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Artificial Intelligence and the Reshaping of SEO: A Quantitative Analysis of AI-Driven Content Effects on Search Algorithms

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Abstract:- What follows is a discussion of how Search Engine Optimisation (SEO) might benefit from the use of AI. Classifiers and statistical models, fuzzy logic, and evolutionary computation are the three main approaches to artificial intelligence. Using this framework, the author searches for scholarly articles that discuss the various ways AI is being used in search engine optimisation. Application of Support Vector Machine and K-Nearest Neighbour Algorithm were among the many prototypes that were obtained. Other examples are Polidoxa and the Fuzzy Inference System. Commercial programmes included SPSS Clementine the SearchDex Hyperloop. The search engines' and SEO firms' insistence on algorithm secrecy limits the scope of their investigation.

Keywords:- *Algorithms, search engine optimisation, artificial intelligence.*

I. INTRODUCTION

Nowadays, artificial intelligence is present in many parts of people's lives. Education, healthcare, investing, the legal system, cyber defence, daily living, and transportation are just a few of the many areas that make use of AI. The rise of AI, which many worried would strip humans of their agency, is now serving as a personal secretary, empowering individuals to direct their own destinies [3]. “Artificial intelligence might one day supersede humans on Earth,” even Apple co-founder Steve Wozniak said [4]. Search engines in the digital realm are one area where AI is finding use. Through search engine optimisation, artificial intelligence has made it easier for users to find the accurate and relevant information they need online. Problems have been identified with search engine optimisation strategies that use AI. Despite the fact that this programme is useful for finding information online, contextual-based search algorithms have taught computers biases that contemporary people find repugnant, like racism, ageism, and sexist [5].

A website's search engine traffic can be optimised with the help of artificial intelligence, despite the fact that it has many drawbacks as the ones listed above. According to the 2017 search engine optimisation (S Proficiency in Marketing Survey, 96% of SEO experts believe that AI can enhance SEO strategies. Additionally, 73% agree that AI can analyse data for SEO purposes, 61% say that AI can help them find and fix SEO anomalies, 58% believe that AI gives them an advantage over competitors, 49% think that AI will outperform Google RankBrain, and 41% say that AI does away with the need for take phrases as keywords [6]. Traditional SEO tactics have been losing ground, and as a result, many SEO companies have been unable to stay in business. This has led many to believe that AI holds the key to SEO's future. This paper will therefore examine the current state of artificial intelligence (AI) search engine optimisation (SEO) applications [7].

II. ARTIFICIAL INTELLIGENCE AND SEARCH ENGINE OPTIMIZATION (SEO)

In an effort to train computers to handle complex intellectual issues autonomously, rather than relying on humans, discussions about artificial intelligence began to take shape in the 1950s [8]. It follows that this computer is considered an intelligent machine. During its evolution, an intelligent machine exhibits traits typically associated with human intellect, namely, a smart computer [9]. The idea that computing can be configured in a way that yields a system with more intelligence than the sum of its parts is known as a system for realisation. The term "Multi-Agent System" (MAS) describes this type of system, which describes a "loosely-coupled network of creatures which collaborate along to find solutions for those issues which are beyond the competence of a single entity" [10]. Every computer is seen as an agent, part of a network of minds that work together as a process to build a mind, which is part of a network of minds [11]. Following this line of thinking, AI is characterised as the study and development of methods for creating intelligent machines [12]. To elaborate, "a part of the field of computing dealing with sophisticated computer systems construction" [9] is the definition of artificial intelligence. Alan Turing established the Turing test in 1950 [13]. An intelligent system is one that passes this test.

The application of AI to the process of building a multi-agency in step with the expansion of the Internet's reach. Researchers strive to identify the factors that enable a multi-agent system to display a desired behaviour. The creation of XML (Extensible Packaging Language), a framework for which an endless number of additional frameworks can be defined, is one example of such an endeavour. With XML, there is no limit to the number of languages that may be created and described explicitly, making them all amenable to translation into other XML-based languages [14].

A. In contemporary times, AI already has many versions and applied to various purposes. Some versions of AI models includes:

A model for evolutionary computation. In order to improve the machine's capabilities, these models imitate the evolutionary process in organic things. Swarm intelligence or evolutionary algorithms are employed by this paradigm.

Alpha Colony Optimisation (ACO) and Particle Swarm Optimisation (PSO) are swarm intelligence algorithms, while Genetic Algorithm (GA), Gene Expression Programming (GEP), and Genetic Programming (GP) are evolutionary algorithms [15].

Modelling with Fuzzy Logic. Fuzzy logic, which these models are based on, is a mathematical framework for dealing with uncertain situations by making use of observations of language values [15]. When dealing with inadequate or uncertain knowledge, another variant of fuzzy logic in order is grey theory. To lessen the impact of data randomness, grey theory employs AGO (Accumulated Generation Operation) [16].

Classifiers and Statistical Neural Models. The learning strategy used by these models is based on statistics. NN (Neural Network), kernel-based approaches (e.g., SVM supported vector Generator), k-nearest neighbour algorithms (e.g., SOM Self-Organizing Map), decision tree, Gaussian mixture models, and a Bayesian naive classifier are all examples of AI models that fall under this category [15].

Current AI research and development has come a long way, but most people think we have a long way to go before we can rely on them entirely. This work included the proposal of an overarching theory of AI [17]. More focus on models for classification and statistical training has gone into the broad framework of AI that has been established [17]. Among the many axioms that make up this theory are: 1. Similar to the human nervous system. 2. Artificial neurons, or neural-like units, are the fundamental building blocks of intelligent systems' nervous systems. 3. Any neural-like element that does not contain any data is considered novel. 4. Any neural-like element that does contain some information is considered equivalent. 5. When there is no information about the receptors of the fresh neural-like element, it continues to operate in the mode of light inflexible background excitation. (6) Bac Proponents of this idea argue that it will pave the way for AI research to incorporate a wide range of behaviours that mimic human intelligence, such as motivation, deliberate action, thinking, consciousness, a person's and furthermore [17].

Websites that employ search engine optimisation (SEO) strategies see an increase in traffic from these online resources [18]. Improving a term's position in search engine results is one way to do this [19]. In this vein, a typical practice is to adjust the site's layout and content so that it better conforms to search engines' guidelines and criteria [20]. In turn, this boosts the site's exposure in SERPs [21]. "White hat" SEO refers to the method in its most basic form, while "black hat" SEO refers to more extreme forms of metadata manipulation, such as artificially inflating the site's age or using keywords unrelated to the content, with the intent of misleading search engines. Site owners often use SEO consultants to alter their sites' attributes in a way that appeals when you look at engine algorithms [22].

III. APPLICATION OF AI IN SEO

Search engine managers are able to continuously enhance their algorithms by utilising the latest approaches from artificial intelligence, thanks to the advancement of AI. In order to respond effectively, search engine optimisation (SEO) designers must pursue and comprehend search engine algorithms. In order to get the right data and do what the user wants, search engines use a variety of AI techniques. As an example, there is the Forest Generation Algorithm [24], the Self-Organizing Map [25], and the Support Vector Machine [23]. When deciding where to place a website in their online rankings, search engines take a wide variety of variables into account. As an example, Google employs over 200 parameters that are not publicly available [25]. The procedures and weights used to evaluate each of these 202 factors remain a mystery, even if they were known in advance. Google has now acknowledged using RankBrain, an AI system that helps them rise in search engine rankings [26].

Search engine optimisation (SEO) experts use time-honoured techniques to boost a website's visibility in organic search results. Using AI, a large SEO firm can improve its ranking in Google's index. That is correct; the algorithm is obviously a trade secret that the corporation cannot share with the general public. Consequently, a variety of goods from businesses and the findings of the still-prototype academic research should be relied upon in the quest to discover the AI application in SEO.

B. Here are some of the application of artificial intelligence in search engine optimization which is found in the literature:

- *Polidoxa*

Craft Polidoxa, an algorithmic trust-based search engine that takes advantage of members' actions on the network, and a trust-based social network with a holonic system for privacy and social security [27]. The swarm intelligence principles that informed Polidoxa's development were based on studying how insect colonies work together. To accomplish the collective information of social networks, Polidoxa use swarm intelligence. According to the claims, using Polidoxa can reduce the time it takes to evaluate inlinks—links that originate from other pages—from months to minutes, depending on the amount of activity in the network. Search engine optimisation (SEO) is a third party process; social network users select what content is relevant.

Polidoxa gives its consumers a glimpse into what the trusted network is up to, but they still need to use caution when deciding how to interpret the data. As a result, the "deep Web"—all the data that search engines don't crawl—should have a better chance of making it to the surface of the Web. The Polidoxa ranking improves the information quality, makes discussions easier, and could even make people's lives better just by talking to each other and sharing what they know. Approximately 80% of people only click on the top three results provided by search engines, according to statistics from seo-scientist.com

(http://www.seo-scientist.com). Consequently, information ranking is crucial, and providing a trust ranking determined by user behaviours is essential to provide better results in terms of quality, since it involves enhancing the top three positions based on user priorities and likes. The user and their trusted network have an impact on the ranking in Polidoxa, and everyone has an equal opportunity to acquire a customizable ranking.

➢ *Fuzzy Inference System*

To make Persian-language things rank higher in the search engine, create a web-based fuzzy logic. The search engine can now get Persian-speaking topics from the web thanks to this technique [28]. Readers will be able to access Persian language sites even when using Google search thanks to this method.

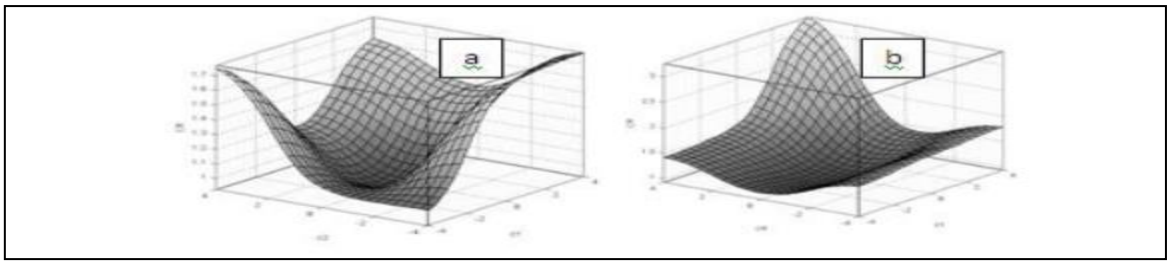

Fig. 1: Response from the Inference System with Changes of States for (a) C1 & C2 Inputs and (b) C4 & C1 Inputs

Instead of focusing on keywords with the goal of improved search engine indexing, try using a system that uses fuzzy inference to boost site conversion. This means getting more out of your traffic in the form of signups, obtains, purchases, and other actions [23]. User behaviours at a site are the basis for this, and these habits are often characterised by a sequence of pages loading plus repetition of information. A fuzzy inference system was created to determine the audience's characteristics and choose a method to guarantee that a specific approach would have an impact on conversion rates. The inference model teaches us about the input-output relationship, and the fuzzy method allows us to pay for decision space with little empirical data. The relationship between the chosen parameter settings and conversions is shown in Fig. 1.

The results demonstrate that conversion rates can be reduced to 1% if what differentiates t and t−1 falls to a minimum value within the range of -4 for both c2 in normal and c.Users were less affected by these one adjustment, which involved switching the thumbnail image's backdrop colour from lively to light blue and using compelling language instead. By combining backdrop and textual adjustments, we were able to achieve a 1.7% improvement in conversion, as shown by maximal change for c1 and c ranging from 1 to 5.

➢ *Commercial Packages*

IBM's SPSS Flavia is an ANN-powered data-mining programme [29]. Search engine optimisation (SEO), automated visits and user segmentation, homepage activity, activity series analysis, trend analysis, and analysis of user behaviour and site activity are the six that internet analytics application modules included in SPSS Clementine (Fig. 2). SPSS takes advantage of online databases, enabling SEO analysts to analyse various marketing campaigns for high search engine rankings [30]. In addition to SearchDex SDX Hyperloop, there are other AI-based SEO commercial solutions [31].

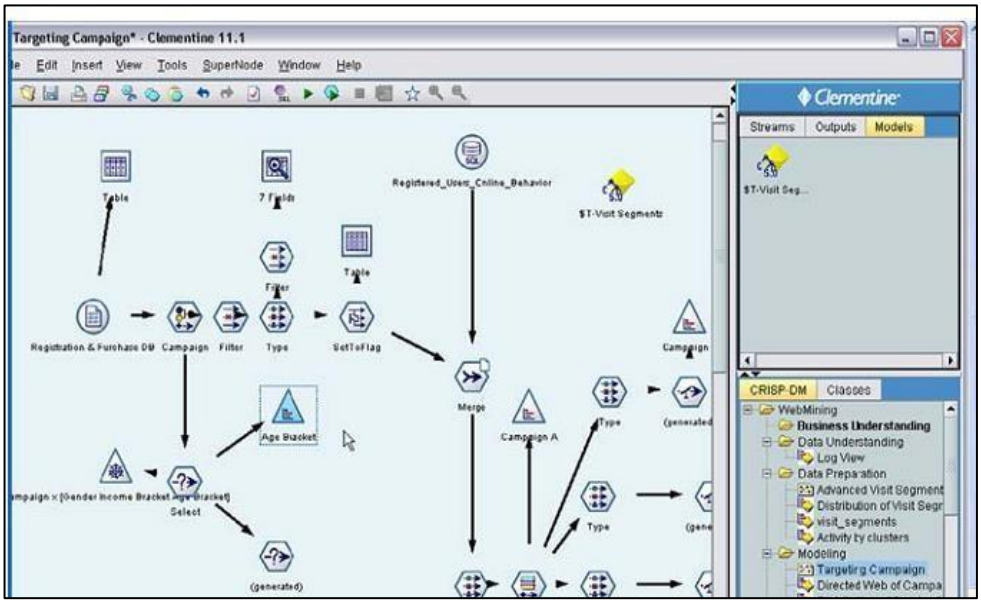

Fig. 2: Workspace of SPSS Clementine 11.1

Link analysis of campaign, socioeconomic status, age, and gender data categories, in addition to graphical representations of the aim of client web activities, were both carried out using SPSS Clementine. The percentage gains of utilising each of the four models with SPSS Clementine for web mining were compared, and as shown in Figure 3, they were nearly equal between the 40-100 and 0-10 percent regions.

Fig. 3: Viewer Flow, Top Search Terms, and Bob's Fruit Site Example

As previously stated, many online mining technologies that operate with text data from motel consumer feedbackare incompatible with web data from marketing promotions and click data streams from Bob's Fruit. These internet mining tools work better with the click stream data from Bob's Fruit than with the online data from the marketing effort. It is crucial to think about the data types that will be encountered and the web mining strategies offered by the software you choose for web mining.

➢ *Support Vector Machine (SVM) Application*

Make use of support vector machines (SVMs) to improve findability, or the process of making websites more visible to people using search engines [32]. The degree in which a document may capture the keyword and related topics and how well it is segregated from the full collection are two factors that contribute to this. In addition to predicting how many facets of a topic search engines can grasp, this model may also estimate how complicated a keyword is. Figure 4 shows that the model's performance is significantly enhanced by adjusting the values of the parameters used by machine learning techniques. Let's have a look at the SVM parameter list.

This page lets you view and manage the reports of your Web Site content.

Group by: No Grouping

Name	Start URL	Start Time	URL Count	Link Count	Duration
alpha_seo	http://www.alphabank.ro/	10/1/2010 1:21:43 AM	2010	51008	00:03:02
ate_seo	http://www.atebank.ro/	10/1/2010 1:48:36 AM	516	10916	00:01:37
bancpost_seo	http://www.bancpost.ro/	10/1/2010 12:58:50 AM	2007	55726	00:02:09
bccarpat_seo	http://www.carpatica.ro/	10/1/2010 1:50:57 AM	1149	64779	00:06:00
bcr_seo	http://www.bcr.ro/	9/30/2010 11:49:34 PM	2010	117267	00:04:06
brd_seo	http://www.brd.ro/	10/1/2010 3:04:35 AM	2006	39202	00:08:54
brom_seo	http://www.banca-romaneasca.ro/	10/1/2010 12:16:04 AM	2006	0	00:28:13
btransil_seo	http://www.bancatransilvania.ro/	10/1/2010 2:21:47 AM	1253	38928	00:03:33
cec_seo	http://www.cec.ro/	10/1/2010 2:34:02 AM	1417	21676	00:04:45
citi_seo	http://www.citibank.ro/	10/1/2010 1:38:02 AM	1356	19918	00:04:13
crediteur_seo	http://www.crediteurope.ro/	10/1/2010 2:17:55 AM	2010	84933	00:02:58
emporiki_seo	http://www.emporiki.ro/	10/1/2010 2:51:49 AM	1357	48728	00:02:01
eximbank_seo	http://www.eximbank.ro/	10/1/2010 1:58:49 AM	894	21625	00:01:50
garanti_seo	http://www.garantibank.ro/	10/1/2010 2:39:25 AM	999	18907	00:00:34
ing_seo	http://www.ing.ro/	10/1/2010 2:27:36 AM	1712	24467	00:03:52
leumi_seo	http://www.leumi.ro/	10/1/2010 2:40:54 AM	686	10632	00:01:00
libra_seo	http://www.librabank.ro/	10/1/2010 2:01:50 AM	1239	47826	00:11:35
marfin_seo	http://www.marfinbank.ro/	10/1/2010 3:03:20 AM	338	13521	00:00:38
millenium_seo	http://www.millenniumbank.ro/	10/1/2010 2:54:31 AM	1230	29434	00:06:15
otp_seo	http://www.otpbank.ro/	10/1/2010 1:25:24 AM	2009	0	00:08:27
piraeus_seo	http://www.piraeusbank.ro/	9/30/2010 11:42:06 PM	913	31435	00:01:57
procredit_seo	http://www.procreditbank.ro/	10/1/2010 2:47:52 AM	673	20074	00:02:30
raiffeisen_seo	http://www.raiffeisen.ro/	10/1/2010 1:17:51 AM	2007	104049	00:03:22
roib_seo	http://www.roib.ro/	10/1/2010 2:32:51 AM	212	3921	00:00:29
romext_seo	http://www.romexterra.ro/	10/1/2010 1:34:28 AM	900	12978	00:02:41
unicredit_seo	http://www.unicredit-tiriac.ro/	10/1/2010 2:42:36 AM	2010	47207	00:04:54
volks_seo	http://www.volksbank.ro/	10/1/2010 1:42:58 AM	815	25389	00:04:49

```
sklearn.svm.SVC(C=1.0, kernel='rbf', degree=3, gamma=0.0, coef0=0.0, shrinking=True, probability=Fals
e,tol=0.001, cache_size=200, class_weight=None, verbose=False, max_iter=-1, random_state=None)
```

Fig. 4: Some Important Parameters Having Higher Impact on Model

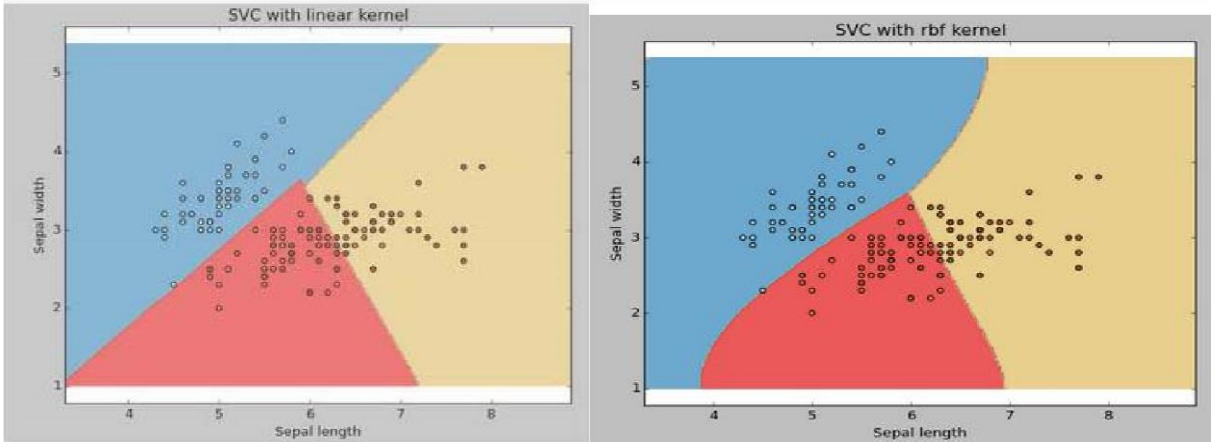

Fig. 5: In Fig. 6, the kernel type is changed to RBF and look at the impact

➢ *K-Nearest Neighbour Algorithm Application*

If you want to get data from Microsoft's Internet IT (IIS) Manager, you can use the SEO Accelerator (Fig. 7). With SEO Toolkit, you may explore a website's architecture and get performance-related data. A more visible online presence while yet adhering to SEO guidelines is now within reach for admins. Afterwards, we will simulate the efficacy of different strategies for the online presence of several banks [33].

Score	K=3		K=4		K=5		K=6	
	Vote	confidence	Vote	confidence	Vote	confidence	Vote	confidence
5	D	0.66	n.d	n.d	n.d	n.d	D	0.5
10								
15					D	0.6	D	0.66
20								
25	C	0.66						
30	D	0.66			C	0.6	n.d	n.d
35					D	0.6	D	0.66
40			D	0.75	D	0.8		
45	B	0.66	B	0.5	n.d	n.d	D	0.5
50							B	0.5
55	n.d	n.d			B	0.6		
60			C	0.5	n.d	n.d		
65	C	0.66						
70								
75					C	0.4	n.d	n.d
80	n.d	n.d						
85								
90								
95								
100								

Fig. 7: Screen Capture from Search Engine Optimization (SEO)

Ultimately, if the bank puts in the effort across all four dimensions of the scorecard—Communication, Functionality, Orientation, and Training—and gets a score above 50, it will be considered popular on the Internet. For ODBank, the range of possible scores is 40–50. If the bank tries to do anything below 50, it will most likely end up in Internet popularity class D, with less than 20 internet views per 100,000 users. Internet Appreciation for ODBank will be classified as C or B if the score is greater than 50, indicating that more effort has been put into the online presence.

IV. CONCLUSION

Mysterious search engine selection criteria and the secrecy surrounding SEO algorithms are two of the biggest obstacles to the widespread usage of AI in the industry. The use of AI in search engine optimisation has nevertheless been the subject of several attempts, although in experimental or commercially packaged forms. Possible application of AI to enhance search engine optimisation, even just as a tool for data analysis in website design. Professionals in the field of search engine optimisation (SEO) can now use AI-powered tools to determine the best course of action regarding structure, keywords, content, and links in order to boost their online visibility.

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Table 1: The Results of the AI Methods

TABLE I. THE RESULTS OF THE AI METHODS

No	Name	Results of the AI methods
1	Polidoxa	Polidoxa use swarm intelligence to achieve collective intelligence of social networks.
2	Fuzzy Inference System	By adding the entry criteria and should defined more rules so greater accuracy is required.
3	Commercial Packages	Applying data mining to customer relationship management (CRM), mining web-based text of customer surveys, and web-based marketing strategies for identifying potential customers, and also the technologies used for web mining. The selection of appropriate web mining software should be based on both its available web mining technologies and also the type of data to be encountered.
4	Support Vector Machine(SVM) Application	This model can be used to predict the degree of complexity of a keyword and predicted the number of aspects of the topics that can be captured by the search engines.
5	K-Nearest Neighbor approach based on Algorithm Machine the K- Application	An innovative Learning Techniques, Nearest Neighbor Algorithm to estimate the Internet Popularity that a bank is likely to achieve based on its size and efforts in Internet presence.

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