Mini Project Final Report
On
"TransSummarize: Leveraging NLP for Transcription and Summarization"

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PROJECT COMPLETION CERTIFICATE

This is to certify that the below mentioned students of Sikkim Manipal Institute of Technology have worked under my supervision and guidance and successfully completed the Mini project entitled **"TransSummarize: Leveraging NLP for Transcription and Summarization"**.

Registration No	Name of Student	Course
202000004	**Hari Om**	**B.Tech (IT)**
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PROJECT REVIEW CERTIFICATE

This is to certify that the work recorded in this project report entitled **"TransSummarize: Leveraging NLP for Transcription and Summarization"** has been jointly carried out by **Hari Om(202000004), Sushma Oinam(202000048) and Aryan Raj Pradhan(202000012)** of Information Technology Department of Sikkim Manipal Institute of Technology in partial fulfillment of the requirements for the award of Bachelor of Technology in Information Technology. This report has been duly reviewed by the undersigned and recommended for final submission for Mini Project Final Presentation.

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DECLARATION

We, the undersigned, hereby declare that the work recorded in this project report entitled "**TransSummarize: Leveraging NLP for Transcription and Summarization**" in partial fulfillment for the requirements of award of B. Tech (IT) from Sikkim Manipal Institute of Technology is a faithful and bonafide project work carried out at "**SIKKIM MANIPAL INSTITUTE OF TECHNOLOGY**" under the supervision and guidance of **Dr. Saumya Das, Assistant Professor**, Department of Information Technology.

Table of Contents

1.Introduction

Natural Language Processing (NLP) is a field of study under Artificial Intelligence and Linguistics, devoted to make computers comprehend and interpret human language.

Speech recognition refers to the capacity of a computer system to recognize and transcribe spoken language into written text, while text summarization will condense lengthy texts into summaries without losing vital information.

The objective of TranSummarize Project is to provide assistance in extracting information from spoken conversations or original audio data,

It will reduce the time and effort that takes in manual documentation.

Sometimes, the main points from a communication in the same language tends to be missed due to accent according to the person.

This project will integrate features for both speech recognition and text summarization.

In small scenarios like seminar where only one person will speak, this feature will be helpful as it can provide summarizing lectures into a document without losing vital information.

2.Literature Review

Author Name , Journal Name, Vol., Year	**Title of the Paper**	**Inference**	**Research Gap**	**Relevance with the present work**
Shaikh Naziya S, R.R.Deshmukh IOSR Journal of Computer Engineering(IOSR-JCE), Volume 18 (July- Aug, 2016) [1]	Speech Recognition System - A Review	• Techniques in Speech Recognition Systems(SRS) • Various SRS modeling techniques are listed. • The different models have their pros and cons.	• Problems about noise, echoes, background noise and how to counter them are not mentioned.	• Vocabulary of HMM is very high - can be used for large amounts of data for speech recognition. • Machine learning techniques for speech recognition.

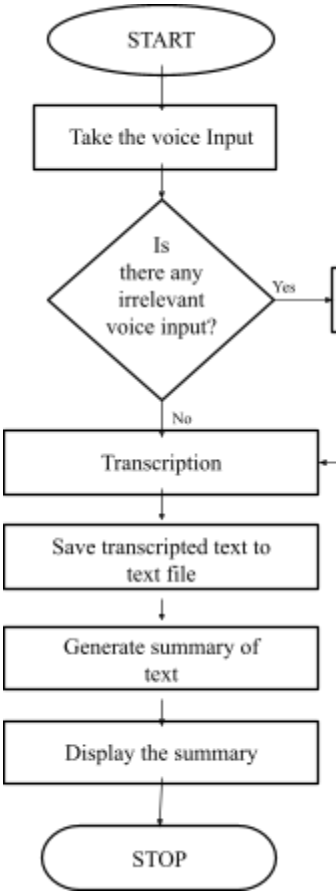
Nenkova A., & McKeown, K. Mining text data, 43-76.(2012) [2]	A survey of text summarization techniques	• Topic Representation extracts topics discussed in the input document. • Indicator representation scores the importance of each sentence which will come in the summary.	• Generation of summary for multiple documents • Complexity of human language	• Provides ideas about how text summarization works.
Kågebäck, M., Mogren, O., Tahmasebi, N., & Dubhashi, D. . Proceedings of the 2nd Workshop on Continuous Vector Space Models and their Compositionality (CVSC) (pp. 31-39). (2014, April)	Extractive summarization using continuous vector space models	• evaluate different compositions for sentence representation on a standard dataset using the ROUGE evaluation measures.	• It returns the exact phrase from the information provided just in shortened form.	• the effects of using phrase embeddings for summarization, and showed that these can significantly improve the performance of the state-of-the-art summariz

				ation method
Gupta, S., & Gupta, S. K. Expert Systems with Applications, 121, 49-65. (2019).	Abstractive summarization: An overview of the state of the art.	• Its approaches are broadly divided into structure based and semantic based. • sentence compression, concept fusion, calculation of path scores and summary generation are few common parts of an abstractive summarization system	• tend to generate false information • Need of quantitative measures	• abstractive summarization systems consist of 3 steps namely pre-processing, inferencing and Natural Language Generation.

3.Problem definition

Currently, there are many speech-to-text tools available, but most of them simply transcribe the speech into text without providing any summary or analysis. This can be time-consuming and inefficient, as the user has to manually read through the entire text to understand the main points.

4.Solution Strategy



- Taking voice input from microphone using Pyaudio

- If irrelevant information generated, it will be removed

-Transcription is done by Speech to Text using Speech-recognition

- Generated transcription is saved in text file using python file-handling

-Based on a trained model, Summary is generated.

-Final summary is displayed.

Figure 1: Flowchart Of Solution Strategy

5.Design

5.1Workflow Diagram

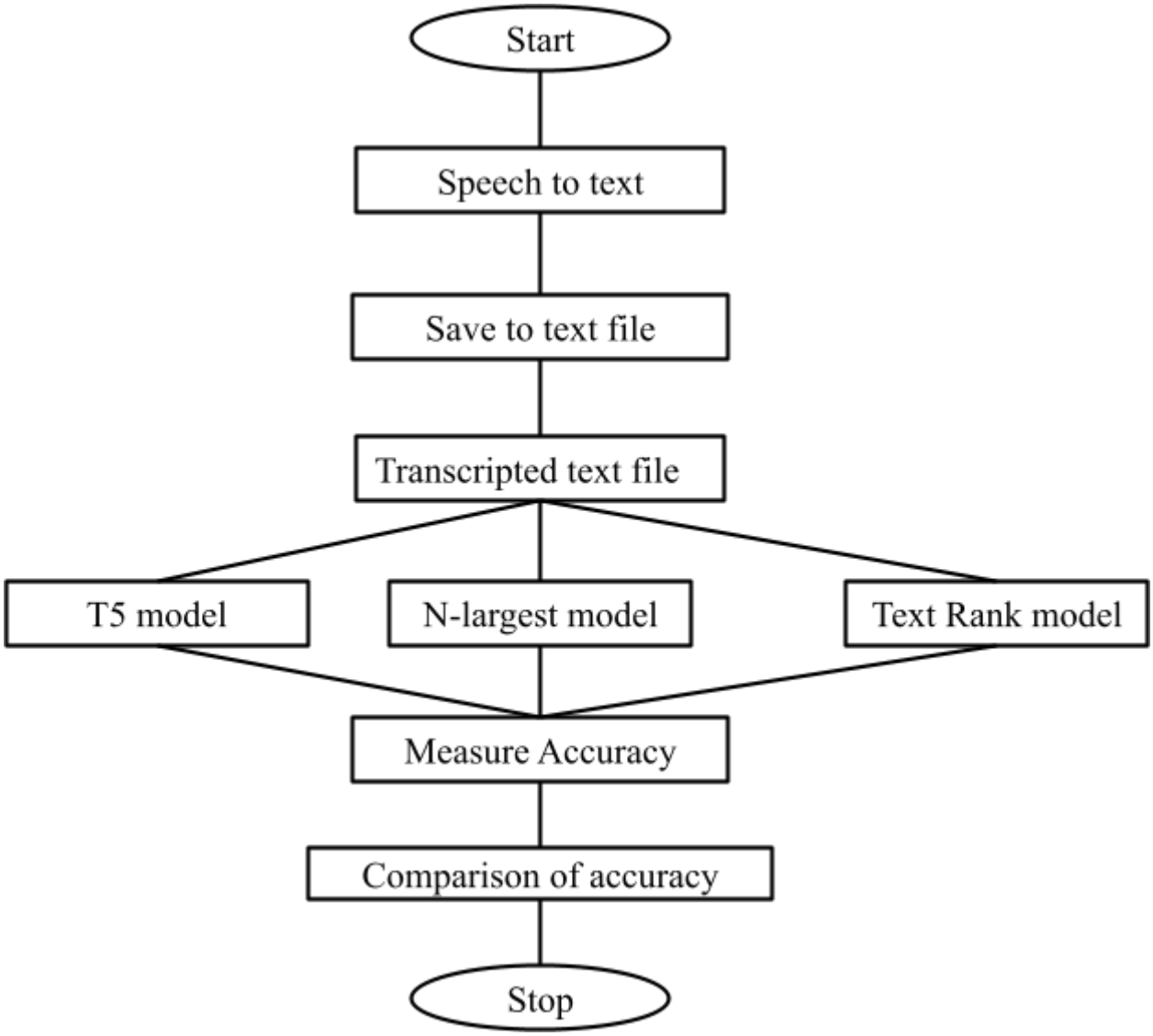


Figure 2: Workflow Diagram

5.2Work Done

Text Summarization

Summarization is a process of going through a corpus and discovering and identifying the important topics, points, or keywords in it and generating a brief paragraph or text that allows us to get the gist of the corpus.

- Short, fluent and accurate summary

Two main Summarization techniques:

- Extractive Text Summarization
    - Extracts original sentences from the corpus directly if they are deemed important or ranked so. i.e subset of the corpus.
    -
- Abstractive Text Summarization
    - Attempts to discover the important topics, points, or keywords and tries to understand their context and generate the summary intelligently. More difficult to implement than extractive text summarization.

1. Extractive Text summary

   Algorithms used: TextRank, nlargest

   Text Rank

   - TextRank is based on the PageRank algorithm used on Google Search

Engine.

- It is a graph-based ranking model.
- It prefers pages with a higher number of pages hitting it.
- Originally the "TextRank" algorithm used the percentage of words appearing among two sentences as the weights of an edge between them.
- The algorithm then creates a graph with sentences as the nodes and overlapped words as the links.

nlargest

- nlargest is a function that finds n number of elements that is the largest or have the largest value for a given key.
- it can be used to find the rank of sentences in the corpus for extractive text summarization.

2. Abstractive text summary

   Algorithms: T5 (Text-To-Text Transfer Transformer)

   - T5 model

   The Text-To-Text Transfer Transformer (T5) is a natural language processing model that utilizes the Transformer architecture. This pre-trained language model is capable of being fine-tuned for various NLP tasks like text classification, question answering, and summarization.

   T5 works by encoding the input text into a vector representation of a fixed length and then decoding that representation into the desired output text. To attend to relevant parts of the input and output sequences, the model uses attention mechanisms within a sequence-to-sequence architecture.

The T5 model is trained on a large dataset of data using a multi-task learning approach, allowing it to learn different NLP tasks at the same time and generalize well to new tasks. The model is trained on input and output sequences using a variant of the transformer architecture called pre-training task. During this process, T5 learns to predict the output sequence from the input sequence.

T5 is highly effective in text summarization tasks, making it a preferred choice for news and content summarization due to its ability to generate coherent and concise summaries from lengthy input text. By fine-tuning the T5 model on specific domains, it can produce high-quality summaries for particular types of content, such as scientific papers or legal documents.

5.3 Flowchart

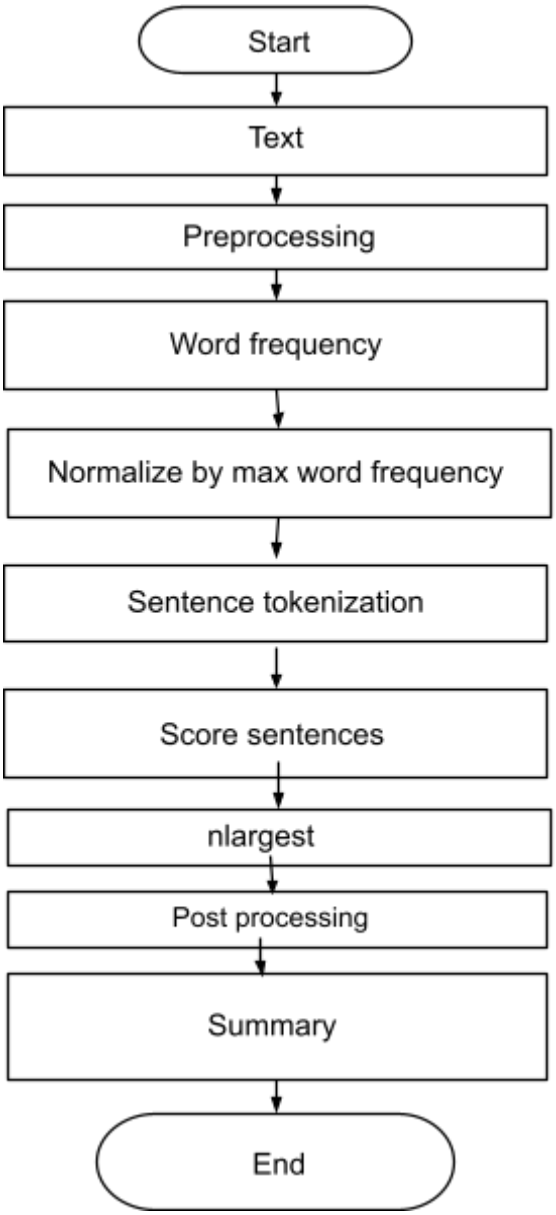


Fig 3: Flowchart for nlargest model

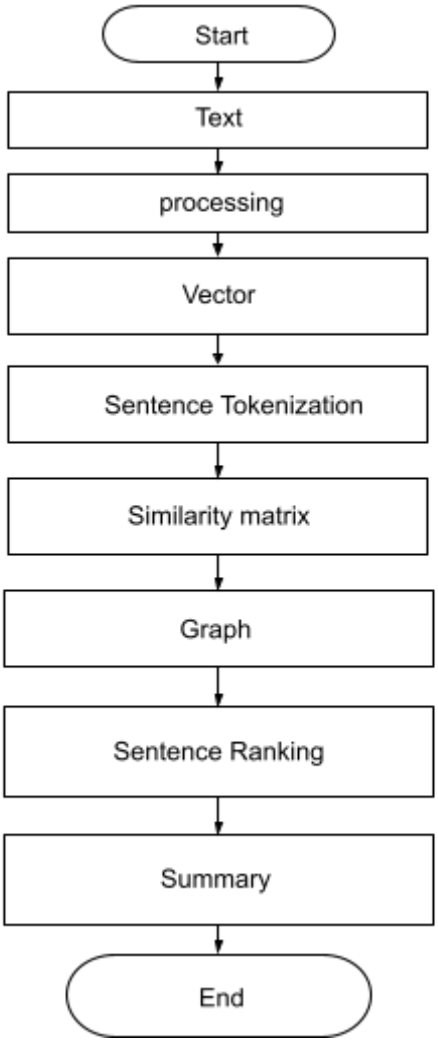


Fig 4: Flowchart for TextRank model

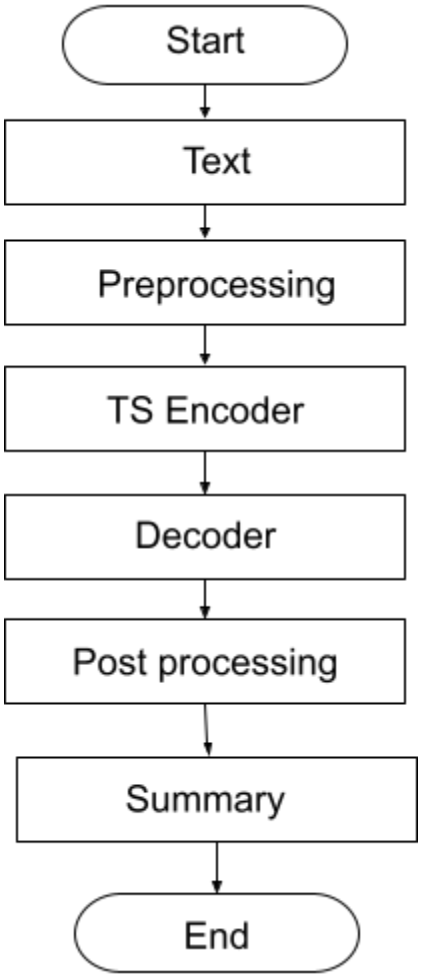


Fig 5:Flowchart for T5 model

5.4 Requirements

Hardware :

- RAM : 16 GB
- Hard Disk : 750 GB SSD
- Processor : Intel i5
- GPU : Nvidia RTX 3050 ti

Software :

- Programming Language : Python 3.10
- Packages : nltk, T5Tokenizer, pyaudio, SpeechRecognition, spacy,rouge, gensim, networkx, nlargest, sumy etc
- Operating System : Windows 11

6. Implementation Details

(CNN) -- The National Football League has indefinitely suspended Atlanta Falcons quarterback Michael Vick without pay, officials with the league said Friday. NFL star Michael Vick is set to appear in court Monday. A judge will have the final say on a plea deal. Earlier, Vick admitted to participating in a dogfighting ring as part of a plea agreement with federal prosecutors in Virginia. "Your admitted conduct was not only illegal, but also cruel and reprehensible. Your team, the NFL, and NFL fans have all been hurt by your actions," NFL Commissioner Roger Goodell said in a letter to Vick. Goodell said he would review the status of the suspension after the legal proceedings are over. In papers filed Friday with a federal court in Virginia, Vick also admitted that he and two co-conspirators killed dogs that did not fight well. Falcons owner Arthur Blank said Vick's admissions describe actions that are "incomprehensible and unacceptable." The suspension makes "a strong statement that conduct which tarnishes the good reputation of the NFL will not be tolerated," he said in a statement. Watch what led to Vick's suspension » . Goodell said the Falcons could "assert any claims or remedies" to recover $22 million of Vick's signing bonus from the 10-year, $130 million contract he signed in 2004, according to The Associated Press. Vick said he would plead guilty to one count of "Conspiracy to Travel in Interstate Commerce in Aid of Unlawful Activities and to Sponsor a Dog in an Animal Fighting Venture" in a plea agreement filed at U.S. District Court in Richmond, Virginia. The charge is punishable by up to five years in prison, a $250,000 fine, "full restitution, a special assessment and 3 years of supervised release," the plea deal said. Federal prosecutors agreed to ask for the low end of the sentencing guidelines. "The defendant will plead guilty because the defendant is in fact guilty of the charged offense," the plea agreement said. In an additional summary of facts, signed by Vick and filed with the agreement, Vick admitted buying pit bulls and the property used for training and fighting the dogs, but the statement said he did not bet on the fights or receive any of the money won. "Most of the 'Bad Newz Kennels' operations and gambling monies were provided by Vick," the official summary of facts said. Gambling wins were generally split among co-conspirators Tony Taylor, Quanis Phillips and sometimes Purnell Peace, it continued. "Vick did not gamble by placing side bets on any of the fights. Vick did not receive any of the proceeds from the purses that were won by 'Bad Newz Kennels.' " Vick also agreed that "collective efforts" by him and two others caused the deaths of at least six dogs. Around April, Vick, Peace and Phillips tested some dogs in fighting sessions at Vick's property in Virginia, the statement said. "Peace, Phillips and Vick agreed to the killing of approximately 6-8 dogs that did not perform well in 'testing' sessions at 1915 Moonlight Road and all of those dogs were killed by various methods, including hanging and drowning. "Vick agrees and stipulates that these dogs all died as a result of the collective efforts of Peace, Phillips and Vick," the summary said. Peace, 35, of Virginia Beach, Virginia; Phillips, 28, of Atlanta, Georgia; and Taylor, 34, of Hampton, Virginia, already have accepted agreements to plead guilty in exchange for reduced sentences. Vick, 27, is scheduled to appear Monday in court, where he is expected to plead guilty before a judge. See a timeline of the case against Vick » . The judge in the case will have the final say over the plea agreement. The federal case against Vick focused on the interstate conspiracy, but Vick's admission that he was involved in the killing of dogs could lead to local charges, according to CNN legal analyst Jeffrey Toobin. "It sometimes happens -- not often -- that the state will follow a federal prosecution by charging its own crimes for exactly the same behavior," Toobin said Friday. "The risk for Vick is, if he makes admissions in his federal guilty plea, the state of Virginia could say, 'Hey, look, you admitted violating Virginia state law as well. We're going to introduce that against you and charge you in our court.' " In the plea deal, Vick agreed to cooperate with investigators and provide all information he may have on any criminal activity and to testify if necessary. Vick also agreed to turn over any documents he has and to submit to polygraph tests. Vick agreed to "make restitution for the full amount of the costs associated" with the dogs that are being held by the government. "Such costs may include, but are not limited to, all costs associated with the care of the dogs involved in that case, including if necessary, the long-term care and/or the humane euthanasia of some or all of those animals." Prosecutors, with the support of animal rights activists, have asked for permission to euthanize the dogs. But the dogs could serve as important evidence in the cases against Vick and his admitted co-conspirators. Judge Henry E. Hudson issued an order Thursday telling the U.S. Marshals Service to "arrest and seize the defendant property, and use discretion and whatever means appropriate to protect and maintain said defendant property." Both the judge's order and Vick's filing refer to "approximately" 53 pit bull dogs. After Vick's indictment last month, Goodell ordered the quarterback not to report to the Falcons training camp, and the league is reviewing the case. Blank told the NFL Network on Monday he could not speculate on Vick's future as a Falcon, at least not until he had seen "a statement of facts" in the case. E-mail to a friend . CNN's Mike Phelan contributed to this report.

Fig 6: Actual text 1

The suspension makes "a strong statement that conduct which tarnishes the good reputation of the NFL will not be tolerated," he said in a statement.Goodell said the Falcons could "assert any claims or remedies" to recover $22 million of Vick's signing bonus from the 10-year, $130 million contract he signed in 2004, according to The Associated Press.Vick said he would plead guilty to one count of "Conspiracy to Travel in Interstate Commerce in Aid of Unlawful Activities and to Sponsor a Dog in an Animal Fighting Venture" in a plea agreement filed at U.S. District Court in Richmond, Virginia.The charge is punishable by up to five years in prison, a $250,000 fine, "full restitution, a special assessment and 3 years of supervised release," the plea deal said."The defendant will plead guilty because the defendant is in fact guilty of the charged offense," the plea agreement said.In an additional summary of facts, signed by Vick and filed with the agreement, Vick admitted buying pit bulls and the property used for training and fighting the dogs, but the statement said he did not bet on the fights or receive any of the money won."Peace, Phillips and Vick agreed to the killing of approximately 6-8 dogs that did not perform well in 'testing' sessions at 1915 Moonlight Road and all of those dogs were killed by various methods, including hanging and drowning."Vick agrees and stipulates that these dogs all died as a result of the collective efforts of Peace, Phillips and Vick," the summary said.The judge in the case will have the final say over the plea agreement.The federal case against Vick focused on the interstate conspiracy, but Vick's admission that he was involved in the killing of dogs could lead to local charges, according to CNN legal analyst Jeffrey Toobin.Vick agreed to "make restitution for the full amount of the costs associated" with the dogs that are being held by the government."Such costs may include, but are not limited to, all costs associated with the care of the dogs involved in that case, including if necessary, the long-term care and/or the humane euthanasia of some or all of those animals."After Vick's indictment last month, Goodell ordered the quarterback not to report to the Falcons training camp, and the league is reviewing the case.Blank told the NFL Network on Monday he could not speculate on Vick's future as a Falcon, at least not until he had seen "a statement of facts" in the case.

Fig 7:Extractive summary 1

"NEW: NFL chief, Atlanta Falcons owner critical of Michael Vick's conduct .
NFL suspends Falcons quarterback indefinitely without pay .
Vick admits funding dogfighting operation but says he did not gamble .
Vick due in federal court Monday; future in NFL remains uncertain ."

Fig 8: Abstractive summary 1

" Vick also agreed that "collective efforts" by him and two others caused the deaths of at least six dogs."Such costs may include, but are not limited to, all costs associated with the care of the dogs involved in that case, including if necessary, the long-term care and/or the humane euthanasia of some or all of those animals."Both the judge's order and Vick's filing refer to "approximately" 53 pit bull dogs"The defendant will plead guilty because the defendant is in fact guilty of the charged offense," the plea agreement said.Vick said he would plead guilty to one count of "Conspiracy to Travel in Interstate Commerce in Aid of Unlawful Activities and to Sponsor a Dog in an Animal Fighting Venture" in a plea agreement filed at U.S. District Court in Richmond, Virginia.Blank told the NFL Network on Monday he could not speculate on Vick's future as a Falcon, at least not until he had seen "a statement of facts" in the case. Goodell said the Falcons could "assert any claims or remedies" to recover $22 million of Vick's signing bonus from the 10-year, $130 million contract he signed in 2004, according to The Associated Press."Peace, Phillips and Vick agreed to the killing of approximately 6-8 dogs that did not perform well in 'testing' sessions at 1915 Moonlight Road and all of those dogs were killed by various methods, including hanging and drowning.Judge Henry E. Hudson issued an order Thursday telling the U.S. Marshals Service to "arrest and seize the defendant property, and use discretion and whatever means appropriate to protect and maintain said defendant property."Vick agreed to "make restitution for the full amount of the costs associated" with the dogs that are being held by the government.The charge is punishable by up to five years in prison, a $250,000 fine, "full restitution, a special assessment and 3 years of supervised release," the plea deal said."Most of the 'Bad Newz Kennels' operations and gambling monies were provided by Vick," the official summary of facts said.The suspension makes "a strong statement that conduct which tarnishes the good reputation of the NFL will not be tolerated," he said in a statement. "Vick agrees and stipulates that these dogs all died as a result of the collective efforts of Peace, Phillips and Vick," the summary said

Fig 9: Output generated from Nlargest model

In an additional summary of facts, signed by Vick and filed with the agreement, Vick admitted buying pit bulls and the property used for training and fighting the dogs, but the statement said he did not bet on the fights or receive any of the money won. The federal case against Vick focused on the interstate conspiracy, but Vick's admission that he was involved in the killing of dogs could lead to local charges, according to CNN legal analyst Jeffrey Toobin. Vick agreed to "make restitution for the full amount of the costs associated" with the dogs that are being held by the government. Blank told the NFL Network on Monday he could not speculate on Vick's future as a Falcon, at least not until he had seen "a statement of facts" in the case. "It sometimes happens -- not often -- that the state will follow a federal prosecution by charging its own crimes for exactly the same behavior," Toobin said Friday. Vick said he would plead guilty to one count of "Conspiracy to Travel in Interstate Commerce in Aid of Unlawful Activities and to Sponsor a Dog in an Animal Fighting Venture" in a plea agreement filed at U.S. District Court in Richmond, Virginia. But the dogs could serve as important evidence in the cases against Vick and his admitted co-conspirators. Your team, the NFL, and NFL fans have all been hurt by your actions," NFL Commissioner Roger Goodell said in a letter to Vick. After Vick's indictment last month, Goodell ordered the quarterback not to report to the Falcons training camp, and the league is reviewing the case. " In the plea deal, Vick agreed to cooperate with investigators and provide all information he may have on any criminal activity and to testify if necessary. "Vick agrees and stipulates that these dogs all died as a result of the collective efforts of Peace, Phillips and Vick," the summary said. The judge in the case will have the final say over the plea agreement. The suspension makes "a strong statement that conduct which tarnishes the good reputation of the NFL will not be tolerated," he said in a statement. In papers filed Friday with a federal court in Virginia, Vick also admitted that he and two co-conspirators killed dogs that did not fight well.

Fig 10: Output generated from TextRank model

new: "your team, the NFL, and NFL fans have all been hurt by your actions," nfl says. "conduct which tarnishes the good reputation of the football will not be tolerated," owner says. ap: 'vick did not gamble by placing side bets on any fights.' he will plead guilty to conspiracy to travel in interstate commerce in aid of unlawful activities.

Fig 11: Output generated from T5 model

Once upon a time, in a small village nestled in the hills, there was a young girl named Lily. She lived with her parents and spent most of her time playing in the fields and forests surrounding their home. One day, while exploring a nearby creek, Lily stumbled upon a small, injured bird. She took the bird back to her home and cared for it until it was able to fly again. From that day on, Lily became known as the village's protector of injured animals, and she spent much of her time nursing them back to health.

Fig 12:Text 2

Once upon a time, in a small village nestled in the hills, there was a young girl named Lily.From that day on, Lily became known as the village's protector of injured animals, and she spent much of her time nursing them back to health.

Fig 13:Extractive summary 2

Lily is a young girl who lives in a small village in the hills. She becomes known as the protector of injured animals after caring for a small, injured bird she found while exploring a nearby creek.

Fig 14:Abstractive summary 2

Global warming refers to the long-term rise in the Earth's average surface temperature, primarily due to the increasing concentrations of greenhouse gases in the atmosphere. These gases trap heat from the sun that would otherwise escape back into space, leading to a gradual warming of the planet. The most important greenhouse gas is carbon dioxide, which is released into the atmosphere through the burning of fossil fuels like coal, oil, and gas. Other human activities, such as deforestation and agriculture, also contribute to greenhouse gas emissions. Global warming has a number of negative impacts on the environment and human societies. These include rising sea levels, more frequent and intense heat waves, droughts, wildfires, and hurricanes, and the spread of diseases like malaria and dengue fever. These impacts are not evenly distributed, with poorer countries and communities often bearing the brunt of the damage.

From that day on, Lily became known as the village's protector of injured animals, and she spent much of her time nursing them back to health.Once upon a time, in a small village nestled in the hills, there was a young girl named Lily.One day, while exploring a nearby creek, Lily stumbled upon a small, injured bird.

Fig 15: Output generated from Nlargest model

From that day on, Lily became known as the village's protector of injured animals, and she spent much of her time nursing them back to health. She lived with her parents and spent most of her time playing in the fields and forests surrounding their home.

Fig 16: Output generated from TextRank model

a small village girl named Lily cared for injured animals in the hills. she took the bird back to her home and nursed it until it was able to fly again.

Fig 17:Output generated from T5 model

Global warming refers to the long-term rise in the Earth's average surface temperature, primarily due to the increasing concentrations of greenhouse gases in the atmosphere.The most important greenhouse gas is carbon dioxide, which is released into the atmosphere through the burning of fossil fuels like coal, oil, and gas.These include rising sea levels, more frequent and intense heat waves, droughts, wildfires, and hurricanes, and the spread of diseases like malaria and dengue fever.

Fig 18: Text 3

Global warming is the long-term rise in the Earth's average surface temperature due to increasing concentrations of greenhouse gases in the atmosphere. The most important greenhouse gas is carbon dioxide, which is released into the atmosphere through human activities like burning fossil fuels. This has negative impacts on the environment and human societies, including rising sea levels and more frequent and intense natural disasters.

Fig 19:Extractive summary 3

Global warming refers to the long-term rise in the Earth's average surface temperature, primarily due to the increasing concentrations of greenhouse gases in the atmosphere.The most important greenhouse gas is carbon dioxide, which is released into the atmosphere through the burning of fossil fuels like coal, oil, and gas.These include rising sea levels, more frequent and intense heat waves, droughts, wildfires, and hurricanes, and the spread of diseases like malaria and dengue fever.These gases trap heat from the sun that would otherwise escape back into space, leading to a gradual warming of the planet.

Fig 20:Abstractive summary 3

Global warming refers to the long-term rise in the Earth's average surface temperature, primarily due to the increasing concentrations of greenhouse gases in the atmosphere. Global warming has a number of negative impacts on the environment and human societies. The most important greenhouse gas is carbon dioxide, which is released into the atmosphere through the burning of fossil fuels like coal, oil, and gas.

Fig 21: Output generated from Nlargest model

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the most important greenhouse gas is carbon dioxide, which is released into the atmosphere. other human activities, such as deforestation and agriculture, also contribute to greenhouse
gases, says scott wilson, a u.s. climate scientist and author of the book, "global warming" the impact of global warming is not evenly distributed, with poorer countries and communities
bearing the brunt.
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Fig 22: Output generated from TextRank model

Fig 23:T5 vs original summary

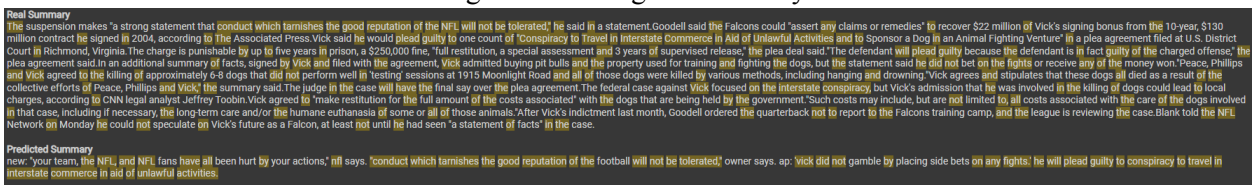


Fig 24:T5 vs extractive summary

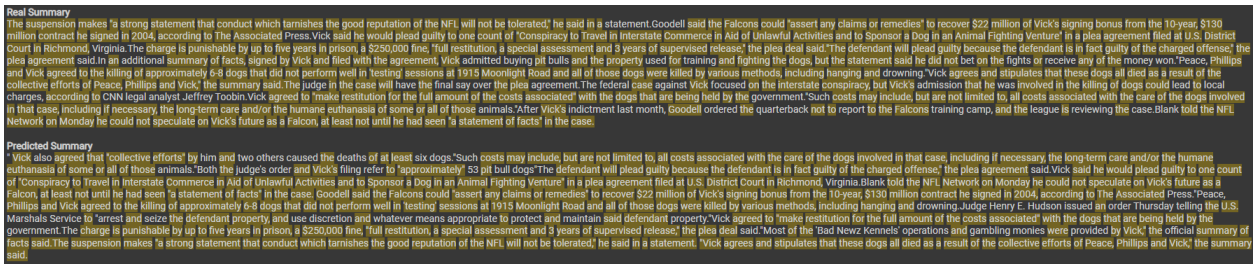


Fig 25:Nlargest vs original summary

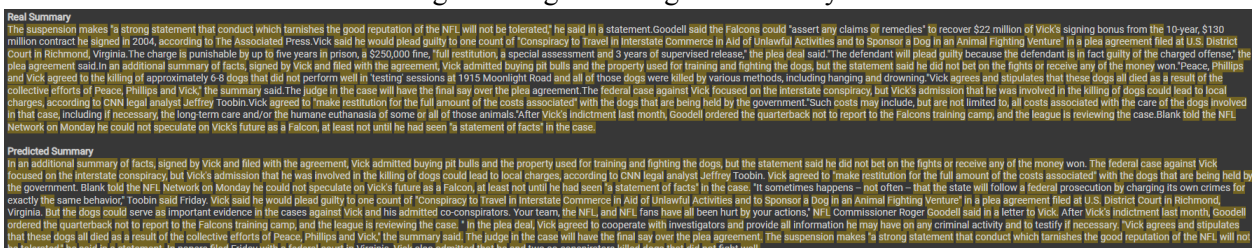


Fig 26:TextRank vs original

6.1 Evaluation

For evaluation of text summarization models, there are some evaluation metrics which are used in the project:

1. ROUGE:

   Rouge(Recall-Oriented Understudy for Gisting Evaluation) evaluation metrics

   is based on the idea that a good summary should include the important content of the original text.

   It works by comparing the computer-generated summary to a set of

human-generated summaries and checking how much they have in common. The more they have in common, the higher the Rouge score will be.

- Rouge-N -> N-gram
- Rouge-N precision -> ratio of the number of n-gram in candidate that appear also in reference
- Rouge-N recall -> ratio of the number of n-gram in reference that appear also in candidate
- Rouge-L -> Longest common subsequent (LCS): the longest sequence of words that not necessarily consecutive, but still in order.
- Rouge-L precision -> ratio of the length of the LCS, over the number of unigrams in candidate
- Rouge-L recall -> ratio of the length of the LCS, over the number of unigrams in reference
- Rouge-N F1= 2*((precision * recall)/(precision +recall))

2. BLEU:

   The BLEU(Bilingual Evaluation Understudy) metric calculates the similarity between the machine-translated text and the reference translations using a modified form of n-gram precision, where n-grams are sequences of n contiguous words. The idea is that a good machine translation should contain n-grams that are present in the reference translations.

   BLEU calculates the precision of n-grams (contiguous sequences of n words) in the machine-translated text that also appear in the reference translations. It then averages the precision scores across all n-gram lengths using a weighted geometric mean and penalizes the machine-translated text for generating rare or unknown words not present in the reference

translations. The resulting BLEU score ranges from 0 to 1, with higher scores indicating better machine translations.

- Number of words in the candidate translation in the reference translations divided by the number of words candidate
- Brevity Penalty (BP)
- BLEU-N -> n-grams
- BLEU = BP * BLEU

Avg Rouge scores

ID	set	nLargest(Avg)	TextRank(Avg)	T5(Avg)
0	d	0.6566666667	0.8533333333	0.08666666667
1	d	0.7466666667	0.8433333333	0.3133333333
2	d	0.65	0.8166666667	0.2633333333
3	d	0.52	0.6233333333	0.21
4	d	0.7733333333	0.7066666667	0.1533333333
5	d	0.6333333333	0.78	0.1933333333
10	d	0.5266666667	0.7333333333	0.3166666667
100	d	0.5466666667	0.6566666667	0.31
293	d	0.74	1	0.1266666667
951	d	0.58	0.8533333333	0.1733333333
1000	d	0.8166666667	0.8933333333	0.25
1247	d	0.7766666667	0.76	0.04
1266	d	0.7266666667	0.77	0.1533333333
2485	d	0.7733333333	0.7466666667	0.3566666667
8843	d	0.7166666667	0.7233333333	0.17
9838	d	0.4133333333	0.3966666667	0.4766666667
9998	d	0.6033333333	0.6366666667	0.1066666667
0	e	0.8333333333	0.59	0.25
1	e	0.8833333333	0.6533333333	0.3
2	e	0.5433333333	0.7333333333	0.4166666667
3	e	0.6066666667	0.7466666667	0.21
4	e	0.89	0.7233333333	0.2933333333

5	e	0.89	0.7233333333	0.2933333333
6	e	0.58	0.6833333333	0.43
7	e	0.7533333333	0.7266666667	0.4066666667
8	e	1	0.6633333333	0.4666666667
9	e	0.6366666667	0.4966666667	0.3833333333
10	e	1	0.7466666667	0.2866666667

Rouge (1,2,L)

ID	set	nLargest r1	nLargest r2	nLargest rL	TextRank r1	TextRank r2	TextRank rL	T5 r1	T5 r2	T5 rL
0	d	0.68	0.62	0.67	0.87	0.82	0.87	0.13	0.00	0.13
1	d	0.77	0.70	0.77	0.86	0.81	0.86	0.37	0.20	0.37
2	d	0.67	0.61	0.67	0.84	0.78	0.83	0.35	0.14	0.30
3	d	0.56	0.44	0.56	0.66	0.55	0.66	0.26	0.11	0.26
4	d	0.79	0.74	0.79	0.73	0.66	0.73	0.21	0.04	0.21
5	d	0.67	0.56	0.67	0.80	0.74	0.80	0.23	0.12	0.23
10	d	0.57	0.45	0.56	0.76	0.69	0.75	0.39	0.20	0.36
100	d	0.58	0.48	0.58	0.69	0.60	0.68	0.41	0.14	0.38
293	d	0.76	0.70	0.76	1.00	1.00	1.00	0.19	0.00	0.19
951	d	0.61	0.53	0.60	0.87	0.82	0.87	0.24	0.09	0.19
1000	d	0.84	0.77	0.84	0.91	0.86	0.91	0.29	0.17	0.29
1247	d	0.79	0.76	0.78	0.77	0.74	0.77	0.06	0.00	0.06
1266	d	0.75	0.68	0.75	0.80	0.73	0.78	0.18	0.10	0.18
2485	d	0.78	0.76	0.78	0.76	0.72	0.76	0.41	0.25	0.41
8843	d	0.76	0.63	0.76	0.74	0.69	0.74	0.29	0.04	0.18
9838	d	0.48	0.32	0.44	0.45	0.32	0.42	0.57	0.33	0.53
9998	d	0.63	0.55	0.63	0.66	0.59	0.66	0.17	0.00	0.15
0	e	0.85	0.80	0.85	0.62	0.53	0.62	0.31	0.13	0.31
1	e	0.90	0.85	0.90	0.68	0.60	0.68	0.44	0.15	0.31
2	e	0.59	0.49	0.55	0.76	0.68	0.76	0.51	0.23	0.51
3	e	0.63	0.56	0.63	0.78	0.70	0.76	0.28	0.09	0.26
4	e	0.90	0.87	0.90	0.74	0.69	0.74	0.34	0.22	0.32

5	e	0.90	0.87	0.90	0.74	0.69	0.74	0.34	0.22	0.32
6	e	0.60	0.54	0.60	0.69	0.67	0.69	0.50	0.31	0.48
7	e	0.77	0.73	0.76	0.76	0.68	0.74	0.50	0.27	0.45
8	e	1.00	1.00	1.00	0.69	0.61	0.69	0.54	0.35	0.51
9	e	0.67	0.58	0.66	0.57	0.40	0.52	0.47	0.21	0.47
10	e	1.00	1.00	1.00	0.75	0.74	0.75	0.40	0.09	0.37

BLEU-4

ID	set	N-Largest BLEU-4	TextRank BLEU-4	T5 BLEU-4
0	d	0.6184805269	0.855381283	0.869507054
1	d	0.7649843834	0.8299640116	0.8384292024
2	d	0.6663214031	0.8670924075	0.8767762477
3	d	0.5192685876	0.6651227603	0.7541420703
4	d	0.8414128375	0.7752878566	0.8263142878
5	d	0.7282953598	0.8716458973	0.8280796786
10	d	0.5967403931	0.8301211742	0.9048667022
100	d	0.7092808728	0.7437637338	0.7390356441
293	d	0.9903375348	1	0.7286368408
951	d	0.607457306	0.8705910192	0.7824952116
1000	d	0.6814526804	0.9118765894	0.8546263528
1247	d	0.8627193177	0.8081610394	0.8170300634
1266	d	0.8562705998	0.8810831609	0.7956252112
2485	d	0.7946458915	0.7368360967	0.8350754075
8843	d	0.6532562465	0.7895421739	0.8671354412
9838	d	0.7281450078	0.6641679359	0.5546799645
9998	d	0.6144513819	0.7831763268	0.8207998462
0	e	0.7308490158	0.7846086573	0.6062937958
1	e	0.8405735838	0.7433563123	0.7766086084
2	e	0.6304547294	0.8040699385	0.7447427416
3	e	0.8737259927	0.9424095164	0.4004374959

4	e	0.816066298	0.9013999146	0.5917364665
5	e	0.816066298	0.9013999146	0.5917364665
6	e	0.6977085648	0.8572063569	0.6106653409
7	e	0.8585486748	0.6633187819	0.3728716684
8	e	1	0.7127165725	0.9044579637
9	e	0.6303047117	0.8097630544	0.6763036061
10	e	1	0.8524914313	0.2373076081

N-Largest BLEU

ID	set	BLEU-4	BLEU-1	BLEU-2	BLEU-3	2-gram Ind	3-gram Ind	4-gram Ind	2-gram	3-gram	4-gram
0	d	0.62	0.72	0.69	0.65	0.66	0.58	0.53	0.65	0.52	0.38
1	d	0.76	0.84	0.82	0.79	0.79	0.73	0.70	0.78	0.67	0.55
2	d	0.67	0.75	0.72	0.69	0.70	0.63	0.59	0.69	0.58	0.45
3	d	0.52	0.68	0.63	0.57	0.59	0.46	0.40	0.58	0.39	0.23
4	d	0.84	0.92	0.90	0.87	0.87	0.81	0.77	0.85	0.73	0.60
5	d	0.73	0.83	0.80	0.76	0.77	0.69	0.64	0.75	0.61	0.46
10	d	0.60	0.74	0.70	0.64	0.66	0.55	0.48	0.65	0.48	0.30
100	d	0.71	0.87	0.82	0.76	0.77	0.65	0.58	0.76	0.55	0.35
293	d	0.99	1.00	1.00	0.99	0.99	0.99	0.98	0.99	0.98	0.96
951	d	0.61	0.71	0.68	0.64	0.66	0.57	0.51	0.65	0.52	0.37
1000	d	0.68	0.70	0.70	0.69	0.69	0.67	0.66	0.69	0.66	0.62
1247	d	0.86	0.96	0.93	0.89	0.89	0.82	0.79	0.86	0.70	0.55
1266	d	0.86	0.96	0.92	0.89	0.89	0.82	0.77	0.85	0.70	0.54
2485	d	0.79	0.86	0.84	0.81	0.81	0.77	0.74	0.80	0.70	0.59
8843	d	0.65	0.71	0.69	0.67	0.67	0.63	0.61	0.66	0.57	0.48
9838	d	0.73	0.96	0.88	0.80	0.82	0.65	0.55	0.78	0.51	0.28
9998	d	0.61	0.70	0.68	0.64	0.65	0.59	0.53	0.64	0.53	0.40
0	e	0.73	0.72	0.73	0.73	0.75	0.74	0.72	0.54	0.40	0.29
1	e	0.84	0.77	0.81	0.83	0.84	0.88	0.88	0.65	0.57	0.50
2	e	0.63	0.65	0.66	0.65	0.67	0.63	0.58	0.43	0.27	0.16

3	e	0.87	0.92	0.89	0.88	0.87	0.86	0.85	0.80	0.69	0.58
4	e	0.82	0.82	0.83	0.82	0.83	0.81	0.80	0.68	0.55	0.44
5	e	0.82	0.82	0.83	0.82	0.83	0.81	0.80	0.68	0.55	0.44
6	e	0.70	0.71	0.72	0.71	0.74	0.70	0.65	0.52	0.36	0.24
7	e	0.86	0.93	0.90	0.88	0.87	0.83	0.80	0.83	0.70	0.57
8	e	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	e	0.63	0.59	0.62	0.63	0.66	0.64	0.63	0.39	0.25	0.16
10	e	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TextRank BLEU

ID	set	BLEU-4	BLEU-1	BLEU-2	BLEU-3	2-gram Ind	3-gram Ind	4-gram Ind	2-gram	3-gram	4-gram
0	d	0.86	0.93	0.90	0.87	0.87	0.83	0.80	0.85	0.75	0.63
1	d	0.83	0.89	0.87	0.85	0.85	0.80	0.78	0.84	0.76	0.66
2	d	0.87	0.96	0.93	0.89	0.89	0.83	0.80	0.87	0.73	0.59
3	d	0.67	0.82	0.77	0.71	0.72	0.61	0.55	0.72	0.54	0.36
4	d	0.78	0.89	0.85	0.81	0.82	0.73	0.67	0.81	0.66	0.50
5	d	0.87	0.96	0.93	0.90	0.90	0.84	0.80	0.87	0.74	0.59
10	d	0.83	0.95	0.91	0.86	0.87	0.78	0.74	0.82	0.64	0.47
100	d	0.74	0.89	0.83	0.78	0.79	0.69	0.64	0.78	0.60	0.43
293	d	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
951	d	0.87	0.93	0.91	0.89	0.89	0.85	0.82	0.88	0.80	0.70
1000	d	0.91	0.97	0.94	0.92	0.92	0.89	0.87	0.90	0.82	0.73
1247	d	0.81	0.87	0.85	0.83	0.83	0.78	0.75	0.83	0.73	0.63
1266	d	0.88	0.97	0.94	0.91	0.91	0.84	0.81	0.90	0.78	0.64
2485	d	0.74	0.83	0.79	0.76	0.76	0.70	0.67	0.75	0.62	0.50
8843	d	0.79	0.91	0.87	0.82	0.83	0.74	0.70	0.82	0.66	0.50
9838	d	0.66	0.86	0.80	0.72	0.75	0.59	0.51	0.64	0.38	0.19
9998	d	0.78	0.92	0.88	0.83	0.84	0.74	0.66	0.82	0.65	0.45
0	e	0.78	0.98	0.90	0.83	0.84	0.71	0.66	0.82	0.58	0.38
1	e	0.74	0.89	0.84	0.79	0.79	0.69	0.63	0.70	0.49	0.31

2	e	0.80	0.94	0.89	0.84	0.85	0.75	0.70	0.81	0.62	0.45
3	e	0.94	1.00	0.98	0.96	0.95	0.92	0.90	0.95	0.88	0.79
4	e	0.90	0.93	0.92	0.91	0.91	0.89	0.87	0.90	0.85	0.79
5	e	0.90	0.93	0.92	0.91	0.91	0.89	0.87	0.90	0.85	0.79
6	e	0.86	0.96	0.93	0.89	0.90	0.81	0.78	0.87	0.72	0.56
7	e	0.66	0.73	0.71	0.69	0.69	0.64	0.60	0.67	0.58	0.47
8	e	0.71	0.82	0.78	0.74	0.75	0.67	0.63	0.73	0.58	0.44
9	e	0.81	0.97	0.92	0.85	0.86	0.74	0.69	0.84	0.62	0.43
10	e	0.85	0.92	0.90	0.87	0.88	0.83	0.79	0.87	0.79	0.67

T5 BLEU

ID	set	BLEU-4	BLEU-1	BLEU-2	BLEU-3	2-gram Ind	3-gram Ind	4-gram Ind	2-gram	3-gram	4-gram
0	d	0.87	0.99	0.96	0.92	0.94	0.84	0.73	0.93	0.78	0.57
1	d	0.84	0.99	0.97	0.91	0.94	0.80	0.66	0.94	0.75	0.49
2	d	0.88	1.00	0.97	0.93	0.95	0.83	0.75	0.95	0.79	0.59
3	d	0.75	0.99	0.95	0.85	0.91	0.68	0.53	0.90	0.61	0.32
4	d	0.83	1.00	0.97	0.91	0.95	0.78	0.63	0.95	0.74	0.47
5	d	0.83	0.99	0.97	0.90	0.95	0.79	0.64	0.94	0.74	0.47
10	d	0.90	1.00	0.98	0.95	0.97	0.89	0.78	0.97	0.86	0.67
100	d	0.74	0.84	0.83	0.78	0.81	0.71	0.62	0.81	0.68	0.51
293	d	0.73	0.97	0.88	0.80	0.80	0.65	0.56	0.78	0.50	0.28
951	d	0.78	0.93	0.92	0.86	0.91	0.75	0.60	0.91	0.73	0.47
1000	d	0.85	1.00	0.97	0.91	0.94	0.82	0.70	0.93	0.77	0.53
1247	d	0.82	1.00	0.97	0.90	0.94	0.78	0.61	0.94	0.73	0.45
1266	d	0.80	1.00	0.97	0.89	0.93	0.75	0.57	0.93	0.70	0.40
2485	d	0.84	1.00	0.97	0.91	0.93	0.80	0.65	0.93	0.74	0.49
8843	d	0.87	1.00	0.97	0.92	0.94	0.83	0.72	0.94	0.79	0.57
9838	d	0.55	0.62	0.61	0.58	0.60	0.52	0.48	0.60	0.51	0.39
9998	d	0.82	0.99	0.96	0.90	0.92	0.78	0.63	0.91	0.72	0.45
0	e	0.61	0.79	0.74	0.67	0.69	0.56	0.45	0.54	0.30	0.14

1	e	0.78	0.99	0.94	0.85	0.89	0.71	0.58	0.88	0.62	0.36
2	e	0.74	0.99	0.91	0.82	0.84	0.67	0.55	0.83	0.56	0.31
3	e	0.40	0.45	0.43	0.41	0.42	0.37	0.37	0.41	0.33	0.26
4	e	0.59	0.84	0.76	0.67	0.69	0.52	0.40	0.66	0.39	0.18
5	e	0.59	0.84	0.76	0.67	0.69	0.52	0.40	0.66	0.39	0.18
6	e	0.61	0.68	0.67	0.64	0.66	0.59	0.53	0.65	0.56	0.44
7	e	0.37	0.45	0.43	0.40	0.41	0.35	0.30	0.41	0.32	0.22
8	e	0.90	1.00	0.97	0.94	0.94	0.88	0.81	0.94	0.82	0.67
9	e	0.68	0.77	0.75	0.71	0.72	0.64	0.59	0.71	0.58	0.44
10	e	0.24	0.29	0.28	0.26	0.27	0.22	0.18	0.27	0.20	0.12

7.Conclusion

In this project, it aimed to use speech recognition and text summarization using machine learning techniques. Through experimentation and evaluation, we are able to convert speech to text and summarise the text using various models.

- Goggle API has been found to be successful for using to convert the voice input into text in a short time for the project which completes the Speech Recognition part.
- For shortening the large information obtained from voice input into digestible summaries, various models for both extractive and abstractive methods has been experimented with.
- TextRank and Nlargest models are used for extractive summaries.
- To allow greater flexibility in the summaries we could obtain, T5 model for abstractive method has also been used.
- Since the effectiveness of the summaries obtained is important, two evaluation metrics under NLP is used in the project.
- ROUGE and BLEU evaluation metrics are used to assess the performance of

these summarization models.

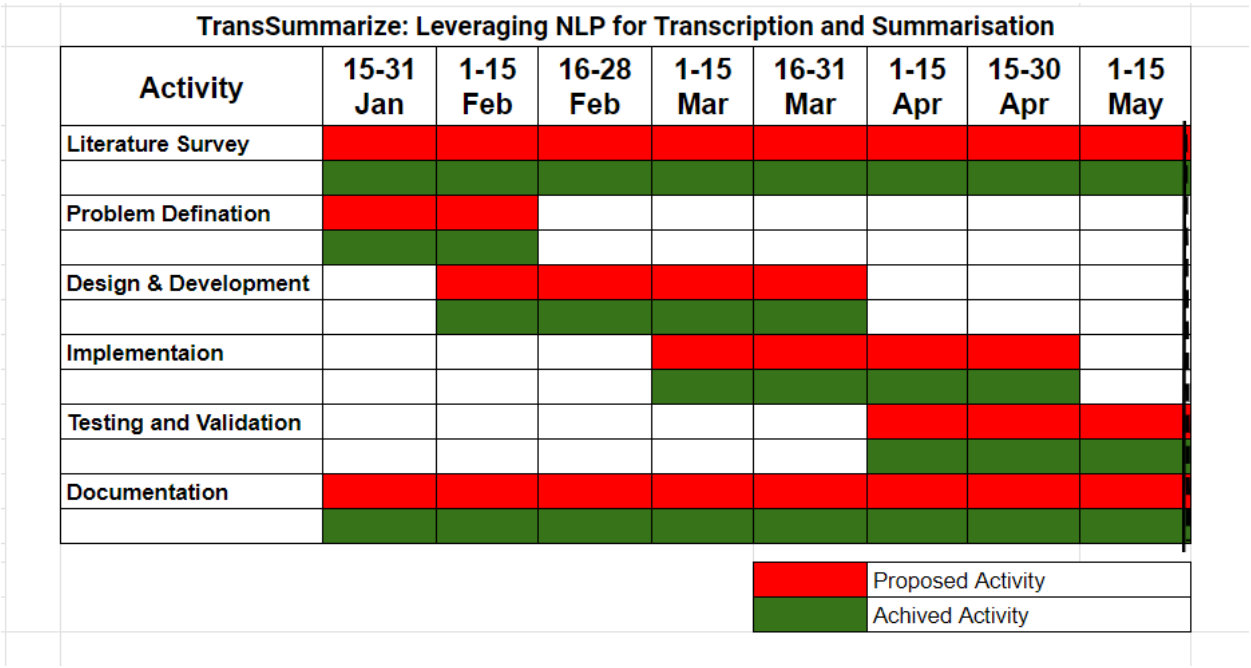
8.Limitation and Future Scope of the Project

While our project **"TransSummarize: Leveraging NLP for Transcription and Summarization"** demonstrated results, there are several limitations that are lacking in.

- Speech Recognition system struggle to transcribe from noisy environment and poor sound quality.
- Our Project are not effective when dealing with texts that are highly technical or domain-specific. This is because the language used in these types of texts can be complex and require specialized knowledge.
- The text summarization model's performance sometimes depends on the length of the input text. While we evaluated our model on texts of varying lengths, we found that longer texts may result in less concise summaries.
- In case of T5 model it is build for input sequence less then 512 using texts with greater length may lead to errors.
- Due to the inability to have apply technology in hand we could not perform models like Seq2Seq which is under abstractive method of text summarization which can be a scope for the future.

Overall, the project showed the significance of speech recognition and text summarization and also offering future research areas and applications.

9. Gantt Chart



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