MINOR PROJECT REPORT

ON

“Text Summarization of Software License Agreement”

Submitted in Partial Fulfillment of Requirements for the Award of Degree of Bachelor of Technology in Computer Science and Engineering

**Submitted to:**



**GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY, DELHI**

**Submitted by**

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**Under the Guidance of**

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**UNIVERSITY SCHOOL OF INFORMATION, COMMUNICATION & TECHNOLOGY**

**Certificate of Originality**

I hear by declare that the project work entitled **“Text summarization of Software License Agreement”** submitted to the **GGSIPU, Delhi** is a record of an original work done by me under the guidance of **Mr Anurag Jain ( Associate Professor) of USICT ,GGSIPU, Delhi** and this project work is submitted in the partial fulfillment of the requirements for the degree of bachelors of technology in computer science engineering. The results embodied in this project have not been submitted to any other university or institute for the award of any degree or diploma.

Date:

----------------------------------- Rahul Chaudhry

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I certify that the above statements made by the student are correct to the best of my knowledge and beliefs.

Date:

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**Assistant Professor**

University School of

Information and

Communication Technology

**ACKNOWLEDGEMENT**

The extensive endeavor and euphoria that accompany the successful completion of any project would be incomplete without the mention of of the people who made it a success and whose constant guidance and encouragement crown all the effort. It was not only a technical endeavor but also the initialization of us into the world of industrial engineering field.

I express my heartfelt gratitude to **Mr Anurag Jain** for his valuable guidance and cooperation throughout the whole project and I finally extent my gratitude to my friends and family whose constant support made me enthusiastic enough to accomplish the task and finally emerge with a successful project.

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**Abstract**

In everyday work to work we download many software’s and due to our laziness we skip the fine details present in the license agreement of the software while installing it.

This project is about summarizing the whole end user license agreement so that we never miss any minor detail due to which we can later get into legal trouble or we may get compromised on our privacy or maybe our personal data be used somewhere else.

EULASummarizer is built in Python and uses the feature-rich Natural Language ToolKit (NLTK) module for preprocessing by splitting documents into sentences which are stemmed, lemmatized, case-normalized, and cleared of stop words.

Sentences are scored using a similarity matrix, which counts term frequency using cosine similarity. These scores are summed over each sentence and normalized by the sentence length. This normalization step ensures the system does not bias long sentences. In order to include additional domain information, EULASummarizer first extracts a list of all entities from the text. Similarly, abbreviations of text are identified by EULASummarizer to aid the reader’s understanding of summaries.

EULASummarizer is basically an example of a single-domain-multiple-documents summarization task, i.e., we will take multiple articles as input and generate a single bullet-point summary.

**INTRODUCTION**

When we install software or download software, there will show up so big mass document to state the rights and obligations, for which lots of person are not patient to read it or understand it. That would may make users feel distrust for the software. In this Project, we propose a solution to summarize the Software License Agreement.

Software license agreement normally designed according to Copy-right Law. The construction of software license agreement domain ontology is based on a large number of law articles and different software license agreements collected from internet.

The modeling of software license agreements is not a trivial issue and hardly to solve, especially concerning the diverse software and terminologies. This project’s objective is to propose an appropriate methodology and a uniform conceptual model to provide a descriptive and strong expansibility semantic knowledge representation for the domain of software license agreement.

The goal of our work is to take an information source, extract content from it and present the most important content to the user in a condensed form that is manner sensitive to the user's or applications' needs. Though this project doesn’t assure the exact legality of but our intention is that with the help of this project, we provide every software end users a utility recommendation system / a summarizer, to acquire the most important part of software license agreement as possible so that the people in haste can’t get trapped into some legal problems.

the omnipresent availability and use of cloud services, soft-

ware tools, Web portals or services, legal contracts in the form of

license agreements or terms and conditions regulating their use are

of paramount importance. Often the textual documents describing

these regulations comprise many pages and can not be reasonably

assumed to be read and understood by humans. In this work, we

describe a method for extracting and clustering relevant parts of

such documents, including permissions, obligations, and prohibi-

tions. The clustering is based on semantic similarity employing a

distributional semantics approach on large word embeddings data-

base. An evaluation shows that it can signicantly improve human

comprehension and that improved feature-based clustering has a

potential to further reduce the time required for EULA digestion.

Our implementation is available as a web service, which can directly

be used to process and prepare legal usage contracts

**BACKGROUND**

Text summarization is the process of distilling the most important information from a source (or sources) to produce an abridged version for a particular user (or users) and task (or tasks).

Humans are generally quite good at this task as we have the capacity to understand the meaning of a text document and extract salient features to summarize the documents using our own words. However, automatic methods for text summarization are crucial in today’s world where there is an over-abundance of data and lack of manpower as well as time to interpret the data. There are many reasons why Automatic Text Summarization is useful:

1. Summaries reduce reading time.
2. When researching documents, summaries make the selection process easier.
3. Automatic summarization improves the effectiveness of indexing.
4. Automatic summarization algorithms are less biased than human summarizers.
5. Personalized summaries are useful in question-answering systems as they provide personalized information.
6. Using automatic or semi-automatic summarization systems enables commercial abstract services to increase the number of text documents they are able to process.

Text summarization methods can be classified into different types.

**Based on input type:**

1. Single Document, where the input length is short. Many of the early summarization systems dealt with single document summarization.
2. Multi Document, where the input can be arbitrarily long.

**Based on the purpose:**

1. Generic, where the model makes no assumptions about the domain or content of the text to be summarized and treats all inputs as homogeneous. The majority of the work that has been done revolves around generic summarization.
2. Domain-specific, where the model uses domain-specific knowledge to form a more accurate summary. For example, summarizing research papers of a specific domain, biomedical documents, etc.
3. Query-based, where the summary only contains information which answers natural language questions about the input text.

**Based on output type:**

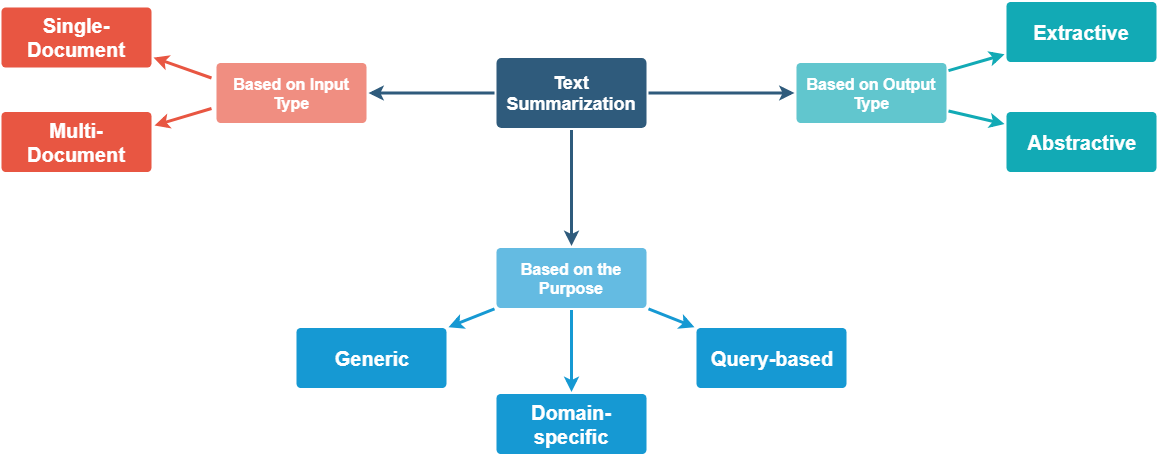
1. **Extractive**, where important sentences are selected from the input text to form a summary. Most summarization approaches today are extractive in nature.
2. **Abstractive**, where the model forms its own phrases and sentences to offer a more coherent summary, like what a human would generate. This approach is definitely a more appealing, but much more difficult than extractive summarization.

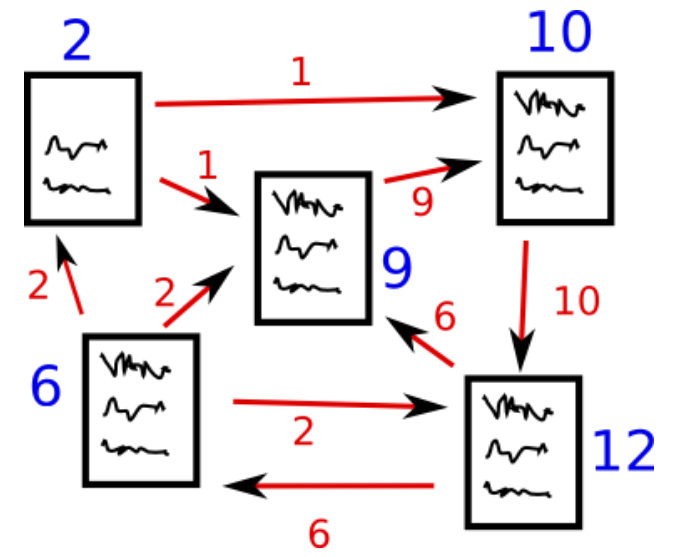
Figure – Types of Text Summarization

## Understanding the TextRank Algorithm

Before getting started with the TextRank algorithm, there’s another algorithm which we should become familiar with – the PageRank algorithm. In fact, this actually inspired TextRank.

**PageRank is used primarily for ranking web pages in online search results.** 

**PageRank Algorithm**

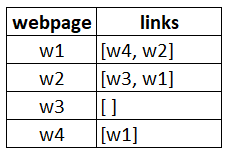


http://www.scottbot.net/H Figure – Example of page ranking/

**PageRank** (**PR**) is an [algorithm](https://en.wikipedia.org/wiki/Algorithm) used by [Google Search](https://en.wikipedia.org/wiki/Google_Search) to rank [web pages](https://en.wikipedia.org/wiki/Webpages) in their [search engine](https://en.wikipedia.org/wiki/Search_engine) results. PageRank was named after [Larry Page](https://en.wikipedia.org/wiki/Larry_Page),[[1]](https://en.wikipedia.org/wiki/PageRank" \l "cite_note-1) one of the founders of Google. PageRank is a way of measuring the importance of website pages. PageRank works by counting the number and quality of links to a page to determine a rough estimate of how important the website is. The underlying assumption is that more important websites are likely to receive more links from other websites.

Currently, PageRank is not the only algorithm used by Google to order search results, but it is the first algorithm that was used by the company, and it is the best known

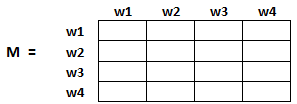
Suppose we have 4 web pages — w1, w2, w3, and w4. These pages contain links pointing to one another. Some pages might have no link – these are called dangling pages.



* Web page w1 has links directing to w2 and w4
* w2 has links for w3 and w1
* w4 has links only for the web page w1
* w3 has no links and hence it will be called a dangling page

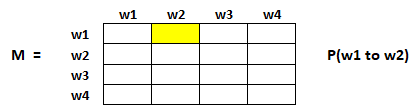
In order to rank these pages, we would have to compute a score called the **PageRank score**. This score is the probability of a user visiting that page.

To capture the probabilities of users navigating from one page to another, we will create a square **matrix M**, having n rows and n columns, where **n** is the number of web pages.



  Each element of this matrix denotes the probability of a user transitioning from one web page to another.

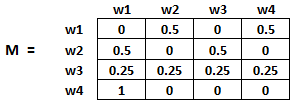
The highlighted cell below contains the probability of transition from w1 to w2.



The initialization of the probabilities is explained in the steps below:

1. Probability of going from page i to j, i.e., M[ i ][ j ], is initialized with **1/(number of unique links in web page wi)**
2. If there is no link between the page i and j, then the probability will be initialized with **0**
3. If a user has landed on a dangling page, then it is assumed that he is equally likely to transition to any page. Hence, M[ i ][ j ] will be initialized with **1/(number of web pages)**

Hence, in our case, the matrix M will be initialized as follows:



Finally, the values in this matrix will be updated in an iterative fashion to arrive at the web page rankings.

### TextRank Algorithm

Let’s understand the TextRank algorithm, now that we have a grasp on PageRank. I have listed the similarities between these two algorithms below:

* In place of web pages, we use sentences
* Similarity between any two sentences is used as an equivalent to the web page transition probability
* The similarity scores are stored in a square matrix, similar to the matrix M used for PageRank

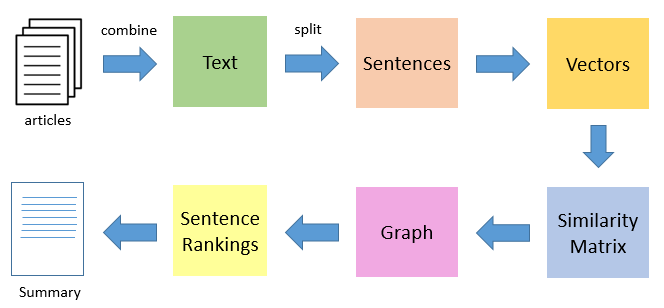
**TextRank is an extractive and unsupervised text summarization technique.** Let’s take a look at the flow of the TextRank algorithm that we will be following:

Figure – Process of Text Summarization

* The first step would be to concatenate all the text contained in the articles
* Then split the text into individual sentences
* In the next step, we will find vector representation (word embeddings) for each and every sentence
* Similarities between sentence vectors are then calculated and stored in a matrix
* The similarity matrix is then converted into a graph, with sentences as vertices and similarity scores as edges, for sentence rank calculation
* Finally, a certain number of top-ranked sentences form the final summary

**Cosine Similarity**

Cosine similarity is a metric used to determine how similar the documents are irrespective of their size.

Mathematically, it measures the cosine of the angle between two vectors projected in a multi-dimensional space. In this context, the two vectors I am talking about are arrays containing the word counts of two documents.

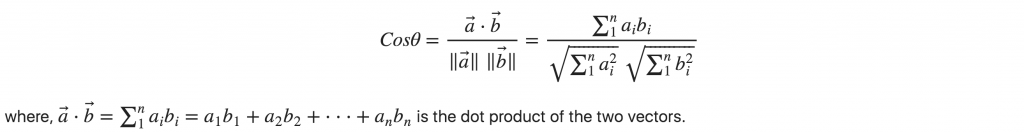
As a similarity metric, how does cosine similarity differ from the number of common words?

When plotted on a multi-dimensional space, where each dimension corresponds to a word in the document, the cosine similarity captures the orientation (the angle) of the documents and not the magnitude. If you want the magnitude, compute the Euclidean distance instead.

The cosine similarity is advantageous because even if the two similar documents are far apart by the Euclidean distance because of the size (like, the word ‘cricket’ appeared 50 times in one document and 10 times in another) they could still have a smaller angle between them. Smaller the angle, higher the similarity.

**COSINE SIMILARITY FORMULA**

As you include more words from the document, it’s harder to visualize a higher dimensional space. But you can directly compute the cosine similarity using this math formula.

[](https://www.machinelearningplus.com/wp-content/uploads/2018/10/Cosine-Similarity-Formula-1.png)

**Benefits of text summarization**

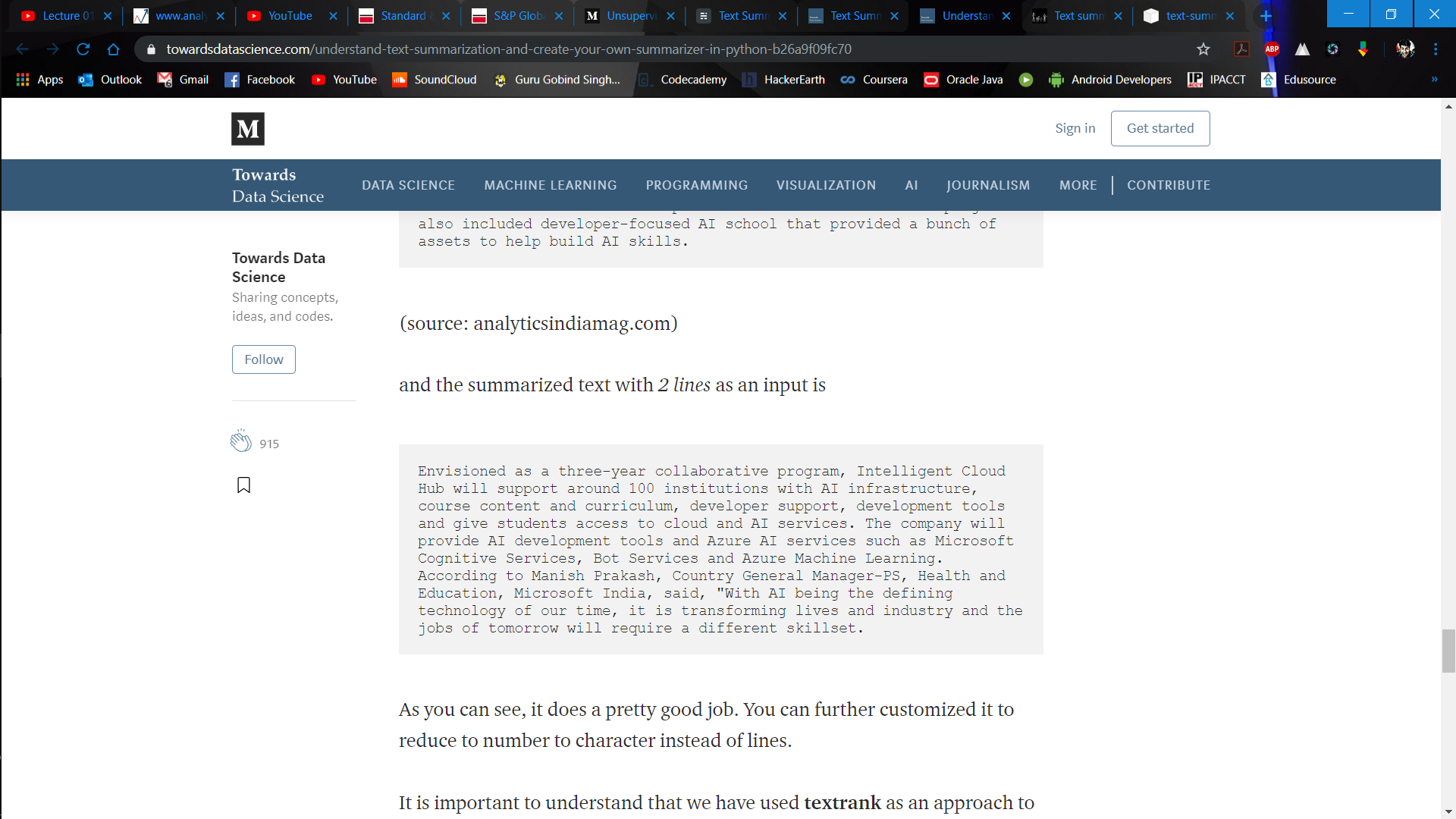
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**Methodology**

**PROBLEM STATEMENT**

The goal of this project is to build a model that can summarize the whole license agreement, based on a combination of features that describes the legal terms so that the user saves the time in reading the bylaws which can later land them in some legal problems or infiltration of their privacy.

**EXAMPLE SUMMARIZED TEXT**

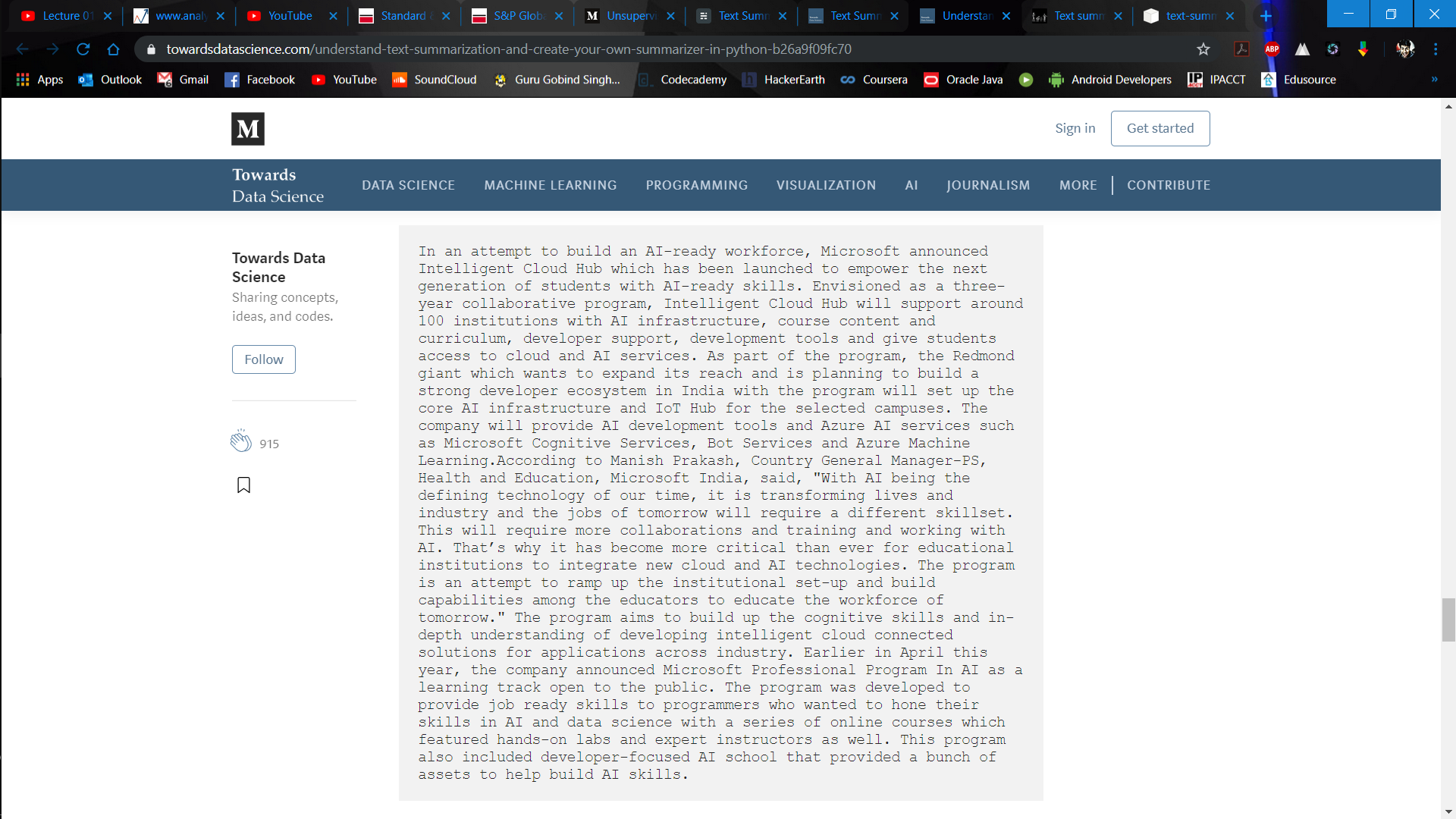
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Figure – Example of Text Summarization

**Flow of work**

**Flow of work**

1. Import the Libraries
2. Read the dataset
3. Drop Duplicates and NA values
4. Preprocessing

* Text Cleaning
* Convert everything to lowercase
* Contraction mapping
* Remove (‘s)
* Remove any text inside the parenthesis ( )
* Eliminate punctuations and special characters
* Remove stopwords
* Remove short words
* Summary Cleaning
* Understanding the distribution of the sequences

1. Preparing the Tokenizer

A tokenizer builds the vocabulary and converts a word sequence to an integer sequence

## Generate the summary

* Import tokens
* Create a similarity matrix
* Apply test rank algorithm
* Extract the summary

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* The biggest challenge we have to face is the accuracy of the summary of the text i.e. - the meaning and the interpretation of the whole text.
* The next challenge that occurs is to convert the whole data to one language if it contains multiple languages
* The most major task of this whole project was to extract the major points out of the whole data.

**Conclusion and** **Future Scope**

As you can see that EULASummarizer has summarized 3 of the major EULAs but we have faced a lot of design issues and most importantly the verification.

But via this we have atleast got a basic summary of the EULA so that we don’t miss the minor/ fine details of the agreement.

Automatic Text Summarization is a hot topic of research, and we have covered just the tip of the iceberg. Going forward, we can explore the abstractive text summarization techniques where deep learning plays a big role. In addition, we can also look into the following summarization tasks:

Problem-specific

* Multiple domain text summarization
* Single document summarization
* Cross-language text summarization (source in some language and summary in another language)

Algorithm-specific

* Text summarization using RNNs and LSTM
* Text summarization using Reinforcement Learning
* Text summarization using Generative Adversarial Networks (GANs)

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