Digital Learning For Kids

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Abstract: The current educational system changed to use the digital learning system due to the Covid-19 pandemic situation. There is a huge need for the Digital Learning platforms that could use by the students and kids for the educational purpose. The currently available digital learning platforms needs to enhance, ensure the safety for kids, and can provide variety of services for the kids using the newly available technologies like Text to speech (TTS), Machine Learning (ML), Image Processing, and Web scraping Technologies. The research paper is proposing a new system that could help to the kids to learn the things very easily via watching the videos that is generated automatically using the new technologies.

Keywords: Text To Speech (TTS), Machine Learning(ML),Image Processing, Web Scraping.

I. INTRODUCTION

The Educational Sector is one of the most affected sectors due to the covid-19. The Educational system changed a lot with the Covid-19 pandemic. It caused an unprepared transition to build emergency remote learning platforms. The whole schools, academy, colleges, and universities are closed and moved to the online educational system like zoom, Google meet also including social media, email, telephone and even post. These online educational systems highly depend on the digital learning platforms. Most of the educational organisations started broadcasting video lessons by the television or the online distance learning platforms. In this research, A Digital Learning Platform for kids is introduced. With the loss of interaction between the teachers and the students, kids are the most affected. They are in the stage of development period for their life as a human being. They can better absorb content by watching a video than listening to an audio book or reading a book. Because it is very effective, engaging to see, and effectively communicates the contents meaning. As a result, the majority of people create videos to explain their information. Today video learning is widely accepted learning method. While studying, children may become distracted by book reading, audio learning, or other methods. Kids can’t be as comfortable studying with book reading and audio learning methods, and they can’t learn whenever and wherever they want. Outsourcing can have an impact on children’s studies when they are studying using other methods. Other factors may cause them to lose their ability to study effectively. Video production is expensive when done manually. Making videos by hand takes far too long. Making videos using the cutting-edge technologies is aimed. In this paper cutting edge technologies like Machine Learning, NLP (Natural Language Processing), TTS(Text To Speech) and Web scraping are used. When the user give input keyword the system will extract information and sentiment analysis from the text and audioinput. Then, generating text description using extracted information and summarizing that text description into meaningful sentences. Identify complicated terms in meaningful statements and replace them with simple words before translating the sentence to audio. Extracted information was found by finding irrelevant photos from web sources, and then merging audio and visuals to build and create a digital video production system. Natural Language Processing is a branch of linguistics, computer science, and artificial intelligence concerned with computer-human interaction, particularly how to design computers to process and evaluate huge volumes of natural language data. Natural Language Processing frequently involve speech recognition, natural language understanding and natural language generation. Machine learning is an area of research focused on comprehending and developing "learning" processes, or even processes that use data to enhance performance on a given set of tasks. It is considered to be a component of artificial intelligence. Machine Learning has become a significant differentiator for many use cases. Machine Learning can be categorized by how an algorithm learns to more become accurate in predictions. The categories are Supervised Learning, Unsupervised Learning, Semi-supervised Learning, and Reinforcement Learning. The likeness to the human voice and the clarity with which it can be comprehended determine the quality of TTS, or more specifically, the quality of a speech synthesizer. The use of this program is significantly impacted by the TTS’s lack of emotions in the sound. As a result, it identifies the primary challenge in the development of TTS, which is the
creation of an sound from text that is as natural-sounding as the human voice. The goal of TTS is to be able to produce the entire speech spectrum of a human being, including all speech variations, and to lessen the robotic gasp of the output voice in order to increase the difference between human performance and machine voice. The internet is filled with data, thus in order to fully utilize it, its content must undergo specific processing, and a unique online information system must be created. The categorization of online pages is suggested as a crucial stage in those systems. Various machine learning techniques have used to categorize web pages in this research. Web scraping (also known as Screen Scraping, Web DataExtraction, and Web Harvesting etc.) It is a technique in which meaningful data from the HTML of websites are extracted and stored into a local database or spreadsheet. The goal of a Web scraper is concentrated on conversion of unstructured data while preserving organized databases. Web scraping is presently cast-off on various aspects including online price comparison, weather data monitoring, website change detection, Web mashup, Web research, and Webdata integration. Further, it may be noted that Web scraping might be alongside the tenures of usage of few websites. In this research it is introduced a system which take key word or audio as input and using web scraping related paragraph or images will be extracted from a relevant website such as Wikipedia. Then using the extracted image and the description a creative video is to be generated.

[1] [2]

II. RELATED RESEARCH

A. Digital Learning

Zaharah, Indrayanto, C. Dhiene Nourwahidah, A. Saehudin, H. Hasan, and Kamarudiniana states that Information and Communication Technology (ICT) is a means that makes it easier for humans to obtain, process, and communicate information without being limited by space and time. As a result of the covid-19 outbreak, the impact of e-learning has an impact on all sectors, especially in the field of education. Government policy requires learning to be carried out from home, this is to prevent the transmission of the disease. Students are accustomed to learning online and many lecturers are still not proficient in using information technology to teach using. [3] The students of early Z generation at these Hungarian universities still like the traditional type of learning combined with e-learning, that is they like classroom activities and face-to-face education but at the same time studying on their smart phones. For the Hungarian universities the application of blended learning is a possible transition in today’s educational shift and tertiary education should invest in providing e-learners with varying degrees of computer literacy. [4] Some e-technologies and especially the adaptive e-Learning can be useful, since it constitutes the personal tutor for students. There are many challenges in relation to the appropriate methods and strategies, which must be applied to meet the needs of students. This work, which is the result of a brief review of e-Learning and e-Technology systems, allowed to focus on the technological and operational aspects that can contribute to the conception, design and innovation of these systems. [5]

B. TTS

Existing information and communication technologies, developed platforms and applications for e-learning allow to successfully switch to e-learning, if this is a preferred form of education or necessary. The mentioned applications and platforms provide the necessary functions and tools for creating, editing and presenting the educational content in electronic form. In order to implement successful e-learning, the technological competence of teachers must be ensured, which will ensure the achievement of educational goals. [6] States that the demands to synthesized speech are more natural, personalized and emotional. Speech synthesis technology based on cloud source and embedded TTS systems would provide higher quality and more convenient for users, and they would become the hot spots of applications in the future. With the development of speech synthesis, text to speech synthesis will play a greater role in social life. [7] [8] In this paper, Min-Jae Hwang, Ryuichi Yamamoto; Eunwoo Song, and Jae-Min Kim propose a TTS-driven data augmentation method to improve a quality of non-AR TTS system. Using a large-scale synthetic TTS database generated by high-quality AR TTS systems, they successfully improved the quality of the target TTS System. The future studies should test the augmentation with various phoneme distributions, such as uniformly distributed case. [8]

C. NLP

Pre-trained models can be used to extract polarity from datasets without the need to build a model from scratch. XLM-R outperforms in more tasks compared to other models but its computational complexity is very high. Performance evaluation with the two latest models, Bigru and BERT using IMDB dataset shows an improvement in accuracy with number of epochs. The study can be further extended by comparing the performance of various models with more datasets. [9] There are five important tasks in Natural Language Processing which enable the machine or a computing device to understand the human language. The accuracy with which these tasks are performed determine the level of natural language understanding by the machine. This paper showcases how researchers have successfully employed different machine learning and deep learning techniques in performing such tasks. These techniques have performed them far better than any of the traditional techniques. [10] Developed language model, based on deep learning methods, can be used to generate new sequences of text that have the same statistical properties as the source text. Application of relevant language corpus as a training text for deep language model learning can be practically used to improve speech recognition. The results presented in this article concern the Polish language but the achieved research results can also be applied to other languages. [11]

D. Web classification

In this work L. Safae, B. E. Habib, and T. Abderrahim review the existing machine-learning algorithms used for web page classification and compare them to related methods based on some characteristics. For future work, the visual analysis of web
pages, the removal of noisy content and the implicit and explicit links with other pages should be taken into consideration, in order to have the maximum accuracy possible. [12] This paper tries to solve the problems of webpage classification by combining structure and semantics of. The research trains on the basis of the CNN model framework. There are still many aspects that need to be further studied and improved on the problem of web page classification. Given the chosen sizes of the training corpus and test corpus have a certain impact on the classification. [13] In this paper, they have explored how well to classify phishing URLs from a set of URLs containing benign and malicious URLs. They have also discussed the randomization of the data set, feature engineering, feature extraction using lexical analysis host-based features and statistical analysis. In the future, they would like to incorporate a rule-based prediction based on the content of a URL in order to provide a comprehensive solution for phishing URL detection. [14]

E. Web scraping

In this research paper, Stephanie Lunn; Jia Zhu; Monique Ross show that web scraping and Natural Language Processing (NLP) can be used to obtain and analyze information from internet sources. They argue that computer science educators should consider using these tools further their own work and to inform pedagogical practice. Since new information is constantly being generated, finding new acquisition methods can only serve to benefit education. [15] In this paper, V. Singrodia, A. Mitra, and S. Paul have reviewed the various aspects of Web Scraper. They have seen the operating principle, strength and drawbacks and finally viewed the applications of web scraping system. Web scraping is a recognizable phrase which has expanded its meaning owing to the requirement of "free" data. [16] The main outcomes of this project were user-friendly search interface, indexing, query processing, and effective data extraction technique based on web structure, form submission analysis and new submission plan. Hidden web data need synthetic and semantic matching to fully achieve automatic integration in this thesis fully automatic and domain dependent prototype system is proposed that extract and integrate the data, being behind the search form. [17]

III. METHODOLOGY

A. Extract the information

While generating the text descriptions for relevant key words web scraping is used. Web scraping is basically extracting data from website using a bot or a web crawler. It is an automated process which is using Hypertext Transfer Protocol or web browser. First it is used to fetch data from website and extract data from it. Web page content is downloaded as fetching and stored for later processing. Later they are processed and stored in a database or excel files.

B. Generating text description using extracted information and summarizing that text description into meaningful sentences.

There are many libraries can be used for web scraping. Such as Beautiful Soup, newspaper, also selenium can be used for automation purpose. Beautiful Soup is a python package. It can be used for parsing HTML and XML documents. It created parse tree from the parsed pages, so that they can be used for extracting data. Selenium is an open source umbrella project can be used for browser automation. Newspaper is a python module used for the same purpose. It uses advance algorithms to extract all the useful text from a website. Newspaper is used in our project as it extract all the information from a website. As the text output is aimed for study purpose.
C. sentiment analysis from the text and audio input.

Sentiment analysis is an information extraction method from text input. It is basically a text mining technique that uses Machine Learning and Natural Language Processing, automatically analyse text for the sentiment of the writer. The overall purpose is to derive high quality information and actionable insights from text. Aspect based sentiment analysis organizes text into categories and then when mining text it gives output as positive or negative.

Technology going to use in information extraction from text and audio. Speech recognition is a method to recognize words spoken aloud and convert into readable text. It first analyze the audio then breakdown it into parts, digitize it into computer readable parts and finally use an algorithm to match it to most suitable text representation. Technology going to use in sentiment analysis from text and audio

Machine Learning algorithms extract the features from the provided text according to the given tags. Then the classifier model classifies the text into the relevant tags. NLTK is a Natural Language Processing toolkit which is a suite of libraries and programs for symbolic and statistical Natural Language Processing in English language. SpaCy is an open-source software library for advanced natural language processing, written in the programming languages Python and Cython. First the particular text input is downloaded and tokenized into sentences. Then using SpaCy detected the tense of the sentence, part of speech, dependency relation and the language. In order to tokenize the text used WordNet Lemmatizer from the NLTK. Lemmatizer is a process of grouping inflected forms of words together. So that they can be analysed as a single item. Lemma is based on intended meaning of the word. Also there is a similar process called stemming. But lemmatization identify the efficient intended part of speech not only within the sentence but also with the neighbouring sentences and also from the entire document. Then the entire document was tokenized into words. In the content analysis all 16 classes was used.

Then NLTK was used for sentiment analysis. SentimentIntensityAnalyzer from NLTK sentiment package. It takes input as a string and return a dictionary of scores for each category. Speech recognition was used for audio input identification purpose. Recognizer class was used by creating an instance to recognize the audio source. Here the main and the most important thing is to notify the system to only add positive content.

D. Website Classification

Classify websites is needed according to the categories. Which are

Machine Learning classification algorithms are a supervised learning approach. Main purpose is to classify data in to given classes. Both structured and unstructured data can be performed. Always in the beginning the class is predicted which the data points belongs.

It is an approximation. Mapping function will map input variables to discrete output variables. There are many terms used in classification. Such as Classifier, Classification Model, Feature, Binary Classification, Multi-class classification, Multi label classification, initialize, train the classifier, predict the target, evaluate. There are many classification algorithms used in classification. Logistic Regression, Naive Bayes Classifier, Stochastic Gradient Descendent, K-Nearest Neighbour, Decision
Tree, Random Forest, Artificial Neural Networks, Support Vector Machine are some machine learning algorithms used in classification. Naive Bayes Classifier has been as the main algorithm and other algorithms.

1) **Naive Bayes Classifier**: This classifier based on Bayes’s Theorem. It gives an assumption of independence among other predictors. It makes sense that when there is a particular feature in the class, it is not related to another feature present in the same class. All properties contribute independently to the probability even they depend on each other. This algorithm is easy to use for comparatively large data sets. In the below figure it is given the Bayes Theorem which use to implement Naive Bayes Classifier.

The reached accuracy was,

```
The mode training accuracy: 0.97948
The model Testing accuracy: 0.89362
```

Confusion Matrix
Confusion matrix is a popular measure for classification problems. Confusion matrix visualize the performance of a classification matrix. It represents the counts from predicted and actual values. This figure shows the formula which uses to calculate the accuracy of a model. Since accuracy might be deceptive when applied to unbalanced data sets, alternative metrics based on confusion matrix are also relevant for assessing performance.

2) **Random Forest**: Random Forest is a Ensemble learning method for classification. It constructs multitude of decision trees while constructing. It gives output as a classification or mean prediction of individual trees. It fits a number of trees on various sub-samples of data sets. Then it uses the average to improve the accuracy of the model’s predictive nature. The original input size and the sub sample size is always similar. Random Forest is more accurate than the decision tree. Because of the reduction of the over fitting. But Random forest is complex for implementation and become slow when it predicts in real time. It is a bad estimator but fast in nature in comparison to other classifiers. But it needs only small amount of training data to estimate parameters to get the best results.

The reached accuracy was,

```
The mode training accuracy: 1.0
The model Testing accuracy: 0.82979
```

3) **Linear Support Vector**: Here the training data is represented by points in a space. Separate the categories by a gap as wide as possible, when new points added it has to decide which space does it belongs to. This algorithm is highly effective in high dimensional spaces and memory efficient. But the algorithm does not directly provide probability estimates.

4) **Decision Tree Regressor**: Decision tree build the classification model as tree structure. This uses if else rules. If else rules are equally exhaustive and mutually exclusive for classification. The algorithm breaks down data into small structures and build them assertively incremental decision tree. The rules are used sequentially and use training data one at a time. When the rule is learned rules will be removed which cover tuples process continue until the termination point meets. The final structure looks like a tree with nodes and leaves.
A top down recursive divide and conquer approach symbolizes the tree. Node has two or more branches. Leaf has a decision or a classification. The topmost node is called the root node. Decision tree can process both numerical and categorical data. Decision tree is simple to understand and for visualization. Not required to prepare data as well. But it is quite unstable because a small change to data can make a change to the whole structure of the tree.

The reached accuracy was,

5) **K-Nearest Neighbour Classifier**: This stores all instances in n-dimensional space according to training data. It works on storing instances of training data and it doesn’t construct a general internal model. So it is called as a lazy learning algorithm.

The mode training accuracy: 1.0
The model Testing accuracy: 0.89362

The classification is determined by a simple majority vote near k-nearest neighbors for each point. It is monitored and uses a large number of marked points to mark new points. If a new point needs to be labeled, the nearest neighbor (or labeled point) of the new point is taken into account. The label that receives the majority of votes from those neighbors will be the label for the new point. k indicates the number of neighbors to check. This algorithm is easy to implement. It is robust to noisy training data. It is efficient to large data sets. But for computation is pretty high.

The reached accuracy was,

6) **Logistic Regression**: This classification algorithm uses in machine learning when there is one or more independent to determine an outcome. Always it has two possible outcomes. The main goal of the algorithm is to make best fitting relationship between the the set of independent variables and dependent variable.

This curve helps to understand the impact of set of independent variables on the dependent variable. This algorithm works only when the predicted variable is binary and it assumes the data is free of missing values and predictors are independent of each other.

The reached accuracy was,

7) **Stochastic Gradient Descendent**: It is used when there is large number of sample data. It supports different number of loss functions and penalties for classification. It calculates derivative from each training data instance and calculate the update immediately.

It is easy to implement. It needs large number of hyper parameters to increase the efficiency and the sensitivity of the algorithm. There are classification evaluators too. It is the most important part to check the efficiency and the accuracy
of the algorithm. They are Holdout method, cross validation, classification report, ROC curve. Cross validation is used in the research. It supports to decrease over fitting problem. When K-fold cross validation was conducted whether the model is over fitted or not can be confirmed.

Data set randomly partitioned into k mutually exclusive subsets. The subsets are of same size. One set is kept of testing and another is kept for training. The process continues for all the k folds.

Here what has been received for the model:

\[
\begin{align*}
0.8361465 & 0.82383465 0.8268669 & 0.7904667 0.790531381 \\
0.6377952 & 0.6535331 0.66798419 & 0.78750986 0.65217391 \\
0.88976378 & 0.87795276 0.88142292 & 0.90118577 0.87351779
\end{align*}
\]

Python libraries is used in order to perform classification. Pandas is the most popular python library for data preparation and process. It is fast, flexible and easy to use. It is a data analysis and manipulation tool. It is built on python programming language. Scikit-learn is also python library which can be used for machine learning operations. Such as classification, regression, clustering algorithms. It is a free software.

E. Identify the complex words from the meaningful sentences and substitute it with simple words after that converting that sentence into audio

In this step identifying complex words from sentences and substituting them with simple words, convert the sentence into audio was took place. In order to fulfill the requirement more python package and modules is used.

We used NLTK Wordnet corpus in order to fulfill the requirement. It is a lexical database of English.

F. Finding related images from web sources for extracted information

Finding images from web pages, how to find images from web pages also done using the same python libraries such as newspaper.

Result of the image scraping is as follow image.
G. Merge audio and images to design and create a digital video production team.

Deliver digital video production with the combining of image and audio was the next step. Modern technologies is used for this too. Combined images and audio have used to deliver video production. OpenCV is used to develop real-time computer vision. Also MoviePy i a python module which is used for video editing. It can do basic operations like cut, concatenation, title insertions. Using this real-time optimized Computer Vision library and MoviePy was developed a video using the scraped images and generated audio.

H. Mobile application

For developing mobile application Flutter was used. It is a modern mobile app developing tech stack created by Google. It is open source UI software development kit. It is used to develop Android, iOS, web apps and many other from a single codebase. Fig. 1 shows the app UI that was developed for the digital learning.

I. Web development

React is used mostly in building Front End of web applications. It is free and open source. It is a javascript library for building user interfaces based on UI components. React is maintained by Meta and community of individual developers and companies. React’s modular nature makes its code more flexible and easier to maintain when compared to competing frontend frameworks. Businesses benefit greatly from this flexibility in terms of time and money savings. Fig. 2

J. Backend API development

Laravel is used to develop the back end which is also a PHP Web framework. It is also a free and open source framework. The majority of web developers are already familiar with Laravel, the top PHP framework. Most websites may easily be configured with Laravel’s strong security capabilities to improve security and defend against hackers and cybercriminals. For the website, Laravel offers caching out of the box, which is helpful for speeding up the site. Laravel offers the ability to create both a straightforward and expert B2B website and a full-featured eCommerce website. It may delay completing certain online operations, including sending emails, until a later time since it employs a novel message queuing mechanism. Countless third-party packages are also readily accessible to provide the website a variety of features and functionality. Django is a high level web framework based on python and it follows models-template-views architecture pattern. It helps to rapid development, clean and pragmatic design.

IV. DISCUSSION

Digital Learning comes with many advantages and disadvantages to kids. Advertising is relatively harmful for kids. Easily kids can be influenced by kids. Because their critical thinking skills and impulse control aren’t fully developed. Thus adult contents, food advertising, drugs, cultural biases etc. During Covid-9 most of the educational bodies faced this type of issues and they had to delay their teaching. Also with the current economic crisis all the transportation has come under limitations and it is same as theovid pandemic. This kind of system helps in this kind of situation for all the educational sector. Parents can turn on monitor privacy settings on personal devices, apps, social media, virtual assistants, and wireless networks. Also they can use a plan with children to help guide them toward quality media content with fewer ads. Use this plan to talk with children about data collection and media content with fewer ads. As well as it is okay to talk to school administrators, and teachers about avoiding digital products with advertising and using digital privacy settings on the education technology tools they use. As a solution It is been categorized all the keywords into categories which can be easily recognized by the system and stop proceeding for unnecessary contents.

Fig. 1. Mobile UI
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