1.2736

Aldrich, H. E., & Cliff, J. E. (2003). The pervasive effects of family on entrepreneurship: toward a family embeddedness perspective. Journal of Business Venturing, 18(5), 573–596. https://doi.org/10.1016/S0883-9026(03)00011-9

André, Q., Carmon, Z., Wertenbroch, K., Crum, A., Frank, D., Goldstein, W., … Yang, H. (2018). Consumer Choice and Autonomy in the Age of Artificial Intelligence and Big Data. Customer Needs and Solutions, 5(1–2), 28–37. https://doi.org/10.1007/s40547-017-0085-8

Barker, R. (2018). Creatives talk technology: exploring the role and influence of digital media in the creative process of advertising art directors and copywriters. Media Practice and Education, 1–16. https://doi.org/10.1080/25741136.2018.1464741

Desmet, P. (2018). Measuring Emotion: Development and Application of an Instrument to Measure Emotional Responses to Products. Dalam M. Blythe & A. Monk (Ed.), Funology 2 (hlm. 391–404). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-68213-6_25

Fu, W. (2016). Industrial clusters as hothouses for nascent entrepreneurs? The case of Tianhe Software Park in Guangzhou, China. The Annals of Regional Science, 57(1), 253–270. https://doi.org/10.1007/s00168-016-0776-3

Fuxman, L., Elifoglu, I. H., Chao, C., & Li, T. (2018). Digital Advertising: A More Effective Way to Promote Businesses' Products. Journal of Business Administration Research, 3(2), 59. https://doi.org/10.5430/jbar.v3n2p59

Hurst, J. (2018). Sole proprietors' perceptions of benefits of and barriers to using digital marketing. Journal of Aesthetic Nursing, 7(2), 108–109. https://doi.org/10.12968/joan.2018.7.2.108

Khoshroo, A., Emrouznejad, A., Ghaffarizadeh, A., Kasraei, M., & Omid, M. (2018). Sensitivity analysis of energy inputs in crop production using artificial neural networks. Journal of Cleaner Production, 197, 992–998. https://doi.org/10.1016/j.jclepro.2018.05.249

Khosrow-Pour, D.B.A., M. (Ed.). (2018). Encyclopedia of Information Science and Technology, Fourth Edition: IGI Global. https://doi.org/10.4018/978-1-5225-2255-3

Kullgren, J. T., Cliff, E. Q., Krenz, C., West, B. T., Levy, H., Fendrick, A. M., & Fagerlin, A. (2018). Consumer Behaviors Among Individuals Enrolled in High-Deductible Health Plans in the United States. JAMA Internal Medicine, 178(3), 424. https://doi.org/10.1001/jamainternmed.2017.6622

Lawless, W. F., & Sofge, D. A. (2017). Evaluations: Autonomy and Artificial Intelligence: A Threat or Savior? Dalam W. F. Lawless, R. Mittu, D. Sofge, & S. Russell (Ed.), Autonomy and Artificial Intelligence: A Threat or Savior? (hlm. 295–316). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-59719-5_13

Management Association, I. R. (Ed.). (2018). Digital Marketing and Consumer Engagement: Concepts, Methodologies, Tools, and Applications. IGI Global. https://doi.org/10.4018/978-1-5225-5187-4