Techniques to Estimate the Status of Legal Proceedings Considering Sequential Text Data.

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***Abstract*—The relationship between law and natural language processing is impressively expanding, and it has the potential to fundamentally alter how prosecutors go about their regular tasks. The volume of text produced by legal practitioners is enormous and has not yet been fully investigated by data science. Recent developments in NLP and machine learning allow us the capability to develop forecasting analytics that can be used to identify trends influencing judicial judgments. This study's objective is to generate a classifier that can anticipate judicial decisions in the Bangladeshi Supreme Court law. According to our exploratory research, the fundamental facts of a case are the most significant predictor. A few judicial subjects were then chosen, and some of their characteristics were obtained. Subsequently, a variety of classifiers were utilized to predict the legal outcomes while taking into account these linguistic properties.**

***Index Terms*—Legal judgment forecast, Legal Nlp , Extraction of features, legal computation, Data Labelling, Model Tuning.**

I. Introduction

Access to justice as an idea refers to the reality that different people around the world have varying opportunities for receiving legal assistance. Law has always had a tight relationship with language because it is essentially a "discourse." Language of the law must be considered broadly in this context to include both written and spoken words, legal writings, judgements, and regulatory texts like decrees, rules, contracts, or obligations. The fundamental goal of Legal Artificial Intelligence (Legal AI) is to use the technology utilizing artificial intelligence to support legal to assist with legal activities. The vast majority of resources in this area are text-based and include things like contracts, judgment documents, and legal opinions. Artificial intelligence, more generally, and natural language processing have long been used in the legal industry. In the 1960s and 1970s, the first systems for accessing online legal content debuted, and in the 1970s and 1980s, legal expert systems were a popular topic of conversation[7]. But throughout the recent years, interest in this region has significantly increased. Since language and law are inextricably linked, it is crucial to develop Legal NLP techniques in order to comprehend legal language and discourse, to create tools supporting the use of legal sources by law enforcement, and to enable open, global, and interoperable legal systems on the internet. Thus, addressing objectives and aims in the fields of Legal-Tech has revolved around language processing. We can claim that these activities and purposes are applications of current technology to well-defined and scoped textual challenges to the extent that they offer remedies and are already commercialized .The goal of this thesis is to investigate techniques for anticipating legal entities and judgments in court case documents using legal NLP. Studying how pre-trained models can be adjusted for the legal domain and how this can impact performance on subsequent tasks in an environment with little unstructured data is another goal.

II. Problem Statement

Researchers have been working hard over the past few years to anticipate the results of judicial cases using NLP application software and Machine Learning techniques in Different countries Legal textual cases. According to Branting et al,the involvement of technology in legal arguments and its solution has been an aim of computer science research since its inception[2]. However, legal computer systems were never widely used, and computer science and law remained a specialized field of study with minimal application. As of 2022, no research has been conducted in the context of Bangladesh's Supreme Courts with this purpose.

III. Research Objective

The principal objective of this study is to provide a framework for predicting judicial outcomes at the Supreme Court of Bangladesh. The Constitution of Bangladesh provides provisions regarding the Supreme Court of Bangladesh's legal authority.

In addition, the Supreme Court of Bangladesh is the most important court and a great field for this study, given the volume of cases it hears each year. First of all, there will be an implementation of a text extractor to obtain data from the judicial decisions. After that there is an integration of NLP methods to gather characteristics from the content in order to pre-process raw data, choosing what is considered to be the key details that can produce precise prediction. Furthermore, these pre-processed data would be incorporated into machine learning frameworks. Later,there is a comparison of the outcomes of each strategy to the actual court decisions to evaluate the effectiveness of each approach.

IV. RELATED WORKS

Presently we will examine about a portion of the past works connected with our examination field. Here in paper , 'How Does NLP Benefit Legal System: A Summary of Legal Artificial Intelligence' The authors noted that where NLP scholars concentrate more on driving data and embedding methods, legal practitioners frequently consider solving problems using rule-based and symbol-based approaches. They discuss the past, the present, and the possible directions of development in Legal NLP in this paper. They demonstrate the tasks from the viewpoints of NLP academics and legal experts, and they display various illustrative applications in Legal NLP to investigate potential future approaches, conduct tests and offer a thorough review of the benefits and drawbacks of the work that has already been done [8]. In this 2nd paper , The objective is to incorporate several processes into functional applications that address certain needs. Due to the interlaced levels of linguistic analysis in legal language, from character string analysis (for the identification of citations, for example) to arguments, this objective is particularly difficult and crucial. This issue of TAL seeks to raise awareness of the problems and difficulties with legal NLP, to provide recent findings in this area, and, more broadly, to demonstrate how various analytic techniques are organized for this specialized language[5]. The creators of the paper [3] of given reference, conducted an extensive analysis of the traits of legal and unlawful material in the Darknet and contrasting it with content from a clearnet website as a control. Using drug-related websites as a test example, they find that texts for selling legal and illicit drugs have different linguistic features from one another and from the control condition, including the distribution of POS tags and the coverage of their named entities in Wikipedia. In the paper [4], Author Robert Dale, examined the application of NLP in the field of legal technology. It turns out to be a very crowded market: a Stanford website includes 1084 companies that are "changing the way law is done." 2 It is helpful to have a map when reviewing such a landscape. Conveniently, there are point solutions accessible for a variety of specific tasks that a typical law firm faces because the practice of law is a well-structured activity. According to his analysis, there are five sectors of legal practice where NLP is becoming more prevalent: 1. Legal research: gathering data necessary for a legal conclusion 2. Electronic discovery: assessing the records' relevance to a request for information 3. Contract review: making sure a contract is thorough and risk-free. 4.Automation of documents: creation of standard legal documents 5. Personalized legal guidance through question-and-answer sessions Here researcher, Mark S. Krass used four kinds of convolutional neural networks and train them on a dataset of about 300,000 decisions made by the Board of Veterans' Appeals (BVA). Predicting whether the BVA's decisions will be (a) not appealed, (b) appealed, and (c) within the category of appeals, whether the decision will be (I) upheld, (ii) overturned, (iii) remanded (showing error), or (iii) whether the appeal will be rejected is the goal. He contends that three obstacles—hierarchical labeling, embedding weakness, and abstract decision rules—can be used to account for the classifiers' subpar performance.[6] As per the paper [7], the author stated that the advantages of human processing are overcome by automatic legal document processing, which will also be highly beneficial to the average person for a better grasp of a legal subject. In this paper, they examine current developments in the area of legal text processing and offer a comparative review of methods employed. They grouped the approaches used in this work into three classes. methods based on NLP, deep learning, and KBP.They have given the KBP approach particular attention since they are convinced that it can successfully handle the complexity of the legal sector. Finally, they go over some potential future research avenues for the processing and analysis of legal documents.

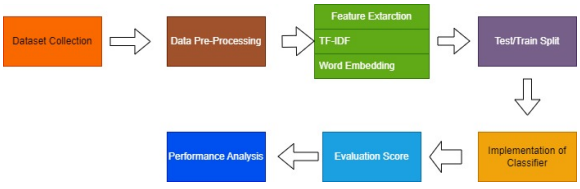

Fig. 1. Proposed Work Flow Diagram

V. DATA PRE-PROCESSING

Once the dataset has been collected, it would need to be preprocessed to prepare it for analysis. Data preprocessing was done by:

i)We tokenized the text of the legal judgments, which involves breaking the text down into individual words or phrases.

ii)Removed stopwords, which are common words that do not add meaning to the text and can often be ignored.

iii)Lemmatized the text, which involves reducing words to their base form, such as by converting all verb forms to the base form.

iv)We also removed punctuation and normalizing cases.

The Dataset of Supreme court contains properties like name of places, convicts, alibi, and date and time are also mentioned. We had to manually remove them from the dataset.

VI. Methodology

The methodologies for conducting research on legal judgment prediction via topological learning with natural language processing (NLP) would likely involve a combination of several approaches, including the following:

A. Dataset Collection

The first step in this research would be to collect a dataset of legal judgments, which could include decisions made by courts or other legal tribunals. This dataset could be gathered from a variety of sources, such as legal databases, court websites, or other online sources. This process includes:

1) Identified sources of legal judgments, such as legal databases, court websites, or other online sources.
2) Gathered the legal judgments from these sources, possibly using web scraping techniques or by accessing APIs provided by the sources.
3) Clean and standardize the data as needed, such as by removing duplicates or irrelevant information.

We have used the judgements published in Supreme Court Online Bulletin (SCOB)'s High Court division [1] which is open for all and found effective in determining our model evaluation.

B. Feature extraction

We know that the cases listed in Supreme Court's Bulletin was written in a paragraph or text. In order to make to make it more sensible for our NLP algortim, we had to use Unsupervised Dataset to make the dataset meaningful.

So, we extracted relevant features from the text of the legal judgments in order to represent them in a way that can be used by machine learning algorithms. This could involve techniques such as term frequency-inverse document frequency (TF-IDF) and word embeddings to represent the text as numerical vectors.

i)To complete this process, we had to: Select a method for representing the text of the legal judgments as numerical vectors, such as TF-IDF and word embeddings.

ii)Extract the features from the preprocessed text using that method.

1) Term frequency-inverse document frequency: Term frequency-inverse document frequency (TF-IDF) is a method used to weight the importance of words in a document or a corpus (a collection of documents). It is often used in information retrieval and natural language processing tasks. Here is the process for calculating TF-IDF:

1) Found the number of documents in the corpus. This is referred to as the document frequency, or "N."
2) For each document in the corpus, evaluated the frequency of each term (word) in that document. This is referred to as the term frequency (TF).
3) For each term in the corpus, determined the number of documents in which it appears. This is referred to as the inverse document frequency (IDF).
4) Calculated the TF-IDF score for each term in each document by multiplying the TF and IDF scores.
5) Then, we normalized the TF-IDF scores by dividing each score by the maximum TF-IDF score in the document. This is known as "normalized term frequency-inverse document frequency," or "TF-IDFn."

C. Topological learning

After the features have been extracted, We applied topological learning techniques to analyze the structure of the data and identify patterns or relationships that may be relevant to legal judgment prediction. This could involve techniques such as graph-based analysis or network analysis.

D. Model training and evaluation:

Finally, we trained and evaluated a machine learning model on the extracted features in order to predict legal judgments. This could involve techniques in which the model is trained on labeled data, or unsupervised learning, in which the model is trained to identify patterns in the data without explicit labels. The model's performance would then need to be evaluated using metrics such as accuracy or precision. In brief, this can be done by:

i) We have used GBC, SVN and XGBOOST as the machine learning algorithm to train and test data.

ii) We trained the dataset after applying TF-IDF so that we could get more accurate data

iii) We evaluated the performance of the trained model using appropriate metrics, such as accuracy, precision, f1-score and recall.

iv) We repeated the steps to get scores for other Machine Learning models. However, we did not change much parameters to keep the result fair and accurate

TABLE I
PERFORMANCE ANALYSIS OF THE CLASSIFIERS

Classifier	Feature Extraction	Accuracy	F1 Score	Recall	Precision
GBC	TF-IDF	0.87	0.85	0.83	0.83
	Word Embedding	0.89	0.89	0.86	0.87
SVM	TF-IDF	0.91	0.87	0.89	0.89
	Word Embedding	0.90	0.85	0.87	0.85
XGBOOST	TF-IDF	0.87	0.83	0.85	0.85
	Word Embedding	0.89	0.87	0.86	0.84

VII. Results and Analysis

Here, the comparison between Classifiers has been done on some of the criterias. The criterias are accuracy, F1 score, precision and Recall. These comparisons between algorithms can give better predictions. As we can see in Table I ,it has ilustrated the performance of the classifiers in terms of the feature extarction.Here, the GBC gave the accuracy of 0.87, F1 Score 0.85, Recall 0.83, Preision 0.83 in TF-IDF and in Word Embedding accuracy of 0.89, F1 Score 0.89, Recall 0.86, Preision 0.87. In Addition, the SVM showed the accuracy of 0.91, F1 Score 0.87, Recall 0.89, Preision 0.89 in TF-IDF and in Word Embedding accuracy of 0.90, F1 Score 0.85, Recall 0.87, Preision 0.85. At last, in XCBOOST accuracy is 0.87, F1 Score 0.83, Recall 0.85, Preision 0.85 in TF-IDF and in Word Embedding accuracy of 0.89, F1 Score 0.87, Recall 0.86, Preision 0.84. However, SVM architecture gave the best result among all the classifiers and it also also can be seen that the TF-IDF worked best as feature Extractor.

VIII. Conclusion

In this research, we emphasize on the subject of legal judgment prediction and employ a topographical learning framework to solve several subtasks of verdict projection. In the context of Bangladesh's judicial system, legal case result prediction has not gotten much consideration in machine learning and natural language processing application. For the Supreme Court of Bangladesh, we have methodically investigated the problem of anticipating outcomes. Almost every conceivable kind has been thoroughly investigated, and we have reported the findings of several methodologies in comparison for many cases.

Future steps in this approach include the following:

i) We would then evaluate how to include the sequential factors, which are not taken into account in this work, in LJP.

ii) To broaden the range of potential study topics, we aim to embrace additional algorithms.

iii) We shall analyze further Law Judicial Prediction subtasks and case study situations

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