APPLICATION OF AI AND MACHINE LEARNING IN SEARCH ENGINE OPTIMIZATION

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Abstract

In recent years, the phrase artificial intelligence (AI) has become too familiar to marketers. There is no denying that artificial intelligence is rapidly becoming the center of the digital world and creating a big change in the way businesses reach their target customers. For every industry, machine learning is penetrating and bringing a lot of benefits, however, for the digital advertising industry, the benefits of machine learning are huge. AI and machine learning provide the ability to collect, analyze, and learn, the output of which is providing valuable customer insights to companies. AI and machine learning are changing the world of digital strategies, where search engine marketing (SEM) is an aspect of digital marketing that has benefited greatly from the adoption artificial intelligence and machine learning. Most of all, every aspect of a business today is touched by search engine optimization (SEO).

Keywords: *artificial intelligence, machine learning, search engine marketing, search engine optimization.*

1. Introduction

Nowadays, businesses have been in the process of changing their business models to adapt to the new economic context during the covid pandemic. Most businesses have focused on building their e-commerce sales channels, specifically websites. In the near future, businesses will compete more fiercely with the battle for rankings on search engine results pages (Pinsky, 2022). They may find their sites go through big ups and downs in ranking in Google or some other search engine. In the era of rapidly changing technology, search engines are also constantly updating their core technology to provide better services with new algorithms. Therefore, businesses can experience drops in search results rankings as search engines have implemented more machine learning and artificial intelligence (AI) applications in ranking websites. In recent years, SEO specialist have had to admit that their goals and roles will need to change, update, and evolve soon, so they can prepare and adapt good response to reality.

2. AI and machine learning

AI is a technology that simulates human thinking and learning processes for machines, especially computer systems. AI is often applied in controlling, planning, surveying, or identifying information of the target audience and it represents a human goal. Machine learning is a means that is expected to help humans achieve that goal. Machine learning and AI have a close relationship, and currently machine learning focuses on short-term goals such as making computers have basic human cognitive abilities such as hearing, seeing, understanding language, math, programming, etc. In a more intuitive way, machine learning is a subfield of AI, which uses algorithms that allow computers to learn from data to perform tasks instead of being programmed clearly. People's lives today have the intervention of artificial intelligence in many different aspects, including education, health care, investment, cybersecurity, family life and traffic (Matoševi´c, Dobša, Mladeni´c, 2021). In the above fields, the field of search in cyberspace is also an application area of artificial intelligence. For each specific

desired context, artificial intelligence has optimized search engines to help people find reliable sources of information and it has many benefits in terms of optimizing website traffic. (Zhang and Dimitroff, 2005).

The AI process input is collected from multiple websites, analytics reports, business metrics, social media information, and proceeds the data to produce accurate, optimal and highly predictive results (Theodoridis and Gkikas, 2019). There are many different technologies covered in the term AI including machine learning, computer vision, natural language processing, and natural language generation (Kaput, 2021). The current AI model has many versions and is applied for many different purposes including Evolutionary computing model, Fuzzy logic model, Classifiers and Statistical Models (Nourani, Hosseini Baghanam, Adamowski and Kisi, 2014). In terms of machine learning, this is one of the areas of artificial intelligence. Machine learning uses empirical data, processing them with algorithms. Machine learning is an interdisciplinary field that deals with information science, databases, statistics, and data science. After the processing, the goal of machine learning is to learn from the data and predict variable values, detect structures, or recognize patterns. Machine learning is divided into two main categories including supervised and unsupervised (Witten, Frank, Hall and Pal, 2016).

3. Search engine marketing

With the development of search engines, consumer behavior has changed a lot. Search engines have become the primary means by which consumers find information about products and services (Hennig-Thurau et al., 2010, Rangaswamy, Giles & Seres, 2009). Search engine marketing (SEM) is the optimal way to display a website's search results in the most accessible position on search engines like Google or Bing, Yahoo, etc. Report, Silverman pointed out that 47% of spending in digital marketing goes to SEM, the largest number of most spends (Silverman, 2010).

Chaffey et al. defined that SEM includes SEO (Search Engine Optimization) and PPC (Pay Per Click). Basically, SEM is a marketing tactic that advertises a company's products or services through the use of paid advertisements that appear on search engine results pages (SERPs). SEM is an effective way to grow your business because it provides the opportunity to show ads to the right people at the right time, thereby increasing conversion rates. However, to optimize SEM, businesses need to research and process data, and this is the ability of artificial intelligence. Machine learning uses algorithms to manage bids and budgets by analyzing data and creating effective strategies. (Jalil, 2022). Over time, websites compete by rankings, SEO is a technique that has a direct correlation with pageview rate and frequency of visits (Egri and Bayrak, 2014) and it plays a huge role in internet and search engines (Sunny, 2020). SEO is the process of optimizing a website to get high rankings for Keywords in search engines. SEO principles also help the company create a website with quality content that meets the needs of the visitors. Through some optimization techniques like SEO and PPC, it is possible to improve website ranking (Yang, Shi & Wang, 2015). To sum up, SEO is a set of techniques and practices that enable a website to get more traffic from search engines by improving the structure and content of the website to conform to the rules and regulations of the search engine standards (Özel, 2011). When combined with machine learning, whatever SEM technique is, machine learning shows the outstanding performance of machine learning-powered SEO tools in increasing business value (Park, 2020).

4. Applications of AI and machine learning in SEO

The techniques of artificial intelligence have evolved and allow search engine managers to continuously improve their algorithms. However, it is also a challenge to respond appropriately to the change in pursuing and understanding algorithms. Search engines collect data by applying various

artificial intelligence methods including Polidoxa, Fuzzy inference system, Commercial Package, Support vector machine application and K-nearest neighbor algorithms application (Yuniarthe, 2017). In addition, there are many other techniques that tools powered by machine learning and AI have helped humans do SEO related jobs. The following techniques are compiled from many research papers by different researchers.

4.1 AI and web page classification in search engine optimization

There are many factors that influence a website's ranking results, and these results impact the functionality and effectiveness of websites. Machine learning techniques build a classification model that automatically adjusts to SEO optimization guidelines and identifies on-page factors that influence SEO optimization of a website. This classification model is implemented through four successive stages. First, a random site is selected. In stage 2, experts will perform ratings and classifications according to the categories they define. The third stage builds and evaluates the classification models. In the final stage, the important factor extraction from the classification models is performed. Compared to the classification method in the majority class, the classification model based on the level of SEO optimization has higher accuracy. In general, this model will use machine learning and expert ratings to identify and predict important factors affecting on-page SEO (Matoševi´c, Dobša, Mladeni´c, 2021). The stages are described in Fig 1 as follows:
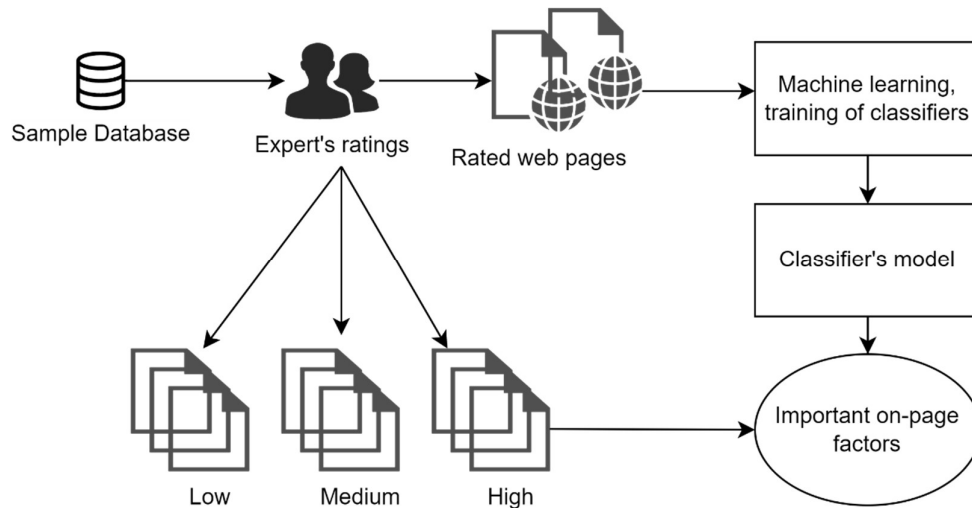
Fig 1. The workflow of classification models.
Adapted from Matošević et al. (2021)

With 4 main stages described in Fig 1, the input of the process including random sample sites. Experiencing the classification stages, the output is the important factor that affects the on-page SEO so that SEO specialist can use to adjust the SEO optimization guidelines appropriately.

4.2 Applying machine learning, AI in data analysis to improve website rankings

The data collected from SERPs includes number of pages, domain authority, site rating, keyword relevance, content type, and more. Over time, the landscape of SEO has changed, it has spawned a lot of new things: mobile SERPs, social media, page speed, personalized search, schema and other new web technologies, etc. These aspects also include a lot of factors that influence the battle for rankings on search engines. SEO specialist can put data blocks into machine learning models corresponding to their analysis purposes to discover which ranking factors are the winning benchmark factors, between sites with significant differences, which ranking factors and how many unit changes in those factors

can affect the ratings.

According to Voniatis (2021), it is necessary to define the right machine learning model. The two types of problems that machine learning solves include classification and regression. Competitor analysis and search engine rankings improvement would be suitable for regression models because rankings are essentially a series of numbers. However, it is necessary to determine the outcome metric for this problem, which is the ranking. Next, it is necessary to define the parameters, input variables for the model, and data types. After the variables are declared, the regression model needs to be shaped in mathematical terms. Everything needs to be done in the process after the data block is collected, from data transformation, data cleaning to modelling. In fact, choosing the best model can take many tries of algorithms on training and evaluation datasets.

The analysis needs to take place continuously because the data collected is only temporal in nature, it is necessary to collect and analyze data on a regular basis to adjust and perform SEO work continuously. Nowadays, tools are often a combination that includes building a data warehouse, building dashboards, analyzing data, and automating the ELT (Extract – Load - Transform) process to find out what the key drivers are, winning benchmarks, and calculating how much identify key drivers lift in rank when adjusting for those key factors (Voniatis, 2021).

4.3 Application of machine learning in building predictive models

Build a machine learning model to predict how adding Keywords to title tags can affect organic search clicks. The training data source will be pulled from search engines like Google Search Console and title tags (and meta descriptions) from scraping the pages (Batista, 2020). Following the ELT processes, the code snippets will connect to the data source and get the training data. Next step, find the page titles, meta description and calculate whether the queries are in the title page or not, choose the desired target columns to predict. Finally, import the data set in the expected format into the machine learning system and select the predictive model to train. Usually, experts use deep neural nets (Salminen et al., 2019).

4.4 Applying AI in content marketing

Today, the landscape of content marketing has changed with the arrival of AI (Chintalapati and Pandey, 2021). AI can save humans a lot of time and can do a lot of things including content creation and content analysis (Fach, 2019). AI can analyze content, select Keywords, create data-driven content, optimize, analyze, recommend, create personalized content, and A/B test to improve content. AI will perform reading, writing of human language and improve, adjust accordingly after each writing. Aspects of AI content marketing include forecasting, optimization, expert support, adaptive guidance, and correction of marketing mistakes. The prominent element of AI in content marketing is the adaptability in the process, flexibility, interaction and intelligence to the needs and preferences of the user (Kose and Sert, 2016). This helps to speed up the execution of specialized human tasks because intelligent machines learn very quickly (Klass, 2022). Integrated AI tools will convert numerical statistics into readable text and bring this data to narrate reports through automated insights (Kaput, 2021).

According to the research of Kose and Sert (2016), there are 3 scenarios for AI content marketing and have been summarized by the researchers through 3 models including intelligent scenario, optimized scenario and self-learning digital content. The first scenario is the intelligent scenario, which is based on a digital content on the web, using the elements that make up the content. The artificial neural network model is applied to control the values of each element for the defined scenario. The second model is optimized scenario, in digital content, key values set by experts (total views, total sold, total cost, income and results) were used to calculate the success rate. In addition, several other additional variables need to be optimized (total follow-up visits, total target users, etc.). Then the scenario is applied, the variables are optimized, and the process is continued until the company is satisfied with

the script and marketing. The third model is self-learning digital content, digital content uses parameters related to user interaction and self-updates, improves, and adapts to different web environments through a combination of many AI techniques such as neural networks and machine learning. In content creation and personalization, AI Thinking has huge potential. Besides, Feeling AI is also a technique that will become increasingly popular when it can rely on customers' emotional reactions to analyze feelings, feelings, reactions and adjust promotions in real time (Huang and Rust, 2020). Message value and effectiveness can be optimized by content analytics, and customer responses can be tracked in real time with emotional AI algorithms (Verma, Sharma, Deb and Maitra, 2021).

5. The role of SEO specialist

Although AI and machine learning bring many benefits and reduce human tasks by performing automated techniques, however, the roe of SEO experts is undeniable and irreplaceable. In the above sections, when applying AI and machine learning to SEO, there are still many processes and activities that need SEO experts. For example, to implement a website classification model, SEO experts need to evaluate and rank websites according to criteria of their choice before building a classification model and using machine learning. In applying AI to content marketing, SEO experts also need to identify the components related to content, the parameters that need to be optimized for AI to perform in the best way.

As for the problem of content creation, language is one of the difficult elements for machines because it requires understanding the overall context and using knowledge of culture, history, and other factors. The stories and content created need to attract, connect, and arouse the emotions of the readers. This makes it difficult for AI because only a human can create a content properly (Klass, 2022). Human thought process, experience, creativity, and analysis are what machines cannot replace (Park, 2020). The responsibility of SEO specialists to ensure that content is relevant and useful today across all devices, platforms, and content formats to provide a positive user experience (Burton, 2020). Since search engines also use a variety of evaluation criteria powered by AI and machine learning techniques to better rank search engine results, the related SEO job requires human involvement and supervision.

6. Conclusion

AI is an ever-evolving machine designed to meet user requirements and it is not a static method. Beyond the simple keyword phrases, AI skills will greatly enhance the future of SEO (Mohapatra, 2018). Machine learning has many amazing benefits, allowing marketers to enable real-time insights, analyze customer behavior to personalize, and optimize content for their individual needs to improve search visibility and customer engagement (Park, 2020). In addition, machine learning and AI help reduce costs, generate customer insights and intelligence, enhance the experience, focus on creating quality content, and improve rankings on SERPs. With the advancements of AI and machine learning, SEO is changing rapidly and delivering desired results for users. (Burton, 2020). SEO analysts can decide on aspects related to structure, Keywords, content, links to increase website presence on the internet with the help of artificial intelligence-based tools and devices (Yuniarthe, 2017). However, SEO specialist cannot be replaced by machines because there are tasks that only they can do like training, explaining, and sustaining (Daugherty and Wilson, 2018). In the future, techniques of AI and machine learning will be developed and applied in SEO, but humans need to have elements of testing and monitoring to get the expected output results.

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