Predicting Brazilian court decisions

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Abstract—Predicting case outcomes is useful but still an extremely hard task for attorneys and other Law professionals. It is not easy to search case information to extract valuable information as this requires dealing with huge data sets and their complexity. For instance, the complexity of Brazil legal system along with the high litigation rates makes this problem even harder.

This paper introduces an approach for predicting Brazilian court decisions which is also able to predict whether the decision will be unanimous. We developed a working prototype which performs 79% of accuracy (F1-score) on a data set composed of 4,043 cases from a Brazilian court. To our knowledge, this is the first study to forecast judge decisions in Brazil.

Index Terms—jurimetrics, legal outcome forecast, predictive algorithms

I. INTRODUCTION

Since Code of Hammurabi, we have been trying to improve legal certainty in human relationships by making public the law and the rulings of courts. In addition to publicizing the laws, legal systems usually provide further support to legal certainty through judicial decisions. These decisions are useful not only for judging specific situations, but also to influence society behavior by exposing the legal consequences of our actions. Thereby, predicting legal decisions is fundamental to understand the legal consequences of our actions as well as for supporting law professionals to improve the quality of their work.

In Brazil for example, lower court judges decisions might be appealed to Brazilian courts (Tribunais de Justiça) to be reviewed by second instance court judges. In an appellate court, judges decide together upon a case and their decisions are compiled in Agreement reports named Acórdãos. Similar to lower court decisions, Acórdãos include Report, Fundamentos, Votes, and further metadata such as judgment date, attorneys, judges, etc. These Agreements documents are very useful for understanding jurisprudence thus guiding lawyers and court members about the decisions. For instance, attorneys often use these documents to prepare cases while judges should take them into account – or even use them as guidelines – for next decisions.

In order to understand Acórdãos decisions, one has to read the subject at the summary, read the decision Report, how each judge voted in this case (Votes), and the final decision which can be unanimous or not. Moreover, each Acórdão might have more than one decision – regarding one or more appealed case claims – which can increase the Acórdão complexity. This problem becomes harder as there usually are hundreds – and sometimes thousands – of Acórdãos related to the case on which a Law professional is working.

A very common and extremely important task for Law professionals is to speculate how a specific court would decide given the ideas and the facts which compose the case. For example, this is useful for preparing and tuning a case to have a favourable decision. Hence, attorneys can rely on substantial assumptions on how judges will decide based on their arguments. Although this information can be found in public Acórdãos, the myriads of available documents make this task very complex and error prone, even for experiment lawyers.

In addition to Brazil, several other legal systems in the world share the very same problem of predicting legal decisions. The challenge is hence generalized as how to predict legal decisions with a satisfactory level of accuracy to support the work of attorneys, judges, and other professionals such as counters and real state offices. By satisfactory, we mean that the quality of the prediction in terms of accuracy should be better – or even higher – than Law experts.

Nevertheless, it still is very hard to perform any legal decision prediction with satisfactory accuracy, even though computers have been used for such challenge for decades. For instance, Ashley and Brünninghaus propose a method for classifying and predicting cases which is able to meet 91.8% of accuracy, however the evaluation takes only into account a small data set (146 cases). Katz et al. uses historical data for predicting USA Supreme Court decisions by classifying decisions in two and three classes and by presenting judge profiles. That approach reaches 70.2% of accuracy for predicting case decisions and is assessed by on a data set with 28,000 cases. Also using data from the USA Supreme Court, Ruger et al. exposes how the prediction of Law experts performs in comparison to a trained statistical model for different Law fields by using less than 200 cases.

In [1], Aletras et al. uses Support-vector Machine (SVM) for predicting if cases violate Articles 3, 6, and 8 of European Convention on Human Rights of Human Rights. Their results achieved 78% of accuracy performed on 584 European Court cases separated by subjects.

Other related work takes advantage of machine learning

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1https://en.wikipedia.org/wiki/Code_of_Hammurabi
2C.f. Brazilian Law: Art. 489, Lei 13105/15.
techniques to support further legal tasks. In [8], the authors propose a framework for automatically judging legal decisions by using Attention neural network models. They applied the approach for divorce decisions in China. In [13], Shulayeva et al. separates legal principles from case facts on legal documents by using a Naive Bayesian Multimodal classifier. In [4], the authors proposes to use transfer learning to recognize the same words which have different meanings in different contexts, i.e., name-entity linking task. In [3], the authors uses Bayesian networks to classify legal decisions from a Brazilian Labor court and conclude that both employees and employers are roughly successful in their litigation. Last, Ruhl et al. [12] overviews some perspectives on how complex systems are useful for supporting policy-makers on legal-related topics such as appellate jurisprudence and tax policy analysis.

We are also motivated by recent results that show that intelligent systems can perform better than Law experts\(^3\). Our hypothesis is that by taking advantage of Natural Language Processing (NLP) and Machine Learning techniques it is able to build a system that meets high quality legal decision predictions. Different from the closest related works of this paper [1], [2], [6] which address United States and European courts, we propose an approach for legal decision prediction for Brazilian courts which also predicts whether the court decision will be unanimous. Moreover, in contrast to [1], [2], we trained a model at thousand-scale data set with 4,043 cases. Moreover, in contrast to [1], our approach does not rely on a binary classification problem – since it uses three possible prediction results – nor require that case data set should be separated by specific Law articles, hence being a more generic approach.

The reminder of this paper is structured as follows. In Section II, we present details on the aforementioned problem such as the case study and the methodology employed. Section III exposes the results while Section IV concludes our investigation and proposes future directions on this subject.

II. MATERIAL AND METHODS

The research question which guides our study is how to predict legal decisions with a satisfactory level of accuracy for Brazilian courts by including the prediction of the court unanimous behavior. Next sections provide further information about our assumptions and the proposed methodology.

A. A generic approach

We focus on Brazilian courts as Brazil legal system is not trivial. We believe that if we are able to solve this problem for such complex legal system, our approach would also fit other simpler or it could be straightforwardly adapted for more complex legal systems which share similarities. Nevertheless, it is worth to state that other legal systems also rely on similar documents. For instance, in Indiana Court of Appeal (United States), the Appellate Court decisions are composed by a group of three judges whose decisions (opinions) are divided in Case Summary, Facts, Procedural History, and the court conclusion at the end of that document. In France, the Appellate Court (Cour d’appel) also renders decisions coming from the agreement of three judges. That decision is called an Arrêt whose structure is also composed of legal basis for the appeal, case history, and the final decision.

Further, we share the same assumption of Aletras et. al [1]: “there is enough similarity between (at least) certain chunks of the text of published judgments and applications lodged with the Court and/or briefs submitted by parties with respect to pending cases”.

B. Decision labels and data set

Regarding the flow process of a Brazilian appeal, when lawyers lodge appeals at a court it is analyzed by a group composed of three judges to check whether the appeal is able to be judged by the court. If the appeal does not meet the formal requirements, the appeal is identified as not cognized (recurso não conhecido) hence not judged by the court. Otherwise, the appeal is therefore judged and classified in various categories. We therefore assumed that court decisions can be classified by using the following labels:

- **not-cognized**, when the appeal was not accepted to be judged by the court;
- **yes**, for full favourable decisions;
- **partial**, for partially favourable decisions;
- **no**, when the appeal was denied;
- **prejudicada**, to mean that the case could not be judged for any impediment such as the appealer died or gave up on the case for instance;
- **administrative**, when the decision refers to a court administrative subject as conflict of competence between lower court judges.

In addition to the decision labels, an orthogonal concern of Brazilian court decisions – as well as for other legal systems – refers to its unanimity aspect, being labeled as:

- **unanimity** which means that the decision was unanimous among the three judges that voted in the case; and
- **not-unanimity** by meaning that one of the judges disagreed on the decision.

With respect to the data set, we relied on 4,762 decisions (Acórdãos) from a State higher court (appellate court), the Tribunal de Justiça de Alagoas. From this data set, we removed the decisions that had repeated descriptions to not bias the sample thus resulting 4,332 examples. Repeated decision descriptions occur owing to very similar cases which share the same description. Moreover, for the sake of predictability, we removed all the decisions classified as prejudicada, not-cognized and administrative as these labels refer to very peculiar situations which are not useful for prediction purposes addressed by this paper. Finally, the total amount of examples were 4,043 cases.

C. Methodology

Figure 1 depicts an overview of our methodology. From the legal decision data set, we extracted and separated the texts which hold information about the case description, the

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\(^3\)https://www.bbc.com/news/technology-41829534
decision, and their unanimity aspect. This Natural Language
Pre-processing task includes removing stop-words and word
suffixes for improving the capacity of word representation.
Then, we took advantage of Term Frequency-inverse Docu-
ment Frequency (tdf-df) statistics to increase the importance
of relevant words while decreasing the importance of general
repetitive words not relevant to the addressed problem. As
follows, we used texts which refers to decisions and unanimity
to classify them to one of the possible labels (c.f. Section II-B).
As a result, we built a structured training data set depicted by
Table I.

Next, we used 80% of the data set to train a Machine
Learning model which was then assessed by using the latter
20% of the data set (c.f. Figure 1). To train a model means to
automatically find out which parameters are the most suitable
for predicting decisions based on the training data set. Because
we address decision and unanimous predictions, it requires to
train two models to address both predictions. Once trained, the
models can be used to predict decision and unanimity given
a case description. Last, to evaluate our approach, we used
the F1-score metrics and performed 5-fold cross-validation
to improve the practicability of our approach. Results are thus
exposed as success accuracy rate in percentage.

Furthermore, in order to assess the exposed methodology,
we developed a working prototype in Python. We used the
NLTK framework [9] for Natural Language Processing in such
a way that our prototype is easily configurable for various lan-
guages in addition to Portuguese. The prototype also provides
a graphical user interface which can be accessible from any
Web browser.

III. RESULTS

Our approach was able to score 78.99% F1-score ($\sigma^2 =
0.000017$) when predicting legal decision for the Tribunal
de Justiça de Alagoas Brazilian court by using 4,043 judge
decisions. The number of samples for each label is exposed
in Table II.

In order to analyze our prediction over a more uniformly
distributed data set, we randomly removed 1,549 no-labeled
decisions to have the same number of partial-labeled
decisions. Table III depicts the distributions of each decision
label. The accuracy of case outcome prediction in this situation
was 74.07% ($\sigma^2 = 0.00029$) for the F1-score metrics. This
result is very interesting as it does not validate our previous
assumption that the not regularly distributed data set would
strongly bias the model.

With respect to predicting the unanimous behaviour of the
Tribunal de Justiça de Alagoas Brazilian court, our approach
scored 98.46% ($\sigma^2 = 0.000031$) for the F1-score metrics.
This assessment was performed in a data set with 2,274
cases. From the 4,332 data set – which had no repeated
decision descriptions –, we removed the samples that either
our classifier did not managed to label or the decision itself
did not had any information about unanimity. The resulting
data set had 2,289 samples. As follows, we removed from
this data set the decision whose labels were prejudicada,
not-cognized and administrative – as these labels are not relevant for the predictive addressed problem – re-
sulting in a data set with 2,274 examples. The distribution of
unanimity and not-unanimity labels are depicted by Table IV.

The very-high unanimous predictive accuracy of 98.46% is
explained by the fact that most of decisions are unanimous,
therefore the model was biased to this label. We indeed
expected that most decisions were unanimous since this is well
known by law experts. However, the great difference between
unanimous and non unanimous decision is a surprising result.
In order to understand how our approach would perform when
predicting unanimity by using a more uniformly distributed
data set, we therefore performed another evaluation by ran-
domly removing decisions whose label was unanimity to
meet the same number of not-unanimity decisions. The resulting
data set had 90 examples, half of them labeled as
unanimity and the other half not-unanimity. With this
configuration, our prototype reached 76.94% ($\sigma^2 = 0.015$)
F1-score accuracy.

IV. CONCLUSION

This paper proposes a methodology for predicting Brazilian
court legal decisions which is able to reach 79% of accuracy
when employed for a Brazilian court data set with 4,043
cases. Our approach is able to predict case outcomes by using
three different labels: yes, no, partial. Moreover, the proposed
method also predicts whether the decision will be unanimous,
which fits not only Brazil legal system, but also several others
whose decisions are judged by more than one judge. The
unanimity prediction performance of our approach is 77% of
accuracy. To our knowledge, this is the first study to predict
Brazil legal decisions.

Moreover, our approach is easy to use as it only requires that
users provide the description of their litigation and the output
will be one of the aforementioned case outcome predictive
label along with its predictive unanimity label. These informa-
tion are very useful for attorneys, judges, and other Law
professionals as they provide practical support for their work.
Moreover, our contribution also includes a working prototype
which can be configured to further languages as well as for
different data sets.
Although we believe that our contribution is quite satisfactory given the accuracy rate aforementioned, future investigations might consider comparing our results with Law experts, as performed in [11] and by current Lawtech products such as Case Crunch and LawGeex. Other future work includes to investigate whether taking advantage of existent Named-entity recognition data sets for Brazilian law documents [10] improve the prediction quality. Furthermore, the assessment of the proposed method can be performed on larger and/or different data sets, such as the European Court of Human Rights for instance. Ultimately, despite the various directions one might take to leverage our work, we believe that Mireille Hildebrandt’s viewpoint on “agnostic machine learning” and its consequences to the Rule of Law [5] should be taken into account when designing and using a legal predictive system.

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**TABLE I**

| Data | Decision description | Decision | Unanimity | Label | Unanimity label |
|------|----------------------|----------|-----------|-------|----------------|
| Sample 1 | Direito Processual Civil... | Recurso conhecido e provido | Unanimidade | yes | unanimity |
| Sample 2 | Apelação criminal... | Recurso conhecido e parcialmente provido | Decisão unanime | partial | unanimity |
| Sample 3 | Apelação Civil em Ação Ordinária... | Recurso conhecido e não provido | Decisão unânime | no | unanimity |

**TABLE II**

| Labels | no | partial | yes |
|--------|----|---------|-----|
| N. of decisions | 2,415 | 866 | 762 |

**TABLE III**

| Labels | not-unanimity | unanimity |
|--------|--------------|-----------|
| N. of decisions | 45 | 2,229 |

**TABLE IV**

**TABLE I**

TRAINING DATA SET INCLUDES DECISION TEXTS AND LABELS WHICH WERE CLASSIFIED ACCORDING TO RESPECTIVE DECISION TEXTS. E.G., IN SAMPLE 1, provido WAS CLASSIFIED AS A FAVORABLE (YES) DECISION AND Unanimidade WAS CLASSIFIED AS UNANIMITY.