Deep Learning Model for Digital Sales Increasing and Forecasting: Towards Smart E-Commerce

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Abstract

In this paper, we have proposed a system that will be able to forecast the sales of the e-commerce systems by using the techniques of the deep learning, the main goal of this paper is to help the business and the top management level of the company in decision making in order to provide the workplace the effectiveness and the efficiency in the workplace and to provide an efficient and effective system that it is intelligence to forecast and increase the sales of an e-commerce system, this paper will start with building an e-commerce website using different programming languages which are HTML, CSS, Django, JavaScript Bootstrap, and it this e-commerce website will have a specific database that contains different tables for the product list, the orders, and for the user information and many other tables, then the deep learning algorithms such as Deep Belief Networks and Convolutional Neural Networks will be applied in order to provide an effective system for digital marketing usage, so, it will be able to function as a marketing manager.

Keywords: Digital Marketing, Deep Learning, Artificial Intelligence, Smart E-Commerce, Business Intelligence, sales forecasting, sales increasing, E-Marketing, Python, Machine Learning.

1. Introduction

In the world today, technological disruptions such as artificial intelligence (AI), the Internet of Things (IoT), and big data analytics (BDA) have provided digital solutions to attract and retain a customer base.

Artificial Intelligence (AI) is a technology that helps organizations track data in real-time to analyze it and respond quickly to all customer requirements. Artificial intelligence is essential to attracting and retaining customers. It stimulates the customer's next step, redefines the overall experience, and is useful for inferring customer expectations and navigating the future path.

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Artificial intelligence finds its applications in today's business scenario. Practitioners and academics believe that artificial intelligence is the future of our society. With the advancement of technology. The application of technology leads to investment in artificial intelligence (AI) for big data analytics to generate market intelligence.

AI applications are not limited to marketing only but are also used in other sectors such as medicine, e-commerce, education, law, and manufacturing. Artificial intelligence is constantly being applied to benefit many different industries. As organizations advance towards the industry artificial intelligence and other emerging technologies are also developing in parallel. However, the application of artificial intelligence in all sectors has not been possible due to many limitations, but scientists are working on systems that meet the theory of mind and Self-awareness of artificial intelligence systems.

Nowadays people interact with some form of artificial intelligence in daily activities. For example, the user has the advantage of automatic email filtering. In a smartphone, the user might fill in a calendar with Siri, Cortana, or Bixby. The new car user is assisted while driving. Artificial intelligence can automate the business process, learn insights from past data, consumer and market creation, gather insights through the program-based algorithm. Technologies such as machine learning (ML), deep and natural learning Language Processing (NLP) training machines to handle big data to generate market information [2].

This is the first section of this paper, the second section is about the related work, the third section is about the methodology, the system proposed and the implementation details and the last section is the conclusion and the references. A literature review showing the in-depth research pattern of the consumer market driven by artificial intelligence.

2. Related work

Artificial intelligence and machine learning have played an important role in big data analytics to anticipate and deliver targeted experiences to meet customer expectations. Through this research, the authors have provided a comprehensive view of the use of artificial intelligence to improve customer experience [9].
Many practitioners and academics around the world are trying to discover the best AI solutions that their organizations can benefit from. However, there is a lack of bibliometric reports showing the detailed research pattern of AI in marketing.
As the concept of artificial intelligence and deep learning models got introduced in the world, many companies globally started to put these into action. Some of them were required to present the customer with the next best offer they would like to avail based upon their search history and previous buying behavior, others would use it for targeted ads, evaluating the customer behavior to learn from it, examine the success of a campaign and what not. The whole idea revolves around recording the external data and then processing the relevant streams to come up with insights upon which the decisions can be based.
The marketing domain itself is huge and there are many areas where machine learning has great applications.

- The data collected or processed by AI can either be numerical data such as digits or non-numerical such as text, face expressions, voice tone, etc. AI can learn from both. There are algorithms, simple and complex to support this. A real-life example of such a case where AI is used to process non-numerical data such as images includes Kroger's AI system. It is used to identify the empty shelves such that the item is out-of-stock. This helps the store officials and distributors to know when the stock needs to be refilled [10].
- The organization has also been using AI to understand how their competitors and the big market giants can grab the attention of consumers, keeping them hooked and what kind of messaging is being used by them. The marketing content of 11 organizations was examined that operated in the B2B domain in which they found that the use of emotions tends to bring a competitive edge.

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- The customer product recommendation is another example of the use of ML techniques to stay relevant and yet marketing your products to the customers in a way that has a higher success rate because the customer is not forced to go through the recommendation but if they click on it, it certainly means that the customer found it relevant.
- Sales forecasting is a vast subject with many variables involved. However, if the weightage that needs to be given to these variables is identified, one can ensure that they are in the right direction. One way of doing sales forecasting is to closely look at that customer journey and monitor what kinds of product pages attract them the most, or which landing page is getting the most visits meaning it is doing its job well in leading the consumers to the target product. There are several methods to evaluate the consumer's interest. One way of doing it is through buying the product. The second way is to look at the number of visits that a product page gets. It certainly can attract users for some reason. A product with the most visits is certainly in demand. Another way of looking at is to see what products are being put in to the cart and how frequently. These numbers can also act as a great indicator for future planning.
- ML techniques are known to automate a lot of marketing and other processes. For example, a lot of robotic movements require the robots to use their best judgment to proceed instead of trying to find answers within the program. For example, handling the robotic balance when about to trip. More automation in customer journey means a smooth.

3. Study Approach

To forecast sales using the deep learning method, it is important to develop an in-depth understanding of the subject. To begin, it is important to gather the historical data that can be used for the forecasting method. A forecasting method general relies on previous data points to come up with a future-based forecasted value. For that to happen, it is important to extract the relevant data from the e-commerce website and or provide a mechanism to access or crawl through it to come up with results. Moreover, this data should not be hardcoded but should be dynamic. As time goes on, the trends may change, hence, we don't want to hard code the initial values in the system till eternity. It needs to keep picking up the latest data in the system.

Secondly, it is important to make use of a mechanism to deal with outliers and similar data points which may impact the results for no good, causing discrepancies. There is also a possibility to have missing data which needs to be identified and extrapolated.

All this data needs to be analyzed in a certain python environment using libraries and technical frameworks.

To predict the sales, we will need to identify the independent variables. This is followed by measuring the significant variables that might have a stronger impact and ignoring those with negligible effect.

The data collection and variable definition process may not be that simple as products in the e-commerce websites may belong to various categories and each category may have different variables than the previous category. Similarly, the consumer segment size for each category will vary, hence there needs to be a mechanism to keep these parameters into consideration to ensure that forecasts are as accurate as possible.

AI models can be used for forecasting. With the kind of complex system an e-commerce platform can be, an AI forecast system makes sense to use as it has many variables under the banner of a category. Moreover, for the system to suggest methods to increase sales, an AI can be an ideal choice that can still give suggestions before and after the ML technique has been applied.

Deep learning methodology makes use of object features, their relationship with various other variables, and analysis of the interactions to build the relationship from that is further learned by the system. This artificial neural network is supposed to copy the human way of connecting the dots from the observed data points. As mentioned earlier, a dataset will be required from the e-commerce site, it is worth noticing that the data needs to be in huge numbers. Moreover, it needs to be available for at least those products which are critical to business and can provide enough information to test the system. The second thing here is to define the frequency of product data collection from a website. The

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various relationships and features associated with each product category will need to be defined. This requires a lot of initial work to be done to ensure the system has some grounds to start from. Moreover, the significant variables with an expectedly great impact on the sales will need to be assigned with a weightage, this weightage may vary from one product category to another product category.
As a feedback methodology, the forecasted data needs to be compared with the original data to see how close the results were and how well the model is performing for the model itself to learn from its mistakes and make better estimates in the future.

4. Proposed System

The This system is proposed in order to predict the future sales and to increase the sales of any e- commerce system using the technology of deep learning such as using its algorithms which are Convolutional Neural Network, and Deep Belief Networks; it started by installing the pip in our machine using this line of command **sudo easy_install pip**, then preparing the virtual environment using this line of command **pip install Virtualenv**, and then install all the required packages and libraries that will be used the website and for the deep learning such as Django, Scikit-Learn…..etc, then the creating phase of the website started, the content of this website is about the smartphones, this website is contained of different pages, a home page, page for product list, and one page for each product, a page for login, and sign in, and forget password page, and many different pages using several languages which are HTML, CSS, JavaScript, Django, and Bootstrap, the Bootstrap is used in order to open without any error the whole website using smartphones; then we started to create the database for the website which will store the personal data of the users, orders details, and the data related to the products….etc, after all of these are ready, we used the deep learning algorithms in our proposed ecommerce website in order to predict the sales and increase the profit of it.

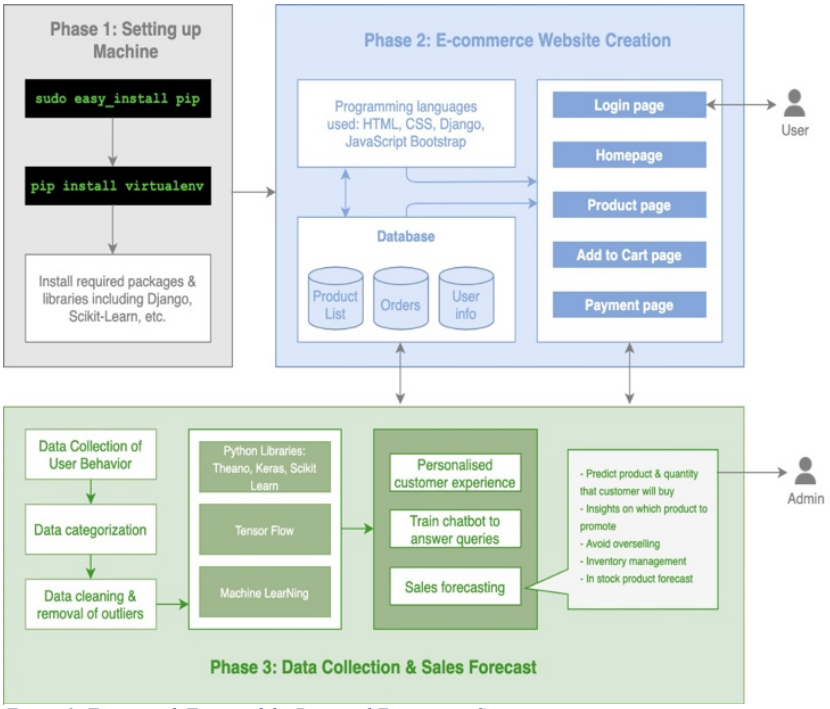

Figure 1: Framework Figure of the Proposed Ecommerce System

5. Implementation Details

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5.1 Website Development

For this system proposed, as it is mentioned before, we will create an e-commerce website to implement the deep learning techniques and algorithms for sales increasing and forecasting; for the website, we will use the languages of HTML, CSS, JavaScript, Bootstrap, and Django to build the e-commerce system; and the libraries of python will be used are Theano, Keras models with Scikit- Learn for general Machine Learning, and TensorFlow.

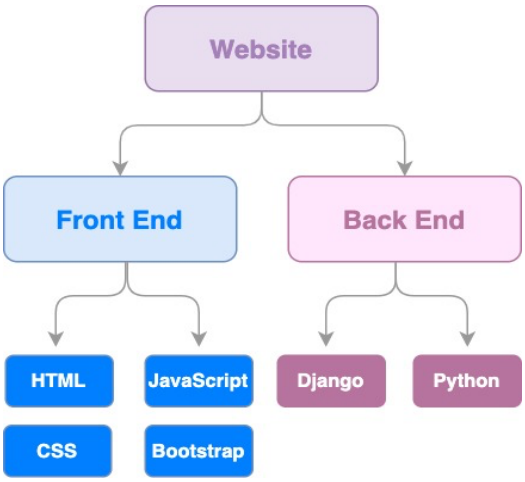

Figure 2:Website Development Process

And the methodology used is Incremental Development Methodology, which we had requirements we had to achieve following three phases are Design and development, testing, and implementation, and we repeated this cycle until the final result is achieved, the figure below represents the Incremental Development Methodology.

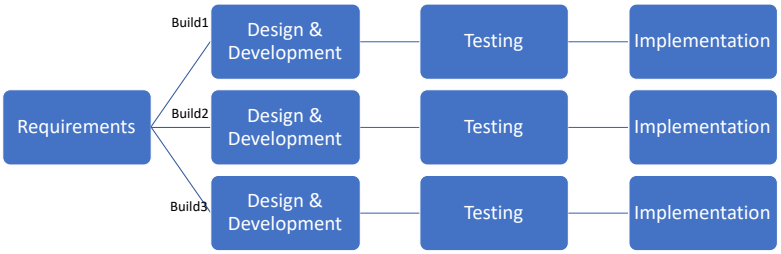

Figure 3: Incremental Development Methodology

5.2 Database Creation

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The database used in this system is PostgreSQL, where we purchased from Amazon Webservices, to be able to store all data related to the users, orders, products….etc, and the below screenshot represent the way of connecting the cloud PostgreSQL database to our website.

```
#S3 BUCKETS CONFIG
AWS_ACCESS_KEY_ID = 'AKIAYVTXSIM4UDER6DLS'
AWS_SECRET_ACCESS_KEY = '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'
AWS_STORAGE_BUCKET_NAME = 'kamtech-bucket'
AWS_S3_FILE_OVERWRITE = False
AWS_DEFAULT_ACL = None
DEFAULT_FILE_STORAGE = 'storages.backends.s3boto3.S3Boto3Storage'
STATICFILES_STORAGE = 'storages.backends.s3boto3.S3Boto3Storage'

AWS_S3_REGION_NAME = "ap-south-1"
```

Figure 4: Database Connection

5.3 Website Hosting & SEO

After that the stage of website hosting started, where we used the Heroku cloud platform to host our website, these commands were used to perform this task, were we wrote in the terminal the following commands

$ pip install Heroku

$ Heroku login

$ heroku createapp <app name>

After adding files to git

$ git push Heroku <branch_name>

And we added the keywords of our website in the metadata to be ranked in the user google search, but according to the low access to the website, it needs time to be ranked at the beginning and is recommended to the users.

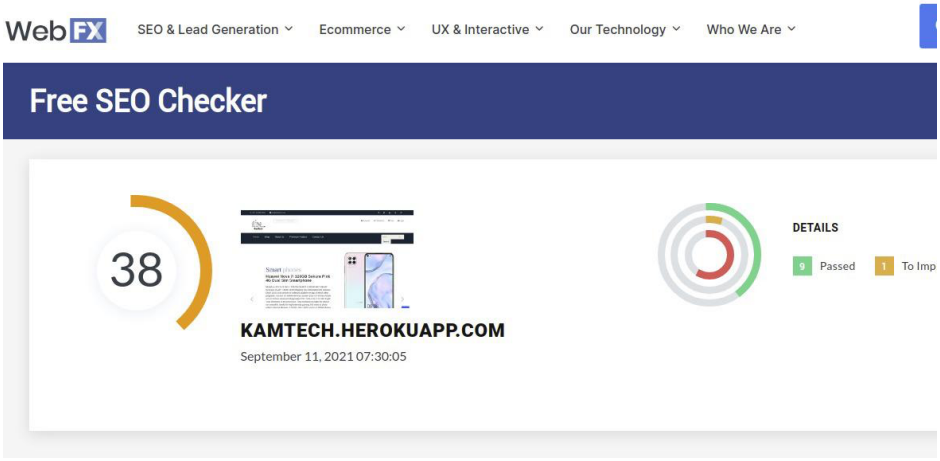

Figure 5: SEO Score Checker of the Proposed Website

6. Deep Learning Applications

There are many ways in which artificial intelligence and deep learning are used in the marketing process [1], and the most important things we implement in which artificial intelligence is used are:

6.1 Sales Forecasting

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One of the most important things that any business aims for is to meet customer expectations and earn more sales [3]. To do this, companies must know what to do and then know the right way to do it.

The application of artificial intelligence in marketing helps to better understand customers and participate in their actions based on data collected from their contacts and through their previous purchases [1]. By doing this, it is possible to predict the products that customers will buy and to predict their quantity. This helps determine which product to promote to increase sales. This method also helps to avoid overselling a product or selling products that are not available. It also assists in inventory management processes and forecasting the number of products that must be in stock.

And in here we implement machine learning and deep learning into this website to predict the future sales of the product, and to do that, we had to consider some factors such as collecting datasets, where we collected them for the third party which is Sharafdg, three datasets were used and each dataset is related to one product, and we used two different algorithms for training and predicting those are CNN and DBN, and we selected specific features such as the date (days) and the sale for that particular date (day), then preparing the algorithms to train the datasets, and after that validating the result, and we took as input nearly 120 days of its product and then rectal sales spell and through a training network we were able to predict for the data set of next 45 days, as the figure below it shows that the Samsung Galaxy Note20 5G 256GB Mystic Bronze Smartphone sales will be increased in the next 45 days.

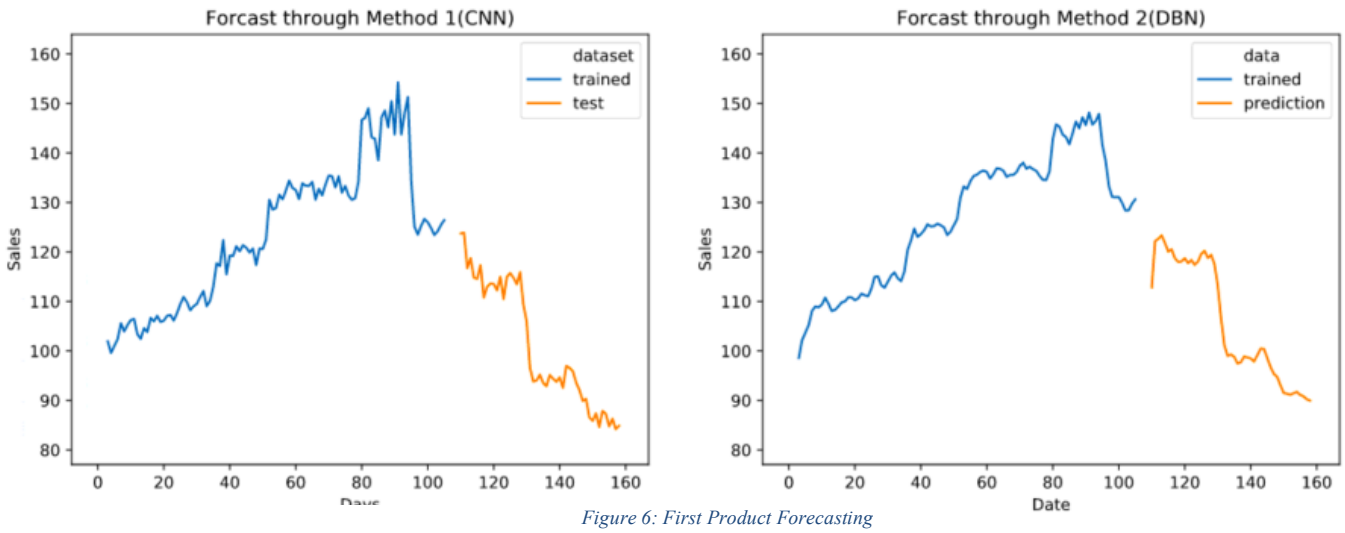

Figure 6: First Product Forecasting

6.2 Chatbot

While browsing the web, you may have talked at least once with chatbots on many websites, especially online stores or social media such as Facebook Messenger, this helps to answer customer inquiries automatically without the need for staff to do so. The chatbots are programmed to answer the majority of questions that customers ask intelligently. Such as questions related to the price, size, quantity, specifications, and advantages of the products. Chatbots can also learn from the questions asked by customers and develop their answers until they reach the optimal answer, this contributes to gaining customer loyalty, as the customer usually needs an immediate and adequate response to his inquiries. The customer most likely will not wait for half an hour, for example, in an online store, to get an answer to his question about the specifications of a particular product.

For this system-built IBM, Watson assistant was used because it is using recent technologies such as cloud computing and deep learning to train their data and giving response to the users, and for the data of IBM, we trained it manually at first by giving user input examples and creating the intents, and the IBM Watson is a lightweight and a good option

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to be integrated into the website online; the following screenshot represents the way of connecting the chatbot to the website.

```
<script>
    window.watsonAssistantChatOptions = {
        integrationID: "76bb7dfb-ca95-4c1b-bf46-507372eb45ca", // The ID of this integration.
        region: "au-syd", // The region your integration is hosted in.
        serviceInstanceID: "72ff1aca-0a0d-4359-8b16-32c49a9cb4f4", // The ID of your service instance.
        onLoad: function(instance) { instance.render(); }
      };
    setTimeout(function(){
      const t=document.createElement('script');
      t.src="https://web-chat.global.assistant.watson.appdomain.cloud/loadWatsonAssistantChat.js"
      document.head.appendChild(t);
    });
  </script>
```

Figure 7: connecting IBM Watson Chatbot to the website

7. Conclusion:

AI is more about the ability to think and analyze data than it is about a particular form or function. Although AI presents images of high-performance human-like robots taking over the world, it is not intended to replace humans. It aims to significantly enhance human capabilities and contributions. This makes it a very valuable business asset. The emergence of AI-powered solutions and tools means that more companies can benefit from AI at a lower cost and in less time. Off-the-shelf AI refers to solutions, tools, and software that either have built-in AI capabilities or automate algorithmic decision-making. Off-the-shelf AI can be anything from autonomous databases, which are self-repairing using machine learning, to prebuilt models that can be applied to a variety of data sets to solve challenges such as image recognition and text analysis. It can help companies achieve value faster, increase productivity, reduce cost, and improve customer relationships. Artificial intelligence has been able to help marketers face the challenge of understanding customer behavior across multiple channels. Artificial intelligence has made social networking sites, such as Facebook, Twitter, and Instagram, tools that facilitate the marketing campaigns provided by the company. The AI program aims to facilitate campaigns and the ways and means of managing them, and all of this is done without any human intervention. AI can be used to develop predictive models to analyze user behavior such as predicting how likely a customer is to open an email, make a purchase or register online. Also, Chatbots will get smarter, by activating the AI program. Chatbots experience has been implemented, which allows all users to communicate with all brands easily and conveniently.

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