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Efficient Business Meeting Summarization through NLP Techniques

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Abstract: ***Every company or organization conducts meetings to discuss certain topics, issues or development. Having a meeting summary is for the people to keep track of the certain points that have been discussed during the meetings. Generally, it is time consuming to read and understand the whole documents. Summaries are very important as they convey the essential content of discussions in a concise form. It plays an important role as the readers are interested in only the important context of discussions. The main idea of the project is to develop a text and video summarizer using Natural Language Processing. This helps the user to get the summary of the documents instead reading and analyzing the whole document. In text summarization, we are building a Seq2Seq model using LSTM and Attention Layer. Then we are training the model using the datasets and test them. With the help of this, we are able to generate a summary for the text document. For video summarization, we are considering NLP based text summarization algorithms such as Text Rank, Lex Rank, LUHN and LSA. These algorithms are performed on the subtitles and the summary of the video will be generated. Eventually we are able to get the summarization of the text and video documents using NLP.***

Keywords: Business Meeting Summarization, Text Summarization, Video Summarization, Natural Language Processing.

I. INTRODUCTION

Natural Language Processing (NLP) is a branch of Artificial Intelligence that deals with the interaction between computers and humans using the natural language. It is a subfield of artificial intelligence that helps machines understand natural human language. It helps machines "read" text by simulating the human ability to understand language. By utilizing NLP, developers can organize and structure knowledge to perform tasks such as automatic summarization, translation, named entity recognition, relationship extraction, sentiment analysis, speech recognition, and topic segmentation. NLP algorithms are typically based on machine learning algorithms[10]. Here NLP is used for summarizing the text and video documents of the Meetings.

A. Text Summarization

In this project, Abstractive text summarization is used to build a Seq2Seq model with help of LSTM and Attention Layer for text summarization[7].

B. Video Summarization

NLP based Text summarization algorithms – Text Rank, Lex Rank, LUHN and LSA are used on the subtitles [2].
The main applications of NLP are

- Language Translator
- Chatbots
- Survey Analysis
- Voice Assistants
- Email Filtering

C. Long Short Term Memory (LSTM)

Long Short-Term Memory (LSTM) network is depicted in Fig. 1. It is modified version of recurrent neural network capable of learning order dependence in sequence prediction problems. It can learn to recognize context-sensitive languages. It can by default retain the information for long period of time. It is used for processing, predicting and classifying on the basis of time series data. They are explicitly designed to avoid the long-term dependency problem. It trains the model by using backpropagation [8]

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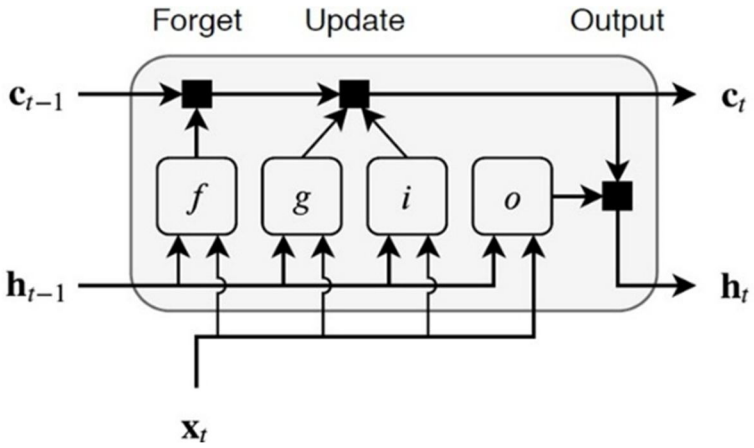


Fig. 1. LSTM

Summarization is the task of condensing a piece of text to a shorter version, reducing the size of the initial text while at the same time preserving key informational elements and the meaning of content. Having a meeting summary is for the people to remember the meeting and to keep track of the certain points that have already been discussed. Manually changing the report to a summed-up form is too time taking. With the help of Natural Language Processing, we are able to achieve it.

II. LITERATURE SURVEY

The proposed system for summarization is done both for Text and Video documents. For Text summarization, we have to build a Seq2Seq model using LSTM and Attention Layer which is used to generate the summary by training the model and in Video summarization, we have to use NLP based text summarization algorithms such as Text Rank, Lex Rank, LUHN, LSA and use it on subtitles to summarize the video. In Text Summarization part, Abstractive Summarization approach is used which generate new sentences from the original text. Our objective is to build a text summarizer where the input is a long sequence of words and the output is a short summary. So, it is treated as a Many-to-Many Seq2Seq problem. The two major components of a Seq2Seq model are Encoder and Decoder. The Encoder-Decoder architecture is mainly used to solve the Seq2Seq problems where the input and output sequences are of different lengths [4]. The performance of a basic encoder-decoder deteriorates rapidly as the length of an input sentence increases. To overcome this Attention Mechanism is used. It aims to predict a word by looking at a few specific parts of the sequence only, rather than the entire sequence which results in the target sequence [5][6].

In case of Video Summarization, the subtitles of the video will be converted to a text document and then the Automatic NLP based summarization algorithm will be applied on the subtitle text file. Here a python library called sumy which provides the summary for a text document [3]. There are several summarization algorithms that we can use with the help of this library. But here we have used four algorithms namely Latent Semantic Analysis, LUHN, Text Rank and Lex Rank. Using sumy, we can rank each sentence. Each subtitle has a certain duration in the video. So to fit the duration which the user provides the average duration is found out. Using this average duration the approximate no of sentences is founded which is needed to produce the summarized video [1][2]. The summarization works in such a way that the topmost ranked subtitles are included in the video. If the total duration of the summarized subtitles is more, then we can reduce the one that is least ranked and vice versa. The summarized subtitles will be generated. Then the python module called **Moviepy** is used to modify the video files. Using the time stamps in the summarized subtitles the video will be divided into several segments and finally merged to create the final summarized video and it will be successfully generated [9].

III. PROPOSED METHODOLOGY

A. Sequence To Sequence Modelling (SEQ 2 SEQ)

Sequence-to-sequence learning (Seq2Seq) is about training models to convert sequences from one domain to sequences in another domain. It is also called as Encoder – Decoder model. The Encoder-Decoder architecture is mainly used to solve the sequence-to-sequence (Seq2Seq) problems where the input and output sequences are of different lengths. The two major components of sequence to sequence modelling is:

Long Short Term Memory (LSTM), is preferred as the encoder and decoder components. This is because they are capable of capturing long term dependencies by overcoming the problem of vanishing gradient.

1) Encoder

An Encoder Long Short Term Memory model (LSTM), shown in Fig. 2 reads the entire input sequence wherein, at each timestep, one word is fed into the encoder. It then processes the information at every timestep and captures the contextual information present in the input sequence. The hidden state (h_i) and cell state (c_i) of the last time step are used to initialize the decoder.

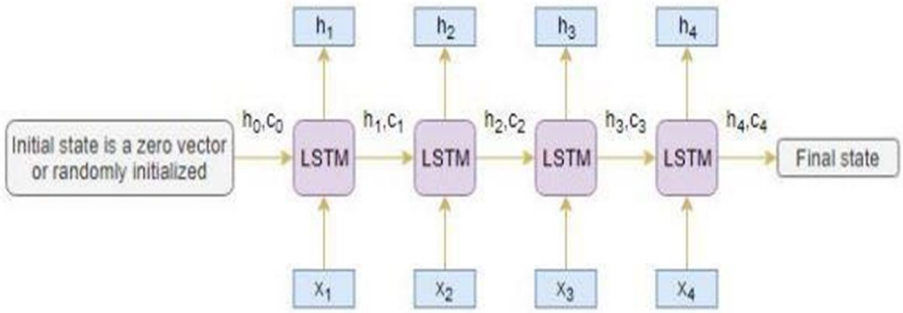


Fig. 2. Encoder

2) Decoder

The decoder illustrated in Fig. 3 is also an LSTM network which reads the entire target sequence word-by-word and predicts the same sequence offset by one timestep. The decoder is trained to predict the next word in the sequence.

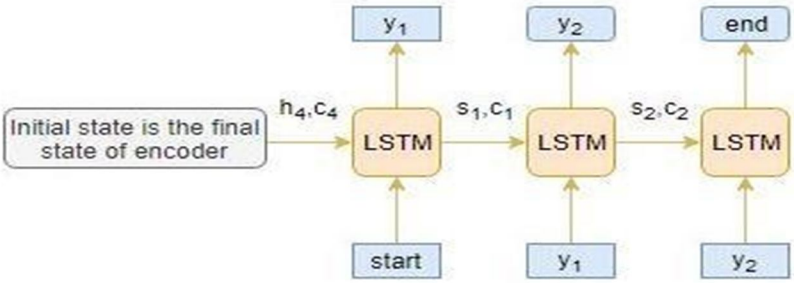


Fig. 3. Decoder

<start> and <end> are the special tokens which are added to the target sequence before feeding it into the decoder. The target sequence is unknown while decoding the test sequence. So, we start predicting the target sequence by passing the first word into the decoder which would be always the <start> token. And the <end> token signals the end of the sentence.

B. Proposed Module

The proposed system for summarization is done both for Text and Video documents. For Text summarization, we have to build a Seq2Seq model using LSTM and Attention Layer which is used to generate the summary by training the model and in Video summarization, we have to use NLP based text summarization algorithms such as Text Rank, Lex Rank, LUHN, LSA and use it on subtitles to summarize the video.

IV. PROPOSED SYSTEM MODULES

In general there are two modules in our proposed system namely

A. Text Summarization

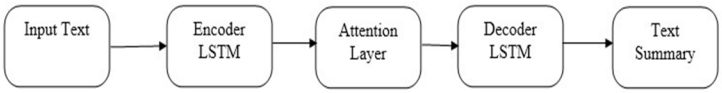


Fig. 4. Text Summarization

Fig. 4 depicts the business meeting summarization in the form of text using LSTM (Seq2Seq model). The performance of a basic encoder - decoder deteriorates rapidly as the length of an input sentence increases. To overcome this Attention Mechanism is used. It aims to predict a word by looking at a few specific parts of the sequence only, rather than the entire sequence which results in the target sequence in the form of a text summary.

B. Video Summarization

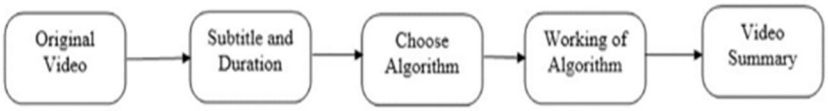


Fig. 5. Video Summarization

It uses Automatic NLP based summarization algorithm to produce the video summary of the business meeting and it is also depicted in Fig. 5. The original video and the subtitle is given as an input along with the expected duration of the summary video. Based upon the users choice any of these algorithms Latent Semantic Analysis, LUHN, Text Rank and Lex Rank is performed on the subtitle file and finally the summarized video is generated.

V. CONCLUSION

In this project a time saver has been introduced in the form of a summarizer. With the help of summarizer a quick idea could be derived without spending hours. Both the Text and Video summarizer can be a boon in the forthcoming stages of life. People who hate reading can also get to know the content by reading the summarized version of long paragraphs and videos instantly This project can be further developed as a mobile application by integrating both the text and video summarizer.

Further the subtitle file can also be generated as a separate text file automatically which will be very useful since all videos may not have subtitles along with them. In case the user does not have a subtitle file then the subtitles can be generated. Summarization of audio files in the form of text can also be included. More efficiency can be achieved in the summary by increasing the amount of training datasets.

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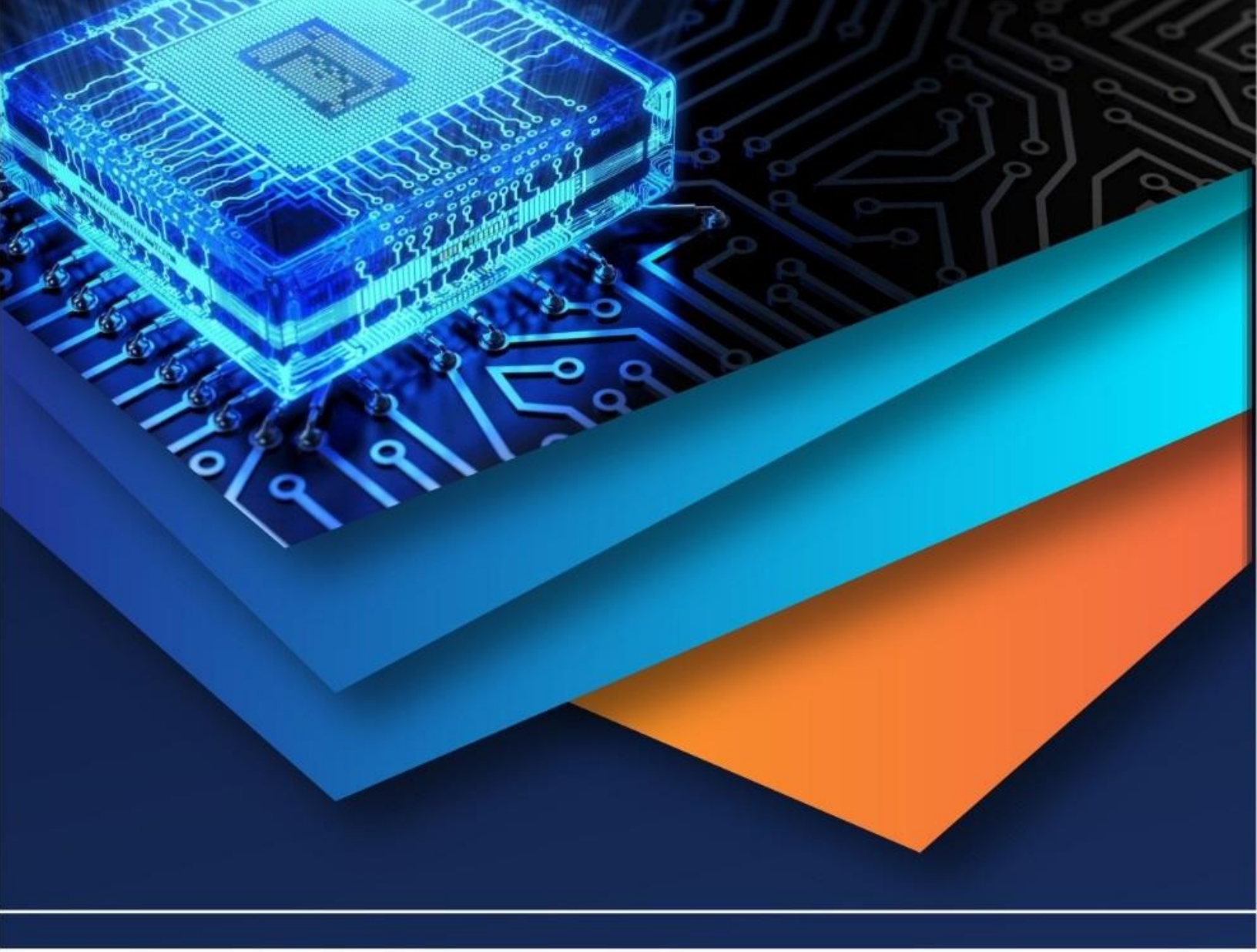
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