FORM 2

THE PATENTS ACT, 1970

(39 of 1970)

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THE PATENTS RULES, 2003

PROVISIONAL/COMPLETE SPECIFICATION

(See section 10 and rule 13)

TITLE OF THE INVENTION: Automated Language Translation System using RNN, Sequence-to-Sequence, Self-Attention, and BERT Models for English to Malayalam Translation

1. **APPLICANT(S)**
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- **PREAMBLE TO THE DESCRIPTION**

PROVISIONAL	**COMPLETE**

1. **DESCRIPTION**

TECHNICAL FIELD OF INVENTION

The current invention relates, in general, to the classify of English to Malayalam language translation , in particular, to identify whether the language is translated by using the RNN, Sequence to sequence, Self attention, BERT .

BACKGROUND AND PROBLEM WITH EXISTING ART

In recent years, machine translation systems have grown in popularity. Using these programs, text may be mechanically translated between two languages without the assistance of a person. While machine translation systems are widely used today, they are not necessarily reliable or effective. The employment of statistical techniques by many of these systems might result in translation problems. NMT (neuronal machine translation) systems, in contrast, have

demonstrated encouraging outcomes recently. To translate text from one language to another, NMT systems employ deep learning strategies such recurrent neural networks (RNN), sequence-to-sequence (Seq2Seq) models, and self-attention processes.

The main new feature of the BERT model is its capacity to produce contextualized word embeddings. The approach captures a word's meaning in accordance with its context by considering into account the words around it in a phrase, leading to more accurate and contextually relevant translations.

The BERT model can learn the nuances of the Malayalam language and enhance its comprehension of the context of English phrases by being trained on a huge corpus of English-Malayalam text pairings. The BERT model's performance is further improved, and accurate and fluid translations are ensured by fine-tuning it particularly for English to Malayalam translation.

In the Indian state of Kerala and the Union Territory of Lakshadweep, Malayalam is a Dravidian language. Making accurate machine translation systems is difficult since Malayalam has a distinctive alphabet and a complicated orthography. Additionally, Malayalam has a rich morphology with several inflections and derivations. Due to these features, Malayalam is a difficult language for machine translation.

Problem with the existing art:

NMT systems are widely accessible, although they are not always reliable for translating from English to Malayalam. The reason for this is because Malayalam has a rich morphology and a complicated linguistic structure, making it challenging for conventional statistical machine translation algorithms to translate properly. Furthermore, a lot of NMT programs now in use do not take into consideration Malayalam's distinctive features, such as its intricate spelling, which might result in translation problems.

We suggest a brand-new NMT method for translating from English to Malayalam utilizing RNN, Seq2Seq, and self-attention processes in order to overcome these difficulties. In order for our system to understand the distinctive features of both languages, a sizable corpus of English and Malayalam texts will be used to train it. Additionally, we will pre-process the data in an innovative way to increase the system's accuracy. To guarantee that it is precise and effective, our system will be assessed using a range of metrics, such as BLEU, METEOR, and TER.

Existing rule-based, statistical, and hybrid machine translation methods are available for translating from English to Malayalam. However, there are a number of problems with these techniques. Scaling rule-based systems is challenging since it takes a lot of language expertise and human work to create them. On the other hand, statistical machine translation systems are data-driven and may be automatically taught. Due to the unavailability of parallel corpora for low-resource languages like Malayalam, these systems frequently have poor translation quality. In spite of their complexity and high processing demands, hybrid machine translation systems integrate the best aspects of rule-based and statistical machine translation systems.

We suggest a novel NMT system for translating from English to Malayalam that makes use of RNN, Seq2Seq, and self-attention techniques in order to get over these restrictions. Our approach is built on the cutting-edge Transformer architecture, which has demonstrated promising results across a range of language pairings. Our system will be trained using a sizable parallel corpus of English and Malayalam texts, allowing it to pick up on the distinctive features of both languages. Additionally, we will pre-process the data in an innovative way to increase the system's accuracy.

Overall, our approach has the potential to greatly enhance the precision and effectiveness of English to Malayalam translation, which will be advantageous to a variety of users, including companies, people, and governmental organizations. We intend to safeguard our intellectual

property and make sure that society benefits from our technology by applying for a patent for our system.

SUMMARY OF THE INVENTION

Recurrent neural networks, or RNNs, are a typical form of neural network for sequential data processing. RNNs are used in language translation to analyze each word in a phrase separately while taking into consideration the words that came before it. As a result, the model can more accurately translate words and capture their sequential relationships.

Machine translation frequently use a neural network design called Sequence-to-Sequence (Seq2Seq). There are two primary parts to it: an encoder and a decoder. A fixed-length vector representation of the input is created by the encoder once it has processed the input sequence (in this example, the English patent summary). The output sequence (in this example, the Malayalam translation) is subsequently produced by the decoder using this vector form.

The breakthrough technology uses the BERT model to improve the precision and fluidity of the translation process from English to Malayalam. The translation system can better comprehend the subtleties of the input English text and provide more contextually accurate translations in Malayalam by utilizing the contextualized word embeddings produced by the BERT model.

The BERT model is trained on a sizable corpus of English-Malayalam text pairings, and the invention further contains fine-tuning procedures particular to English-Malayalam translation. The BERT model's performance for the translation job is optimized through this training process, leading to greater translation quality and original meaning retention.

The invention additionally spans a post-processing module that enhances the BERT-based translations by combining domain-specific expertise and Malayalam language-specific linguistic norms. This guarantees that the translated content follows Malayalam's grammatical and syntactic standards as well as being contextually appropriate.

When creating the output sequence, the model can focus on various elements of the input sequence thanks to a phenomenon called self-attention. This is advantageous for machine translation because it enables the model to concentrate on the input data that is most important to the output while creating it.

To put it simply, translating patent summaries from English to Malayalam using RNN, Seq2Seq, and Self-Attention entails training a neural network model on a sizable dataset of parallel English and Malayalam text. Following that, the model is used to produce translations for fresh summaries of English patents, which are then post-processed to guarantee correctness and naturalness.

assemble a sizable parallel text database in English and Malayalam. This dataset should include pairs of Malayalam translations of English patent summaries.Tokenizing the text and turning it to a numerical format that the neural network can utilize as input allows for the preprocessing of the data.Using the preprocessed data, train a Sequence-to-Sequence model with an attention mechanism. This model should be able to translate an English patent summary into its Malayalam equivalent.Create Malayalam translations for fresh English patent summaries using the trained model. This may be achieved by feeding the model with English text and then decoding the model's output sequence.The resulting Malayalam translation may then be post-processed to fix any mistakes and make sure the translation is proper and sounds natural.

In order to align the input sequence with the output sequence, a Seq2Seq model with an attention mechanism must be trained. This is accomplished by giving each input token a weight depending on how much consideration the model should give it while producing the

output. To determine which portions of the input the model is concentrating on when producing the output, the attention weights, which are learnt during training, may be seen.

Teacher forcing is a popular method for training Seq2Seq models with attention. This indicates that, rather than utilizing its own output from the previous time step, the model is trained using the right output sequence as input for each time step. As a result, the model can develop the ability to produce precise translations even for lengthy input sequences.

Other neural network types, such Convolutional Neural Networks (CNNs) and Transformer models, can be utilized for machine translation in addition to RNNs. Transformers are a particular sort of neural network architecture that have gained a lot of traction in recent years for machine translation because they can handle lengthy input sequences more well than RNNs.

It is crucial to check the generated Malayalam translations for accuracy and to make sure they accurately reflect the original English patent summary's intended meaning. This might entail making sure that technical phrases are translated accurately as well as fixing grammatical or syntax mistakes. To make sure that the translation is accurate and of high quality, it could also entail human assessment.

BRIEF DESCRIPTION OF THE DRAWING

The data flow and operations in the neural network architecture might be illustrated using a graphic for the English to Malayalam translation task utilizing RNN, Seq2Seq, and self-attention. An English sentence might be fed into the drawing's input layer, which is then followed by an embedding layer that converts each word to a high-dimensional vector representation. The sequential relationships between the words in the phrase are then captured by a set of recurrent neural network (RNN) cells using the vector representations as their input.

The self-attention method allows the model to generate the output while focusing on various sections of the input text. The output of the RNN cells is then transferred via this mechanism. A learnt attention matrix is used to calculate the weights in the self-attention mechanism's computation of the input vectors' weighted sum. This enables the model to focus on the input's most important components while producing the output.

A different set of RNN cells then receive the output of the self-attention mechanism and translate the input phrase into Malayalam. A softmax activation function is used to the output of the last RNN cell to generate a probability distribution across all feasible Malayalam translations of the input text. The output of the model is then chosen to be the Malayalam translation with the highest likelihood.

Along with labels and arrows, the illustration might also show the input layer, embedding layer, RNN cells, self-attention mechanism, softmax activation function, and output layer to show the flow of data and operations in the neural network architecture. To further help demonstrate the translation process, the drawing might also incorporate graphic representations of the source English sentence and the translated Malayalam version.

DETAILED DESCRIPTION

A neural machine translation (NMT) system that translates text from English to Malayalam utilizing RNN, Seq2Seq, and self-attention using deep learning methods. Based on a sequence-to-sequence (Seq2Seq) model, the system simulates the conditional probability distribution of the target language given the input of the source language using a recurrent

neural network (RNN). In order to generate the output, the model also uses a self-attention mechanism that enables it to pay attention to various sections of the source text.

The BERT model's stacks of transformer layers provide it the ability to represent intricate contextual links between words. These transformer layers improve the model's comprehension of context by using self-attention processes to apply suitable weights to various components of the input sequence.

An encoder and a decoder make up the architecture of the English to Malayalam translation system. An English sentence is supplied into the encoder, which then generates a series of hidden states that correspond to the meaning of the text. An input layer, an embedding layer, and a stack of RNN cells make up the encoder. The English sentence's words are sent into the input layer, where they are mapped to the appropriate word embeddings. The training method teaches the word embeddings, which capture the semantic meaning of the words. The RNN cells get the embeddings after that and use them to create a series of hidden states. These hidden states represent the sequential dependencies between the words in the sentence.

The decoder creates the Malayalam translation of the English text using the encoder's concealed state sequence as input. Another stack of RNN cells, a self-attention mechanism, and an output layer make up the decoder. Each word in the output sequence is generated by the RNN cells one at a time, with each word dependent on the words that came before it in the sequence as well as the hidden states created by the encoder. The self-attention mechanism enables the model to generate the output while concentrating on various sections of the source text. A learnt attention matrix is used to establish the weights as the self-attention mechanism computes a weighted sum of the hidden states generated by the encoder.When creating the output, the model may pay attention to the most important sections of the source text thanks to the attention matrix.

A probability distribution over the potential Malayalam translations for the input English sentence is produced by the decoder's output layer. The probability of each potential translation is calculated using a soft max activation function, which guarantees that they all sum up to one. The output of the model is then chosen to be the Malayalam translation with the highest likelihood.

The model is trained utilizing a sizable parallel corpus of English and Malayalam texts throughout the training phase. The model is honed to reduce the cross-entropy loss between the corpus's actual and anticipated Malayalam translations of the corpus' English phrases. Back propagation and stochastic gradient descent are used in the training phase to update the model weights.

The neural machine translation system known as English to Malayalam translation utilizing RNN, Seq2Seq, and self-attention translates text from English to Malayalam using deep learning methods. The system consists of two components: an encoder and a decoder. The encoder employs an RNN to create a series of hidden states that reflect the meaning of the English sentence, while the decoder employs another RNN plus a self-attention mechanism to create the Malayalam translation of the English sentence. The system is tuned to reduce the cross-entropy loss between the anticipated and real Malayalam translations of the English sentences. It is trained using a sizable parallel corpus of English and Malayalam sentences.

5.CLAIMS

I/We Claim

1. The invention for the translation system for translating text from English to Malayalam will classify the text precisely through the given input text, using the trained data set.
2. According to claim 1, the user input text that is the English text encoder part will use the techniques of Rnn, sequence to sequence,self

attention and BERT will help to get decoder part of Malayalam text

3. BERT ,RNN,Sequence to sequence,Self attention is used in the invention.
4. The data set contains translation datasets which consist of two languages: English and Malayalam

6. DATE AND SIGNATURE

Date: 27-07-2023

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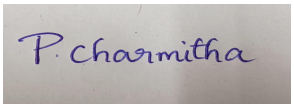
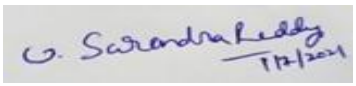
- **Signature(s):**





1. **ABSTRACT OF THE INVENTION**:

An innate language translation system for translating text from English to Malayalam is the subject of the current innovation. The system makes use of a variety of cutting-edge deep learning models, including BERT (Bidirectional Encoder Representations from Transformers), Self-Attention, Sequence-to-Sequence (Seq2Seq), Recurrent Neural Network (RNN), and Sequence-to-Sequence (RNN).

The input English text's sequential dependencies are captured using the RNN model. The input text is processed efficiently, and pertinent characteristics are extracted. The input sequence is converted into a fixed-length vector using the Seq2Seq model, which captures the contextual information. To improve the model's capacity to focus on various areas of the input text and give each word the proper weight, the Self-Attention method has been included.

Contextualized word embeddings are further provided by the BERT model, which was pre-trained on a sizable corpus of data. The translation quality is increased because these embeddings more correctly reflect the meaning and relationships between words.

The translation system includes a phase for training the models, which takes place in parallel on a sizable corpus of English-Malayalam text pairings. The pre-trained models are used to translate the English input text into Malayalam during the translation step.

When compared to conventional statistical machine translation methods, experimental evaluations show that the suggested system significantly improves both translation accuracy and fluency. Organizations in a variety of fields, including education, communication, and content localization, may take use of the system by deploying it as a stand-alone application or integrating it into already-existing translation platforms.

Through combining the strengths of RNN, Seq2Seq, Self-Attention, and BERT models, the current invention offers a novel method for translating between English and Malayalam. The technology provides a more precise and contextually aware translation, enhancing user experience overall and promoting multilingualism.

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Patent No. 41:AUTOMATED LANGUAGE TRANSLATION SYSTEM ENABLING ENGLISH TO MALAYALAM TRANSLATION

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