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Implementation of Artificial Intelligence in Arbitration

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SCOPE

The study aims to deal with question regarding implementation of Artificial Intelligence in Arbitration. It will focus on how execution of AI in arbitration can raise concerns. The research will limit itself to the legal and technological aspects of AI that can adversely affect arbitration procedure. For accomplishing this goal, it will cover up the basic arbitration process practiced currently, highlight studies conducted on prediction of legal decision-making and provisions of current legislations, on national and international platform regarding AI arbitrator. The research will also throw some light on the influence of Online Dispute Resolution in arbitration. The focal point of this research is limited to the legal aspect of implementing AI in arbitration. The scope of the thesis covers the scenario of arbitration at international level and is not focusing on a specific geographical area.

The research paper will not be providing with comprehensive detail on the technological aspect; however, it will provide basics of it and will be explained in the legal context. Also, the paper will not be elaborating much on the Online Dispute Resolution mechanism and its categories. It will be limited only to the part that can influence the application of AI in arbitration in a productive manner.

METHODOLOGY

For this research paper, the descriptive research method is applied. This research paper starts by giving a brief introduction about the application of Artificial Intelligence in already existing legal field which further puts up the research question of the thesis- *“How can the framework of arbitration get affected legally while implementing Artificial Intelligence in it?”*

The research question is broken down in four sub-questions and answered. The basics of AI and arbitration will be explained, in order to understand the further chapters. For answering the research question, we will be first looking at the legislations whether it is permitted to use machines as arbitrators in the arbitration procedure. This part of thesis will try to answer the sections of arbitration can be automated by the Artificial Intelligence and will be followed by rest of the chapters.

The question of whether the procedure of Artificial Intelligence and its arbitral award provides fair solution to the disputes is then discussed. It is explained in a detailed format with the help of various some study conducted by some well published researchers. This part of the thesis

will deal with the application of AI arbitrator and its comparison with human arbitrator. Till this part, the research paper provides with a proper scenario of AI's execution in arbitration sector. This further leads to the main portion of the research question, i.e., the concerns, both legal and technical. Out of numerous legal and technical concerns regarding implementation of AI, the paper will be focusing on the most common and important issues.

Under the category of legal concerns, the research has highlighted the points of self-sufficiency concern of impartiality, which is likely to be the first question that would come across any person's mind- whether the award is rendered in a fair manner or not. Other legal concerns included are due process of law, reasoned decision and public policy. All these points are selected keeping in mind what would be the party's expectation with the arbitration procedure, i.e., a requirement of an arbitrator with no biased mindset, appropriate law to be applied in deciding the dispute, a proper and relevant logic behind the decision made and the decision made not to be in contravening with the existing public policy. The technological concerns are also discussed in the similar manner and highlights the fundamental requirement of data that AI model can use for providing with the outcomes. With the absence of big data, AI model cannot be success. The change in policies, diversity of patterns, generalisation of decision, possibility of biasness and black box issue are discussed.

The research paper has also taken into account the concept of online dispute resolution. It has tried to cover up the basic techniques applied in resolving disputes, especially under the process of negotiation. As negotiation is the first and foremost step before any arbitration procedure begins, the AI methods applied under online dispute resolution can be of great help to arbitration process.

The research conducted for the thesis is mainly through the websites, online journals, legal research papers and legislations. Various legal books from the law library of University of Oslo have been referred.

INTRODUCTION

In the current scenario, the world is undergoing a transformation which is leading to change in every aspect of lives, especially in terms of technology. The core of such transformation is Artificial Intelligence (AI). It influences the techniques which are used to conduct business such as block chain and other technologies; affects the manner of entering transactions such as Bitcoin, Smart Contracts etc.¹ It also deals with the disputes raised and settled.

Artificial Intelligence is not considered a precursor to the future. Several countries have started implementing the use of AI technologies in their procurement procedures. Estonia is currently developing an AI judge for the purpose of resolving small claim disputes of less than 7000 Euros.² Similarly, China³ has already started digital courts where millions of legal cases are decided by internet courts (smart courts) that consists of non-human judges powered by Artificial Intelligence and does not require citizen's presence in the court.

The idea of implementing Artificial Intelligence in International Commercial Arbitration have raised many speculations. The most optimistic element of AI focuses on replacing human arbitrators by robot arbitrators. The theory of adapting AI technologies in arbitration aims at strengthening the efficiency and quality of the procedure. For attaining this goal without human intervention requires technological effort and global consent in the International Commercial Arbitration community.

During this time where resources and time are essential elements of resolving disputes, AI technologies have the potential of reducing the time period of the proceedings, lowering the cost of dispute resolution, reducing risk by increasing predictability, avoiding claims with no merits, etc. However, on the other hand there are concerns regarding the consequences that AI might have on the legal decision making and other aspects such as transparency of the data and

¹ Kathleen Paisley and Edna Sussman, *Artificial Intelligence Challenges And Opportunities For International Arbitration* (11th edn, Dispute Resolution Section of the New York State Bar Association 2018) <<https://nysba.org/app/uploads/2020/03/DisputeResolutionLawyerSpring18.pdf#page=35>> accessed 12 August 2021, page 35

² Eric Niller, 'Can AI Be A Fair Judge In Court? Estonia Thinks So' (*Wired*, 2019) <<https://www.wired.com/story/can-ai-be-fair-judge-court-estonia-thinks-so/>> accessed 14 August 2021.

³ Weidong Ji, 'The Change Of Judicial Power In China In The Era Of Artificial Intelligence' (2020) 7 *Asian Journal of Law and Society* <<https://www.cambridge.org/core/journals/asian-journal-of-law-and-society/article/change-of-judicial-power-in-china-in-the-era-of-artificial-intelligence/374DE8EEEB28405CAE5CD3C7D8CFAD78>> accessed 18 August 2021.

algorithms, including the publication of arbitral award and risks to confidentiality and personal data protection.

Within the domain of Alternative Dispute Resolution (ADR), arbitration has attained a leading status. Where the parties to a dispute needs a legally binding decision without going to the court, the procedure of arbitration is preferred for resolving such dispute. Traditionally, the arbitral tribunal consists of human arbitrators who are assigned for conducting hearings in person.⁴ The development in technology has disrupted the traditional form of arbitration. The COVID-19 pandemic has accelerated the trend of complying with smart technologies for the purpose of resolving disputes as physical hearing is not feasible.

Artificial Intelligence have been into existing since a long time but now it has been modernised with techniques of machine learning and deep learning. The usage of AI algorithms has been a struggle for legal professionals. For the purpose of implementing AI in arbitration without human intervention, it has become necessary to understand the functioning of algorithms and legal implication of applying such algorithms.

The research question of the thesis is – “How can the framework of arbitration get affected legally while implementing Artificial Intelligence in it?”

In this paper we will focus on the following questions listed below:

- I. What components of arbitration procedure can be automated by the Artificial Intelligence?
- II. Whether the procedure of Artificial Intelligence and its arbitral award provides fair solution to the disputes?
- III. What are the technical and legal concerns of using Artificial Intelligence in Arbitration?
- IV. How can Online Dispute Resolution Mechanisms influence the application of AI in arbitration?

The first chapter will provide with a brief about Artificial Intelligence and its basics which will include the concept of rule-based system. It will also state about the Artificial Intelligence

⁴ Horst Eidenmüller and Faidon Varesis, 'What is an Arbitration? Artificial Intelligence and the Vanishing Human Arbitrator' (*University of Oxford*, 24 August 2020) <<https://www.law.ox.ac.uk/business-law-blog/blog/2020/06/what-arbitration-artificial-intelligence-and-vanishing-human>> accessed 11 August 2021

models and Machine Learning. Chapter two will state about the eligibility of machine as an arbitrator in accordance to the current legislations, on national and international platform. Chapter 3 will discuss about the requirement of AI as a human arbitrator and its application without any human interference. It will cover the question if AI is capable enough to work as an independent arbitrator on each step of the arbitration process. The studies conducted by the researchers on prediction of legal decision-making will be stated. The fourth chapter focuses on fairness of AI arbitration process and award along with the legal concerns of AI arbitration. Other than legal concerns, the essay will examine the technical aspects of AI arbitrator in the fifth chapter. It will discuss various challenges that AI arbitration can face. Chapter six will present the application of AI in online dispute resolution. The last chapter will be the conclusion of the research conducted.

CHAPTER 1: BASICS

This chapter will define the meaning of Artificial Intelligence and explore the relation of Artificial Intelligence with the field of law, especially arbitration, stating about rule-based approach as well as the concept of machine learning. Various models of Artificial Intelligence in the domain of Arbitration will be explained.

1.1 Artificial Intelligence and Law

John McCarthy defines Artificial Intelligence as “making a machine behave in ways that would be called intelligent if a human were so behaving.”⁵ Oxford Dictionary defines artificial intelligence as the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, speech recognition, decision making, and translation between languages.⁶ Back in 1950s AI had adopted the logic-based AI models. Later in 1970s, there was emergence of a rule-based approach. They are usually in form of “if-then” instruction. The rule-based system⁷ involves two main components- first is a set fact of the situation; other is the set of rules which can be

⁵ Maxi Scherer, 'Artificial Intelligence And Legal Decision-Making: The Wide Open?' (2019) 36 Journal of International Arbitration
<<https://kluwerlawonline.com/journalarticle/Journal+of+International+Arbitration/36.5/JOIA2019028>>
accessed 13 August 2021. Page 542

⁶ ibid

⁷ Bruce G. Buchanan and Richard O. Duda, *Principles Of Rule-Based Expert Systems* <<https://www.sciencedirect.com/science/article/abs/pii/S0065245808601291>> accessed 15 August 2021.

applied to those facts. In other words, the system uses logical inferences in accordance with the rules stored in the knowledge base. This procedure requires assistance of human experts for the purpose of determining the steps to reach on to the decision. Even though this procedure is reliable and transparent, it is not considered as economically viable for various functions.⁸ There is a consistent need of human efforts for gathering of information, combining expert knowledge, keeping the information updated by adding new ones, etc. Thus, it becomes difficult to deal with complex situations. This led to emergence of new wave of AI- the procedure of Machine Learning.

Machine Learning is a sub-field of AI which refers to a science of automatic pattern recognition between variables in a dataset for drawing the results.⁹ It is a program which learns from the past experience and improves its performance over time i.e., trial and error methodology. Machine learning relies on hidden factors or from observed data patterns. The computer extracts required algorithms from its computing system and from large amounts of sample data. For predicting the outcome of the case few steps are followed. The first step is collecting the data and transforming it in a manner which can be used by machine learning technology. Such data is then analysed which generates a quality input, resulting in fair outcomes. Next step is determining model that can be applied. Some specific issues are dealt by particular algorithms and thus choosing appropriate model of machine learning can lead to best results. The third step relates to training of the AI model chosen. It involves extensive training with data sources. AI consists of various types of machine learning. In supervised learning the programmer trains the program with a set of desired outcomes, while in unsupervised learning there is no such human interference.¹⁰ The program detects patterns within data sets on its own. Once the algorithm is trained, it becomes convenient to predict decisions. In context of AI, the machine learning program searches through huge amount of data for finding appropriate model. It becomes easy for predicting future cases when the accurate model is detected. Thus, it is an attractive problem-solver in situations where the rules are complicated.

⁸ See supra note 7

⁹ Mirza Golam Kibria and others, 'Big Data Analytics, Machine Learning, And Artificial Intelligence In Next-Generation Wireless Networks' (2018) 6 IEEE Access <<https://ieeexplore.ieee.org/abstract/document/8360430>> accessed 18 August 2021.

¹⁰ Azael Socorro Márquez, *Can Artificial Intelligence Be Used To Appoint Arbitrators?* (2020) <<https://avarbitraje.com/wp-content/uploads/2021/03/ANAVI-No1-A12-pp-249-272.pdf>> accessed 11 August 2021. Page 263

There are two universal assumptions about the application of Artificial Intelligence. The first assumption is that performance of the model will improve in proportion to the data available for training. Another assumption is that automation will be more dependent on data analytics, which would result in less human interference.¹¹ Thus, a correct balance is needed between these two assumptions for application of AI in the field of law.

1.2 Artificial Intelligence model in Arbitration

There is no existence of an AI model that can act as an arbitrator but there are models that have the ability to develop assisting tools in arbitration proceedings such as gathering, analysing facts. Few of the technical possible AI models that can contribute in supporting parties for the selection of appropriate arbitrator are:

- Instant meeting scheduling:¹² This is an AI application that assists the parties to arbitration and the arbitrators of the case in scheduling the meetings. With the help of this application, it becomes simple for the parties to arrange all the meetings and hearings. In other words, it associates party's agendas such as fixing up meeting time, venue of meetings, etc. without much interference of human.
- Ross:¹³ This application of Artificial Intelligence grants access to the parties and arbitrators to navigate through the documents, case laws and other related stuff. It can be useful for the parties for comparing the arguments with similar cases.
- DISCO: The DISCO model of Artificial Intelligence is suitable for tasks such as organising the evidences, searching and reviewing transcripts and many more.¹⁴
- Kira: The AI application Kira "identifies, extracts and analysis text in contracts and other documents" in a short period of time.¹⁵ It is an effective and efficient mode of reviewing relevant information on specific cases.
- Arbilex: This application of AI is created for international arbitration for predictive analytics "to enhance decision making by law firms and litigation funds".¹⁶ With the help of predicting data, it becomes convenient to measure uncertainties and increase the chances of desirable outcomes. Research has been conducted on this model of artificial

¹¹ See Supra note 10

¹² See supra note 10, Page 264

¹³ ibid

¹⁴ ibid

¹⁵ ibid

¹⁶ ibid

intelligence. The research was conducted on US Supreme Court decisions from 1816 to 2015. More than thousands of outcomes were analysed and the AI model was successful in predicting the outcome of all the decisions, made with accuracy of 70.2 percentage. Such AI models are an example of technical development in the field of arbitration. Features of this AI model can used in future for appointing AI arbitrator as the model can assist in determining availability of potential or suitable list for arbitrators for cases.

CHAPTER 2: APPOINTING AI AS ARBITRATOR

2.1 Is AI eligible to be Arbitrator?

Before we begin with the discussion of implementing AI in arbitration, we need to first look into the basic question whether a non- human arbitrator is eligible for being appointed as an arbitrator and what does the current legislation on arbitration, both national and international, states about AI being appointed as an arbitrator.

In accordance to the New York Convention on Recognition and Enforcement of Arbitral Awards, there are two provisions which states about the arbitrators, i.e., -

Article I (2): The term "arbitral awards" shall include not only awards made by arbitrators appointed for each case but also those made by permanent arbitral bodies to which the parties have submitted.¹⁷

Article V (1) (b): Recognition and enforcement of the award may be refused when the party against whom the award is invoked was not given proper notice of the appointment of the arbitrator or of the arbitration proceedings or was otherwise unable to present his case.¹⁸

In both these articles, there is no such mention about that arbitrators need to be human being and not a machine. The arbitrator is referred only as the person who renders an arbitral award. Since there is no provision which states explicitly or implicitly any restriction against the application of AI arbitrator under the New York Convention, the AI arbitrators could issue an arbitral award which can be enforced under this convention. Also, the arbitral award will be recognised and enforced where the parties to a dispute have explicitly expressed, either through an agreement or other legally recognised means, that they wish to appoint an AI arbitrator.

¹⁷ Article I (2) of New York Convention on Recognition and Enforcement of Arbitral Awards

¹⁸ Article V (1) (b) of New York Convention on Recognition and Enforcement of Arbitral Awards

¹⁹Even though international law does not expressly state the requirement of arbitrators as human beings but envisage them such by laying down standards or attributes that is possible to be carried out by humans only.

As per national laws of some countries, the scenario regarding an AI arbitrator is quite different from international arbitration. The Dutch Code of Civil Procedure,²⁰ the French Code of Civil Procedure,²¹ and the Portuguese Voluntary Arbitration Law²² lays down the requirement of a natural person with full capacity to act as an arbitrator. Thus, making it crystal clear that AI is not eligible to act as an arbitrator. Countries like Vietnam,²³ China,²⁴ North Korea²⁵ and Indonesia²⁶ have stated in their arbitration law a specification for qualifying as an arbitrator. This qualification is regarding the mandatory experience of being a judge or a lawyer for certain number of years, or having specialised knowledge in a particular field of law, etc. In a similar manner, arbitration laws of Sweden,²⁷ Finland,²⁸ Iceland,²⁹ Egypt³⁰ and Italy³¹ establishes that a person needs to be in full capacity to act as arbitrator, which includes not being a minor, bankrupt or an incapacitated. The kind of skills and abilities specified in this legislation strongly support human beings as the only arbitrators.

Some legislation presumes an arbitrator as a natural person and refer to these arbitrators by using gender pronoun, i.e., him/his. According to Section 26 of the English Arbitration Act of 1996 it is stated that “the authority of an arbitrator is personal and ceases on his death.”

³²Several countries follow the UNCITRAL Model law in which arbitrators are indicated as

¹⁹ New York Convention on Recognition and Enforcement of Arbitral Awards

²⁰ '1023 - Netherlands - Arbitration Act * 1 December 1986 Code Of Civil Procedure - Book Four: Arbitration' (*Jus.uio.no*) <<https://www.jus.uio.no/lm/netherlands.arbitration.act.1986/1023.html>> accessed 17 August 2021.

²¹ 'France - Code Of Civil Procedure - Book IV - Arbitration In Force 14 May 1981' (*Jus.uio.no*) <<https://www.jus.uio.no/lm/france.arbitration.code.of.civil.procedure.1981/doc.html#26>> accessed 17 August 2021.

²² Rui Ramos, 'The New Portuguese Arbitration Act (Law No. 63/2011 Of 14 December On Voluntary Arbitration)' (*De Gruyter*) <<https://www.degruyter.com/document/doi/10.9785/9783504384784-003/html>> accessed 17 August 2021.

²³ Article 20 of The Vietnam law of Commercial Arbitration

²⁴ 'Laws' (*Npc.gov.cn*) <http://www.npc.gov.cn/zgrdw/englishnpc/Law/2007-12/12/content_1383756.htm> accessed 17 August 2021.

²⁵ Article 19 of The Law on External Economic Arbitration (Decree No. 875/1999), (N. Kor.),

²⁶ Article 12 of Arbitration and Alternative Dispute Resolution Act of Indonesia (Law No. 30/1999)

²⁷ Section 7 of Swedish Arbitration Act

²⁸ Article 8 of Finland Arbitration Act

²⁹ Article 6 of Act on Contractual Arbitration, Iceland

³⁰ Article 16(1) of The Law Concerning Arbitration in Civil And Commercial Matters, Egypt

³¹ Article 812 of Code of Civil Procedure, Italy

³² Section 26 of the English Arbitration Act of 1996

him/ his. Section 5 of the Federal Arbitration Act, United States also refers arbitrators by using gender pronoun.³³The use of such gender pronoun suggests that arbitrators are considered to be a natural person but there is no such explicit mention that an AI cannot be an arbitrator. This opens the possibility of making AI an arbitrator in near future unless any strict legislation is passed in this regard.

Arbitration is a procedure for settlement of disputes between the parties and it gives the parties the right and freedom to structure the arbitration procedure according to their convenience. It provides the parties the power to choose the law they want be governed with, i.e., party autonomy.

2.2 Selection of AI Arbitrators

In an arbitration procedure, the parties are free to interview and choose arbitrators of their choose. The question now arises is how will the parties to arbitration decide their AI arbitrators and on what be the basis of such selection. As stated earlier, the functioning of AI system depends on the data features and algorithms fed to it.

The motive behind implementation of an AI model for selecting arbitrators is that it reduces the obstacles of the beginning stage of the arbitration proceedings, thus enhancing the quality of the procedure. One of the major advantages of implementing AI system in selection process is regarding bias which prevails in human arbitrators when chosen by party appointed arbitrators, or are repetitive arbitrators, or the one with lack of information.³⁴The first two issues here, i.e., party appointed arbitrators and repetitive arbitrators, can be effectively dealt by AI system, but the issue of insufficient information could be challenging for the AI system.

The hindrance regarding lack of information occurs due to factors like confidentiality of data³⁵ or monopoly of information to a particular section of people. Such factors lead to ineffectiveness in the process of implementing AI technology. Hence, complete information

³³ Section 5 of the Federal Arbitration Act, United States

³⁴ Azael Socorro Márquez, *Can Artificial Intelligence Be Used To Appoint Arbitrators?* (2020) <<https://avarbitraje.com/wp-content/uploads/2021/03/ANAVI-No1-A12-pp-249-272.pdf>> accessed 11 August 2021. Page 266

³⁵ Sayantika Ganguly, Sonal Kumar Singh and Anish Jaipuria, 'Artificial Intelligence In Arbitration: Revolutionary Or Impractical - Litigation, Mediation & Arbitration - India' (*Mondaq.com*, 2021) <<https://www.mondaq.com/india/arbitration-dispute-resolution/1027248/artificial-intelligence-in-arbitration-revolutionary-or-impractical>> accessed 16 August 2021.

about the potential candidates is necessary for enforcing AI in process of appointment of arbitrators in order to achieve desired outcomes. The confidentiality factor is of utmost importance for the parties rather than disclosing profile of an arbitrator. There are circumstances where certain information is not accessible publicly. Such situation occurs when there is monopoly of information or repetitive arbitrators. Such information needs to be revealed in order to ensure appropriate AI arbitrator appointer. The Arbitrator Intelligence Project³⁶ can be considered as an approach to overcome such obstructions and implementing an AI arbitrator appointer. Arbitrator Intelligence Project is a “global information aggregator that collects and analyses critical information about decision making by international arbitrators”.³⁷ An appropriate database regarding the arbitrators could be framed with the help of a global questionnaire where some factual as well as interpretive questions are put up to the parties, regarding the procedural and substantive outcome rendered in a case by the arbitral tribunal. Instead of using AI technology, the Arbitrator Intelligence Projects favours the application of a data collection system, which makes it convenient for the AI arbitrator appointer to look through the gathered information and make a decision.³⁸

The application of Artificial Intelligence and various other technologies that aims at collection of data can be considered extremely useful in diminishing obstacles regarding AI arbitrator appointer which concerns lack of data.

2.3 Opportunities provided by AI

Application of AI Micro-Data:³⁹

The primary application of AI in the area of arbitration concerns the reviewing of large amount of digital arbitral micro-data which lies with the parties to arbitration and their counsel. It is used to establish the significant points required in resolving the dispute. It also contributes in analysing the data and use it in an effective way. This application of AI in the processing of

³⁶ Rogers Catherine a, 'Arbitrator Intelligence: The Pilot Project and Beyond' (*Kluwer Arbitration*, 20 January 2015) <<http://arbitrationblog.kluwerarbitration.com/2015/01/20/arbitrator-intelligence-the-pilot-project-and-beyond/>> accessed 20 August 2021

³⁷ See supra note 34, page 269

³⁸ *ibid*

³⁹ Kathleen Paisley and Edna Sussman, *ArtifiCial Intelligence Challenges And Opportunities For International Arbitration* (11th edn, Dispute Resolution Section of the New York State Bar Association 2018) <<https://nysba.org/app/uploads/2020/03/DisputeResolutionLawyerSpring18.pdf#page=35>> accessed 12 August 2021. Page 36

micro data saves time and cost, as digital data tends to create obstacles in complex issues. Thus, AI technology helps in combatting with the problems created by digitisation.

Reduction in Uncertainty:⁴⁰

In context of uncertainty, AI could be considered of great relevance. It provides assistance in reducing the uncertainties by analysing the arbitral award rendered and provides with legal reasoning behind the arbitral awards. It also provides guidance regarding legal arguments handled in earlier cases with an insight about how arbitrators have settled the disputes and how damages have been handled.⁴¹ Apart from this, AI has greatly contributed in predicting several aspects such as achieving success in both general manner and with a specific decision maker, likely range of damages, concerning costs to be incurred, facts regarding the opposite party (which would consist of party's experience in specific disputes), etc.

Merits of AI: AI modifies the working of arbitration procedure, the manner in which cases are prepared, and many more, by adapting changes in several aspects. It allows the parties to select the arbitrators based on likely outcomes, cut down the cost and time involved in research and data analytics, planning of budget, and many more.

CHAPTER 3: AI AND ARBITRATION

This chapter will be stating about AI arbitrator and Human arbitrator. It will describe the procedure of arbitration with the essence and application of AI in it. Other half of this chapter will be mentioning about the predictions of legal decision-making.

3.1 AI Arbitrator and Human Arbitrator

There is a general belief that AI system can be more effective as well as exact in nature as compared to human arbitrators. In a study conducted, related to predictability of European Court of Human Rights (ECHR) decisions by AI, the rate of accuracy found was 79%.⁴² On the other hand, the accuracy rate was found out to be 70.2% in US Supreme Court where

⁴⁰ See supra note 39

⁴¹ *ibid*

⁴² Nikolaos Aletras, 'AI predicts outcomes of human rights trials' (*UCL news*, 24 October 2016) <<https://www.ucl.ac.uk/news/2016/oct/ai-predicts-outcomes-human-rights-trials>> accessed 23 August 2021

decisions were predicted by AI.⁴³ The question that arises now is whether the AI system can take over human arbitrator? To answer this question, there is a need to focus on different stages of arbitration process and execution of AI on every stage.

Before we begin discussing different stages of the arbitration process, the point to be considered is replacement of Human Counsels by AI Counsels. In an arbitration procedure, there are several tasks such as preparation of claim and defence statements, preparing and filing documents, arguing, cross-examining, etc. Would it be possible for AI to perform all these tasks without human intervention? Unfortunately, AI technology has not been evolved to this level, but for its execution in arbitration sector it requires AI to have the ability to perform various key functions, for instance, analysing and processing of voluminous files, ability to connect facts with the law, knowledge about the sector under which dispute arises, argue in the case and cross examining the witness. It takes a lot of time for human counsels to develop such legal acumen and skills. Thus, it is doubtful if any technology will be able to imitate all these functions effectively in arbitration system.

Appointment of Arbitrators:⁴⁴ The first step in an arbitration process is appointment of arbitrators by the parties to dispute. If an AI arbitrator has been appointed instead of the human arbitrator, there could be some opportunities and obstacles. Usually, appointment of arbitrator is considered as a time-consuming process. AI can be of great advantage here in saving time and avoiding unnecessary hassle. Contrarily, there are chances that parties may have to face some obstacles because of AI arbitrator.

Submissions of claims and defence: The stage where submissions of claims and defence are to be made, there is a concern if AI arbitrator would be able to connect the facts of the case with law and make a fair decision. The reality is that the AI system operates itself only with the data that has been fed to it.⁴⁵ As stated above in the ECHR experiment, where the accuracy rate was

⁴³ Matthew Hutson, 'Artificial Intelligence Prevails at Predicting Supreme Court Decisions' (*ACM Tech*, 2 May 2017) <Communications of the ACM, 'Artificial Intelligence prevails at predicting Supreme Court decisions', (May 5, 2017), [⁴⁴ Sayantika Ganguly, Sonal Kumar Singh and Anish Jaipurkar, 'Artificial Intelligence In Arbitration: Revolutionary Or Impractical - Litigation, Mediation & Arbitration - India' \(*Mondaq.com*, 2021\) <<https://www.mondaq.com/india/arbitration-dispute-resolution/1027248/artificial-intelligence-in-arbitration-revolutionary-or-impractical>> accessed 16 August 2021.](https://cacm.acm.org/news/216852-artificial-intelligence-prevails-at-predicting-supreme-courtdecisions/fulltext#:~:text=Artificial%20Intelligence%20Prevails%20at%20Predicting%20Supreme%20Court%20Decisions,By%20Science&text=The%20algorithm%20correctly%20forecast%2070.2,about%2066%25%20right%20in%20comparison.> accessed 25 August 2021.</p></div><div data-bbox=)

⁴⁵ *ibid*

high, the data fed to the AI system included the facts which were written by judges only.⁴⁶ The data could thus have been biased too and this could have resulted in high accuracy. For rendering a fair and impartial decision, there is a requirement for training the AI arbitrator to overlook the prejudiced submissions and connect the facts with law. Also, sometimes there arises situations where individual skills are needed to resolving the dispute such as body language of witness, facial expressions, assessing circumstances, etc.⁴⁷ Thus, the decision-making function cannot be limited to technical issues.

Production of Documents: Next stage in the arbitration procedure is production of documents and evidences. These documents, when delivered/ input by the parties to AI system, can help AI to deliver a decision. However, there could be circumstances where one party files for discovery of documents or seeks an order for adverse inference. Such situation can cause hindrance to AI system in rendering decision, reason being inadequate data in arbitrations.⁴⁸

Hearing: The parties to arbitration carries the right to be heard,⁴⁹ i.e., oral hearing. Currently AI system is not as advance that it could conduct hearing of parties in a manner that human arbitrators does. The hearings are supposed to be analysed for arriving at a proper decision. It will be convenient for AI system to deliver the decision in cases where there is no hearing and only the documents are enough to reach on a conclusion.

Arbitration is guided by the rules of equity, conscience and natural justice, i.e., due process.⁵⁰ In an AI based arbitration, there are chances that parties may object the arbitral award on some ground such as one party not agreeing on the use of AI in the arbitration, or a party having the access to control AI system. Such situations need to be considered for using AI in arbitration.

Arbitral Award: Arbitral award is the final decision made by arbitrators after analysing the factual position. AI arbitrator might face some obstacles in delivering the arbitral award. The human arbitrators have expertise that leads to delivery of a proper arbitral award, which AI

⁴⁶ See supra note 44

⁴⁷ See supra note 43

⁴⁸ Aditya Singh Chauhan, 'Future Of AI In Arbitration: The Fine Line Between Fiction And Reality' <<http://arbitrationblog.kluwerarbitration.com/2020/09/26/future-of-ai-in-arbitration-the-fine-line-between-fiction-and-reality/>> accessed 12 August 2021.

⁴⁹ Sayantika Ganguly, Sonal Kumar Singh and Anish Jaipurkar, 'Artificial Intelligence In Arbitration: Revolutionary Or Impractical - Litigation, Mediation & Arbitration - India' (*Mondaq.com*, 2021) <<https://www.mondaq.com/india/arbitration-dispute-resolution/1027248/artificial-intelligence-in-arbitration-revolutionary-or-impractical>> accessed 16 August 2021.

⁵⁰ *ibid*

lacks. Such expertise and skills can be crucial in arbitration. Another obstacle is that AI system might not be able to render a reasoned decision,⁵¹ i.e., how and why the decision is made. A reasoned decision involves human process/ psychology. Also there exists several jurisdictions which requires arbitral award in writing and signed.

There are various other aspects that are needed to be considered. For instance, AI arbitration might not be adopted in complicated disputes with larger stakes; also, there is no hierarchical arrangement in AI system so right to appeal cannot be practised by the parties to dispute.

3.2 Study on prediction of legal decision-making

As stated above, there exists several studies that lend support to the computer programs being better than humans in terms of predicting the outcome of legal decision-making, for instance, 79% accuracy rate in European Court of Human Right's (ECHR) decisions by AI;⁵² accuracy rate- 70.2% in US Supreme Court.⁵³ It could be advantageous to review the studies on prediction of legal decision making as these studies can contribute in evolution of AI arbitrators.

Decision of U.S. Supreme Court:

The goal to study the predicting of U.S. Supreme Court decision was to discover a model that would generally be applicable to all US Supreme Court decisions over time and not just laying the focus on individual Supreme Court justice.⁵⁴ Another reason is that the study works on the principle that "all information required for the model to produce an estimate should be knowable prior to the date of the decision."⁵⁵ For attaining these goals, a study was conducted where all the US Supreme Court's decisions from two centuries, i.e., 1816 to 2015, were analysed. It included data of more than 28,009 cases and approximately 240000 votes by individual judges.⁵⁶ Technologies such as complex machine learning, huge volume of training

⁵¹ See supra note 49

⁵² See supra note 39

⁵³ See supra note 42

⁵⁴ Maxi Scherer, 'Artificial Intelligence And Legal Decision-Making: The Wide Open?' (2019) 36 Journal of International Arbitration
<<https://kluwerlawonline.com/journalarticle/Journal+of+International+Arbitration/36.5/JOIA2019028>>
accessed 13 August 2021. Page 551

⁵⁵ *ibid*

⁵⁶ Daniel Martin Katz, Michael J Bommarito, Josh Blackman 'A General Approach for Predicting the Behavior of the Supreme Court of the United States' (*Researchgate*, 2017) <https://www.researchgate.net/publication/311586220_A_General_Approach_for_Predicting_the_Behavior_of_the_Supreme_Court_of_the_United_States> accessed 25 August 2021

data was applied. With the help of these technologies, the researchers selected various sets of input feature for preparing a model. These features involved the details of identity of the parties, the disputed issue or the timing of the decision to be delivered. Another set of features included the information attained from the decision rendered in lower court, which is required to be examined. It comprised of identity of courts of origin, i.e., the Circuit Court of Appeals from which the dispute arose; directions given by lower courts contrary to the issue of dispute. The third category of features included of composition of Supreme Court such as the identity of the judges, political interferences, etc. The last set of features comprised of Supreme Court's procedure, form of oral argument, timing of the case, behaviour of the judges. The use of algorithms in the out of sample data was made for predicting if the court would affirm or reverse a judgement; and how each judge would vote. The model demonstrated a high rate of accuracy: 70.2% in predicting the US Supreme Court's decisions with the accuracy of 71.9% of judge's vote.⁵⁷ The researchers claimed that the model's performance remained stable over time. Despite its success, the application of this study in the field of arbitration appeared narrow as several doubts remained answered. The principle of the study that "all information required for the model to produce an estimate should be knowable prior to the date of the decision",⁵⁸ however in some cases the input data features are accessible for a short period before the decision is delivered. A large amount of input data is specific to Appellate Court or Supreme Court for reviewing the lower court's decision. There are very few input features that are original to the matter in issue. Thus, there is no involvement of training data where the court has original jurisdiction. In such situation there are chances that the court's decision might lead to complex outcome. This situation raises the question if the model would prove to be successful in cases where court are supposed to decide the matter.

The disputes under International Arbitration involves complex fact and law that can be challenging to map into a binary outcome model. This leads to a doubt concerning the ability of AI model in predicting arbitral awards when the facts are complex in nature.

Another point to be considered is that the features of the AI model are influenced by political justices, avoiding the actual court content. In U.S. the appointment of judges is biased, resulting in partial decisions.⁵⁹ Hence, the study's aim to develop a general model does not seem to be

⁵⁷ See supra note 54

⁵⁸ See supra note 53

⁵⁹ *ibid*

applicable in other jurisdictions. From arbitration's point of view, the parties to dispute can argue that the arbitrator's political influence can result in an unfair arbitral award.

Decisions of European Court of Human Rights:

The researchers who conducted the study related to prediction of decision-making of European Court of Human Rights (ECtHR) focused on training the machine learning algorithms with the help of prior decided cases on article of European Court of Human Rights, namely Article 3 prohibiting torture,⁶⁰ Article 6 protecting the right to a fair trial,⁶¹ and Article 8 protecting the right to respect for private and family life.⁶² These provisions were selected as majority of the case decisions were related to them under the convention. From each of these provisions stated, equal number of decisions were studied in which ECtHR found a violation and in which no violation existed. The model used in the study was based on using natural language processing, machine learning and textual information of the decisions, excluding the background or political influence. The data used in the study was taken from the facts, laws and procedure of the decisions.⁶³ The model was trained and predicted legitimate outcome with 79% accuracy.

Even after attaining success with a high accuracy of 79%, there existed several limitations. The first weakness was that other than the text of published judgements, there was no access to other case documents.⁶⁴ The part containing the legal reasoning of the judgement was not made accessible to the parties, prior trial. The second drawback was that the conclusions were drawn on the basis of court's delivery of the case facts, instead of party's own characterizations of facts, thus resulting in obstruction to ex-ante outcome prediction.⁶⁵

Despite of the limitations, the study of ECtHR can be applicable to AI arbitration as the study shows the use of actual text of judgements using natural language processing and not using background information or judge's behaviour. This feature can be applicable in predicting arbitral award. For predicting correct awards of arbitration cases, it would require to data set consisting of transcripts and awards of actual proceedings, judicial opinions by courts,

⁶⁰ Article 3 of European Court of Human Rights

⁶¹ Article 6 of European Court of Human Rights

⁶² Article 8 of European Court of Human Rights

⁶³ David Lehr & Paul Ohm, 'Playing with the Data: What Legal Scholars Should Learn About Machine Learning' (*Law review*, 2017) <https://lawreview.law.ucdavis.edu/issues/51/2/Symposium/51-2_Lehr_Ohm.pdf> accessed 30 August 2021

⁶⁴ Gizem Halis Kasap, 'Can Artificial Intelligence ("AI") Replace Human Arbitrators?' [2021] *Journal of Dispute Resolution* <<https://scholarship.law.missouri.edu/jdr/vol2021/iss2/5>> accessed 30 August 2021. Page 218-220

⁶⁵ *ibid*

admissible statutes and rules of the arbitral procedure, etc. While the actual position is that currently a model uses only prior cases as information. Thus, actual awards and other content is needed for predicting arbitral awards until an improvised model comes into existence. The researchers found out that it was convenient for them to use textual information available from ECtHR judgements as the sections having the contents were separated. Unlike domestic awards, international arbitral awards are in detailed format. What is needed to be included in a reasoned award remains in question. Since the model is based on textual information of arbitral awards, it would be difficult to separate factual findings and legal outcomes.

In both these studies, US Supreme Court and ECtHR, the data happens to come from apex court. However, international arbitration is fact based and opposes reviewing the decision of another tribunal. Thus, it is challenging to answer if AI model can predict awards when the case is not converted to binary classification.

CHAPTER 4: LEGAL SAFEGAURDS

For accomplishing a fair success in arbitration, there are some safeguards that are supposed to be maintained. These safeguards are considered important for maintaining the integrity of arbitration. With the presence of AI arbitrators, it is presumed that the parties, tribunals and arbitration institutions will contribute in maintain the due process of safeguards.

4.1 Self-sufficiency

There are some legal concerns related to AI arbitrators which are to be taken care of. As a matter of fact, arbitrators are required to be independent and impartial to the parties in dispute.⁶⁶ The word “independence” (in terms of arbitrator) relates to the financial interest, personal relationship of the arbitrator with the party to dispute. Such link can be determined by the examination of their relations.⁶⁷ The word “impartial” reflects the prejudice, discrimination of the arbitrator towards a party.⁶⁸ Impartial nature relates to the behavior of state of mind of the

⁶⁶ C Leaua, M Aniței, 'The role of trust in the decision making process of appointing the commercial arbitrators' (*Researchgate*, 2012) <https://www.researchgate.net/publication/271889507_The_role_of_trust_in_the_decision_making_process_of_appointing_the_commercial_arbitrators> accessed 11 November 2021, page 920

⁶⁷ Yu Hong-Lin, Laurence Shore, 'Independence, Impartiality, and Immunity of Arbitrators—us and English Perspectives' (*Cambridge University Press*, 17 January 2008) <<https://www.cambridge.org/core/journals/international-and-comparative-law-quarterly/article/abs/independence-impartiality-and-immunity-of-arbitratorsus-and-english-perspectives/314216A8041D69B3FA253FA8D4BC770F>> accessed 30 August 2021

⁶⁸ See supra note 67

arbitrator.⁶⁹ The question raised here is whether AI arbitrator is capable of maintaining the integrity of arbitration by acting in an independent and impartial manner.

There are higher chances of AI arbitrator being more independent as compared to the human arbitrator. There are several reasons are making it possible. The first one is that AI is a machine and a machine does not carry any sentimental values, emotional intelligence or relations of any kind, neither friendly nor enmity.⁷⁰ The conclusions drawn by the machines are solely based on the facts provided in the data, or in accordance to the logic input. AI arbitrator can never be pulled in a situation of conflict; no involvement of external pressure in making arbitral award. For instance, IBM's Ross⁷¹ - World's first artificially intelligent Attorney, attained the status that it can act as an arbitrator. It would act in an independent way, irrespective of the situation where parties to dispute own IBM's stock or is working in IBM. Ross works on the algorithm that abides by the same set of rules for passing every decision except where algorithms are intentionally designed to favor the party belonging to IBM.

The general rule in arbitration is that, before the arbitral proceedings start, the arbitrator has to disclose their relations with the party, any financial interest in the dispute or any situation that might influence their decision or lead to an unfair arbitral award that can be questioned.⁷² The AI arbitrator will help on concentrating the programming of algorithms.⁷³ For the developers of AI arbitrators, it should be mandatory to explain the working of AI arbitrator in terms of programming and stating the features which depicts the independence of AI machine.

⁶⁹ Pablo Agustín Alonso, 'Impartiality and Independence of Arbitrators in International Arbitration: Issue Conflicts as Grounds for Disqualification with Special Regard to ICSID Arbitrations' (*Brill scholarly publication*, 2017) <https://brill.com/view/journals/mpyo/20/1/article-p535_535.xml?language=en> accessed 11 November 2021

⁷⁰ Nick Bostrom, 'Superintelligence: paths, dangers, strategies' (*Researchgate*, January 2014) <https://www.researchgate.net/publication/320182421_Superintelligence_paths_dangers_strategies> accessed 30 August 2021

⁷¹ Gizem Halis Kasap, 'Can Artificial Intelligence ("AI") Replace Human Arbitrators?' [2021] *Journal of Dispute Resolution* <<https://scholarship.law.missouri.edu/jdr/vol2021/iss2/5>> accessed 10 August 2021. Page 241

⁷² Matti S Kurkela and Santtu Turunen, *Due Process in International Commercial Arbitration* (2nd edn, 2010), page 120

⁷³ Lord Justice Saville, 'Departmental Advisory Committee on Arbitration Law 1996 Report on the Arbitration Bill' (*Oxford Academic*, 2014) <<https://academic.oup.com/arbitration/article-abstract/13/3/275/218455?redirectedFrom=fulltext>> accessed 11 November 2021

The example of Northpointe Corporation’s Correctional Offender Management Profiling for Alternative Sanctions algorithm (COMPAS)⁷⁴, used by U.S. courts for assessing the likelihood of a defendant, is of relevance in this topic. COMPAS assisted the judges for deciding the time period, probation of each defendant in prison. Numerable factors were taken into consideration for conducting risk assessment, avoiding the racism card. Thus, algorithm being independent. Nonetheless, there are some studies claiming the COMPAS algorithm as biased. The example of COMPAS algorithm shows that an independent AI arbitrator could be partial.

4.2 Impartiality

“An arbitrator who is impartial but not wholly independent may be qualified, while an independent arbitrator who is not impartial must be disqualified.”⁷⁵ – Bishop and Reed

This quote is also applicable to AI arbitrators. Where the programming of AI arbitrators is done in such a way that they follow neutral procedure, it might yield partial decisions by considering any pre-existing bias in the training system. In other words, an AI arbitrator is neutral procedurally there is no guarantee that the decision will not be partial, reason being the programming of AI arbitrator. Such circumstances lead to setting aside of the arbitral award on the ground of impartiality.⁷⁶ To determine whether the arbitral award given by AI arbitrator is biased, various jurisdictions have adopted different strategies for setting aside or refusing the enforcement of biased award.

English Law⁷⁷: For avoiding the enforcement of biased award, the party needs to prove that there was existence of real danger of bias.

U.S. Law:⁷⁸ The court may vacate an arbitration award “where there was evident partiality or corruption in the arbitrators.” 9 U.S.C. §10(a).

UNCITRAL:⁷⁹ It is necessary to show the existence of justifiable doubts for setting aside or refusing enforcement of an arbitral award.

⁷⁴ Adel Abusitta and others, Generative Adversarial Network for mitigating biases in Machine Learning system (IOS Press 2020)

⁷⁵ Bishop and Reed

⁷⁶ Article 12 of UNCITRAL Model Law on International Commercial Arbitration

⁷⁷ Section 33(1)(a) of The English Arbitration Act 1996

⁷⁸ 9 U.S.C. §10(a) of U.S. Law

⁷⁹ Article 36 of UNCITRAL Model Law on International Commercial Arbitration

Proving the existence of partiality has always been crucial but with the introduction of AI arbitrator it is going to be more challenging because of the transparency issue of AI.⁸⁰ The parties to dispute who challenges the arbitral award on the ground of lack of impartiality might fail to identify the issue due to the black box nature of AI algorithm.⁸¹ As machine learning based programs is the one that defines rules for AI arbitrators, it becomes difficult for designers of AI system to identify the mistake or the algorithms that leads to mistake.⁸² Since lawyers are not technically trained to deal with algorithms, they require experts for the revealing the partial act done by AI arbitrators.

The fact that both commercial and government algorithms are often proprietary is of concern. For instance, it is still not confirmed if COMPAS is biased. The details of the algorithms and its working were not revealed. It became a hindrance in assessing as to what extent the algorithm was biased.

In accordance to the rules of arbitration, it is the duty of the arbitrator to disclose any circumstances that could later result in questioning on arbitrator's impartiality.⁸³ Where the arbitrator is found out to have acted in a bias manner, he or she will be removed from the case, irrespective of any discovery of evidence of such biasness in the final award or not. However, in case of AI arbitrator, the bias can be identified in algorithm on after reviewing the use or result of such algorithm. This step of the procedure is similar to traditional arbitration procedure and can be used for discovery of impartiality with such disclosure. Despite of such disclosure of algorithms, AI arbitrator may produce unfair results. This problem can overcome by the help of systematic auditing and attain the common goal of anticipating biasness.

⁸⁰ Azael Socorro Márquez, *Can Artificial Intelligence Be Used To Appoint Arbitrators?* (2020) <<https://avarbitraje.com/wp-content/uploads/2021/03/ANAVI-No1-A12-pp-249-272.pdf>> accessed 11 August 2021. Page 268

⁸¹ Ahmed Mohammad Al-Hawamdeh, Noor Akief Dabbas, Qais Enaizan Al-Sharariri, 'The Effects of Arbitrator's Lack of Impartiality and Independence on the Arbitration Proceedings and the Task of Arbitrators under the UNCITRAL Model Law' (*Researchgate*, August 2018) <https://www.researchgate.net/publication/327320717_The_Effects_of_Arbitrator's_Lack_of_Impartiality_and_Independence_on_the_Arbitration_Proceedings_and_the_Task_of_Arbitrators_under_the UNCITRAL_Model_Law> accessed 11 November 2021, page 64-66

⁸² *ibid*

⁸³ Art. 12 (1) of UNCITRAL Model Law

4.3 Due process related to facts

There are three basic components of arbitration, i.e., facts, laws and application of relevant law to the facts of a case.⁸⁴ For maintaining a proper AI arbitrator system, these components are required. Ideally, an AI arbitrator would always have access to the facts and statement of the case. However, in actual situation the facts of the case are not direct. The parties to the dispute are required to expressly give their opinion on the facts that they consider significant. The tribunal then has to decide whether the facts are important and also if the evidence provided is satisfactory for proving the disputed facts.⁸⁵ Another difficulty arises in deciding the question of law. A legal decision or rule could be defined in a classified manner when considering question of law, for instance, parties entered in a valid contract- yes/ no. The question of law and question of fact cannot be separated where the law determines the facts that are relevant legally.⁸⁶ For deciding the issue, AI arbitrator will be needing well-established facts and relevant law. The AI models have been predicting the decisions based on the judicial decisions made earlier and in accordance to the facts of the case provided by the court. According to the observations made by Ben-Ari and others, the application of AI systems in the legal proceedings can lead to replacement of judges.⁸⁷ From such observation it could be presumed that AI technologies could perform tasks such as questioning the witnesses, identifying the emotions of witness, revealing if there is lying or misrepresentation of facts. Such discovery can then be input in the AI model for accomplishing the goal of predicting outcomes of the case.

The ability of human in terms of reasoning, assembling parts of background knowledge, common sense and judgement is way beyond the ability of machine learning. All these elements play a vital role in resolving the issues. There are certain activities that AI performs efficiently as compared to humans but still lacks common sense,⁸⁸ e.g., where a witness asks AI system to call an ambulance, to which the system replies “okay, from now I will call you

⁸⁴ Matti S Kurkela and Santtu Turunen, *Due Process in International Commercial Arbitration* (2nd edn, 2010), page 141

⁸⁵ *ibid*

⁸⁶ *ibid*

⁸⁷ Daniel Ben-Ar, “‘Danger, Will Robinson’? Artificial Intelligence in the Practice of Law: An Analysis and Proof of Concept Experiment’ (*JOLT Richmond Education*, 15 March 2017) <https://jolt.richmond.edu/2017/03/15/volume23_issue2_greenbaum/> accessed 1 September 2021

⁸⁸ Karen Hao, ‘Tougher Turing Test Exposes Chatbots’ Stupidity’ (*MIT Technical Review*, 31 January 2020) <<https://www.technologyreview.com/2020/01/31/304844/ai-common-sense-reads-human-language-ai2/>> accessed 2 September 2021

an ambulance". This depicts that common sense is essential for interacting and resolving the issue. In international arbitration, the arbitral tribunal is not burdened with the duty to establish the facts of the case.⁸⁹ Usually, it's the arbitrators who questions the parties to dispute, requests for evidentiary support and other things; in other words, the arbitrators are the one establishing facts of the case. Thus, discovery of correct facts is mandatory for legal protection and a fair outcome.

It can be now clearly understood that where the application of AI system in arbitration case is unable to use common sense, it would be a hindrance to determine the facts of the case or whether evidence is required or whether there is a need to hear call the witness, etc. All these together would lead to violation of due process of arbitration.

4.4 Reasoned Decisions

An arbitral award is not only limited to the decision of the dispute in question, but extends its scope by providing a proper explanation or justification of the decision made. It gives an elaborated reasoning explaining how the party lost, also assures that both the parties are heard and recognised.⁹⁰ It is the quality and nature of the arbitral award that determines the victory or loss of the arbitration procedure. There are few goals that are to be attained from reasoned arbitral award. Reasoning helps in laying the grounds on which the decision is made, thus letting the losing party know about the steps taken for achieving a fair outcome. Reasoned decision also acts as a safeguard against irrationality. The decision-making power in the hands of arbitral tribunal can be easily supervised by the parties to dispute, appellate tribunals or courts. Due to reasoned decision, it becomes convenient for the appellate authorities or the court to review the arbitral award that is to be enforced.

On the other hand, arbitral awards given by AI arbitrators involves some concerns in the sector of reasoned decision making. According to the AI arbitrator, the algorithms used for predicting decision are effective and efficient in comparison to the human arbitrator but it fails to provide with a reasoned decision in conventional manner. It would be easy for the data analysts or other experts to the decision generated from the algorithms but the parties and legal actors

⁸⁹ See supra note 88

⁹⁰ Maxi Scherer, 'Artificial Intelligence And Legal Decision-Making: The Wide Open?' (2019) 36 *Journal of International Arbitration*
<<https://kluwerlawonline.com/journalarticle/Journal+of+International+Arbitration/36.5/JOIA2019028>>
accessed 13 August 2021. Page 562

involved might not be able to understand the logic behind the decision of algorithm.⁹¹ Thus, it is challenging to inquire an algorithm regarding the justification of each prediction. Even a scientific explanation of the prediction made by algorithm, might not be satisfactory in legal context. Such situations of no appropriate reasoning by AI arbitrator can result in setting aside or refusal to enforcement of an arbitral award given by AI arbitrator.

Even if AI algorithms are able to provide awards with reasons, the reasons will tend to lose it operate as a medium through which arbitrators brings doctrines, as AI cannot produce new type of conclusion.⁹² In general, arbitrators are free to apply the law in a manner moulds the rule according to the facts of case as well as interpret the rules. They are allowed to operate in considerable discretion in applying the law regulating the issue, and uphold such power by providing justified reasoned decisions. As Lord Mustill's put it, [I]n making his award, the arbitrator . . . creates new rules, which he then applies retrospectively to the original bargain [and] in the absence of established norms, the arbitrator exercises a creative function, acting as a social engineer.⁹³

4.5 Public Policy

Primarily, when there are violations of public policies where the sovereignty and the interest of the state is in danger, the courts have contributed in finding such encroachment. In a similar manner, the awards rendered by AI can also face obstacles concerning violation of public policy. Courts presume that AI arbitrators would surely violate the public policy as it would have no human intervention. The judges of courts have not been in favour of the technical legal reasoning and have tried to make progress in human legal reasoning. Few courts have argued that the judges need to resolve the issues by involving human knowledge and experience. The absence of emotional intelligence in AI arbitrators might result in violation of public policy.⁹⁴ There are possibilities where violation of public policy can exist where AI arbitrator causes severe inconsistencies in arbitration procedure. In such case the losing party can raise on

⁹¹ David Lehr & Paul Ohm, 'Playing with the Data: What Legal Scholars Should Learn About Machine Learning' (*Law review*, 2017) <https://lawreview.law.ucdavis.edu/issues/51/2/Symposium/51-2_Lehr_Ohm.pdf> accessed 30 August 2021, page 708

⁹² Karen Maxwell, 'Summoning the demon: robot arbitrators: arbitration and artificial intelligence' (*Arbitration blog*, 17 January 2019) <<http://arbitrationblog.practicallaw.com/summoning-the-demon-robot-arbitrators-arbitration-and-artificial-intelligence/>> accessed 12 September 2021

⁹³ See supra note 68

⁹⁴ Ryan Calo, 'ROBOTS AS LEGAL METAPHORS' (*Harvard law*, 2016) <<https://jolt.law.harvard.edu/assets/articlePDFs/v30/30HarvJLTech209.pdf>> accessed 12 September 2021, page 210

objection on the grounds of procedural unfairness stating about the public policy violation. The court can set aside or refuse to enforce the arbitral award⁹⁵ on such ground where it finds that AI arbitrator has violated the essentials, i.e., fairness, reasoning, impartiality and independence.

The community of international arbitration has always hesitated in adopting new technologies because of the uncertainty that might be caused in future and result in setting aside or refusal of enforcement of arbitral award. For instance, where a national court finds out that an arbitral award has violated the public policy- reason being that the process used by ICC court for reviewing the arbitral award was unknown to the national court, the court can then object and held the process being interrupted with the independence of the arbitrator, thus resulting in violation of public policy. In dealing with the arbitral awards given by AI arbitrators, courts might need to maintain a supportive viewpoint on the unexplored areas.

CHAPTER 5: TECHNOLOGICAL MEASURES

This chapter will give a detailed insight about the technical aspects of AI arbitrator and will discuss about the usefulness of data for achieving a successful AI model.

5.1 Requirement of non-confidential data

The reason behind the success of AI models in most of the industries is the data. The performance of AI model tends to improve with the amount of data it receives as well as the quality of data. More the data, more the efficiency of AI model. Data acts as an essential element for the programming of machines for attaining particular goals.⁹⁶ Technological advancement in machines is capable carrying large amount of data for AI projects, for instance, smartphones. In context of arbitration, the issue of concern is whether the existing data is sufficient for the AI arbitrators to function. The first and foremost requirement of a data driven AI system is access to data. There exists two-fold limitation of AI system in terms of volume of data.⁹⁷

⁹⁵ Article 36 of UNCITRAL Model Law on International Commercial Arbitration

⁹⁶ Azael Socorro Márquez, *Can Artificial Intelligence Be Used To Appoint Arbitrators?* (2020) <<https://avarbitraje.com/wp-content/uploads/2021/03/ANAVI-No1-A12-pp-249-272.pdf>> accessed 11 August 2021. Page 266

⁹⁷ See supra note 84

The first limitation is that the international arbitral awards are not always published⁹⁸ or easily accessible; and the one that are published are accessible in redacted format. Arbitration is known for its nature, i.e., privacy and confidentiality. Such confidentiality exists for protecting the rights of affected parties and underlying transactions. Even though access to arbitral awards and material are extremely limited, but where the confidential arbitral awards are not published, arbitral institutions could gather them and make it accessible with the aim of building up AI models. Thus, it is challenging to compile large data of arbitral awards.

Secondly, where the arbitral awards and material are accessible, a large amount of data size is highly important.⁹⁹ Sometimes even the large amount of data (arbitral decisions) is also not sufficient for building the ideal AI system. There is no such compulsion that a fixed number of arbitral awards are required for a data set, but a few hundreds of case data cannot be considered adequate. Large number of arbitral awards on a particular topic will be considered appropriate for AI models.

In an ideal situation where all arbitral awards are full accessible and are sufficient for creating data set, issue may arise from the variety of disputes covered under arbitration. For instance, international arbitration consists of cross-border transactions¹⁰⁰ which are contractually complex by nature. Such variety contributes AI system in having extensive range of predictions. While on the other hand, such huge variety of issues might be small in size in comparison to applicable sample. Let's assume that there are 5000 arbitral awards, completely accessible, and are supposed to be used for building an AI arbitrator. These 5000 arbitral awards cover a wide variety of disputes from different areas of law such as commercial contracts, banking, finance and many more. Expansion in variety of disputes will tend to lessen the number of arbitral awards in a specific type of dispute. Thus, it is convenient to say that even a large number of arbitral awards here, i.e., 5000 cannot be used for a particular AI prediction model.

5.2 Variety of patterns

Apart from the size of data, a variety of input data is also essential for making an AI model strong. A variety of data can come from different sources and can include both structured as well as unstructured data. In arbitration context, it is not easy to find a variety from different

⁹⁸ See supra note 84

⁹⁹ *ibid*

¹⁰⁰ Paul Klaas, 'International Commercial Arbitration' (*Cc Arbitrators*, 2017) <<https://www.ccarbitrators.org/wp-content/uploads/2021/05/International-Commercial-Arbitration.pdf>> accessed 20 September 2021

sources as data is confined to past arbitral awards. One of the concerns of repetitive patterns or constructing AI model is how much repetitive patterns are needed and will these patterns be able to resolve complex issues.¹⁰¹ Increase in number of inconsistent disputes leads to increase in obstruction in progress of AI model. AI model are much more inclined towards the application of investment arbitration rather than the international commercial arbitration,¹⁰² reason being that investment arbitration consists of several number of familiar issues and commercial arbitration contains diversified issues. Another concern is related to model output. In accordance to the legal prediction stated in the previous chapter, binary classification was applied as output task,¹⁰³ i.e., classification related to presence of violation or non-violation of a provision in the convention (under ECtHR); and classification concerning affirmation of decision given by lower court. Such circumstances raise concerns if such similar models can be constructed for accomplishing for non-binary work.

Lord Hoffman gave an explanation on the issue of standard of proof using binary analogy:

*“If a legal rule requires a fact to be proved (a fact in issue), a judge or jury must decide whether or not it happened. There is no room for a finding that it might have happened. The law operates a binary system in which the only values are 0 and 1. The fact either happened or it did not. If the tribunal is left in doubt, the doubt is resolved by a rule that one party or the other carries the burden of proof. If the party who bears the burden of proof fails to discharge it, a value of 0 is returned and the fact is treated as not having happened. If he does discharge it, a value of 1 is returned and the fact is treated as having happened.”*¹⁰⁴

Several legal queries can be put into binary tasks, but if such approach is adopted then there can be a huge number of binary tasks in every case. The AI model needs to be effective in finding out the appropriate pattern and algorithms from the data input, and for achieving this goal it requires one clear output question that helps making a proper AI model.

¹⁰¹ See supra note 84

¹⁰² Magdalene D’Silva, 'Dealing in Power: Gatekeepers in Arbitrator Appointment in International Commercial Arbitration' (*Oxford Academic*, 2014) <<https://academic.oup.com/jids/article-abstract/5/3/605/866457>> accessed 11 November 2021

¹⁰³ See supra note 84

¹⁰⁴ Lord Hoffmann, 'Judgments - In Re B (Children) (Fc) Appellate Committee Lord Hoffmann Lord Scott of Foscote Lord R' (*House of Lords*, 2008) <<https://publications.parliament.uk/pa/ld200708/ldjudgmt/jd080611/child-1.htm>> accessed 25 September 2021

5.3 Changes in policy

Scarcity of data is an issue under international arbitration rather than abundance of data. There are chances that in near future the decisions might not be persistent. Also, when the decision appears, there could be reformed policy for making the previous data as outdated one. Such change in policy can be sometimes revolutionary and prompt. Due to such change in the policy, the concern here rises whether AI model will be capable of dealing with the situation of policy changes as AI models tends to obtain information from previous data. AI models might favour keeping the perspective that are linked to previous case.

5.4 Concept of Overfitting

It is usually believed that AI arbitrator predicts the dispute by generalizing the decision-making pattern used earlier and on the basis of training given. The function of generalizing decision-making pattern is a core element of a successful AI model.¹⁰⁵ This function of generalizing is not easy to put in effect due to one of the major drawbacks of machine learning, i.e., Overfitting. Overfitting is a type of framework that models the training data. It occurs when the algorithms learn the distinctive feature of the training data to such an extent that it eventually starts affecting the performance of the AI model as the machine tends to creates pattern that fits perfectly with the data.¹⁰⁶ In other words, unplanned fluctuations in training data are chosen and learned as model's approach. Thus, the concept of overfitting negatively affects the generalization of AI model. To explain this further, we can take an example of a situation that occurred in 2019,¹⁰⁷ where an AI model was trained to determine a huge variety of images, out of which a tench (type of large fish) was supposed to be identified. The machine established fingers near the green background rather than establishing the identity of the fish as the image of tench features like a trophy (fingers holding it as a predictive feature).

In context of arbitration, there is a possibility that AI arbitrator can grasp and learn to read the metadata. The AI arbitrator can then use the details of metadata instead of the facts of the dispute in question, for predicting the outcome. The issue with overfitting is that it hinders the process of machine learning. There is a high probability that AI system can get influenced by

¹⁰⁵ Ethem Alpaydin, Machine Learning (Toppan best-set Premedia Ltd 2016), page 176

¹⁰⁶ STUART J. RUSSELL & PETER NORVIG, ARTIFICIAL INTELLIGENCE A MODERN APPROACH 705 (2016).

¹⁰⁷ Wieland Brendel and Matthias Bethge, 'APPROXIMATING CNNs WITH BAG-OF-LOCALFEATURES MODELS WORKS SURPRISINGLY WELL ON IMAGENET' (*Arxiv.org*, 2019) <<https://arxiv.org/pdf/1904.00760.pdf>> accessed 15 October 2021

overfitting when the amount of input features is more in comparison to small dataset which is used for the purpose of training. Since the decisions made are not focused much on question of law and they are fact driven, the number of input features are high in an AI arbitrator. The field of arbitration consists of variety of complex issues, which results in requirement of good amount of input features for resolving the complicated matters.

An observation has been made by the researchers that the shortage or unavailability of data due to the nature of international arbitration (i.e., confidentiality; diversity of disputes; a smaller number of arbitration cases) has led to serious problems. The AI models that are basic and simple are usually the one with the accuracy which is low predictive.¹⁰⁸ On the other hand, the AI model which is complex in nature is the one where there is high possibility of overfitting. Thus, both the AI models, simple and complex, carry its own set of disadvantages in terms of predicting the outcomes of the matters in question. For making the AI model capable of attaining the goal of predicting outcomes with a high accuracy rate and avoiding the issue of overfitting, the experts need to strike an optimal balance between the simplicity and complexity of AI models.

5.5 Risk of biasness

There are three essential elements of AI for achieving a fair outcome: Un-biasness, Trustworthiness and Transparency. It is presumed that AI models have an inability to be wrong or make mistakes unlike humans as there is always a possibility with human getting influenced by subjective factors, thus failure in acting in a rational manner. Multiple studies showed that there are various aspects that appears to be insignificant to the issue in question but influences the human decisions.¹⁰⁹ For instance, a study was conducted by group of Israeli and US researchers which depicted the involvement of unnecessary factors in the process of judicial decision making. More than 1000 decisions were reviewed in that study which showed that a huge number of applications were rejected on an average and lots of favourable decisions were granted after the daily food break of judges.¹¹⁰ Thus, the quote “justice is what the judge had

¹⁰⁸ See supra note 85

¹⁰⁹ Edna Sussman, ' Arbitrator Decision-Making: Unconscious Psychological Influences and What You Can Do About Them' (*Kluwer Arbitration*, 2014) <<https://kluwerlawonline.com/api/Product/CitationPDFURL?file=Journals\RBA\RBA2014020.pdf>> accessed 16 October 2021, page 76-105

¹¹⁰ Shai Danziger, Jonathan Levav and Liora Avnaim-Pesso, *Extraneous Factors In Judicial Decisions* (National Academy of Sciences 2011) <Edna sussman, ' Arbitrator Decision-Making: Unconscious Psychological Influences and What You Can Do About Them' (*Kluwer Arbitration*, 2014)

for breakfast” seems accurate here as the food break, even though irrelevant to the merits of the cases, acts as a factor that influences judicial decisions. This is one of the few reasons AI based decision making is considered superior to human ability to render decision as machine system is immune to cognitive biases or any unnecessary factors that can influence decision making process.

Besides such circumstances, it has been highlighted that AI model might show partial results where the algorithms input is biased. The data which trains the algorithm might be affected by human bias which can then further make the machine learning algorithms draw biased outcomes. In the area of investment arbitration, it has been pointed that arbitral tribunals are investor friendly because of the investment arbitration data fed to an AI model by human, which shows the presence of human bias.¹¹¹ Thus, AI model is likely to predict outcomes in favour of investors in numerous cases.¹¹² Irrespective of the human bias in data input, AI model has the capability of extracting patterns from the data input that might result in systematic mistakes. The Correctional Offender Management Profiling for Alternative Sanctions (COMPAS) system is an appropriate example where AI model was used for assessing recidivism risks for defendants.¹¹³ This system of AI depicted racial bias in the computer program input (could be due to human bias or systematic error), stating that the percentage of black defendants were at higher rate of committing violence as compared to white people. The algorithms classified black people as criminals because black people are highlighted more in certain crimes. It is a therefore a serious concern as to how should the systematic mistakes in algorithm can be detected and resolved. In some systems, mistake may occur in designing of the algorithm where it is coded by human. However, algorithms that are extracted from the input data, such as machine learning, mistake would lie in the input itself. In the former situation, the mistake can be addressed and fixed easily but, in the latter, it is challenging to detect and fix the mistake.

<<https://kluwerlawonline.com/api/Product/CitationPDFURL?file=Journals\RBA\RBA2014020.pdf>> accessed 16 October 2021> accessed 20 October 2021.

¹¹¹ Shai Danziger, Jonathan Levav and Liora Avnaim-Pesso, *Extraneous Factors In Judicial Decisions* (National Academy of Sciences 2011) <Edna sussman, 'Arbitrator Decision-Making: Unconscious Psychological Influences and What You Can Do About Them' (Kluwer Arbitration, 2014)

<<https://kluwerlawonline.com/api/Product/CitationPDFURL?file=Journals\RBA\RBA2014020.pdf>> accessed 16 October 2021> accessed 20 October 2021.

¹¹² *ibid*

¹¹³ Jeff Larson and others, 'How We Analyzed The COMPAS Recidivism Algorithm' (*ProPublica*, 2016)

<<https://www.propublica.org/article/how-we-analyzed-the-compas-recidivism-algorithm>> accessed 30 October 2021.

Another example of AI biases is the case of Amazon in 2014¹¹⁴ where Amazon applied an AI program for the task of filtering the resumes and selecting candidates for employment purpose. The data that had been fed to the system 10 years ago was still prevailing, which consisted of previously selected employees. The company later realised that the data that had been input to the AI system was trained in a manner that discriminated against women and depicted male dominance in the tech industry. It can be clearly said that the data that has been fed to the AI arbitrator appointer needs to be firmly impartial as well as independent, or else the AI system would be of no great use in arbitrator appointment process.

In terms of arbitration, AI arbitrators can be prone to show bias, for instance, when an award rendered previously shows a pattern which is biased in nature towards consumers and favourable towards companies. Also, under investment arbitration, when an AI arbitrator draws a conclusion in favour of investors at expense of host state, if such AI arbitrator has found a biased pattern. In one of the arbitration cases, the arbitrator reacted that all the Italians are liars in that case and will say anything that favours them after one party specified a case with involvement of Italians.¹¹⁵ In the worst-case scenario, if the arbitrator here would not have been removed and the award rendered would have still prevailed, AI arbitrator might have used such data and learn that all Italians are liars, irrespective of any proof from Italians.¹¹⁶ Under investment arbitration, where an AI arbitrator is trained about cases related to international sale of goods, having immense number of awards in favour of sellers and not buyers, the AI arbitrator would predict the conclusion favouring the seller.¹¹⁷ In order to avoid such situation, it is crucial to provide training sample which consists of cases of equal number which can assist in representing each party to dispute and draw fair outcome. The process of arbitration is similar to the trial court litigation, consisting of numerous cases. Under international arbitration, some disputes are simple while some are complex and diversified in nature. The complicated issues are capable of creating hinderances in terms of maintaining a proper balance between the number of sample awards.

¹¹⁴ Jeffrey Dastin, 'Amazon Scraps Secret AI Recruiting Tool That Showed Bias Against Women' (*U.S.*, 2018) <<https://www.reuters.com/article/us-amazon-com-jobs-automation-insight/amazon-scraps-secret-ai-recruiting-tool-that-showed-bias-against-womenidUSKCN1MK08G>> accessed 30 October 2021.

¹¹⁵ William Park, *ARBITRATOR BIAS* (Boston University School of Law 2015) <https://scholarship.law.bu.edu/faculty_scholarship/15/> accessed 30 October 2021.

¹¹⁶ *ibid*

¹¹⁷ Masha Medvedeva, Michel Vols and Martijn Wieling, 'Judicial Decisions Of The European Court Of Human Rights:' (2018) <<http://www.martijnwieling.nl/files/Medvedeva-submitted.pdf>> accessed 31 October 2021.

5.6 Feature selection

Feature selection is the process of reducing the number of input variables when developing a predictive model.¹¹⁸ In other words, it is a process where data analysts determine the variables that are needed to be noticed as well as identified as the most relevant by AI model for the purpose of analysing interrelationship and patterns for the prediction function. For illustrating about the same, we can take a basic example of traffic lights.¹¹⁹ While driving through an intersection, the traffic lights have predictive value and provides information if the person can drive safely through it. Here traffic lights system observes and identifies the important features.¹²⁰ The function of identifying the relevant features from a data set that are required for the prediction work is to be conducted in a skilful manner.

In legal field, legislatures as well as court are required to use and interpret the words written in a proper sense. One single word can change the entire meaning of a sentence. Likewise, the particulars necessary for accomplishing a fair outcome, in machine learning, depends on the quality of being granular. The features need to reveal variations within a group so that the AI model is able to differentiate among the group members.

Under the international arbitration, an AI model does not consist of all possible relevant factors, which further leads to generating of unfair outcomes from feature selection. In the case of *Dow Chemical France v. Isover Saint Gobain*, a doctrine named “Group of Company’s doctrine”¹²¹ was invented and along with it an arbitration agreement was extended to non-signatory companies in the group having interest of fairness. Such act was done by the court because the non-signatory companies were acting like a signatory while negotiating and involving in other related acts, but these non-signatory companies did not agree to get bounded by an arbitration agreement as it did not benefit their position.¹²² Thus, data analyst is well known with the

¹¹⁸ Jiliang Tang, Salem Alelyani and Huan Liu, *Feature Selection For Classification: A Review* (2014) <<http://www.math.chalmers.se/Stat/Grundutb/GU/MSA220/S18/featselect.pdf>> accessed 31 October 2021.

¹¹⁹ James Franklin, 'Feature Selection Methods For Solving The Reference Class Problem' (*Academia.edu*, 2010) <https://www.academia.edu/886268/Feature_Selection_Methods_for_Solving_the_Reference_Class_Problem> accessed 1 November 2021.

¹²⁰ *ibid*

¹²¹ Pietro Ferrario, 'The Group Of Companies Doctrine In International Commercial Arbitration: Is There Any Reason For This Doctrine To Exist?' (2009) 26 *Journal of International Arbitration* <<https://kluwerlawonline.com/journalarticle/Journal+of+International+Arbitration/26.5/JOIA2009035>> accessed 1 November 2021. Page 647-673

¹²² See *supra* note 68

features in a data set that are considered important and ensure that the non-signatories are bounded by the arbitration agreements.

5.7 Black Box issue

With the thought of implementation of AI, words like fairness, rationality, neutrality strikes the mind. These factors are considered beneficial when compared to human selection procedure. However, these factors of AI model can be prone to opacity or some discriminatory results. Such complexity of technology has proved to be one of the major challenges of AI model. The reason behind this hindrance is that it requires technical expertise to deal with obstacles and understand the reasoning behind the conclusion drawn by AI model, and most of the people lacks such technical knowledge. In some situations, the systems are safeguarded by trade secrecy.¹²³ AI algorithms are of great use for companies as companies have legitimate interests in protecting their trade secrets and information, and can deny any kind of disclosure due to privacy concerns.

The term Black Box means the issue of transparency. The first and foremost obstacle for attaining transparency originates technical aspects of AI algorithms. The algorithms of AI system used for decision making is controlled in a black box which algorithms as opaque instead of being transparent.¹²⁴ It has been observed that a category of algorithms that tends to mimic human brain neurons are crucial to be understood even by humans. Such situation leads to hardships in identifying if an algorithm has made a mistake. The incompetence to understand the internal mechanism of an AI arbitrator's process of legal decision making can undermine the legitimacy of the AI arbitration and can lead to set aside of award or refusal to enforce the award rendered by an AI arbitrator.

In context of AI, transparency also depicts the accessibility of attaining information related to the outcome given by the AI model.¹²⁵ It can also be called the "reasoned decision" as it concerns the reason behind the decision made, how and why it has been made. AI models are considered opaque and rarely "have any concrete sense of how or why a particular

¹²³ Frederik J. Zuiderveen Borgesius, 'Strengthening Legal Protection Against Discrimination By Algorithms And Artificial Intelligence' (*Taylor & Francis*, 2020)

<<https://www.tandfonline.com/doi/full/10.1080/13642987.2020.1743976>> accessed 1 November 2021.

¹²⁴ Jenna Burrell, 'How The Machine 'Thinks': Understanding Opacity In Machine Learning Algorithms - Jenna Burrell, 2016' (*SAGE Journals*, 2016) <<https://journals.sagepub.com/doi/full/10.1177/2053951715622512>> accessed 3 November 2021.

¹²⁵ See supra note 119

classification has been arrived at from inputs".¹²⁶ The selection of arbitrators with the help of AI models or the algorithms can be a challenging process. The motive of implementing AI technology and algorithms is to develop transparency and encouraging the provision of explaining how the outcomes are rendered. Another motive is to provide explanation where the party to dispute have justifiable doubts or non-possession of the qualification regarding the appointment of arbitrators by AI model. Selection of AI arbitrators by the parties is one of the aspects to be considered as specific qualifications are required to analysed by the parties for appointing an arbitrator. Most of the AI arbitrators are developed in such a manner that they are able to read and interpret the human emotions.

The decision-making process of AI arbitrator may pose the question of ability of parties in identifying the basis on which the parties to dispute can challenge such decision. Where a decision made is to be put in enforcement, the court can rise question and deny such enforcement of arbitral award on the grounds of lack of reasoning behind the decision made, just in similar manner it is conducted when an arbitral award is rendered by human arbitrator. Reasoned decision is of the fundamental features of legal decision making (arbitration). One of the reasons behind it is that the losing party is made well aware of the legitimate grounds on which it lost the case, thus making the decision more acceptable. Another reason is that the reasoned decision permits the parties to the dispute to maintain a proper behaviour for issues that might rise in future. The third reason are concerning the decision makers as the reasoning allows the other decision makers to maintain consistency while making legal decisions.

AI system might have serious concerns while providing reasoned legal decisions. Not just in legal sector but also in general scenario, AI system shows the inability in providing a proper explanation of the decision made. To illustrate the same, a study was conducted where an AI program estimated a person's sexual orientation through the profile picture posted. The result obtained was disturbing and showed the researcher's inability in determining the grounds on which such results were acquired by the AI system.¹²⁷ Thus, it shows the lack of ability in providing reasoned decision. Such kind of complication arises because of certain components of AI models. AI system that are expert models tends to follow the pre-established instructions,

¹²⁶ See supra note 119

¹²⁷ Michal Kosinski and Yilun Wang, *Deep Neural Networks Are More Accurate Than Humans At Detecting Sexual Orientation From Facial Images* (2018)

<https://www.researchgate.net/publication/322871591_Deep_neural_networks_are_more_accurate_than_humans_at_detecting_sexual_orientation_from_facial_images> accessed 10 November 2021.

which helps in revealing and explaining the reasons behind the outcomes rendered.¹²⁸ In contrast, other models of machine learning are not based on pre-established rules and are rather used to pattern recognition technique which helps in bringing out the algorithms needed. These systems of AI might also use the hidden units that assists in correlating with the characteristics which cannot be detected directly. As a result of all these obstacles, the procedure by which AI models generates the outcomes are not appropriately justified and are black-boxed.

CHAPTER 6: AI IN ONLINE DISPUTE RESOLUTION

The topic of Artificial Intelligence and Online Dispute Resolution has not been addressed very often at UN Forums on ODR. According to the Harvard Negotiation Law Journal article of 2005:

*“Artificial Intelligence involves the study of automated human intelligence. This includes both practically-oriented research, such as building computer applications that perform tasks requiring human intelligence, and fundamental research, such as determining how to represent knowledge in a computer comprehensible form. At the intersection of Artificial Intelligence on the one hand and law on the other lies a field dedicated to the use of advanced computer technology for legal purposes: Artificial Intelligence and Law.”*¹²⁹

Apart from arbitration, AI has also considered of relevant use in online dispute resolution. Online activities have given rise to online disputes, which requires the application of online dispute resolution. The concern now is that how can the traditional dispute resolution mechanisms such as negotiation, arbitration be modified in technological environment, what techniques could be executed and how can AI improvise the online dispute resolution.

6.1 AI based techniques

For the purpose of developing effective and efficient ODR tools, AI can play a crucial role. Several projects were carried out for attaining this goal.

Rule-based Legal Decision-making Systems (LDS):

¹²⁸ Or Biran and Courtenay Cotton, *Explanation And Justification In Machine Learning: A Survey* (2017) <http://www.cs.columbia.edu/~orb/papers/xai_survey_paper_2017.pdf> accessed 9 November 2021.

¹²⁹ John Zeleznikow, 'Artificial Intelligence And Online Dispute Resolution' (*Academia.edu*, 2012) <https://www.academia.edu/20836120/Artificial_Intelligence_and_Online_Dispute_Resolution> accessed 13 November 2021. Page 91

The Rule-based Legal decision-making system was one of the decision support systems that was developed at an early stage in the liability law domain. It claims the distributors and manufacturers of a product liable where any damage has been caused due to such product.¹³⁰ This system has been incorporated with consistent rules comprising of various skills and knowledge that a human expert possess. It accepts the knowledge input, stores it in the system, uses it, receives and presents it when a relatable decision is made. The tools of decision support system assist decision makers in enhancing their task whilst the tools of decision making automate the procedure. This procedure minimises the part of user. The intelligent negotiation support system comprises of five tools:¹³¹

Rule based reasoning: This tool is where the of knowledge of a particular legal domain is categorized as a set of rules.

Case based reasoning: In this category, prior experiences or cases are analysed for solving a dispute. It defines the reason behind the similarity or dissimilarity of the current dispute with the past dispute and adapts the strategy used in prior case, where required.

Machine learning: Under the machine learning category, the AI system automatically pursuits to grasp the new knowledge.

Neural networks: A neural network consists of various processing elements, being automatic in nature, which cooperates in an interconnected network.¹³² In neural network each and every processing element develops a single output signal. These signals are transmitted to other processing elements. The output signal depends on what is the input to processing element.¹³³

EXPERTIUS:

¹³⁰ Davide Carneiro, Paulo Novais, Francisco Andrade, John Zeleznikow & José Neves, 'Online dispute resolution: an artificial intelligence perspective' (*Springer link*, 2012) <<https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.843.3672&rep=rep1&type=pdf>> accessed 11 November 2021, page 7

¹³¹ John Zeleznikow, 'Risk, Negotiation And Argumentation - A Decision Support System Based Approach' (*research gate*, 2008) <https://www.researchgate.net/publication/228208303_Risk_Negotiation_and_Argumentation_-_A_Decision_Support_System_Based_Approach> accessed 12 November 2021. Page 93

¹³² V. Vishal, R. Ramya, P. Vinay Srinivas and R. Vimal Samsingh, 'A review of implementation of Artificial Intelligence systems for weld defect classification' (*Science direct*, 2019) <<https://www.sciencedirect.com/science/article/pii/S2214785319309769>> accessed 18 November 2021

¹³³ *ibid*

It is a kind of decision support system that provides suggestions to Mexican judges and clerks in determining if the plaintiff is eligible or not for receiving pension;¹³⁴ also, it determines how much amount is to be granted in this regard. It includes 3 main components:¹³⁵

- Tutorial: The tutorial module advises the user for achieving various tasks.
- Inferential: The inferential module tends to evaluate the evidence on the basis of weightage given by the user to each evidence. It assists in determining the evidences that prevails and the one that are defeated.
- Financial: The financial module helps the user in determining the amount of pension values.

There are three stages of expert knowledge that are associated with each other. The first stage is concerned to the expert knowledge; the second layer stands for the decisions that are regulated by the procedure of law; and the third one is responsible for the keeping a link between the statements made and measured in terms of crisis patterns, and the case that occurs from the decision made at second layer.

SmartSettle:

Thiessen's SmartSettle is a refined negotiation system which lends support to numerous decision makers having opposing objectives in resolving the issues, irrespective of any of complexity.¹³⁶ It is a decision support system that searches a common ground among the parties to settle the dispute in concern. For the users that are untrained, the qualified facilitator brings out preferences on the outcome of various negotiable variables. The outcomes of the SmartSettle model favours mathematical formulas.¹³⁷ It further applies optimization along standard mixed-integer programming approach, which helps in accomplishing fair and advantageous results according to the preferences of the parties to dispute. ICANS algorithms are considered as the basis of algorithms used in SmartSettle.¹³⁸

The parties firstly acknowledge their tenure to every single item which is under dispute to the system. It can be done by using sketching it or by mathematical machinery or by using a

¹³⁴ See supra note 121

¹³⁵ *ibid*

¹³⁶ Arno R Lodder and Ernest M Thiessen, 'The Role of Artificial Intelligence in Online Dispute Resolution' (*Mediatecom*, 2003) <https://www.mediate.com/Integrating/docs/lodder_thiessen.pdf> accessed 11 November 2021, page 5

¹³⁷ See supra note 121

¹³⁸ See supra note 125

combination that represents their preferences. There is a possibility that during the negotiation procedure the assigned preferences might change and adjust according to the first choice of the parties.¹³⁹ The parties are also required to make a decision regarding a constructive outcome for each item and try combining it on a single text. SmartSettle may provide some suggestions according to the on-going circumstances of the case, and it depends on the parties whether they want to accept it or not.¹⁴⁰ Once the parties reach the last stage, they can request the system for equal distribution of merchandise. The preferences need to be well defined for allocating the items. An essential component of SmartSettle system is a neutral site that regulates preferences, which are confidential by nature, and incorporates them into a model that produces the outcome preferences of all the parties.¹⁴¹ Thus, it is convenient to say that negotiation support packages are capable of assisting the parties in defeating the challenges of conventional negotiations through analytical tools which can be used to clarify interests,¹⁴² recognising the party's satisfaction and generating fair solutions.

Family Winner:

The project of Family Winner is established by Zelezinikow and Bwellucci. It lends support to the Australian family law domain.¹⁴³ This system works on the basis of a game theory and is dependent on algorithms. The working of Family Winner project is quite similar to the that of SmartSettle, where the parties are required to present their tenure to each item of dispute to the system as an input. The parties have to present a value that shows the desire of the parties regarding each single item of dispute. In accordance to the values given by the parties, the system tries to designate the items with the help of algorithms. The parties are then asked if they agree with such designation of items and if they do not agree with it then the system commences with the procedure of negotiation regarding every individual item.¹⁴⁴

Automated Legal Intelligent System (ALIS):

¹³⁹ See supra note 121

¹⁴⁰ See supra note 121

¹⁴¹ See supra note 125

¹⁴² Emilia Bellucci and John Zelezinikow, 'Developing Negotiation Decision Support Systems that Support Mediators: A Case Study of the Family_Winner System' (*Researchgate*, 2005) <https://www.researchgate.net/publication/37377142_Developing_Negotiation_Decision_Support_Systems_that_Support_Mediators_A_Case_Study_of_the_Family_Winner_System> accessed 17 November 2021, page 233-271

¹⁴³ See supra note 125

¹⁴⁴ Arno R Lodder and Ernest M Thiessen, 'The Role of Artificial Intelligence in Online Dispute Resolution' (*Mediatecom*, 2003) <https://www.mediate.com/Integrating/docs/lodder_thiessen.pdf> accessed 11 November 2021, page 6-8

The Automated Legal Intelligent System (ALIS) is a kind of decision support system which grants a rapid, dependable and a transparent access to legal data in the intellectual property rights area, to the European citizens and private companies within Europe.¹⁴⁵ The goal of this system is to resolve the disputes with the application of tools for regulatory compliance, Alternate dispute resolution, making technical developments that assists law making.¹⁴⁶ The legal systems in various countries faces severe complications in understanding and applying this system. Some of reasons behind such struggle is that numerous laws and regulations makes it challenging to comply with the relevant legal framework, which results in occurrence of conflicts and inconsistency within the system.

PERSUADER:

PERSUADER is a system which aims at resolving disputes by integrating AI with techniques of decision making. It is a structure for intelligent computer-supported dispute resolution through the medium of negotiation or mediation.¹⁴⁷ The system acts a mediator and works towards settling the issue in concern by mutually agreeing on the terms of both the parties to dispute.¹⁴⁸

These several kinds of methods, as stated above, are contributing immensely in the area of online dispute resolution. All these methods have different versions of AI in it and the common goal is to resolve the dispute in question either by way of negotiation or mediation or applying AI in both negotiation and mediation procedure. The first step of resolving any dispute starts with the process of negotiation and can then further lead towards arbitration. In other words, negotiation acts as a primary step of any dispute resolution procedure, including arbitration. SmartSettle, Family winner, etc. are some of the techniques for reaching a fair conclusion; it is of great relevance in online dispute resolution and it encourages the application of AI in arbitration.

¹⁴⁵ Davide Carneiro, Paulo Novais, Francisco Andrade, John Zeleznikow & José Neves, 'Online dispute resolution: an artificial intelligence perspective' (*Springer link*, 2012) <<https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.843.3672&rep=rep1&type=pdf>> accessed 11 November 2021

¹⁴⁶ *ibid*

¹⁴⁷ See *supra* note 145

¹⁴⁸ John Zeleznikow, 'Artificial Intelligence And Online Dispute Resolution' (*Academia.edu*, 2012) <https://www.academia.edu/20836120/Artificial_Intelligence_and_Online_Dispute_Resolution> accessed 13 November 2021. Page 100

CHAPTER 7: CONCLUSION

It is a fact in today's world that countless tasks can be performed with the help of technology, which seemed impossible in the past. The use of technology is no less in the legal field. The field of AI has been so progressive that machines are capable to compare and contrast the cases of past for predicting the outcome of any present case in question. Thus, contributes in enhancing the legal area in an efficient manner at low cost and accessible procedures.

AI has been presented as an effective alternative in eliminating any biases prevailing during the appointment of arbitrators. The legal framework of International Commercial Arbitration provides with no constraint the right of parties regarding appointment of machines as arbitrator. AI model has the ability to build a set of rules that can lead to performance of tasks in an effective and efficient manner where it receives huge amount of data over time. The already existing AI models in arbitration such as Ross, Disco, Kira and Arbilex are some of the examples contributing in process of appointing AI arbitrator.

The research conducted above aimed at exploring the application of AI in arbitration sector by focusing on the legal and technical aspects involved. In accordance to the research conducted, various conclusions can be drawn regarding the implementation of AI in arbitration, legal implications of having AI arbitrators, etc.

Even though the studies on outcome prediction of decision shows a high accuracy rate of 70 to 80%, it still consists of major constraints. The research raises a concern that these models might make a way for ex ante outcome predictions. It also raises a doubt whether AI models can apply equally and present successful outcomes for cases where the court decides the dispute originally and not by reviewing the decision made by lower court. The technical factors of AI involve certain essentials for its application in the process of judicial decision making. The major essential requirement is of sufficient non-confidential data of cases, following the need of binary outcomes and consistent fact patterns. The basis for working of AI model relies on the information that has been extracted from data input previously. There is a possibility that a conservative approach might be followed and not be modified to adjust according to the significant changes made in policy over time. Data base computers are as good as any input data and so the risk of preserving existing biases prevails.

One of the serious barriers analysed in this research was of the requirement of reasoned decision in AI based legal decision making. Due to the black box issues in AI models, it can be challenging to determine the elements that have led to a certain outcome prediction. Even

though where in some situation these elements of outcome prediction are determined, they might not be considered as useful explanation for human addressees.

The availability of limited amount of data regarding arbitral awards, technical restraints of AI models, the inefficiency of AI in incorporating emotions are some of the short comings observed in this research, which can limit the widespread application of AI arbitrators. It is difficult task to put all the complexities in dataset, irrespective of the technological advancement. The arbitration procedure requires the goal, challenges and prospects of the parties to dispute to reach on a fair conclusion, and so there is a demand of advanced level of emotional intelligence to render an arbitral award, showing the need of human intervention for providing outcomes in arbitration. The structure of arbitration procedure is arranged in a manner keeping human decision makers in thought. The expansion of this structure for application of AI arbitrators can lead to collapse of arbitration, if applied without feasible legal framework.

On the basis of study conducted above, we can conclude that AI arbitrator are not yet properly ready to take over human arbitrator, however it can be used as a support system in arbitration. This article has tried to conduct in-depth research regarding the application of AI in arbitration, including the contribution AI arbitrators can make and many more. The focus of whole research was on the legal and technical safeguards which were analysed and were used to answer the research question. AI can fundamentally affect the decision-making process in arbitration and other legal activities. There does exits several obstacles stated in the article, that can hamper the rendering of arbitral awards and can lead to doubts regarding the decision made; it is therefore necessary to study further how can AI be used at its best and lead to successful results.

BIBLIOGRAPHY

Online articles:

- Quiñones J, *Two Artificial Intelligence Domains To Explore In The Conquest Of The Modern International Arbitration*. <https://www.academia.edu/48892855/Two_Artificial_Intelligence_domains_to_explore_in_the_conquest_of_the_modern_international_arbitration> accessed 15 August 2021
- Ganguly S, Singh S, and Jaipuria A, 'Artificial Intelligence In Arbitration: Revolutionary Or Impractical - Litigation, Mediation & Arbitration - India' (*Mondaq.com*, 2021) <<https://www.mondaq.com/india/arbitration-dispute-resolution/1027248/artificial-intelligence-in-arbitration-revolutionary-or-impractical>> accessed 16 August 2021
- Niller E, 'Can AI Be A Fair Judge In Court? Estonia Thinks So' (*Wired*, 2019) <<https://www.wired.com/story/can-ai-be-fair-judge-court-estonia-thinks-so/>> accessed 14 August 2021
- Buchanan B, and Duda R, *Principles Of Rule-Based Expert Systems* <<https://www.sciencedirect.com/science/article/abs/pii/S0065245808601291>> accessed 15 August 2021
- Kibria M and others, 'Big Data Analytics, Machine Learning, And Artificial Intelligence In Next-Generation Wireless Networks' (2018) 6 IEEE Access <<https://ieeexplore.ieee.org/abstract/document/8360430>> accessed 18 August 2021
- Larson J and others, 'How We Analyzed The COMPAS Recidivism Algorithm' (*ProPublica*, 2016) <<https://www.propublica.org/article/how-we-analyzed-the-compas-recidivism-algorithm>> accessed 30 October 2021
- Franklin J, 'Feature Selection Methods For Solving The Reference Class Problem' (*Academia.edu*, 2010) <https://www.academia.edu/886268/Feature_Selection_Methods_for_Solving_the_Reference_Class_Problem> accessed 1 November 2021
- Kosinski M, and Wang Y, *Deep Neural Networks Are More Accurate Than Humans At Detecting Sexual Orientation From Facial Images* (2018) <https://www.researchgate.net/publication/322871591_Deep_neural_networks_are_m

ore_accurate_than_humans_at_detecting_sexual_orientation_from_facial_images>
accessed 10 November 2021

- Zeleznikow J, 'Risk, Negotiation And Argumentation - A Decision Support System Based Approach' (*research gate*, 2008) <https://www.researchgate.net/publication/228208303_Risk_Negotiation_and_Argumentation_-_A_Decision_Support_System_Based_Approach> accessed 12 November 2021
- Katz D.M., Bommarito M. J., Blackman J. 'A General Approach for Predicting the Behavior of the Supreme Court of the United States' (*Researchgate*, 2017) <https://www.researchgate.net/publication/311586220_A_General_Approach_for_Predicting_the_Behavior_of_the_Supreme_Court_of_the_United_States> accessed 25 August 2021
- Bostrom N., 'Superintelligence: paths, dangers, strategies' (*Researchgate*, January 2014) <https://www.researchgate.net/publication/320182421_Superintelligence_paths_dangers_strategies> accessed 30 August 2021
- Ben-Ar D., "'Danger, Will Robinson"? Artificial Intelligence in the Practice of Law: An Analysis and Proof of Concept Experiment' (*JOLT Richmond Education*, 15 March 2017) <https://jolt.richmond.edu/2017/03/15/volume23_issue2_greenbaum/> accessed 1 September 2021
- Bellucci E. and Zeleznikow J., 'Developing Negotiation Decision Support Systems that Support Mediators: A Case Study of the Family_Winner System' (*Researchgate*, 2005) <https://www.researchgate.net/publication/37377142_Developing_Negotiation_Decision_Support_Systems_that_Support_Mediators_A_Case_Study_of_the_Family_Winner_System> accessed 17 November 2021
- Al-Hawamdeh A.M., Dabbas N.A., Al-Sharariri Q.E., 'The Effects of Arbitrator's Lack of Impartiality and Independence on the Arbitration Proceedings and the Task of Arbitrators under the UNCITRAL Model Law' (*Researchgate*, August 2018) <https://www.researchgate.net/publication/327320717_The_Effects_of_Arbitrator's_Lack_of_Impartiality_and_Independence_on_the_Arbitration_Proceedings_and_the_Task_of_Arbitrators_under_the UNCITRAL_Model_Law> accessed 11 November 2021

- Alonso P.A., 'Impartiality and Independence of Arbitrators in International Arbitration: Issue Conflicts as Grounds for Disqualification with Special Regard to ICSID Arbitrations' (*Brill scholarly publication*, 2017) <https://brill.com/view/journals/mpyo/20/1/article-p535_535.xml?language=en> accessed 11 November 2021
- C Leaua, M Aniței, 'The role of trust in the decision making process of appointing the commercial arbitrators' (*Researchgate*, 2012) <https://www.researchgate.net/publication/271889507_The_role_of_trust_in_the_decision_making_process_of_appointing_the_commercial_arbitrators> accessed 11 November 2021

Online journals and Law Reviews:

- Maxwell K., 'Summoning the demon: robot arbitrators: arbitration and artificial intelligence' (*Arbitration blog*, 17 January 2019) <<http://arbitrationblog.practicallaw.com/summoning-the-demon-robot-arbitrators-arbitration-and-artificial-intelligence/>> accessed 12 September 2021
- Sussman E., 'Arbitrator Decision-Making: Unconscious Psychological Influences and What You Can Do About Them' (*Kluwer Arbitration*, 2014) <<https://kluwerlawonline.com/api/Product/CitationPDFURL?file=Journals\RBA\RBA2014020.pdf>> accessed 16 October 2021
- Chauhan A, 'Future Of AI In Arbitration: The Fine Line Between Fiction And Reality' <<http://arbitrationblog.kluwerarbitration.com/2020/09/26/future-of-ai-in-arbitration-the-fine-line-between-fiction-and-reality/>> accessed 12 August 2021
- Eidenmüller H, 'What Is An Arbitration? Artificial Intelligence And The Vanishing Human Arbitrator' (*Oxford Law Faculty*, 2020) <<https://www.law.ox.ac.uk/business-law-blog/blog/2020/06/what-arbitration-artificial-intelligence-and-vanishing-human>> accessed 13 August 2021
- Kasap G, 'Can Artificial Intelligence (“AI”) Replace Human Arbitrators?' [2021] *Journal of Dispute Resolution* <<https://scholarship.law.missouri.edu/jdr/vol2021/iss2/5>> accessed 10 August 2021
- Scherer M, 'Artificial Intelligence And Legal Decision-Making: The Wide Open?' (2019) 36 *Journal of International Arbitration*

- Ji W, 'The Change Of Judicial Power In China In The Era Of Artificial Intelligence' (2020) 7 Asian Journal of Law and Society
<<https://www.cambridge.org/core/journals/asian-journal-of-law-and-society/article/change-of-judicial-power-in-china-in-the-era-of-artificial-intelligence/374DE8EEEB28405CAE5CD3C7D8CFAD78>> accessed 18 August 2021
- Park W, *ARBITRATOR BIAS* (Boston University School of Law 2015)
<https://scholarship.law.bu.edu/faculty_scholarship/15/> accessed 30 October 2021
- Ferrario P, 'The Group Of Companies Doctrine In International Commercial Arbitration: Is There Any Reason For This Doctrine To Exist?' (2009) 26 Journal of International Arbitration
<<https://kluwerlawonline.com/journalarticle/Journal+of+International+Arbitration/26.5/JOIA2009035>> accessed 1 November 2021
- Burrell J, 'How The Machine ‘Thinks’: Understanding Opacity In Machine Learning Algorithms - Jenna Burrell, 2016' (*SAGE Journals*, 2016)
<<https://journals.sagepub.com/doi/full/10.1177/2053951715622512>> accessed 3 November 2021
- Biran O, and Cotton C, *Explanation And Justification In Machine Learning: A Survey* (2017)
<http://www.cs.columbia.edu/~orb/papers/xai_survey_paper_2017.pdf> accessed 9 November 2021
- Lehr D. & Ohm P., 'Playing with the Data: What Legal Scholars Should Learn About Machine Learning ' (*Law review*, 2017) <https://lawreview.law.ucdavis.edu/issues/51/2/Symposium/51-2_Lehr_Ohm.pdf> accessed 30 August 2021
- Hong-lin Y., Shore L., 'Independence, Impartiality, and Immunity of Arbitrators—us and English Perspectives' (*Cambridge University Press*, 17 January 2008) <<https://www.cambridge.org/core/journals/international-and-comparative-law-quarterly/article/abs/independence-impartiality-and-immunity-of-arbitratorsus-and-english-perspectives/314216A8041D69B3FA253FA8D4BC770F>> accessed 30 August 2021

- Calo R., 'ROBOTS AS LEGAL METAPHORS' (*Harvard law*, 2016) <<https://jolt.law.harvard.edu/assets/articlePDFs/v30/30HarvJLTech209.pdf>> accessed 12 September 2021
- D'Silva M., 'Dealing in Power: Gatekeepers in Arbitrator Appointment in International Commercial Arbitration' (*Oxford Academic*, 2014) <<https://academic.oup.com/jids/article-abstract/5/3/605/866457>> accessed 11 November 2021
- Lord Justice Saville, 'Departmental Advisory Committee on Arbitration Law 1996 Report on the Arbitration Bill' (*Oxford Academic*, 2014) <<https://academic.oup.com/arbitration/article-abstract/13/3/275/218455?redirectedFrom=fulltext>> accessed 11 November 2021
- Danziger S, Levav J, and Avnaim-Pesso L, *Extraneous Factors In Judicial Decisions* (National Academy of Sciences 2011) <Edna sussman, ' Arbitrator Decision-Making: Unconscious Psychological Influences and What You Can Do About Them' (Kluwer Arbitration, 2014) <<https://kluwerlawonline.com/api/Product/CitationPDFURL?file=Journals\RBA\RBA2014020.pdf>> accessed 16 October 2021> accessed 20 October 2021
- Eidenmüller H. and Varesis F., 'What is an Arbitration? Artificial Intelligence and the Vanishing Human Arbitrator' (*University of Oxford* , 24 August 2020) <<https://www.law.ox.ac.uk/business-law-blog/blog/2020/06/what-arbitration-artificial-intelligence-and-vanishing-human>> accessed 11 August 2021

Books:

- Kurkela M. and Turunen S., *Due Process in International Commercial Arbitration* (2nd edn, 2010)
- Abusitta A. and others, *Generative Adversarial Network for mitigating biases in Machine Learning system* (IOS Press 2020)
- Alpaydin E., *Machine Learning* (Toppan best-set Premedia Ltd 2016)
- Russell S.J. & Norvig P., *Artificial Intelligence- A modern approach* 705 (2016).

Websites:

- Márquez A, *Can Artificial Intelligence Be Used To Appoint Arbitrators?* (2020) <<https://avarbitraje.com/wp-content/uploads/2021/03/ANAVI-No1-A12-pp-249-272.pdf>> accessed 11 August 2021
- Paisley K, and Sussman E, *Artificial Intelligence Challenges And Opportunities For International Arbitration* (11th edn, Dispute Resolution Section of the New York State Bar Association 2018) <<https://nysba.org/app/uploads/2020/03/DisputeResolutionLawyerSpring18.pdf#page=35>> accessed 12 August 2021
- '1023 - Netherlands - Arbitration Act * 1 December 1986 Code Of Civil Procedure - Book Four: Arbitration' (*Jus.uio.no*) <<https://www.jus.uio.no/lm/netherlands.arbitration.act.1986/1023.html>> accessed 17 August 2021
- 'France - Code Of Civil Procedure - Book IV - Arbitration In Force 14 May 1981' (*Jus.uio.no*) <<https://www.jus.uio.no/lm/france.arbitration.code.of.civil.procedure.1981/doc.html#26>> accessed 17 August 2021
- Ramos R, 'The New Portuguese Arbitration Act (Law No. 63/2011 Of 14 December On Voluntary Arbitration)' (*De Gruyter*) <<https://www.degruyter.com/document/doi/10.9785/9783504384784-003/html>> accessed 17 August 2021
- 'Laws' (*Npc.gov.cn*) <http://www.npc.gov.cn/zgrdw/englishnpc/Law/2007-12/12/content_1383756.htm> accessed 17 August 2021
- Dastin J, 'Amazon Scraps Secret AI Recruiting Tool That Showed Bias Against Women' (*U.S.*, 2018) <<https://www.reuters.com/article/us-amazon-com-jobs-automation-insight/amazon-scraps-secret-ai-recruiting-tool-that-showed-bias-against-womenidUSKCN1MK08G>> accessed 30 October 2021
- Medvedeva M, Vols M, and Wieling M, 'Judicial Decisions Of The European Court Of Human Rights:' (2018) <<http://www.martijnwieling.nl/files/Medvedeva-submitted.pdf>> accessed 31 October 2021
- Tang J, Alelyani S, and Liu H, *Feature Selection For Classification: A Review* (2014) <<http://www.math.chalmers.se/Stat/Grundutb/GU/MSA220/S18/featselect.pdf>> accessed 31 October 2021

- Zuiderveen Borgesius F, 'Strengthening Legal Protection Against Discrimination By Algorithms And Artificial Intelligence' (*Taylor & Francis*, 2020) <<https://www.tandfonline.com/doi/full/10.1080/13642987.2020.1743976>> accessed 1 November 2021
- Zeleznikow J, 'Artificial Intelligence And Online Dispute Resolution' (*Academia.edu*, 2012) <https://www.academia.edu/20836120/Artificial_Intelligence_and_Online_Dispute_Resolution> accessed 13 November 2021
- Carneiro D., Novais P., Andrade F., Zeleznikow J. & Neves J. , 'Online dispute resolution: an artificial intelligence perspective' (*Springer link*, 2012) <<https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.843.3672&rep=rep1&type=pdf>> accessed 11 November 2021
- Lodder A.R. and Thiessen E.M., 'The Role of Artificial Intelligence in Online Dispute Resolution' (*Mediatecom*, 2003) <https://www.mediate.com/Integrating/docs/lodder_thiessen.pdf> accessed 11 November 2021
- Aletras N., 'AI predicts outcomes of human rights trials' (*UCL news*, 24 October 2016) <<https://www.ucl.ac.uk/news/2016/oct/ai-predicts-outcomes-human-rights-trials>> accessed 23 August 2021
- Hutson M., 'Artificial Intelligence Prevails at Predicting Supreme Court Decisions' (*ACM Tech*, 2 May 2017) <Communications of the ACM, 'Artificial Intelligence prevails at predicting Supreme Court decisions', (May 5, 2017), <https://cacm.acm.org/news/216852-artificial-intelligence-prevails-at-predicting-supreme-courtdecisions/fulltext#:~:text=Artificial%20Intelligence%20Prevails%20at%20Predicting%20Supreme%20Court%20Decisions,By%20Science&text=The%20algorithm%20correctly%20forecast%2070.2,about%2066%25%20right%20in%20comparison.>> accessed 25 August 2021.
- Hao K., 'Tougher Turing Test Exposes Chatbots' Stupidity' (*MIT Technical Review*, 31 January 2020) <<https://www.technologyreview.com/2020/01/31/304844/ai-common-sense-reads-human-language-ai2/>> accessed 2 September 2021

- Klaas P., 'International Commercial Arbitration' (*Cc Arbitrators*, 2017) <<https://www.ccarbitrators.org/wp-content/uploads/2021/05/International-Commercial-Arbitration.pdf>> accessed 20 September 2021
- Hoffmann L., 'Judgments - In Re B (Children) (Fc) Appellate Committee Lord Hoffmann Lord Scott of Foscote Lord R' (*House of Lords*, 2008) <<https://publications.parliament.uk/pa/ld200708/ldjudgmt/jd080611/child-1.htm>> accessed 25 September 2021
- Brendel W. and Bethge M., 'APPROXIMATING CNNs WITH BAG-OF-LOCALFEATURES MODELS WORKS SURPRISINGLY WELL ON IMAGENET' (*Arxiv.org*, 2019) <<https://arxiv.org/pdf/1904.00760.pdf>> accessed 15 October 2021
- Vishal V., Ramya R., Vinay Srinivas P. and Vimal Samsingh R., 'A review of implementation of Artificial Intelligence systems for weld defect classification' (*Science direct*, 2019) <<https://www.sciencedirect.com/science/article/pii/S2214785319309769>> accessed 18 November 2021

LEGISLATIONS:

- The Vietnam law of Commercial Arbitration 2010
- The Law on External Economic Arbitration- North Korea
- Arbitration and Alternative Dispute Resolution Act of Indonesia 1999
- Swedish Arbitration Act 2019
- Finland Arbitration Act 1992
- Act on Contractual Arbitration, Iceland
- The Law Concerning Arbitration in Civil and Commercial Matters, Egypt
- Code of Civil Procedure, Italy
- English Arbitration Act of 1996
- U.S. Code
- UNCITRAL Model Law on International Commercial Arbitration
- The English Arbitration Act 1996

