Integrating Artificial Neural Network and Smartbot on the Development of an E-learning Platform

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Abstract:

An e-learning is overtaking conventional classroom teaching methods. It is a teaching-learning approach that entails to maximize learning opportunities of learners through the integration of current technology in the classroom and to practice the principle of Learning Management System (LMS). Through this approach, knowledge could propagate possibly and absorbed irrespective of the teaching personnel and learners. This study is specifically addressed the following objectives: (1) utilize an e-learning platform with the integration of Artificial Neural Network focused on the predictive readiness of Science, Technology, Engineering and Mathematics (STEM) learners for Work Immersion; (2)To evaluate the developed learning platform (SMARTBOT) using ISO 25010 in terms of functional suitability, performance efficiency, usability, security, reliability and portability. In this study, applied and developmental research will utilize; it is a type of research design that deals on the formulation or development of such research output. The study came out with the following salient findings: 1) the ANN which is highly optimized system has a data accuracy of 92.80% based on WEKA results; and 2) the developed android application meets the software quality standards in terms of functional suitability, performance efficiency, usability, security, reliability, and portability.

Keywords: *Artificial Neural Network, e-learning, SMARTBOT, Learning Management System (LMS)*

I. INTRODUCTION

Learning is an integral part of one's life. A person needs to continually acquire new knowledge and put it into practice to adapt to the environment. Along with this reason, there is a need to send young learners to attend classes to school and even adult learners for possible upgrades and personal development. However, some intervening factors impede the quality of learning in school. These factors may include natural calamities, national and local holidays, and even school-based programs. With the conduct of these activities, scheduled lessons are delayed, which leads to unfinished coverage of learning topics.

The potential solution to these problems is e-learning. E-Learning is learning to utilize electronic technologies to access educational curriculum outside of a traditional classroom. It is a teaching technique applied to students because it is accessible at any time of the day and anywhere. E-learning has never been a problem for learners who have their smartphones and are focused on their use and application of this teaching-learning methodology.

In Don Mariano Marcos Memorial State University Mid La Union Campus – Laboratory High School, learners do own one (1) to two (2) smartphones. With that, the researcher conceptualized the idea to use these gadgets as a form of a learning tool in assessing the predictive readiness of STEM learners for Work Immersion through an android learning app environment with Artificial Neural Network (ANN) and chatbot integration. This learning tool will further be called SMARTBOT – a short term for smart robots.

Artificial Neural Networks (ANNs) or Connecting Systems, on the other hand, are computing systems vaguely inspired by biological neural networks that make up animal brains. The neural network itself is not an algorithm, but a system for working together to process complex input data for many different machine learning algorithms. Such systems "learn" to perform tasks by considering examples, generally without having to comply with any task-specific rules. An ANN focuses on a collection of artificial neurons called connected units or nodes that loosely model the neurons in a biological brain. Every connection, such as the synapses in a natural brain, can deliver a signal from one artificial neuron to another.

An artificial neuron that receives a signal will process it and then signal additional artificial neurons that are attached to it. The sign at the connection between the artificial neurons is a real number for typical ANN implementations, and some non-linear input sum function calculates the output of each artificial neuron. The relationships between artificial neurons are called 'edges.' Artificial neurons and edges typically have a weight that varies as learning continues. The weight increases or decreases the signal strength of the connection. Artificial neurons may have a threshold so that the signal is transmitted only when the aggregate signal crosses that threshold. Artificial neurons are typically aggregated into layers. On their inputs, different layers can perform various types of transformations. Signals migrate from the first layer (the input layer) to the last layer (the output layer), possibly multiple times after going through the layers.

Sayed and Baker [2] utilized an artificial neural network model as supervised learning. The network provides an example of the learning input parameters and the optimal optimized and accurate output base on the input. They describe how to use an artificial neural network to produce a converging mathematical model by utilizing e-learning interactions and social analytics. It can predict the performance of the students; There should, therefore, be a reduction in the risk of failure of the enrolled e-course.

Furthermore

, input parameters have to be investigated in the extensive data generated during the semester and analyzed to improve and correct the process of learning [3],[4].

Moreover, this can also be a Learning Management System. The Learning Management System (LMS) is a software application for the implementation, recording, tracking, reporting, and distribution of training courses, training programs, and learning and development programs. The concept of the learning management system emerged directly from e-learning. Although the first LMS has appeared in the higher education sector. Currently, most LMSs focus on the corporate market. Learning Management Systems is the largest segment of the learning system market. The introduction of LMS was in the late 1990s. Learning management systems have been designed to identify differences in training and learning, to use analytical data and to document. LMSs focus on online learning delivery but promote a variety of uses, serving as a portal for online content, including courses, both asynchronous-based and synchronous-based. An LMS may offer classroom management for instructor-led training or a flipped classroom, used in higher education, but not in the corporate space.

Objectives of the Study

The primary objective of this study is to develop a device learning tool that would optimize e-learning through the integration of SmartBot and Artificial Neural Network. Below are the specific objectives of the study.

1. To utilize an e-learning platform with the integration of Artificial Neural Network focused on the predictive readiness of Science, Technology, Engineering, and Mathematics (STEM) learners for Work Immersion.

2. To evaluate the developed e-learning platform (SMARTBOT) using ISO 25010 in terms of functional suitability, performance efficiency, usability, security, reliability, and portability.

II. METHODOLOGY

The applied research design includes the search for new applications of scientific knowledge to solve a problem, such as the development of a modern system or technique or an advanced method, to solve the problem.[2]

By using Natural Language Processing (NLP), developers can arrange and structure information to complete tasks like automated synthesis, translation, entity recognition, extraction of relationships, analysis of emotion, recognition of speech, and theme segmentation.

2.1 Text Conversion and Extraction

Unstructured data or unstructured text is generated and collected in a wide range of forms, including word documents, email messages, powerpoint presentations, survey responses, transcripts of call center interactions, and posts from blogs and social media sites. The lesson plan for the Senior High School of Don Mariano Marcos Memorial State University, which is the primary source of data, will be converted into basic text pre-processing with Natural Language Toolkit (NLTK). It has been referred to as "a great resource for training and operating with Python in machine linguistics" ans "a natural language compendium". NLTK is a main program to develop Python programs to operate with the information about the human language. NLTK offers user-friendly interfaces for more than fifty corporate and semantic devicessuch as WordNet, together with a set of text analysis, resources for classification, tokenization, stemming, tagging, filtering, and

lexical reasoning, industrial-strength containers for Natural Language Processing (NLP) compendiumand an active discussion forum.

2.2.Pre-processing

Initial pre-processing is necessary before going through with the operation. It will translate the text file. It will turn the whole text into upper case and lower case so that in different cases, the algorithm does not look as distinct as the same terms.

Tokenization defines the methodby which the regular text strings are converted to a set of tokens, which is the terms we normally prefer. To find a list of phrases, we can use the sentence tokenizer and the word tokenizer to look for a list of words in strings.With the tokenization, the cleaning of input is easy because of the identification and removal of noisy words.

As the text is cleansed, each token was tagged with their part-of-speech labels. Smartbot tagging is the preparation for topic detection. Each symbol has been marked with its part of speech usage.

As pre-processed data was now noise-free and ready for a further process, all inputs were operated with the same procedure. Smartbot produced qualitative data that identifies the polarity of the information.

The system may accept sarcastic input depending on its sarcasm level. Deep sarcasms are may be impossible to understand when it is not verbal as it identifies its true meaning when the tone of the voice of the speaker is included.

Polarity value is to be shown on the result as with the objectives is needed to show both quantitative and qualitative output to define the most significant effect. Before transforming the data, that is the only time the stop words were removed as it is vital on sentiment classification because of the statistics formula on training the classifier.

Text Pre- Processing

The pre-processing of the primary text involves translating the whole text into an upper or lower case so that in different cases, the algorithm does not view the similar terms as distinct.

Noise Removal. That is, anything which are not included in a regular letter or number.

Stop Words Removal. Prevalent terms that seem to be of little value to help find documentationthat suit the needs of the user are completely removed from the vocabulary as a whole. These terms are called "*stop words.*"

Stemming. It is a mechanismin which inflected phrase are reduced to their core, root, or stem form — normally aterm that is written. For instance, if we tend to use the subsequent words: "Compile," "Compiling," "Compiled," "and Compilation," consequently, itwouldturn to one word "compile."

Lemmatization.The minor form of stemming is lemmatization. The primary distinction between the two is that stemming frequently lead to terms that are non-existent, while lemmas are actual words. For instance, the word "dance" is a root word for phrase such as"dancing" likewise the term "acquire" and "obtain" are in the same lemma, definitely, they are regarded as similar.

2.3 Bags of Words

Following the preliminary pre-processing stage, the text is necessary for transforming into a constructive vector or number array. The bag of words represents the text which defines the frequency of words in a document.There are two things involved, the first is the vocabulary of known words, and the second is the influence of notable phrase on a scale. It is named a bag of words as any data is excluded on the arrangement of words in the documentation, and the framework is concerned solely with whether the best-known words appear in the text, not wherever they seem within the document.

One solution is to dynamically resize the occurrence of terms by how often they occur in all datain order to penalize the ratings of repeated words

like "the" which are often prevalent throughout all data. This scoring method is known asTerm Frequency-Inverse Document Frequency, or TF-IDF for brief, where Term Frequency is a measure of the word frequency in this documentwhereasInverse Document Frequency is an indicator of the occurrence of the word in documents at times.

*TF = (The number of times the term **t** is shown in the document)*

Number of terms in the document   *Eq.1*

$$IDF = 1+log(N/n),$$

Eq.2

Where N is the number of documents, and n is the number of documents in which tappears. TF-IDF weight is a weight usually used in the recovery of data and text mining. This weight is a statistical assessment utilized to measurethe significanceof a word to a document in a corpus or collection.

Cosine Similarity

TF-IDF is a conversion used for text in order to obtain 2 vectors of actual value in vector space. Then, by trying to take their dot product and divide it by the product of their norms, we can acquire the Cosine similarity of any combination of vectors. It provides the angle cosine among the vectors. A similarity measure between two non-zero vectors is the cosine similarity. Use this formula to determine the similarity between any two documents d1 and d2.

*Cosine Similarity (d1, d2) = Dot product(d1, d2) / ||d1|| * ||d2||eq.3*

where d1,d2 is two non-zero vectors

III. RESULTS AND DISCUSSION

The output of this study is an e-learning platform or SMARTBOT that deals with the concepts of Work Immersion patterned in the K to 12 STEM Curriculum Guide for the strand, as shown in Figure 1. Python was utilized to develop the system.

Figure 1. The developed Smartbot Application

This e-learning platform is optimized by Artificial Neural Network (ANN), which is responsible for analyzing, selecting, and tagging of input contents in the HR Interview and behavioral traits examination.
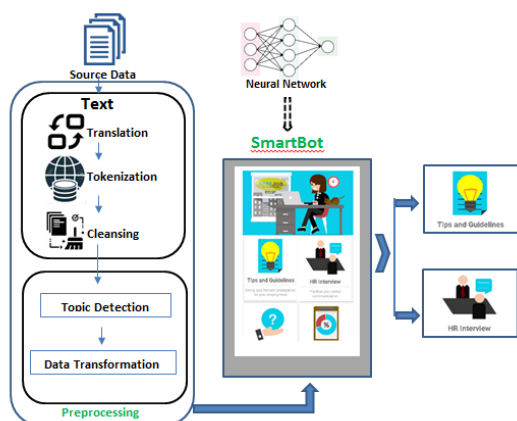
Figure 2. The architecture of the E-Learning platform with the integration of ANNand Smartbot

As to the input contents of the data set of the study, the user will be asked to answer specific HR Interviews and qualitative responses of the interviewee. The HR Interview and qualitative responses will serve as the meat of the researcher. As to the architecture of the output, details are presented in Figure 2, integrating ANN on the predictive readiness of Science, Technology, Engineering, and Mathematics (STEM) learners for Work Immersion.

The system is highly optimized by ANN and 92.80 percent accurate based on WEKA results. The android-based system app is easy to execute, and the

developed learning managementsystem app for e-learning highly passed the standards of ISO 25010. It is concluded that the e-learning platform is accurate and highly optimized by ANN.

The Table 1 below sums up the software quality of the developed application. The respondents strongly agreed that the application is "Highly Quality," as evidenced with the grand mean of 4.24. Overall, this implies that the respondents generally perceived that the developed system is functional, efficient, usable, secure, reliable, and portable.

This idea was also strengthened by Benzon [5] that auseful product delivers the content, functions, and features that the end-users desire, but as important, it performs these assets in a reliable and error-free way.

Table 1. Evaluation of the developed e-learning platform (SMARTBOT) using ISO 25010.

Indicators	Mean	Descriptive Equivalent
1. Functional suitability	4.25	Highly Quality
2. Performance efficiency	4.21	Highly Quality
3. Usability	4.30	Highly Quality
4. Security	4.20	Highly Quality
5. Reliability	4.28	Highly Quality
6. Portability	4.24	Highly Quality
Grand Mean	**4.24**	**Highly Quality**

IV. CONCLUSION

This paper introduces the integration of Artificial Neural Networkand Smartbot in the development of an e-learning platform. The developed E-Learning Management System through the SMARBOT could be adapted by Senior High School learners of the K-12 Basic Education Program since it meets the criteria or standards of learning management system that is optimized by ANN. The WEKA as the tool used in this study was essential to test the accuracy of the algorithm used.The developed android application reached the criterion level in terms of functional suitability, performance efficiency, usability, reliability,

security, and portability. Therefore, the developed application meets the software quality that can be utilized by STEM learners and could be a basis of other researchers that conducts the same or related to this study.

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