The Use of Data Science in Digital Marketing Techniques: Work Programs, Performance Sequences and Methods

Kawal Arora[1], Alwiyah[2], Muhammad Faisal[3]
[1]Informations Technology, Signy Advanced Technologies
[2]Computer System, Wiraraja University, Madura Indonesia
[2]Information Technology, University of Raharja, Indonesia
Email: kawal@signy.io , alwiyah@wiraraja.ac.id , Muhammad.faisal.faisal@raharja.info

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ABSTRACT

Over the past decade, there have been great strides in using data science to drive decision-making, extracting insights and taking action from large data sets in a digital business environment. However, despite these advances, relevant evidence for actions to improve data science management in the digital enterprise is still lacking. To fill this gap in literature. The purpose of this study is to review usage and performance metrics based on (i) analysis methodology, (ii) (iii). Data science used in digital business methods and strategies. To this end, a comprehensive literature search was performed for important scientific contributions made in this area of research. The results provide an overview of the most important applications of data science in digital business. Generate relevant insights to create innovative data mining and knowledge discovery techniques. Important theoretical implications are discussed and a list of topics for further research in this area is provided. The purpose of this report is to make recommendations for improving digital business strategies for business, marketing, and non-technical researchers, and to provide direction for further research on innovative data mining and discovery applications in academia. That's it.

1.   Introduction

Starting from the early 21st century, both Digital Business (DM) and data science (DS) have grown rapidly in terms of usage and profitability [1]. This has created a digital ecosystem that connects users 24/7 in the process of forming new user habits and behaviors [2]. Digital Marketing is defined as a technological tool that is enhanced on the Internet to convince users to buy products and services [3]. Today, methods such as search

engine optimization (SEO), that is, optimizing search results for major search tools, are part of the daily roadmap for companies operating on the Internet. Strategies for sponsoring ads in search tool marketing (SEM) or programmatic advertising, search tools or ad spaces, banners & websites [4]. Social Media Marketing (SMM), a strategy to attract the hearts of users to social networks through social advertising [5]. In recent years, Digital Marketing has received a large amount of research interest among scientists. To strive to understand the main ways to increase profitability

Digital Marketing or ROI (return on investment) [6]. Measuring the impact of data on ecosystems [7]. Digital Marketing that has been developed by several companies on the Internet. Several studies have shown that the main way to increase the effectiveness of PR strategy is to apply PR methods in this industry [8]. For example, showing that a DS is (i) a user-generated information management company; (ii) forms and sources of data in enterprise data sets and (iii) application of new data analysis and innovative methods for generating knowledge [9]]. In addition, it observes the importance of several aspects, such as the type of data collected from various online sources, as well as purchases and digital habits of users [10]. Similarly, to increase their chances of success on digital platforms and social media, companies must use artificial intelligence (AI) or machine learning (ML) techniques to recognize surprising patterns. Therefore, the Digital Marketing industry is increasingly being influenced by research fields such as informatics. (IS) and computer science (CS), as well as other fields that provide data collection, ordering, and management [11]. Until now, the main tasks of Data Science include increasing the company's data storage capacity, conducting market observations and consumer segmentation, or finding important information about company problems [12]. However, Digital Marketing is a vast ecosystem involving various pattern recognition strategies, analytical models, performance indicators, statistical variables, and technical skills associated with superior technical expertise [13]]. However, several studies indicate that there is a skills gap within the industry [14]. Both marketers without IS, CS, Digital Marketing skills and non-technical researchers without data management knowledge achieve these knowledge and skills, not only technically but also strategically and operationally. I also face challenges in using them. Threats and ways to overcome them became the motivation of this study [15]. In the scientific literature of Digital Marketing strategy. The three aspects above are investigated, explained and analyzed from the perspective of marketers, not data scientists.

2. LITERATURE REVIEW

It can be seen that the data science primer aims to extract knowledge based on data analysis to answer certain research questions [16]. By analyzing data, Data Science techniques make it possible to extract patterns from a database to reveal a problem or to formulate a final hypothesis. In Data Science, the key idea is that the patterns identified in the data are (i) subtle and (ii) beneficial to the company [17]. In Data Science, there are various types of patterns that can be applied in the Digital Marketing industry (see Table 1).

Table 1. *Types of form and meaning in Data Science systems*

Pattern Model	Pattern Meaning
Harmony	This is called segmentation in business. combined according to behavioral identification, tastes, or norms that identify the same consumer group among other uses.
Association Terms	ARM means identify patterns.
ARM settings	Purchase products at the same time.
Detector / anomaly	Deceptive forms, for example

	such as in the financial or insurance sector.
Shape Prediction	The form that guesses the missing value.
(PP)	Symbols (products, services, etc.) and predict the future

It is important to note that in terms of pattern detection, humans can identify up to three attributes. or the nature of the object (product, service, community, etc.). These properties are also called functions or variables [18]. However, with Data Science templates, hundreds of thousands of properties (variables) can be identified simultaneously [19]. Shape is defined as a DS technique, which helps to receive action insights, i.e. what the researcher or data scientist wants to extract based on the identified pattern [20]. Depending on the company's goals when developing Digital Marketing, various types of patterns can be used to enhance this strategy, and increase the company's ability to know and structure the main attributes, features, or variables extracted from the company's database. In this sense, the type of data collection is also important, from a corporate perspective, as a strategy developed targeting digital platforms and social networks must be data-driven. Large data sizes are considered to be Big Data (BD). A crucial achievement in the previous Digital Marketing industry, a separate database of physical storage. Structured Query Language (SQL), the default when it comes to querying the database. Recent developments in data storage have resulted in a new generation of databases known as NoSQL databases [24]. NoSQL databases store variable & attribute data using a language such as Object Notation JavaScript (JSON). JSON is lighter, has higher processing speed, and is self-describing, isn't it according to a relational instance table e.g. SQL.

Table 2. Categories and descriptions of data sources in data science as applied to digital marketing.

Data Model	Meaning of Data
Data Deal	Sales, invoices, receipts, Shipping, payments, insurance, rentals, etc.
Non-transactional data	Demographic, psychographic, behavioral, social style system, etc.
Data Operations	This data is about tactics and actions related to logistics and business operations.
Data source	User-generated essence (UGC), emails, photos, Reply, likes, shares, websites, videos, online purchases, music, etc.

Primary data that comes from can be managed by the company that works using Digital Marketing. In Data Science, databases consist of asynchronous variables or indicators. These databases are known as "datasets" or "data records" (hereinafter, the term "datasets" will be used). Each variable contained in the dataset describes certain characteristics (see Table three). A data set can contain (i) structured or (ii) unstructured data. Structured data can be stored in tables, using each table having the same structure or attributes. In contrast, unstructured data has its own internal structure and, as a result,

attributes can be arranged in an asynchronous manner on each table. Table 3 presents the primary characteristics based on the indicators that are generally used in the data set.

Table 3. Data category index on data science.

Combined Data	Index Description
Score	Shows individual abstractions on the dataset.
Symbol	A symbol usually consists of numeric, ordinal, & face value. Attributes are characteristics of variables.
Characteristics	A character can respond to a variable trait such as an attribute.
Unification	Entities are generally defined using a number of attributes.
Example	In a DS word & indicator for example, the word instance, entity, object, case, individual or record can be used in the DS literature to refer to a row.

Data Science uses machine-based models to analyze data sets. training (OD). At the heart of modern Data Science, ML provides algorithms for: Automated analysis of large data sets. This model can be trained. Researchers (non-technical researchers) or marketers Extract useful information and identify patterns. Algorithm variations can be used. You can use and train this algorithm.Company or researcher database. ML has evolved into what is known as Deep Learning, a technology that allows us to change the way personal computers process language and images. Deep learning consists of a set of neural network examples using multiple layers of units within the same network.

Table 4. Study model on main engine

Model	Description
Combined Models	EM Function to create views on the modeling process.
(EM)	The origin of each model's zone casts a vote on each query.
Serious Learning	A network in this learning has several differences.
Neural Network	With network layers to find patterns You can train. Even a model can learn it With patterns from complex data sets Later apply to others according to what you have learned the standard.
Observation machine	On deep learning neural networks, MV.
(MV)	Visual identification which requires to perform the recognition of objects, people, products, etc.
Natural Accent	Based on the study of a text & a predetermined pattern.
Processing (NLP)	NLP that can operate with language and text to identify insights that explain unidentifiable patterns

	by humans.

Furthermore, in the ML area, there are 2 main types of analytical approaches: (i) Guided Learning (SL) & (ii) Unsupervised Learning (UL) (see Table 5). SL involves training a set of samples, including text rebates, User Generated Content (UGC), such as tweets or Facebook posts, feelings about a product, & so on. All of these samples can be used to practice a solving procedure.

Table 5. Learn more about applying machines to digital marketing.

Tipe	Meaning
Supervision	SL provides reinforcing ML actions.
Learning (SL)	The algorithm is used to describe whether the input to the output can be known as an input-output pair.
Not under supervision	SL can be equated with ML so it can be promising.
Learning (SL)	The function to describe so that it was not previously detected in a pattern in a pre-existing data set is called a label.
Vector projection	Vector protection is a class with supporting vectors.
Machine (SVM)	Machine algorithms for classifying data See how similar the simple Instance units are in the data set.
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Algorithms that work using ML are called Support Vector Machines (SVM), which are known as single-class classifiers. SVM looks at data formations to identify key characteristics and similar conditions according to the instance that created the database and can be trained iteratively. SVM classifies similar values by instance so that investigators can study the anomalies identified. The data analysis process must be framed using relevant concepts. Therefore, in the field of Data Science, the concept of Data Mining (DMI) & Knowledge Discovery (KD) has been introduced. At present, these two concepts (DMI & KW) are used haphazardly by the researcher to refer to the dataset analysis strategy. That's the DMI concept, initially there was an attempt to identify the data set developed in the data warehouse. Thus, today, the DMI concept is more widely used in global businesses and digital businesses to describe the innovation process and identify patterns in data sets.

3.   METHOD

In this study, the system answers the research questions formulated in the previous section. SLP is defined as the following method. The following three steps are typically used for SLR development. Therefore, this review focuses on analytical methods, usage, and usage performance metrics From Data Science to Digital Marketing. The main contributions of related research are identified and categorized according to theoretical ranking. In the second step, the literature is systematically examined for similarities and

details. From the Digital Marketing sector. This step is used for the inductive synthesis of previous research and basic group concepts and definitions. In the third step the key findings from the analysis of a Data Science in Digital Marketing literature are considered and the main uses, applications, and indicators are highlighted. Further research is needed on the technology and outline of this Field. Initial, Predefined and selected terms are searched in the database Regarding title, summary and keywords. Irrelevant results It's deleted. The search terms were chosen to identify the main uses. Applications, indicators, technology, and the future of Digital Marketing according to a theoretical framework (see Table 6).

Table 6. Search terms used in SLR.

Keywoard Research	Aspect		Database
Data Field	Digital Business	Title	ACM Digital Libraries, Dimensions, Taylor & Francis
Data Science	Online	Abstract	AIS Electronics
Mining	Digital Business		Literature review
Science	Internet	Keywords	Explore IEEE
Invention	Digital Business		ScienceDirect Web of Sciences

Results are sorted by CS related categories and filters. IS, Digital Marketing, Digital Business. A detailed list of searches is shown in Table 6. Then identify potential articles, titles, abstracts and keywords read in detail. In our review, the relevant research studies identified the main analyses. Digital Marketing research methods, uses, performance metrics and future. Therefore, the type of analysis and methodology used in the study were not considered when selecting articles. Third, selected articles are categorized based on relevance based on their definitions, applications, and theoretical concepts. The importance of applying Data Science technology in Digital Marketing.

Table 7. *Shows the total number of articles identified by each goal proposed in the SLR process*

Database	Number of relevant results	Number of results
(ACM) Digital Library	13	136
(AIS) Electronic Library	2	5
Explore (IEEE)	10	79
Science Category	9	34
Science Web	15	105
Total	49	354

The nature of SLR is Database must refer to Data Science and Digital Marketing, This article is categorized according to the analyzed factors. Or This is the case when several articles are categorized with the main focus on Data Science. The analyzed factors are justified by a Data Science based view. and For articles classified as DM-focused, the concept analyzed is from the perspective of Digital Marketing and its meaning. in Data

Science. In addition, there are articles that are analyzed from a broader perspective. Both categories of methods, applications, key performance indicators, and perspectives focus on future problems. again, Presented in various categories.

Table 8. *The same articles (methods, usage, performance metrics and upcoming topics) will also be analyzed.*

Article category	Combination of articles	Digital marketing	Data Science
Classification	20	13	16
Method	11	4	12
Utility	11	6	6
Matrix Performance	11	11	4
Event Topic	9	5	4

4.   RESUL AND DISCUSSION

Data Science offers different perspectives and approaches to statistical Data analysis. Statistics is a set of rules for quantitative analysis of all types of data. With the development of mathematics Data Science Development is defined as statistical learning The theoretical framework for manipulating ML from a Data Science perspective. Here's how to apply statistical learning used by Data Science: Functional analysis, (ii) exploratory analysis, and (iii) prediction of results based on analytical data. **Table 10** summarizes the main methods identified and applied to the Digital Marketing ecosystem. After analyzing the main methods applied to the research Use Data Science technology to identify applications and applications. In the Digital Marketing ecosystem, one of the biggest challenges is controlling and determining the success of a Data Science strategy. To do this, marketers and researchers need to select and understand the key performance indicators for the models and measurement methods they use. The results of the SLR analysis highlight the following indicators to measure the success of the SD strategy implemented in the PB sector.

Table 9. *Types of methods used in Data Science as applied to Digital Marketing.*

Analysis Type	Description
Descriptive statistics	Descriptive statistics are used to summarize quantitatively the characteristics of information or data. This includes measures of central tendency, arithmetic mean, or measurements such as variance or range.
Bayes' rule	Bayes rule is used to describe the probability of an event. It is based on knowledge of the conditions that can lead to certain events
Least square method	The least squares method allows you to find the best theoretical model consisting of variables or components that fits your data set and allows quantitative

	validation.
Linear regression	We used linear regression to model the relationship between the scale and the search variable. If linear regression has multiple analytical variables, it is called multiple regression.
Logistic regression	Logistic regression is a regression analysis to predict categorical variables. Categorical variables are variables that can be further categorized into additional categories. It is used as a general rule to model the probability of an event and the factors that shape it.
Artificial neural network	An artificial neural network is a self-learning system consisting of interconnected node neurons with input and output. It is used to find and recognize solutions and features that are difficult to identify with standard programming.

The following is a breakdown of each topic and its impact on the development of a Digital Marketing with Data Science strategy. Health data and eHealth strategies: Analyzing user health data can help identify trends and facilitate the creation of new Vaccines, combat diseases that could lead to uncontrolled epidemics (such as the coronavirus known as COVID19), and predict potential deaths. Digital Business should encourage companies to use such strategies to collect data for further analysis. Smart Cities and Governance: Efficient management of energy resources and sustainable and intelligent construction and development based on automation and artificial intelligence of large structures. Social or responsive marketing, also known as Corporate Social Responsibility (CSR), is driven by DM-based communication between digital platforms and social media channels (Orlandi, Ricciardi, Rossignoli, and De Marco, 2019). Internet of Things (IoT): IoT refers to the management and collection of daily usage data from connected devices. This also includes ordering and identifying new features to help you personalize and deliver new products and services and create new needs (Brous, Janssen, and Herder, 2020).

Table 10. *Average performance metrics to measure the success of the DS approach in DM*

INDEX	DESCRIPTION
Superiority	It is a measure of the accuracy and integrity of the processing of a data set associated with its use.
Precision	Precision is also known as precision, indicating the quality and precision of the stroke model or method.
Accuracy	Known as Positive Prediction (PPV), is a measure of the relevance and success of an approach, DS applied database method
Validity	That is a measure of whether the data correctly and accurately support the results and conclusions obtained.
Consistency	Consistency can evaluate whether the values represented in the data in the data set match the values represented in the data. From other data sets simultaneousl.
Remember	Remember that it is also called sensitivity. This usually refers to the number of correct results divided by the number of rejected values.

One of the functions of Digital Marketing is to increase the number of consumers about how companies will use their data. Digital Marketing has the challenge of personalizing massive messages &, using Data Science methods so as to identify certain norms according to the type of person and their demographic & psychographic characteristics to increase the ROI of digital campaigns. Development of new Machine Learning examples: These include new Machine Learning Models that companies can train and implement on their projects. There is a growing need for serious example in solving certain problems. Model-contoh ini harus dibuat, dilatih, & pada-debug buat tujuan tertentu. Other tasks include designing user-friendly algorithms and ML examples to solve technical barriers between a marketer and a data expert (Caseiro & Coelho, 2019). Data-driven sustainability strategies: These include studies on the origin of data resources and the management of globalization processes for improving strategies and sustainable action according to data analysis. Relevant research areas in this field include social marketing or green marketing. Listen to social media: These include automated surveys Major trends in social networks and news Opinion leaders and crises, epidemics, As environmental or social movements (Reyes Menendez, Saura, & Stefanus, 2020). Digital Marketing needs to understand how this community is organized and take appropriate action in an engaging and effective way, Responsible message.
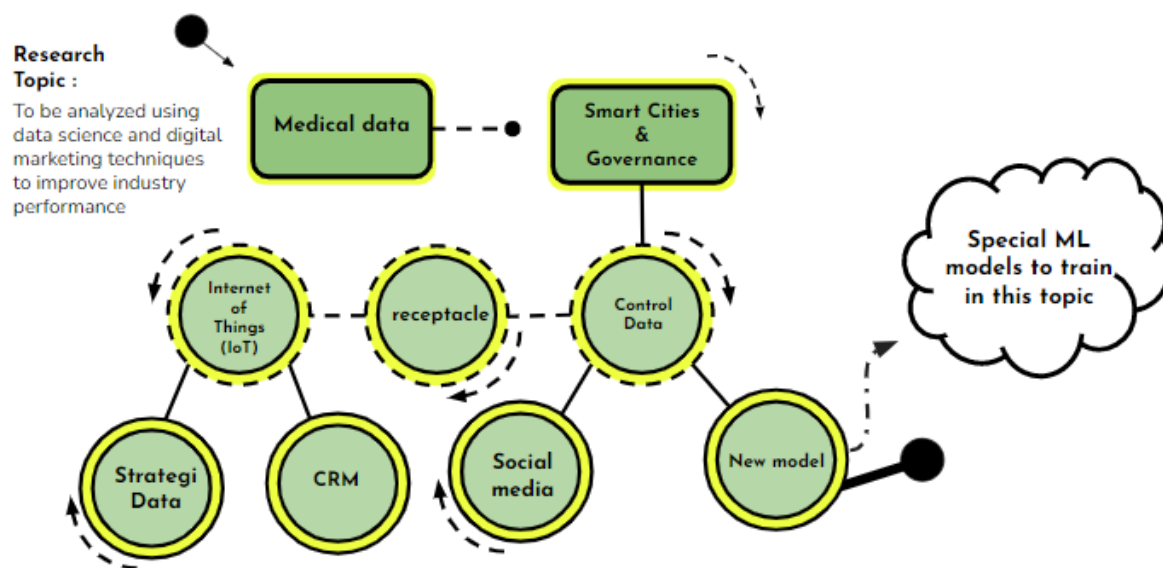
Figure.1 Research Topic

5. CONCLUSION

This overview article defines the key concepts, methods, and performance that have been used over the past two years. Providing a structured presentation of the concepts that decades and their applied marketers in Digital Marketing should take into account when considering a data intelligence based strategy. Related methods used in data science to extract practical insights were also identified from large amounts of data. We also provide Performance in the Digital Marketing environment. These results react to the first research problem addressed in this study. What is it? The primary means of analysis, use and performance metrics of data Are you signed up for marketing digital. Companies today are increasingly operating in a data-driven ecosystem.

Now available to researchers. But an Understanding of Digital Business and Business Idea Research is critical to long-term efficiency and durability. Such a lack of understanding has become a matter of skill. Companies in particular are reported to be wasting a lot of time organizing, cleaning, and compiling a database of users and customers. In this regard, the relevant Performance Indicators and indicators support digital companies and non-technical researchers in Digital Business. Investigate better and more efficiently measure the time They spend on analyzing and compiling databases. Regarding our second research question ("What is your field?" Further research on the use of Data Science in Digital Business?"), Based on the results, we identified a total of nine topics for future research with the Digital Marketing ecosystem security, new application specific model for each of these topics defines the future An industry for the effectiveness of data-driven strategies.From a theoretical point of view, this review identifies a total of 11 methods, 17 applications, and 9 performance metrics. Nine research topics that the researcher can use as a starting pointThe focus of his research is on the use of in Digital Marketing strategy Look at your Digital Marketing study from the perspective of Data Science Analysis methods allow non-technical researchers to consider which Model is best suited for your research objectives For the definitions presented Proceed to explanation In new research, Digital Marketing researchers can use sem number of specific themes to create new hypotheses and discover new research results.

Questions that need to be clarified. In addition, this review provides important practices for Impact on the industry. Currently, the number of companies is increasing. Development of data-driven strategies. So it's best to take advantage of it. Strategy requires a deep understanding of everything you need. The results of this review can be used effectively Familiarize yourself with key Data Science indicators and business professionals Digital Marketing ecosystem metrics. Therefore, organizations can use the results of this review as a starting point for designing new Digital Marketing strategies. In addition, the selection of items and their classification can affect the final result. Future research should focus on issues similar to the nine issues identified in this review. In addition, we should consider expanding the Digital Marketing ecosystem process, which is not identified in this review.

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BIOGRAPHIES OF AUTHORS :

	Kawal Arora Proven Technical Leader with entrepreneurial bent. Spent over a decade in silicon valley working for wide range of industries from Finance to Healthcare . Currently focused on Mobile , IOT , AI/ML and Blockchain. He can be contacted at email: kawal@signy.io
	Alwiyah Lecturer at Wiraraja University who is currently actively writing articles for various scientific journals and has produced several research results and other articles. She can be contacted at email: alwiyah@wiraraja.ac.id
	Muhammad Faisal My current activity is studying at Raharja College. I have become a Personal Raharja with the motto Get the Better Future by the Computer Science Department of Computer Systems, CCIT Concentration with NIM 1933428157. I am interested in taking lectures at Raharja College because it stands in the IT field or Information Technology He can be contacted at email: Muhammad.faisal.faisal@raharja.info