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# **Use of Hidden Markov Model to Enhance the Performance of Density Based Document Summarization**

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*Abstract:* In today's world use of online information increased as it is freely available. The retrieval of this information from available data, leads to a wide research in the area of automatic text summarization. It is necessary to apply the correct method to summarize the all available information. This solution is proposed for the Natural Language Processing (NLP) community.

Document summarization helps in mining data and delivering accurate data in time to the users. The system tries to attempt issues related to the data mining using various summarization methods.

Keywords: Hidden Markov Model, Density Based Algorithm, Document Summarization, Machine Learning.

## **1. INTRODUCTION**

Now days, information is very important in whole world. More unstructured data involves during the internet searching, that is not possible for any user to read content of the any retrieved documents. So, it would be very necessary to discover method which will permit the user for extracting the correct approach by using retrieved documents. Summarizing all retrieved documents is useful to achieve the proposed objective. For this, new approach is introduced which will highlight necessary contents of the document. Summarization of documents are procedure of data mining which creates topic which will targets on minimizing the document size, while keeping in mind the important characteristics of our original document. Information overhead is critical problem in document summarization. This problem is generated by sharing the same topic by the multiple documents. So, document summarization is technique to overcome the above problem. There are different problems related to the document summarization which can be handled like matching of simple word as well as frequencies of word. This method doesn't search for correct similarity among words/or sentences within summary. Because it may happen that documents hold number of words which will explain similar event. It will considered relationship among words or sentences. Document summarization has two main steps. First is extracting information and another is ordering the sentence. This proposed system is focused on ranking as well as ordering. The way of arranging sentences combining which are extracted is known as ordering the sentences. Due to which it increases the summary readability. More research work is done for proposing the method for sentence ranking; these

documents may not consider the semantic aspects for word matching. Both statements has related to each other because the meaning of the both statements are same. Some types of the similarities like Syntactic, lexical and cosine similarity have been used for determining the relation among these statements.

## 2. LITERATURE SURVEY

Ms. Pallavi.D.Patil et al. [1] Provides process of summarizing documents assumes a basic part in numerous applications. Text Summarization has been deliberate on keep hold of the essential data without concerning the archive quality.

*AbimbolaSoriyan[2]*Summarization of documents help us to save information processing time as well as information meaning which is not predictable by user for using. Document summarization is supported by sentence compression by decreasing the summary candidate's length by maintaining candidate's applicable content, thus permitting inclusion space for further objects. Results of the paper does shows that adverbs, conjunctions of word, verb and adjectives and more are get deleted without losing sentence meaning.

*P. Sukumar et.al. [3]* Through fast growth of unstructured information by naturally may leads big problem to algorithm of text mining. This will recover information which is meaningful throughproficient way. But more amounts of data are easilyobtainable; sometime it is not possible to get essential or appropriate information on right time. Hence, for generating the topic summary we needs document summarization. Document verification mainly targets on the ranking and ordering of the sentences. Chronology, succulence, topical and precedence are some of the measures of the sentence ordering which the proposed system deals with.

## 3. EXPERIMENT AND RESULT

#### 3.1. System Design

To provide linguistic knowledge to the computer system is the big challenge for natural language processing. The Figure 1 shows the overall document summarization.



Figure 1: Proposed System Architecture

On the basis of such considerations, the algorithm uses a different color image multiplied by the weighting coefficients of different ways to solve the visual distortion, and by embedding the watermark, wavelet coefficients of many ways, enhance the robustness of the watermark.

#### 3.2. Preprocessing

The tokens are generated from the preprocessing unit by giving the number of documents to this preprocessing unit. These documents are broken into smaller atomic parts these called as token. The word which doesn't explain the sentence meaning is called as stop word. This stop words are deleted to avoid the unwanted word processing.

#### 3.3. Similarity Matrix Calculation

Calculating the weight of word for understanding the summary of the document is very significant. TF–ISF (Frequency–Inverse Sentence Frequency) is utilized for this calculation. The number of occurrences words in the document is known as Frequency. The percentage of containing words in the sentence is calculated by using the Inverse sentence frequency. Term Frequency is calculated as follows:

$$Term \ Frequency = \frac{nj}{\sum_{k} nk} \tag{1}$$

In above Equation,

nj is the number of occurrence of word j in summary

nk is the total words in summary.

Inverse Sentence Frequency is calculated as follows:

$$ISF = \log \frac{N}{ni}$$
(2)

In above Equation,

N represents total sentences in summary.

ni represents no. of sentences holding specific term

Term Weight is determined as follows:

$$Term Weight = TF * ISF$$
(3)

#### **3.4. Mathematical Model**

 $T_{1}[D] = \sum_{ti \in n} [D]$   $T_{2}[D] = \sum_{ti \in n} [D]$ .....  $T_{n}[D] = \sum_{ti \in n} [D]$ Where, T1....Tn = Number of tasks D = d1.....dn (No. of Documents)

#### Algorithm for Document Clustering

**Input:** Ranking score p of each sentence

Output: Clustered Document

- 1. Draw a graph which nodes is the point to be clusterd
- 2. Draw an edge from c to each p (point) do for each core point c around c ε-neighborhood
- 3. Put N on the graph node;
- 4. Delete N if it doesn't holds any core point
- 5. Choose a 'c' (core point) from N
- 6. Let X is node set which may reach from c by moving ahead.

1. Make cluster contains (" $X \cup \{c\}$ ")

2. "N=N/(X∪{c})"

7. Repeat/Continue step

## 4. SUMMARIZATION MODEL

### 4.1. Hidden Markov Model

This model describes an approach that given a set of features computes an a-posterior probability that each sentence is a summary sentence. In contrast to a Naive Bayesian Model(NBM) approach, the HMM has fewer assumptions of independence. In particular, it does not assume that the probability that sentence i is in the summary is independent of whether sentence i1 is in the summary. Furthermore, the joint distribution for the features set, is used is the assumption used by naive Bayesian method. The three features are considered in the development of a Hidden Markov model for text summarization.

- 1. Position of the sentence in the document. This feature is built into the state-structure of the HMM.
- 2. Number of terms in the sentence. The value of this feature is

o1(i) = log(number of terms + 1):

3. How likely sentence terms are, given the document terms

o2(i) = log(P r(terms in sentence i | D)).

The probability that the next sentence is included in the summary will differ, depending on whether the current sentence is a summary sentence or not. The Hidden Markov Model allows such differences with marginal additional cost over a simple Bayesian classifier.

## 5. RESEARCH EVALUATION

## 5.1. Experimental Setup

The experimental setup used for this system is given as below. Windows 7 OS is used on Intel Pentium Dual Core Processor and 2 GB main memory. The hard disk used for this is of 320 GB. This system is implemented using Java framework.

## 5.2. Analysis of work

The quality of summary obtained is measured using following parameters :

Use of Hidden Markov Model to Enhance the Performance of Density Based Document Summarization

1. Precision -

Precision is the fraction of the documents retrieved that are relevant to the user's information need.

$$precision = \frac{\left| \{relevant \ documents\} \cap \{retrieved \ documents\} \right|}{\left| \{retrieved \ documents\} \right|}$$

That is, the fraction of the retrieved documents which is relevant.

2. Recall -

Recall is the fraction of the documents that are relevant to the query that are successfully retrieved.

$$recall = \frac{\left| \{relevant \ documents\} \cap \{retrieved \ documents\} \right|}{\left| \{relevant \ documents\} \right|}$$

That is the fraction of the relevant documents which has been retrieved.

The paragraph is given as input to the system which was further processed by applying summarization technique. The objective of this work is to produce the accurate summary. The result obtained by the system is the summary of that input paragraph. The analysis of result shows that some sentences of the input paragraph are not summarized and some sentences are added into summary those can be omitted. The system is tested for 25 various inputs and following graph indicate analysis of these inputs.

Use of Hidden Markov Model to Enhance the Perform	nance of Density Based Document Summarization
OLD fogies often bemoan technological advance. For some audiobuffs the johnnycomelat transistor will never replace the purity of the valve, nor the compact disc the longplaying record. And in photography it is generally agreed that nothing recent has been as good a But in a world that prizes immediacy (another thing that fogies despise) Kodachrome has Now, though, the Kodachrome process has been revamped into something that cornersh in making his invention, Richard Mackson is merely following tradition. Kodachrome itself Even a modern Kodachrome processor is a behemoth. It is 33 metres (100 feet) long, cost	ely colour film as Kodachromewhich turns 62 this year. The thinner gel, tighter grain a problem: it is a nightmare to develop. Bringing out those perfect images require op developers can afford. And, since many old fogies also believe that a gifted am was devised by two gifted amateursLeopold Mannes and Leopold Godowsky. The s \$1m, occupies 1,000 square metres of floor space and needs to be served by a st
Sentence Segmentation Preprocesing Cluster Algorithm Summarization	Using HMM Summarization Using NBM
Sentence Segmentation Pr	Messane X
The result is a machine that, in all relevant departments, beats the old one by a fail it costs a tenth of the price, requires only one technician to operate it (the chemic by Kodak, and their concentration is monitored by computer) and can fit into a 60s A film can be processed in under 40 minutes. The result, Kodak hopes, will soon be in a highstreet developer near you. Fogies should cheer.	Sentence saperated Successfully OK
Cluster Result Su	mmarization Result
Result Anlysis	
Retrived Sentences Retrived Relevant Sentences	Total Relevant Sentences of Input Data Submit
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**Figure 2: Document Segmentation** 

OLD fogies often bemoan tech transistor will never replace th record. And in photography it i But in a world that prizes imme Now, though, the Kodachrome In making his invention, Richar Even a modern Kodachrome pr	nological advance. For so e purity of the valve, nor s generally agreed that r ediacy (another thing tha process has been revam d Mackson is merely folk occessor is a behemoth. I	me audiobuffs the johnnyc the compact disc the long nothing recent has been as it fogies despise) Kodachro ped into something that c wwing tradition. Kodachron is 33 metres (100 feet) lo	omelately playing good a colour film as K me has a problem: it is ornershop developers c ne itself was devised by ng, costs \$1m, occupie:	odachromewhich turns 62 this year. T a nightmare to develop. Bringing out an afford. And, since many old fogies two gifted amateursLeopold Mannes 1,000 square metres of floor space a	he thinner gel, tighter grain those perfect images require also believe that a gifted am and Leopold Godowsky. The nd needs to be served by a st
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sult Anlysis trived Sentences	Retrived Releva	int Sentences	Total	Relevant Sentences of input Data	Submit
ecision	Recall				
		Figure 3: Doc	ument prepro	ocessing	
Use of Hidden I	Markov Model to	Enhance the Pe	rformance of D	ensity Based Document	Summarization
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Sentence Segmentation	Preprocesing Cluster Algorithm	Summarization Using HMM Sa	ummarization Using NBM
Sentence Segmentation		Pre-Processing Result	
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esult Anlysis etrived Sentences	Retrived Relevant Sentences	Total Relev	ant Sentences of Input Data Submit

Figure 4: Document Clustering

Use of Hidden Markov Model to Enhance the Performance of Density Based Document Summarization
OLD fogies often bemoan technological advance. For some audiobuffs the johnnycomelately transistor will never replace the purity of the valve, nor the compact disc the longplaying record. And in photography it is generally agreed that nothing recent has been as good a colour film as Kodachromewhich turns 62 this year. The thinner gel, tighter grain But in a world that prizes immediacy (another thing that fogies despise) Kodachrome has a problem: it is a nightmare to develope. Bringing out those perfect images require Now, though, the Kodachrome process has been revamped into something that cornershop developers can afford. And, since many old fogies also believe that a gifted am In making his invention, Richard Mackson is merely following tradition. Kodachrome itself was devised by two gifted amateursLeopold Mannes and Leopold Godowsky. The Even a modern Kodachrome processor is a behemeth. It is 33 metres (100 feet) long, costs \$1m, occupies 1,000 square metres of floor space and needs to be served by as st
Sentence Segmentation Preprocesing Cluster Algorithm Summarization Using HMM Summarization Using NBM
Sentence Segmentation Pre-Processing Result
as a consequence, the num need move at a more two metrics the result is a machine that, in all relevant departments, be by kodak, and their concentration is monitored by compute a film can be processed in under 40 minutes. the result, kodak hopes, will soon be in a highstreet develop fogies should cheer.
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Retrived Sentences 22 Retrived Relevant Sentences Total Relevant Sentences of Input Data Submit   Precision Recall



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Sentence Segmentation Preprocesing	Cluster Algorithm Summari	zation Using HMM	Summarization Using NBM
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result, kodak hopes, soon be highstreet developer yn fogies cheer. suit Anlysis etrived Sentences 17 Retrived Re	elevant Sentences	) these have to be s	wept away quickly enough to allow fresh chemicals to do their w

Figure 6: Document Summary Using NBM

Use of Hidden Markov Model to Enhance the Perfo	ormance of Density Based Document Summarization
OLD fogies often bemoan technological advance. For some audiobuffs the johnnycom transistor will never replace the purity of the valve, nor the compact disc the longplay record. And in photography it is generally agreed that nothing recent has been as got But in a world that prizes immediacy (another thing that fogies despise) Kodachrome Now, though, the Kodachrome process has been revamped into something that corn In making his invention, Richard Mackson is merely following tradition. Kodachrome et Even a modern Kodachrome processor is a behemoth. It is 33 metres (100 feet) long,	elately ing xd a colour film as Kodachromewhich turns 62 this year. The thinner gel, tighter grain has a problem: it is a nightmare to develop. Bringing out those perfect images require ershop developers can afford. And, since many old fogies also believe that a gitted am- tself was devised by two gifted amateursLeopold Mannes and Leopold Godowsky. The costs \$1m, occupies 1,000 square metres of floor space and needs to be served by a st
Sentence Segmentation Preprocesing Cluster Algorithm Summariza	tion Using HMM Summarization Using NBM
Sentence Segmentation	Pre-Processing Result
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kodak, their concentration is monitored computer) fit 60squaremetre room. film be processed 40 minutes. result, kodak hopes, soon be highstreet developer you. fogies cheer.	but in a world that prizes immediacy (another thing that fogies despise) kodachron most people have to send the stuff away by post and will probably not see the resu the main problem he had to overcome was the build up of waste products from th not surprisingly, many prefer to use a lesser film that the local chemist can develop these have to be swept away quickly enough to allow fresh chemicals to do their w
Result Anlysis	
Retrived Sentences 22 Retrived Relevant Sentences 16	Total Relevant Sentences of Input Data 21 Submit
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Use of Hidden Markov Model to Enhance the Performance of Density Based Document Summarization



Figure 9: Recall of HMM vs NBM Twenty five input Documents

## 4. CONCLUSION

This paper presents how Hidden Markov Model can be used to enhance the performance of density based document summarization. In the various dimensions the document summarization methods are improved. These implemented method is applied on the document from various domains. The focus of research work is to reduce the information overload at the time of information retrieval. It is especially in the field where large amount of information like World Wide Web, hospital information and biomedical articles is used. Compared with different document summarization technique available and their evaluations compared with human summarization are still not satisfactory. Most document summarization is extractive and while human summarization is mostly abstractive that needs NLP to construct sentences.. This is one of the major issues in abstractive document summarization. This issue will be tackled in the future work. This research work could be integrated in systems like [7,9] and have scope of enhancement

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57

#### Supriya Anandrao Salunkhe and Mrunal Bewoor

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