Automation of patentability for utility models

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Abstract: Automating the process of finding patentability for utility models would involve using technology and tools to assist in patent search and analysis. Levels of automation could depend on how much human interaction a system needs. The automation systems would be fully automated systems, semi-automated systems, and partially automated systems. The utility models only require novelty and industrial application. The process would involve checking patentability requirements and conducting a patentability search. First, the automation will thoroughly inspect industrial applications. Then, it will check the novelty of the device. The automation would involve AI to learn some real-world logic and natural sciences, such as physics, chemistry, etc. The field of science would depend on the operational field of the utility models. The AI would be implemented with OCR capabilities. From that, AI would do some data mining to find some keywords, key terms, and classifications. Since the AI would be implemented in Azerbaijan, the found keywords and key terms would be in Azerbaijani and Russian. But since we are also searching for some English-implemented databases, AI would also have a translation function. We would use the API of patent databases, which would give access to the databases. AI would find a few documents and, based on its training from search reports and search strategies, it could judge those documents (depending on the type of automation).

Keywords: Patentability, patent search, patent law, utility models, automated search, AI, artificial intelligence, patents, inventions, machine learning, text mining, automation

1.Introduction

Automating the process of finding patentability for utility models would involve using technology and tools to assist in patent search and analysis. Patentability searches are usually performed to determine whether an invention is novel, non-obvious, and has an industrial application or utility, which are key criteria for obtaining a patent. However, it is worth mentioning that utility model law differs from country to country. In some countries or Patent Offices, utility models are not considered patentable. Some Patent Offices, on the other hand, consider utility models as the subject of patent law and therefore patentable as utility models. A few of the offices that consider utility models as the subject of patent law give a patent without a patent search, while other offices that consider utility models as the subject of patent law require a patent search to determine the patentability of utility models. There are many ways to automate the process of finding patentability. It would depend on the level of automation of the patent search, since there are many different ways of the patent search process.

One of the ways would be to use keyword-based searches. During the patent search, human examiners could open patent databases and search for patents using the keywords. The examiner examines the given application and finds the keywords. After that, the examiner searches with keywords in the patent databases like PATENTSCOPE or USPTO. Most of the time, the search gives many documents, and the examiner needs to open and inspect them one by one. This only creates partial automation.

Another option would be using more advanced patent search software or AI. There are many patent search software tools. Examples would be PatSeer, InnovationQ, TotalPatent, etc. AI (artificial intelligence) and machine learning algorithms can help automate the process further. Some AI-driven platforms, such as PatSnap and Innography, can analyse large patent datasets to identify relevant prior art and assess patentability. Those methods would create better automation because they would make patent searches simpler and less time-consuming.

I believe automation of patent search would make the process of finding patentability more efficient. When automating patentability searches, it is also important to know that while technology can assist in the search process, human expertise is often essential to interpret search results and make the final determination of patentability. Automating patentability searches would also benefit Azerbaijan. This could make the examination easier and less time-consuming. This could increase the efficiency of the organization.

2. Literature review

According to the patent law of the Republic of Azerbaijan, the subjects of patents can be inventions, utility models, and industrial designs. In the Republic of Azerbaijan, utility models can only be devices. While inventions have three patentability requirements, utility models have only two. Those are novelty and industrial applications. The devices for novelty conditions must have new characteristics. If the device can be made or used in any field of industry or economy, then the invention is considered applicable [1]

Unlike some other national or regional patent legislations, in the Republic of Azerbaijan, examiners also provide supplementary examinations for utility models. The publication of the utility model occurs only after the patent search. Depending on the patent search, the examiner decides whether to grant or reject the application [1].

In many aspects, national patent laws in Azerbaijan and Russia are similar. According to the Civil Code of the Russian Federation, patents are granted for three subjects: inventions, utility models, and industrial designs [2].

Similar conditions can be found for utility models. In the Russian Federation, as it is in Azerbaijan, utility models can only be devices. Here, they again have two patentability conditions. What are novelty and industrial applications? [2].

According to the Civil Code of the Russian Federation, examiners also provide supplementary examination to utility models. This means that, again, a patent for the utility model could only be granted after the patent search [2].

In the Eurasian Patent Office, the protected subjects of patents are inventions and industrial designs. According to the Eurasian Patent Convention, patentability requirements are novelty, inventive step, and industrial applicability. Therefore, utility models cannot be protected since they mostly do not have inventive steps [3].

Like the different regional Patent Office – European Patent Office (EPO) patentability requirements are novelty, inventive step, and industrial applicability. Therefore, utility models cannot be protected since they mostly do not have inventive steps. The difference from the Eurasian Patent Office is EPO only protects inventions [4].

Utility models could also be protected in the contracting states of the EPO individually. According to Article 140 of the European Patent Convention, Articles 66, 124, 135, 137, and 139 shall apply to utility models and utility certificates and to applications for utility models and utility certificates registered or deposited in the Contracting States whose laws make provision for such models or certificates [5].

In the Republic of Belarus, utility model applications may only be a technical solution. Patentability requirements for utility models here are novelty and industrial applicability. However, utility model applications shall not be subject to verification of compliance with the patentability requirements. Examination must be conducted within three months, and after that, the utility model shall be granted. In case, during the examination, it is found that the application is for a utility model that does not relate to patentable subject matter, the Patent Office shall decide to refuse the grant of a patent. After preliminary examination, utility models are granted without substantive examination [6].

In some countries, a utility model system protects “minor inventions” through a system like the patent system. Compared with patents, utility model systems require compliance with less stringent requirements (for example, a lower level of inventive step), have simpler procedures, and offer shorter terms of protection [7].

According to the German Patent and Trademark Office, utility models are considered a fast IP right. However, there is no examination of novelty, inventive step, and industrial application. However, there is a greater risk for a utility model to be challenged and cancelled. Like the Republic of Belarus, in Germany, after preliminary examination, utility models are granted without substantive examination [8].

In Japan, the process for granting a patent right differs from that for granting a utility model right. In the patent system, an examiner performs a substantive examination for a patent application upon receiving a "request for examination," which must be submitted by the patent applicant or any person other than the applicant within three years of the filing date of the patent application. On the other hand, a utility model is registered without a substantive examination if it meets the basic requirements of the Utility Model Act. According to the law, utility models can only be devices in Japan, too. Utility models must fulfil patentability requirements such as novelty and inventive steps. However, these substantive requirements are not examined. Here again, after preliminary examination, utility models are granted without substantive examination [9].

Other data show conditions of patentability. For a device to be patentable, the invention must: consist of patentable subject matter; be novel and have utility. A patent application must sufficiently describe the device in enough detail to enable a person skilled in the invention’s field to make, construct, compound, or use the invention [10].

As mentioned above, the subject of patents and conditions could differ from country to country. However, overall, the national laws of most countries are similar. The main conditions for utility models are that the subject of patents should be new and capable of industrial application. The subjects of the patent are also similar in most countries. Those depend on the national law. Discovery, Scientific theories, mathematical methods; Aesthetic creations; Inventions contrary to morality or public order; Therapeutic and diagnostic methods; and Plant or animal varieties. Plants or animals (other than microorganisms) are usually not considered subjects of the patent [11].

Sometimes, as exceptions to patentability, they also involve software. However, software-implemented inventions might be patentable. The software can also be patentable in some countries, such as the USA, Canada, and some European countries. However, it is not patentable in some other countries, such as the Russian Federation, the Republic of Azerbaijan, etc [1], [2], [11].

To overcome some of these disadvantageous aspects of current keyword-based search approaches, it is necessary to decrease the manual work of the examiner. It is also essential to increase the quality of the search results by avoiding irrelevant patents from being returned, as well as automatically accounting for synonyms to reduce false negatives. This could be achieved by comparing the patent application with existing publications based on their entire texts rather than searching for specific keywords. By considering the entire texts of the documents, much more information, including the context of keywords used within the respective documents, is considered. For humans, it is, of course, infeasible to read the whole text of each relevant document. Instead, state-of-the-art text processing techniques can be used for this task [12].

The search for prior art for a given patent application is, in general, conducted by a single person using keyword searches, which might result in false positives as well as false negatives. Furthermore, as different patent applications are managed by different patent examiners, it is difficult to obtain a consistently labelled dataset. A more reliably labelled dataset would therefore be desirable to rigorously evaluate our automatic search approach [12].

Search for prior art for a given patent application, and thereby the citation process, can be enhanced by a precursory similarity scoring of the patents based on their full texts. With a natural language processing (NLP) based approach, we would not only greatly accelerate the search process, but, as shown in their empirical analysis, our method could also improve the quality of the results by reducing the number of omitted yet relevant documents [12].

The search for a patent's prior art is a particularly difficult problem, as patent applications are purposefully written in a way that creates little overlap with other patents, as only by distinguishing the invention from others does a patent application have a chance of being granted. By showing that the automated full-text similarity search approach successfully improves the search for a patent's prior art, these methods are also promising candidates for enhancing other document searches, such as identifying relevant scientific literature [12].

The work in [13] by K. M. Richmond et al. describes the XAI survey in the field of legal systems, which considers the evidential reasoning needs and other requirements needed to apply AI to law. It is claimed that legal decision-making involves the storage of expert knowledge, precedent, and evidential reasoning; thus, transparency and accountability are vital when it comes to automating the process. The authors note that the current AI systems are often black-box algorithms, which complicates the process of justifying decisions and explaining their reasons to lawyers.

Moreover, a taxonomy of AI methods in legal reasoning is introduced by the authors. They distinguish the following types of AI in legal reasoning: rule-based reasoning, case-based reasoning, argumentation-based reasoning, evidential reasoning, and hybrid approaches. These types connect certain models of legal reasoning to certain AI methods and evaluate the level of explainability of the approaches. Earlier AI systems were based on symbolic AI approaches (such as expert systems), which involved clear rule-based reasoning [13].

One significant contribution of this article lies in the explanation of the trade-off between interpretability and performance. The authors observe that even though deep neural networks are known for delivering important levels of prediction accuracy, they lack interpretability compared to the symbolic approaches. However, this article asserts that interpretability in the legal field is a necessity because of the reasoning needed for making judicial and administrative decisions, which can be understood and reviewed by the involved parties. As such, this research explores the existing XAI methods that seek to increase interpretability but still face numerous challenges [13].

Whereas the study by Richmond et al [13]. It stresses the importance of explainability as a key principle in the application of AI to automate the law; their approach still focuses on decision-making systems and does not classify several types of automation used for patent searches. In contrast, the suggested study attempts to overcome this limitation by developing a system for classifying patent search automation as fully automated, semiautomated, and partially automated, stressing the possibility of automation through deterministic means.

Several countries are already implementing AI tools for examination. For example, in Australia, Data Science techniques are being used to analyse profiles of a patent within the current stockpile and predict the level of manual intervention required from the examiner to progress a patent application to the outcome. The model is used to predict the effort required to conduct a high-quality examination. This approach facilitates the allocation of appropriate resourcing for each examination task, thereby improving examination efficiency [14].

IP Australia's Family Member Analyser (FMA) tool provides patent examiners with direct links to family members and documents from their electronic dossiers (where available) during patent examination. Examiners would often consider observations made in Foreign Examination Reports (FERs) of closely related patent family members to improve examination quality and avoid duplication of work where appropriate [14].

Other countries, such as Austria, Brazil, and China, also use AI for classifying patents. In Canada, they use semantic AI search engines. Semantic search is a set of search engine capabilities that includes understanding words from the searcher's intent and their search context [14].

Some regional Patent Offices, such as the European Patent Office (EPO), also use AI. The EPO has been active in developing business solutions using Machine Learning and AI to manage patent files at various degrees of implementation: Automatic annotation of patent literature; Automatic detection of problem/solution in the patent document; Automatic detection of exclusion from patentability [14].

We could also use text mining tools to investigate patentability. Text mining is also known as text data mining. It is a process of transforming unstructured text into a structured format to identify meaningful patterns. The tools apply advanced analytical techniques, such as Naïve Bayes, Support Vector Machines (SVM), and other deep learning algorithms. In this way, companies can explore and discover some relationships within their unstructured data [15].

Text mining is a process of getting high-quality information from text. With text mining tools like Angoss, DigitalMR, IBM SPSS, and others, the patent examiner might analyse the document much faster. Patent documents usually have significant study results. The documents are usually lengthy and rich in technical terminology. That takes a lot of human effort to analyse. Automatic tools like text mining might make the process faster and more efficient.

Text mining could be done in this order: Firstly, we could use text mining to identify other terms that define the universe of things in which we are interested. Then we could identify the relevant areas and find where those terms fall in the patent classification. After that, we could filter the data by the terms and the patent classifications in the document. Later, we could measure how frequently those terms and classifications appear in the text. In the end, we could use experimental visualisation along the way to evaluate and refine our analysis [16].

Another option we could use for automating the determination of patentability would be machine learning. In recent years, Artificial Intelligence (AI) has been the focus of discussion. In recent years, AI has improved and started to be used widely around the globe. Machine learning libraries will typically make a significant difference in patent analytics. Identifying packages and models that are well-documented and have active communities will allow us to get things done rather than navigating complex layers of documentation or puzzling over what the statistics from a model run mean [16].

Many advanced technologies might help to automate the process of finding patentability. One of the tools could be text mining. Text mining is a process of transforming unstructured text into structured data. With the data, the application performs an easy analysis. It uses natural language processing (NLP), allowing machines to understand human language and process it automatically. With its help, patentability could be automated [17].

Any company, Patent Office, or academic institution that works with patents would benefit from doing patent analytics and machine learning. Patents represent great business value to many organizations, with corporations spending a great deal of money each year developing patentable technology and transacting their rights, and Patent Offices around the world spend a great deal of money each year reviewing patent applications. AI or machine learning might help Patent Offices and companies working with patents [18].

Patent document collections are an immense source of knowledge for research worldwide. The rapid growth of the number of patent documents creates challenges for retrieving and analysing information. There are different patent analysis tasks that have been automated at least partially in the past [19].

The paper [20] introduces an XAI-human collaborative approach to the research of patent novelty. The purpose of the research is to enhance the analysis of patent novelty through the integration of deep learning text classification with human expert feedback due to the inefficiencies of the current black-box approach to patent analysis based on AI. Specifically, the authors state that the current approach to patent evaluation based on AI is concentrated mostly on performance and does not consider the aspect of usability and collaboration.

Three major components of the framework are considered. First, a self-explanatory neural network is trained to classify patent novelty based on historical data. Then, the XAI model is used to make a prediction about novelty and explain it. As a result, a user, especially a technical one, can examine the prediction and give feedback that is further utilized in the training process. According to the experimental results obtained by the authors, the collaborative approach was proven to be effective since the accuracy reached 0.890 and the F1-score was 0.916 [20].

One of the important contributions of the research is the attempt to fill the gap between completely automated AI systems and human knowledge and experience, thus building an intermediate semi-automated approach. As opposed to a complete replacement of human examiners, in this study, the AI is considered as an auxiliary tool for novelty evaluation. According to the authors, explainability promotes trust and applicability, which is particularly important for applications like patent examination [20].

The approach suggested by Jang and Yoon [20], who developed a collaboration-oriented XAI-based model for patent novelty analysis, facilitating human-machine interaction, still lacks full automation due to the necessity of iterative human feedback and retraining of the machine learning algorithm. The present research contributes to the existing literature on the topic by suggesting a formal classification of different approaches to patent search automation into fully, semi-, and partially automated ones, indicating that automation can be reached deterministically as well.

The integration of automation in the patent process can reduce the occurrence of human errors, help to optimize time, and enable more efficient operations. Patent professionals often need to submit an Information Disclosure Statement (IDS) to the United States Patent and Trademark Office (USPTO), along with their patent application, to fulfil their “duty of candour.” This duty requires patent applicants to provide their patent examiners with any information they have come across that could affect patentability. Completing an IDS form is just a matter of data entry; it can be quite daunting and time-consuming to input information for each material prior art reference that is known. The development of patent prosecution strategies will never be a completely automated activity. With automation in the patent process, patent professionals can research to find viable office action rebuttals and produce drafts of office action responses in less time without sacrificing quality [21].

In [22], R. Setchi et al. explore the potential use of artificial intelligence tools in patent prior art searches, examining how AI could help patent examiners in the search phase of the examination process. In the research work, the authors propose a proof-of-concept platform, which is created in partnership with the UK Intellectual Property Office and aimed at testing different AI approaches for solving various important tasks in patent prior art search, such as query expansion, document categorization, clustering, semantic similarity identification, ranking, and topic modelling. The authors describe prior art searches as extraordinarily complex, iterative, and human-focused tasks, during which patent examiners continually modify their search strategy according to new terminology and prior art information.

Another great benefit of the paper is the formal breakdown of the patent prior art search process into several technical subprocesses. The researchers use interviews with skilled patent examiners to identify technical requirements, such as improved query expansion (TR1), improved classification of documents into coding schemes (TR2), recognition of semantically similar patents (TR3), and ranking of the most similar documents (TR4). To perform these tasks, the research employs supervised and unsupervised AI approaches like SVM, clustering, and topic modelling to check their applicability for the patent retrieval process [22].

AI is concluded to be useful when used for reducing the time and costs involved in examining patent documents retrieved, particularly when it comes to analysis and ranking. But one of the key findings of this paper is that AI is ineffective in generating queries since this task requires more contextual knowledge of the examiners. Therefore, the human-in-the-loop approach is recommended in which AI serves as the support tool but not a substitute for the examiners [22].

Although Setchi et al. [22], have proven that the use of AI technology helps to enhance the efficiency of prior art search due to its capacity to help with ranking, classification, and semantic similarity detection. The research also proves that AI technologies are still poor in query generation and are highly dependent on the skills of the examiners. That is why it is clear that most of the present patent retrieval systems are still semi-automatic but not fully automatic.

In [23], An assessment study is performed for the problem of AI-enabled prior art search in patents; it further elaborates on earlier research in applying AI to patent searching processes. The research focuses on the question of whether AI can be used in the patent examination process to help reduce the number of irrelevant items and improve search efficiency. The research views the problem of prior art search in patents from the point of view of being knowledge-intensive and iterative, including the construction of queries, definition of terms, determination of relevant IPC classes, and evaluation of retrieved data.

This study explores the use of artificial intelligence throughout various stages in the retrieval process, including but not limited to semantic similarity analysis, ranking, clustering, and classification. Like previous studies, the researchers conducted tests using diverse types of machine learning techniques to find out which approach would work well in helping the examiners locate pertinent prior art. The proposed methodology cannot replace the role of human examiners but rather functions as a decision-making support tool in enhancing efficiency when analysing results after the queries have been made. According to the feasibility study, the use of AI in the analysis phase can reduce the manual efforts required by the examiners to sift through large volumes of results [23].

The most important finding from this study is that AI works best at the downstream stage of searching, which includes ranking and similarity detection, among others, as compared to upstream stages like formulating search queries and choosing appropriate terminologies. The researchers acknowledge that search query formulation is very knowledge-intensive and heavily relies on the technical expertise of the human examiners [23].

Although some researchers [23], have proven that AI-based approaches to patent searching can enhance the effectiveness of search using ranking, clustering, and similarity algorithms; the research has proven that the main search formulation process still relies heavily on human intelligence. This means that these systems are not completely automated but only semi-automated. The proposed research is going to build further on this topic by categorizing patent searches into full, semi-, and partial automation depending on the level of dependency on examiners.

As we can see, automation of patentability would bring its benefits. However, not every national or regional office considers utility models as the subject of patents. Moreover, some countries that consider utility models as the subject of patents do not conduct patentability searches for utility models. But automation would be helpful for Patent Offices (such as the Republic of Azerbaijan, the Russian Federation, etc.) that conduct patentability searches for utility models.

3. Methodology

The paper suggests a theoretical and simulation-based model of the automation of the examination of utility model patentability. This model relies on three scenarios of automation of patent examination: complete automation, semi-automation, and partial automation. The goal of the methodology is not to substitute the official function of the patent examiner, but to create an explicit representation of diverse types of automation that could be utilized in the examination of utility models concerning their industrial applicability and novelty.

The methodological approach is rule-based and process-oriented. It involves (i) legal criteria of patentability of utility models, (ii) searching logic that is used during patent examination, (iii) retrieval techniques based on keyword searches and patent classification, and (iv) the examiner's validation of the results of processing by the system. This model is designed specifically to take into account the practice of examination of patentability of utility models according to Azerbaijani patent legislation, where utility models include only devices examined against the same set of patentability criteria as inventions, with the exception that the subject matter must belong to the object of the utility model.
The proposed framework will be designed in five steps as follows:

1. Input and claim acquisition. The system gets an application that includes its title, claims, descriptions, and other relevant data, such as examiners' search parameters.

2. Technical features extraction. The system extracts technical features, relevant keywords, significant phrases, and other parameters of classification according to IPC/CPC from applications or search parameters provided by examiners.

3. Search and filtering for patentability. The system conducts one or several patentability searches based on combinations of keywords, IPC classes, and semantic/phrase similarity. The scope of this search varies depending on how this framework will be used: as a fully, semi-, or partially automated framework.

4. Decision-making on novelty. The system analyzes the list of prior art documents found and rates them according to their relevance. Depending on the automation type, novelty decisions are made either automatically, reviewed by human examiners, or made only by human examiners.

5. Human validation and decision making. The final decision of patentability is the responsibility of the patent examiner/patent office. The level of human involvement is different according to automation types.

Thus, the described methodological approach treats automation as a range between fully human and fully automatic frameworks.

4. Formal representation of the proposed framework

To put forward the formalized framework, we will consider that a utility model application can be described as:

[U = {T, C, D, K, I]

where: (T) – title of the application; (C) – set of claims; (D) – set of descriptions and other text components of the application; (K) – extracted set of keywords, key terms, and phrases; (I) – identified patent classification set (for example, IPC).

The process of patentability examination will be considered as a function:

[PE(U) = {IA, N]

Where: (IA) – industrial applicability assessment; (N) – novelty assessment.

The automation framework offered does not consider all three elements equal. On the contrary, it separates them into two analytical levels:

1. Rule-based legal/technical assessment level, mainly related to industrial applicability and admissibility of the subject matter of the utility model;
2. Searching and similarity assessment level, mainly related to novelty.

Therefore, the utility model examination model will be presented as follows:

[PE(U) = {R(U), S(U)]

with the following components: (R(U)) is the output of the rule-based assessment; (S(U)) is the output of the search-based patentability.

The output of the rule-based assessment (R(U)) could include whether the claimed invention belongs to the category of utility model objects; whether the claimed technical solution is industrially applicable; and whether the technical content of the application is sufficiently structured for automated search.

The output of the search-based assessment (S(U)) could include retrieved prior art documents, similarity score rankings, labels A, Y, or X, and novelty suggestions based on automation level.

5. Automation systems

According to the Patent Law of the Republic of Azerbaijan, the utility models only require novelty and industrial application. That would mean the inventions lacking the inventive step could also be protected as utility model patents. This would be the core information for creating the automation [1].

One of the first things a human examiner would do to find patentability is to check industrial applications. This is usually done before the patentability search. Regarding the automation would first check if the device is applicable in the industry. Only after that, the automation would check the second patentability requirement, which is novelty.

The automation systems could have different automation levels. Levels of automation could depend on how much human interaction a system needs. With that, we could divide the automated systems into three parts. Those three parts are the fully automated systems, which require little to no human interaction, semi-automated systems, which require some human interaction, and partially automated systems, where the system requires more human interaction than other systems.

Automated systems:

Depending on the type of automation, the algorithm process would be different. However, the systems would also have a similar configuration.

Algorithm of automated systems:

1. Start the process.
2. Scan the input information about the utility model.
3. Find relevant keywords from the scanned input.
4. Identify corresponding CPC or IPC classifications based on the input's content.
5. Check if the device is applicable in the industry:
   a. If yes, proceed to Step 6.
   b. If not, issue a "Refusal of Grant" and terminate the process.

6. Perform a combined patentability search using the identified keywords and classifications.
7. Locate relevant documents from the patentability search.
8. Evaluate if the device has novelty based on the found documents:
   a. If yes, proceed to Step 9.
   b. If not, issue a "Refusal of Grant" and terminate the process.
9. Grant the device as a utility model if all conditions are met.
10. End the process.

The problem with this algorithm arises because it does not let applicants prove a negative decision otherwise. We will need to upgrade Steps 5 and 8.

5. Check if the device is applicable in the industry:
   a. If yes, proceed to Step 6.
   If not, check if the applicant can prove otherwise:
      i. If yes, accept the proof and proceed to Step 6.
      ii. If no, issue a "Refusal of Grant" and terminate the process.
8. Evaluate if the device has novelty based on the found documents:
   a. If yes, proceed to Step 9.
   b. If no, check if the applicant can prove otherwise:
      i. If yes, accept the proof and proceed to Step 9.
      ii. If no, issue a "Refusal of Grant" and terminate the process.

Fully automated system:

Here, the system would scan the application documents and, according to that, conduct a patent search. AI or machine learning would pick useful information from documents and search by them. Later, the system itself would create a patent search report. That search report would be according to the conducted search by a fully automated system. This search system would need zero to no human interaction.

To automate the process of a patent search or substantive examination, firstly, we need to understand the patent search and substantive examination. Usually, the first step during the substantive examination is to determine whether the application is usable in the said industry. The human examiner reviews the application. Later, they decide if the device is functional according to the laws of nature and logic. For example, many Patent Offices immediately decline any "perpetual motion machine" applications. The reason for that is that it is impossible according to the laws of physics. After finding that the device could be used, the examiner conducts a patentability search. During the search, the examiner finds some documents. Those documents could be relevant or irrelevant. That would be decided by the examiner. After deciding which documents are relevant to the topic of the application, the examiner checks the relevant documents. After inspecting them, the examiner decides if any of the found documents harm the novelty of the device. Following this, the examiner creates the search report. Then, according to the search report, the examiner declines or grants a utility model. In accordance with all of that, we could create automation.

The automation of patentability for utility models would first start with scanning the document. After the scan, the automation would find keywords and would identify IPC or CPC classifications. However, this will not be the next step. That is due to the examination process. During the examination, we need to check the industrial application before we check any other patentability requirements. Prior to conducting the patentability search, it is crucial to ensure that the industrial application has been thoroughly evaluated. Therefore, the next step is to find out whether the device could be useful or not. In case it is not applicable in the said industry, the application would be denied. If it is applicable, the automation would conduct a combined patentability search. By combined search, we mean the system would use both keywords and IPC or CPC classifications. During the patentability search, the system would find some documents. After that, the automation would decide if the device was novel. At the same time, the automation would create a patentability search report. If it is not novel, it will be refused. In case the device has novelty, then it would be granted as a utility model.

Now that we have a working system, we must figure out how every process would work. The first process is "Scanning the document". Here, the system would scan the description, the claims, the abstract, and the drawings. The automation would use advanced tools like text mining and image search. With that, the system would identify the topic of the application.

The important part of the identification is that the automation will not just find some words but will find some phrases and concept-based terms. With this, the system would understand the context of the documentation.

After identifying what the application is about, automation will decide if the device is applicable in the said industry. The automation will check the laws of nature and use logical deduction to determine the applicability.

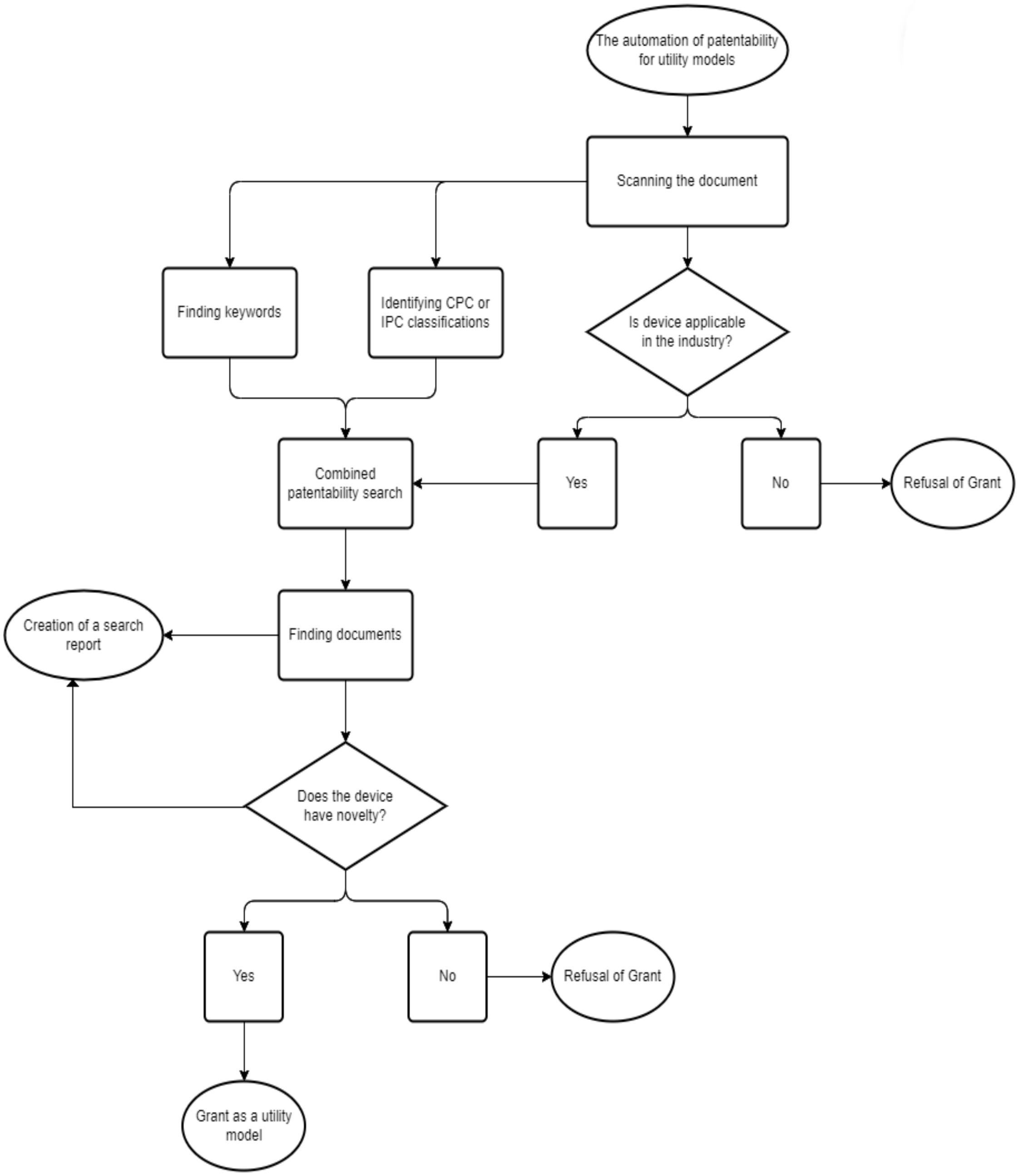
The next step after scanning the document would be finding suitable keywords and patent classifications. With an understanding of the context of the document, the system would identify the appropriate classification and keywords.

After deciding that the device has applicability in the said industry or after the applicant proves industrial applicability, the automation would conduct a combined patentability search. A combined search consists of using keywords and classifications.

The system would find a number of documents after searching. Those would be closest to the application examined according to the automation. The next steps would be finding if the device is novel and, according to that, creating a search report. If the application is not novel and the applicant cannot provide the necessary proof of novelty, the utility model would be refused. Otherwise, it would be granted.

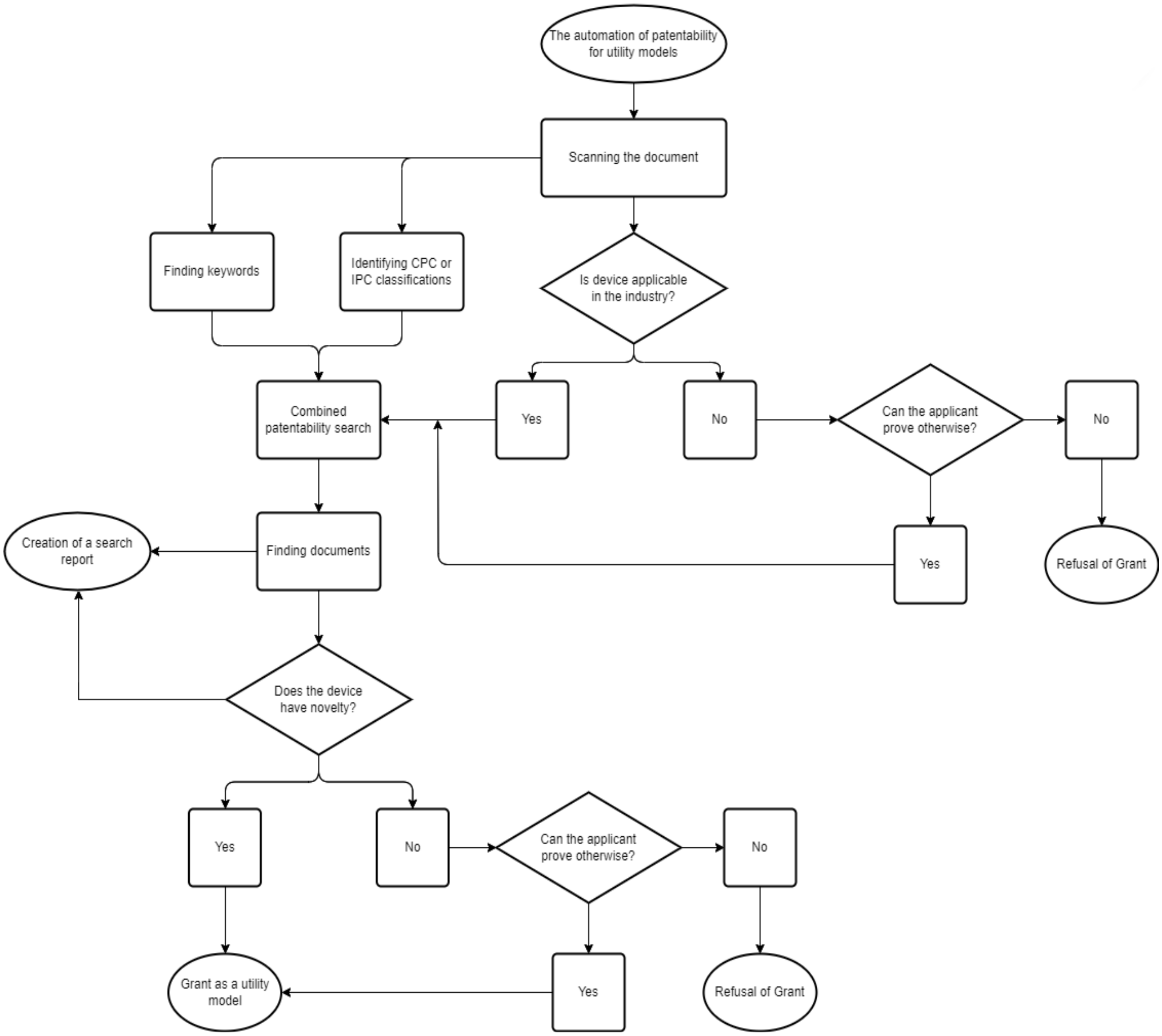
The automation also creates a patent search report, and depending on the national or regional law of the Patent Office, the system could send the report to the applicant. That would save time and prevent exhaustion of the human examiners. By doing this, we can also minimize the likelihood of human error. On the other hand, no inspection by the human examiners could lead to programming or computer errors. AI might find non-harmful documents for the application. It might also misjudge the documents. For example, the system might find that "The application doesn't have novelty", while the application does have novelty.

Another problem of a fully automated system is that it has zero to no human interaction. A patent examiner's view on a subject is essential. It does not matter how good AI or machine learning can be; I believe the view of a human expert will always be important. Another problem that could occur during the process of full automation is that automation might not be perfect, and it might find some wrong, unrelated documents.



Scheme 1 – Block scheme (flowchart) of finding patentability for a utility model (fully automated)

The automation might seem complicated. However, it is almost perfect. The only problem is it makes the human or artificial examiner's decision final. That is mostly right, but it means there is no room for appeal. That means we need to let the applicant try to explain and prove why the examiner's decision is incorrect. That means whenever a patentability requirement is not present, we need to let the applicant try to prove otherwise. Meaning the algorithm would look more like this.



Scheme 2 – Block scheme (flowchart) of finding patentability for a utility model with possible appeal (fully

Algorithm of the fully automated system:

For most of it, the algorithm of a fully automated system would be like the algorithm of general automation. However, it would have a few distinctive characteristics. In comparison to the general algorithm, the fully automated system would have slightly different Steps for Steps 2, 3, 4, and 8.

2. Scan the document to extract necessary information about the utility model.
3. Find relevant keywords from the scanned document.
4. Identify corresponding CPC or IPC classifications based on the document's content.
8. Evaluate if the device has novelty based on the retrieved documents:
   a. If yes, proceed to Step 9.
   b. If no, check if the applicant can prove otherwise:
      i. If yes, accept the proof and proceed to Step 9.

ii. If no, issue a "Refusal of Grant" and terminate the process.

c. Create a search report for the evaluation.

The difference in Step 2 in the fully automated system is that it scans the documents and gets the information from them. In the general algorithm, we have input information that could be provided by the human examiner.

Similarly, in Steps 3 and 4, the fully automated system finds relevant keywords and classification from scanned documents.

In Step 8, we have an extra "create a search report" feature.

Semi-automated system:

Here, the system would again scan the application documents and, according to that, will conduct a patent search. AI or machine learning would pick useful information from documents and search for it. However, this is where the automation would stop. The automation would not create a search report. After inspecting the found documents, the human expert would create a patent search report. That search report would be according to the conducted search by a semi-automated system. This search system would need some human interaction. In basic terms, the semi-automated system is a fully automated system that requires human verification for important decisions.

The sequence of the process is shown in the scheme above. Now we must figure out how every shown process would work in a semi-automated system. As mentioned above, a semi-automated system is remarkably similar to a fully automated system. The difference is that a semi-automated system requires human verification or control.

The first process in the sequence is "Scanning the document". Here, the system would scan the description, the claims, the abstract, and the drawings. The automation would use advanced tools like text mining and image search. With that, the system would identify the topic of the application. The system would find some phrases and concept-based terms, which would help the automation understand the context of the documentation. The next step after scanning the document would be finding suitable keywords and patent classifications.

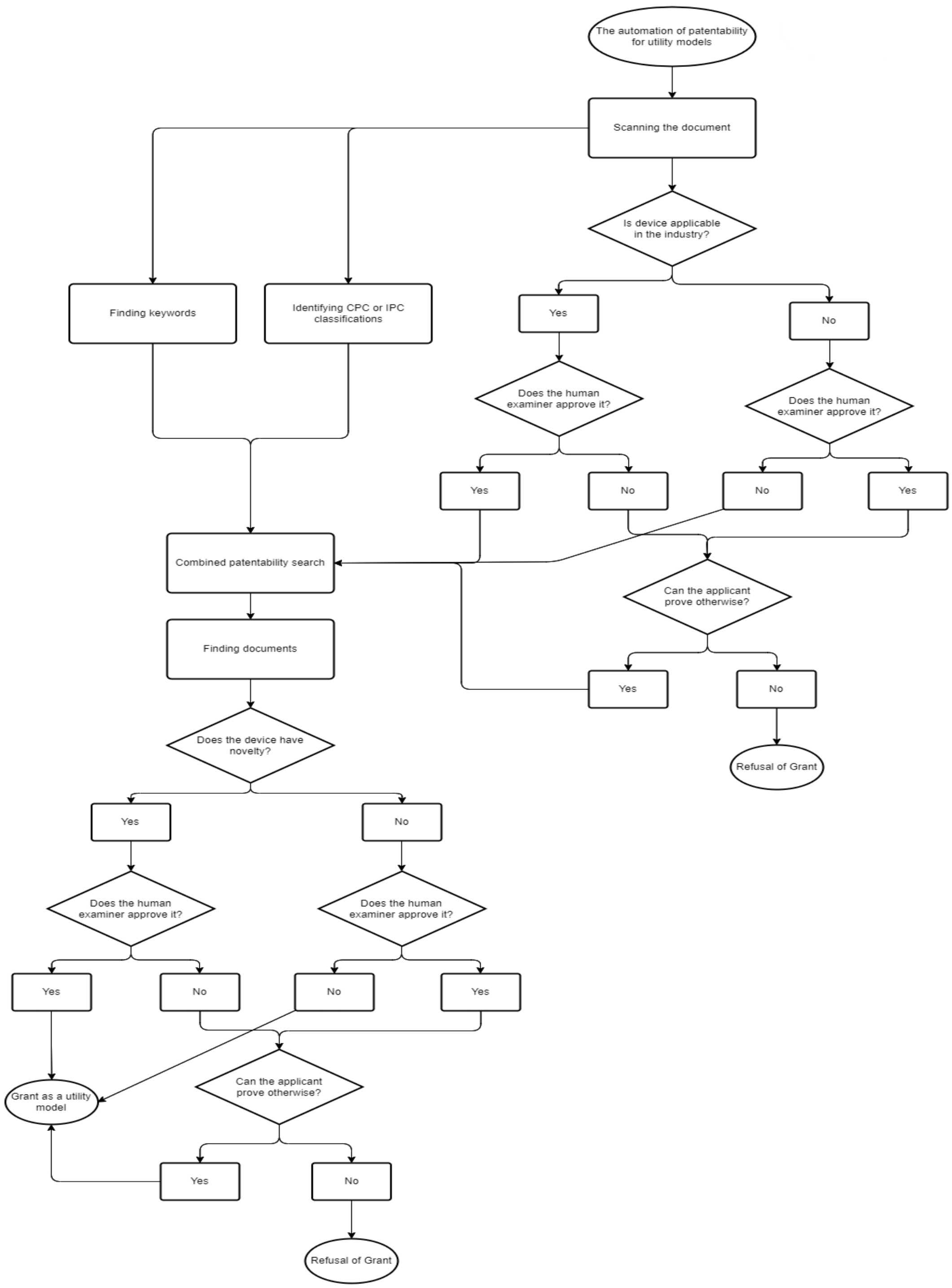
Then the automation will decide if the device is applicable in the said industry. The automation will check the laws of nature and use logical deduction to determine the applicability. However, whether it is right or wrong would be checked by the human examiner.

After deciding that the device has applicability in the said industry or after the applicant proves industrial applicability, the automation would conduct a combined patentability search. A combined search consists of using keywords and classifications.

The system would find a number of documents after searching. Those would be closest to the application examined according to the automation. The next step would be finding if the device is novel. This process would be conducted by automation and checked by the human examiner. Here, the system would not create the search report. It could later be created by the human examiner. If the application is not novel and the applicant cannot provide the necessary proof of novelty, the utility model would be refused. Otherwise, it would be granted as a utility model.

The semi-automated system would be perfect for conducting a patent search. Here, we get a large amount of automation and inspection by a human examiner. The only problem that could occur during a semi-automated system is that the automation might not be perfect. Therefore, it might find the wrong documents.

During the substantive examination, the human examiner conducts a patentability search. The semi-automated system will streamline and enhance the patent search process. However, in this system, there would be some human interaction. The system would conduct a patent search amazingly fast. It would not create a patent search report. The search report would be created by the human examiner. That would again save time and prevent some fatigue for the human examiners. By doing this, we can decrease the likelihood of human error. There could be some programming or computer errors. However, those errors would be inspected and corrected by the human examiner. On the other hand, this might lead to human errors. Since the results of a patent search depend on the opinion and are not fully definite, we cannot fully say whether humans, and AI would make a better decision.



Scheme 3 – Block scheme (flowchart) of finding patentability for a utility model with possible appeal (semi-automated)

Algorithm of the semi-automated system:

The algorithm of the semi-automated system has two main differences from the algorithm of a fully automated system. The differences are in Steps 5 and 8.

5. Check if the device is applicable in the industry:
    a. If yes, ask the human examiner for approval:
        i. If the human examiner approves, proceed to Step 6.
        ii. If no, check if the applicant can prove otherwise:
            1. If yes, accept the proof and proceed to Step 6.
            2. If no, issue a "Refusal of Grant" and terminate the process.
    b. If no, ask the human examiner for approval:
        i. If the human examiner approves, check if the applicant can prove otherwise:
            1. If yes, accept the proof and proceed to Step 6.
            2. If no, issue a "Refusal of Grant" and terminate the process.
        ii. If the human examiner disapproves, proceed to Step 6.
8. Evaluate if the device has novelty based on the retrieved documents:
    a. If yes, ask the human examiner for approval:
        i. If the human examiner approves, proceed to Step 9.
        ii. If no, check if the applicant can prove otherwise:
            1. If yes, accept the proof and proceed to Step 9.
            2. If no, issue a "Refusal of Grant" and terminate the process.
    b. If no, ask the human examiner for approval:
        i. If the human examiner approves, check if the applicant can prove otherwise:
            1. If yes, accept the proof and proceed to Step 9.
            2. If no, issue a "Refusal of Grant" and terminate the process.
        ii. If the human examiner disapproves, proceed to Step 9.

In both steps, the system asks for clarification from a human examination. Different from the fully automated system, this system needs human examiners' opinions. In addition to step 8, the system would not create a search report. The search report would be created by the human examiner.

Partially automated system

Here, the system would not scan the application documents. It would conduct a patent search according to the search information provided by the human examiner, or the system would scan a specific document provided by the human examiner. AI or machine learning would use that search information and conduct a search. This is again where the automation would stop. The automation would not create a search report; it would only find some documents, and the human examiner would need to check them. Here, the automation would not decide the novelty. It would strictly be done by the human examiner. After inspecting the documents found, the human expert will create a patent search report. That search report would be according to the conducted search by a partially automated system. This search system would need more human interaction than other systems. In a way, a partially automated system is a semi-automated system that requires more human verification and control.

The sequence of the process is shown in the scheme above. The first step in the sequence is "The information provided by the human examiner". Here, a human examiner can write some search information, like keywords, patent classifications, the name of the device, etc. Or a human examiner could provide a document for scanning. For example, the examiner could provide the claims documents only. In this case, the system would scan the claims and use the necessary information.
The next step is "Scanning the information". Here, the system would scan the information provided by the human examiner. The automation would use advanced tools like text mining and image search. With that, the system would identify the topic of the application. The system would find some phrases and concept-

based terms, which would help the automation understand the context of the documentation. The next step after scanning the document would be finding suitable keywords and patent classifications. The search information could be delivered by the examiner, or the system could scan a specific document for that.

Then the automation will decide if the device is applicable in the said industry. The automation will check the laws of nature and use logical deduction to determine the applicability. However, whether it is right or wrong would be checked by the human examiner.

After deciding that the device has applicability in the said industry or after the applicant proves industrial applicability, the automation would conduct a combined patentability search. A combined search consists of using keywords and classifications.

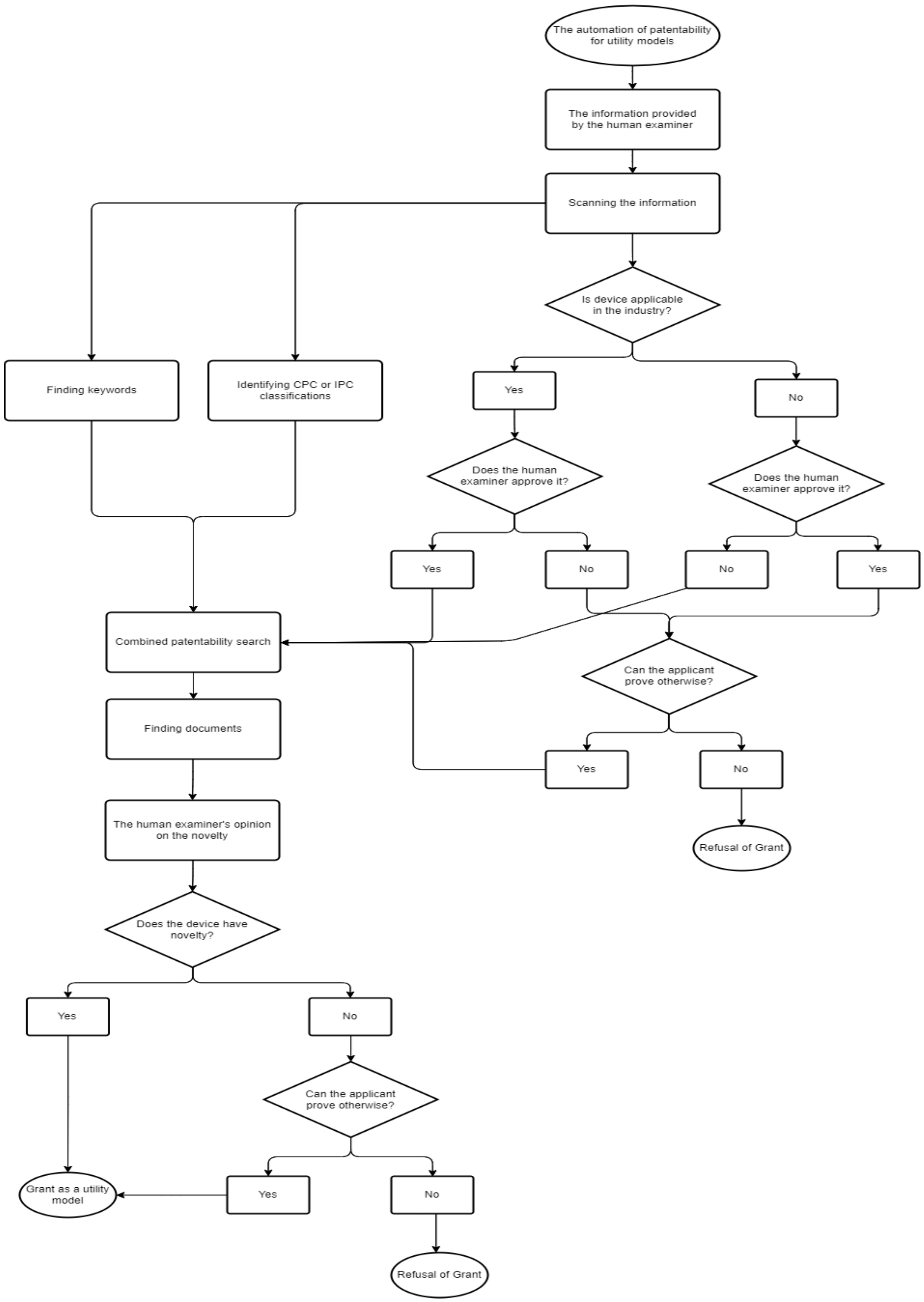
The system would find a number of documents after searching. Those would be closest to the application examined according to the automation. Then the human examiner would analyse them. The automation would not give any opinion regarding the novelty of the device.

The next step would be figuring out if the device is novel. This process would be conducted by a human. The system would not create the search report. It could later be created by the human examiner. If the application is not novel and the applicant cannot provide the necessary proof of novelty, the utility model would be refused. Otherwise, it would be granted as a utility model.

The partially automated system would be perfect for conducting a patent search for some Patent Offices. Not every Patent Office has open patent databases to everyone. Therefore, they might want to use a partially automated system to keep the examined application more secretive. Here, we get some amount of automation and inspection by a human examiner. The problem that could occur during a partially automated system is that a human examiner would need to do most of the work. Therefore, there might not be much automation. Also, we need to note that automation might not be perfect, and it might find the wrong documents. Because of the limited information, the conducted search might be incomplete.

In this system, there would be more human interaction than in the other systems. The system would conduct a patent search. Regardless of the automation, the patent search will not be fast and could be unreliable. This is due to the lesser automation. The system would have limited automation and would not have access to the whole document. It would conduct a patent search regarding some keywords, or it would scan a specific document provided by the human examiner. The found documents would be inspected by the human examiner. That might save time. However, it would not prevent fatigue for human examiners. Because the human examiner would need to check the documentation to create a patent search report. The limitation of automation would mean that the system would find more documents. There could again be some programming or computer errors. However, those errors would be inspected and corrected by the human examiner. On the other hand, this might lead to human errors. Since the results of a patent search depend on the opinion and are not fully definite. Those systems would not be much different from key-based searches on patent databases. That makes those systems less helpful since it creates a slight difference.

The important thing to remember is that not every Patent Office will implement this automation. That is because not every Patent Office has utility models as a subject of a patent. Moreover, in some Patent Offices, utility models are granted without a patentability search. Therefore, implementing this automation would be unnecessary for some Patent Offices. Another point is that Patent Offices that grant utility models without a patentability search could implement this automation. The automation is simple and mostly requires little to no human interaction. Therefore, implementing automation could improve the quality of a grant of utility models. We can also see many countries already implementing AI and modern technologies in their national and regional offices for examination of patentability. This increases efficiency and saves time. The automation of finding patentability for utility models would use an AI with techniques like machine learning algorithms, natural language processing (NLP), or others. Important tools it would use are text mining, search by image, search by significant phrases, sentences, or concept-based terms, etc. It would imitate the process done by the human examiner. The process would involve checking patentability requirements and conducting a patentability search. First, the automation will thoroughly inspect industrial applications. Then, it will check the novelty of the device.



Scheme 4 – Block scheme (flowchart) of finding patentability for utility model with possible appeal (partially automated)

Algorithm of the partially automated system:

The algorithm of the partially automated system is like the general algorithm of automation and to the algorithm of the semi-automated system. The said algorithm has some extra steps in comparison to the other systems.

1. Start the process.
2. Get the input information provided by the human examiner.
3. Scan the input information to extract necessary information about the utility model.
4. Find relevant keywords from the scanned input information.
5. Identify corresponding CPC or IPC classifications based on the input information's content.
6. Check if the device is applicable in the industry:
   a. If yes, ask the human examiner for approval:
      i. If the human examiner approves, proceed to Step 7.
      ii. If no, check if the applicant can prove otherwise:
         1. If yes, accept the proof and proceed to Step 7.
         2. If no, issue a "Refusal of Grant" and terminate the process.
   b. If no, ask the human examiner for approval:
      i. If the human examiner approves, check if the applicant can prove otherwise:
         1. If yes, accept the proof and proceed to Step 7.
         2. If no, issue a "Refusal of Grant" and terminate the process.
      ii. If the human examiner disapproves, proceed to Step 7.
7. Perform a combined patentability search using the identified keywords and classifications.
8. Locate relevant documents from the patentability search.
9. Wait for the input of human examiner regarding the novelty.
10. Evaluate if the device has novelty based on the human examiner's opinion:
    a. If yes, proceed to Step 11.
    b. If no, check if the applicant can prove otherwise:
       i. If yes, accept the proof and proceed to Step 11.
       ii. If no, issue a "Refusal of Grant" and terminate the process.
11. Grant the device as a utility model if all conditions are met.
12. End the process.

The algorithm takes limited input information from the general automation and human examiner's opinion from the semi-automated system.

Principle of operation:

Now that we understand a system, let us discuss how it would work. NLP machine learning-based AI is one of the foundations of any automotive (fully, semi, and partially automated) system.

Please note that we are reviewing the legislation of Azerbaijani Patent Law, and therefore, the AI will operate according to Azerbaijani Patent Law.

Training:

The first important part is training AI. AI training would consist of using human-made patent search reports.

The process of training:

Firstly, we would select human-made patent searches. Then, we would introduce the claim documents and a search report of the application to AI. The claim documents are the most important part of patent documentation, as they hold the most significant elements of the utility model. From this AI would start to understand how to do a patent search. With search reports, we would also use search strategies, which would hold the information of the patent search process. Here, AI would learn how to classify the application based on previous searches. The main classification the AI would use is IPC since it is the most used one in the Republic of Azerbaijan. Later, AI would learn which keywords and key terms to use during the patent search. In addition, AI would also learn from search reports how human examiners determined the documents found. The main elements used during the search are "A", "Y" and "X". "A" means the found document is close to the examined application without damaging any patentability requirements. "Y" means the found document is close to the examined application and is damaging the inventive step requirement of the patent. "X" means the found document is close to the examined application and is damaging the inventive step and novelty requirement of the patent. In this case, "Y" will not be important as inventive step is not a requirement for a utility model. Using how human examiners made decisions, AI could identify and make decisions from the found documents. However, this will not be the end of the training as there is always room for improvement. The AI conducting a patent search would be tightly controlled by the human examiner, who would check if the AI's reasoning were right or not. In addition, the AI would also be taught how to use some logical operations such as "AND", "OR", etc. This would help AI to operate in various databases. Also, if the said AI would check the industrial application of the invention, it would need training in logic and related scientific fields. For this, we would use a structured knowledge base. Here, you will find significant information such as scientific and technical databases, patent databases, regulations, and standards, etc.

The process of decision-making:

The decision-making process primarily consists of two key components: assessing the industrial application and determining novelty.

Industrial application: Usually human examiners check industrial application before conducting a patent search. There are two main ways to approach this: a human examiner can check for industrial applications, or the process can be automated. The automation would involve AI to learn some real-world logic and natural sciences such as physics, chemistry, etc. The field of science would depend on the operational field of the utility models. For instance, the utility model could involve engines, which would require knowledge of mechanics. Alternatively, it could pertain to a new chemical compound, necessitating expertise in chemistry. Although in the Republic of Azerbaijan utility models could only be devices. That means in our case AI would need and expertise on the field of physics and mechanics. In general, the AI here would have data and knowledge bases that would have the necessary information. From what the AI would be able to decide whether the utility model is applicable in the said industry or not. If it is found not applicable, then the human examiner or the AI would create a notification related to it. This process is done to decrease errors and give a chance to the applicant to prove otherwise.

Novelty: This is the last patentability requirement checked by the examiner. During this phase, the examiner conducts a patentability search. According to the search results human examiner decides whether the utility model is novel or not. For automation, we could again use AI. How would AI conduct a patent search? Firstly, the AI would need access to the keywords, key terms, classification (IPC), and databases. The keywords, key terms and classifications could be given in two ways. It could be given by the human examiner or by AI that would scan the claim documents. How would the scanning of the document work? The AI would be implemented by OCR capabilities, which would give access to AI to read the claim documents. From that, AI would do some data mining to find some keywords, key terms, and classifications. According to the Azerbaijani Patent Law, the claim documents are written in two languages. Since the AI would be implemented in Azerbaijan the found keywords and key terms would be in Azerbaijani and Russian. But since we are also searching some English-implemented databases such as PATENTSCOPE, Espacenet and USPTO, AI would also have a translating function. The translation function would also be based on machine learning and would be monitored to ensure the right translation. We would use the API of patent databases. Having APIs of databases would give access to those databases, therefore, AI could use keywords, key terms, and classifications or a combination of them. Lastly, AI would find a few documents at the end, and then it could judge (depending on the type of automation). If it is found not to have a novelty, then the human examiner or the AI would create a notification. The process would be done to decrease errors and give a chance to the applicant to prove otherwise.

Search model and retrieval logic:

The search model uses a mixture of title terms, noun keywords, adjective keywords, configuration keywords, and IPC classes. Let the search query be denoted as:

$$[\ Q = \{Q_T, Q_N, Q_A, Q_C, Q_{IPC}\}\ ]$$

where (Q_T) is the title-based query component; (Q_N) is the noun keyword component; (Q_A) is the adjective/qualifying feature component; (Q_C) is the configuration or relation-based component; (Q_{IPC}) is the patent classification component.

The total similarity score can be separated into two categories:

$$[\ S_Y = f(S_T, S_N, S_A, S_{IPC})\ ]$$

$$[\ S_X = f(S_T, S_N, S_A, S_{IPC}, S_C)\ ]$$

where (S_T) is title similarity; (S_N) is noun keyword similarity; (S_A) is adjective/feature similarity; (S_{IPC}) is IPC similarity; (S_C) is configuration similarity.

The former one (S_Y) is used to check the closeness of the found document to decide about its suitability for novelty or inventive step relevance. The latter one (S_X) includes the similarity at the configuration level and is expected to have an anticipation or inventive step damage effect.

Threshold values can be assigned as follows: Label A if ($5.5 < S_Y$); Label Y if ($S_Y > 7.5$); Label X if ($S_X > 9$); Ignore if ($S_Y < 5.5$). These threshold values are conceptual and can later be adjusted through empirical testing.

Rule-based methodology for utility model examination:

As utility models apply only to devices, there is a set of preliminary subject-matter rules in the framework. The stage is not aimed at novelty assessment, but at legal and technical feasibility filtering.

Examples of such rules include:

Rule 1 - Device determination

IF the subject matter of the claim refers to a technical device, apparatus, mechanical structure, physical combination, or arrangement of parts,

Then, proceed to the utility model examination.

Rule 2 - Non-device exclusion

IF the subject matter of the claim refers exclusively to a method, process, algorithm, or non-device solution,

Then, utility model protection shall not be applied within the utility model framework.

Rule 3 - Presence of technical features

IF the claim contains technical features that can be correlated to structural or functional parts of the solution,

THEN conduct a patentability search.

Rule 4 - Industrial applicability

IF the technical solution disclosed by the claim can be produced, assembled, used, and applied in an industry,

THEN industrial applicability = YES.

Rule 5 - Industrial applicability failure

IF the technical solution disclosed by the claim is impossible to reproduce, violates physical laws, or has no technologically feasible industrial application,

THEN industrial applicability = NO.

Thus, the rule-based phase plays the role of a gate from the technical and legal points of view prior to or along with the novelty search.

Comparison with existing frameworks:

In this sense, the proposed framework diverges from existing frameworks for analysing patents using AI and search technologies in multiple ways.

Firstly, most current frameworks using AI in patent analysis are aimed at faster prior art searches, semantic similarity assessment, or patent landscape analysis. On the other hand, the current framework relies on the legal process of patentability examination, which includes industrial applicability, novelty, and inventive step of the invention.

Secondly, many current research papers deal with inventions in general rather than specifically with the legal concept of utility models. Examination of utility models implies an extra filter as the subject matter should be a device. For this reason, a preliminary rule-based step is included in the proposed framework that will determine whether the object is suitable for utility model protection.

Thirdly, the proposed framework divides all automation processes into fully automated, semi-automated, and partially automated, while existing frameworks usually speak about AI usage in general.

Fourth, the proposed framework is based on combining rule-based and similarity search approaches. In patent AI literature, there is a strong focus on using machine learning or semantic search techniques, but not on integrating law reasoning and searching logic as well as human checking, into one examination-oriented system.

The comparison could be formulated in the following way:

1. Classical tools for searching information in patent databases. Advantage: good availability of the prior art and structured searching fields. Drawback: requires high qualifications of an examiner and does not consider the patentability issues.
2. AI-supported prior art retrieval systems. Advantage: good capabilities in semantic searching, keyword expansion, ranking, and similarity retrieval. Drawback: can be limited only to the retrieval phase and are not integrated into the decision-making about patentability.
3. Patent novelty prediction models. Advantage: They are useful for evaluating novelty scores. Drawback: usually limited by the claim-document comparison and does not consider industrial applicability, legal responsibility, or utility model subject matter filtering.
4. Proposed framework. Advantage: integrates all the above aspects in one system dedicated to the utility model examination process.

Discussion: legal responsibility, explainability, and AI governance:

Legal liability in connection with the outcome of patentability examination represents one of the fundamental problems in the automation of this procedure. In the case when the automated system conducts a search, scoring, or preliminary patentability evaluation, the legal action of granting or denying a patent or utility model still lies within the competence of the respective patent office and, in fact, of the human examiner.

That is why the suggested architecture must be considered a system for decision-making assistance, not an independent legal entity. This aspect is especially important for those cases where: the system cannot find the appropriate prior art; the system gives the wrong recommendation about novelty or inventive step; the system generates an inaccurate explanation or rating.

In these situations, legal responsibility must lie with the human-driven examination procedure, not with the software.

Explanation capability is critical in the process of patentability examination for three main reasons. The first reason is that patentability judgments must be well-reasoned and replicable. In case there is any retrieval of a prior art document that poses harm to novelty and inventive step, the examiner must be able to comprehend the reason that the document was retrieved, and what claims were matched.

The second reason is that an explanation capability is needed for the examiner's trust. Patent examiners are not likely to use a system that provides a relevance score but does not disclose the role of title, IPC classification, noun keywords, adjective features, or configuration components.

The third reason is that explanation capability is required for legal defensibility. In case of any objection from the applicant regarding the rejection or the relevance of the cited document, the office should be able to explain the grounds for using the system in support of the examiner's judgment.

Hence, it is reasonable to prefer the architecture for the proposed system that includes visualized keywords and IPC extraction; weighted search terms; threshold values; distinct title, noun keywords, adjective keywords, and configuration similarities; and human evaluation of the output.

The requirement for explainability also promotes the employment of semi-automated or partially automated algorithms because these algorithms inherently maintain an interpretable logic chain.

AI's employment for purposes of patent examination presents issues regarding governance related to transparency, confidentiality, data quality, bias, reproducibility, and oversight. The Patent Office’s work involves applications that have not been published, confidential information about the applicants, and make important decisions. Therefore, any AI-supported system employed for patent examination needs to be governed.

At least the following requirements of governance should be considered: one. Human supervision. The examiner should have the power to accept, refuse, or correct the work of the system. 2. Traceability. Search strategy, weights, documents retrieved, as well as intermediate scoring, should be saved to restore the process of reasoning in case of need. 3. Confidentiality and security. If the system operates on unpublished applications, the patent office should ensure that the data of applications is not accessible to any external AI system or to third parties. 4. Control over bias and validation. Periodical testing of the system on patentability cases from various areas or in various languages should be conducted to ensure that the quality of retrieval is not too low for some areas or languages. 5. Governance of updates. In case the system uses machine learning or dynamic weighting, any updates to the model should be documented and versioned since a future update can affect the processing of similar applications. Therefore, the governance issue does not lie in the technicality of the issue. It has more to do with the embedding of the automated process within the institutional framework of the patent office's decision-making process.

Limitations

It is important to note that automation would specifically streamline the process of conducting patent searches and speed up the substantive examination process. It would not automate any other part of the examination. For example, it will not be useful during the preliminary examination. For utility models, the system would check patentability requirements. It would not automate anything other than that. The system would be a great tool for speeding up the process of granting or refusing a utility model.

Conclusion

Automating the process of finding patentability offers several advantages, making the search more efficient and effective. Automation reduces the time required for patent searches. It is also necessary to point out that automation would great tool for patent examiners. They could be searching for a single patent or conducting extensive patent landscaping, much easier with the help of automated systems.

AI or machine learning, with the help of advanced tools like text mining, could find relevant documents and could conduct a patent search for the application. The automation of finding patentability for utility models would use an AI with techniques like machine learning algorithms, natural language processing (NLP), or others. Important tools it would use are text mining, search by image, search by significant phrases, sentences, or concept-based terms, etc. It would imitate the process done by the human examiner. The utility models only require novelty and industrial application. The process would involve checking patentability requirements and conducting a patentability search. First, the automation will thoroughly inspect industrial applications. Then, it will check the novelty of the device.

Levels of automation could depend on how much human interaction a system needs. With that, we could divide the automated systems into three parts. Those three parts are the fully automated systems, which require little to no human interaction, semi-automated systems, which require some human interaction and partially automated systems, where the system requires more human interaction than other systems.

Usually, the first step during the substantive examination is to determine whether the application is usable in the said industry. Human examiners check industrial applications before conducting a patent search. The automation would involve AI to learn some real-world logic and natural sciences, such as physics, chemistry, etc. The field of science would depend on the operational field of the utility models. In the Republic of Azerbaijan, utility models could only be devices. That means in our case, AI would need expertise in the field of physics and mechanics. In general, the AI here would have data and knowledge bases that would have the necessary information. From what the AI would be able to decide whether the utility model is applicable in the said industry or not. If it is found not applicable, then the human examiner or the AI would create a notification related to it. This process is done to decrease errors and give the applicant a chance to prove otherwise.

Novelty is the last patentability requirement checked by the examiner. During this phase, the examiner conducts a patentability search. According to the search results, a human examiner decides whether the utility model is novel or not. For automation, we could again use AI. Firstly, the AI would need access to the keywords, key terms, classification (IPC), and databases. It could be given by a human examiner or by AI that would scan the claim documents. The AI would be implemented with OCR capabilities, which would give the AI access to read the claim documents. From that, AI would do some data mining to find some keywords, key terms, and classifications. According to the Azerbaijani Patent Law, the claim documents are written in two languages. Since the AI would be implemented in Azerbaijan, the found keywords and key terms would be in Azerbaijani and Russian. But since we are also searching some English-implemented databases such as PATENTSCOPE, Espacenet, and USPTO, AI would also have a translating function. The translation function would also be based on machine learning and would be monitored to ensure the right translation. We would use the API of patent databases. Having APIs of databases would give access to those databases; therefore, AI could use keywords, key terms, and classifications, or a combination of them. Lastly, AI would find a few documents at the end, and then it could judge (depending on the type of automation). If it is found not to have novelty, then the human examiner or the AI would create a notification. The process would be done to decrease errors and give the applicant a chance to prove otherwise.

The important thing to remember is that not every Patent Office will implement this automation system. That is because not every Patent Office has utility models as a subject of a patent. Moreover, in some Patent Offices, utility models are granted without a patentability search. Therefore, implementing this automation would be unnecessary for some Patent Offices. Another consideration is that Patent Offices that grant utility models without conducting patentability searches could incorporate this automation. The process is straightforward and requires minimal human intervention. Therefore, integrating automation could enhance the quality of utility model grants.

References

[1] Patent haqqında Azərbaycan Respublikasının Qanunu (1997). https://patent.copat.gov.az/files//26290292722835030361312IQ%20Patent%20haqq%C4%B1nda%20(2).pdf
[2] PART, F. (2007). Civil Code of the Russian Federation.
[3] Eurasian Patent Convention (1994). Accessed: [15-July, 2024]. https://www.eapo.org/en/documents-2/legal-protection-of-inventions/eurasian-patent-convention/
[4] European Patent Office. (2024). *Patentability requirements*. Accessed: [15-July, 2024]. https://www.epo.org/en/legal/guidelines-epc/2024/g_i_1.html [
[5] European Patent Office. (2000). *Convention on the grant of European patents*. Accessed: [15-July, 2024]. https://www.epo.org/en/legal/epc/2020/EPC_conv_20240401_en_20240401.pdf
[6] Law of the Republic of Belarus on Patents for Inventions, Utility Models and Industrial Designs (2004). Accessed: [15-July, 2024]. https://www.wipo.int/wipolex/en/text/125417
[7] World Intellectual Property Organization. (n.d.). *Utility models*. Accessed: [15-July, 2024]. https://www.wipo.int/web/patents/topics/utility_models
[8] German Patent and Trademark Office. (2022, October 26). *Utility model protection*. https://www.dpma.de/english/utility_models/utility_model_protection/index.html
[9] Japan Patent Office. (n.d.). *Utility model*. https://www.jpo.go.jp/e/faq/yokuaru/utility.html
[10] Fleck, L. M. (2021, March 18). *Word of law: An intellectual property primer for manufacturers*. Manufacturing AUTOMATION. https://www.automationmag.com/word-of-law-an-intellectual-property-primer-for-manufacturers/
[11] Mai, C., & Bhatti, A. (2017). Topic 3: Legal Requirements for Patentability and typical Parts of a Patent Application. *Wipo*. https://www.wipo.int/edocs/mdocs/mdocs/en/wipo_ip_cnx_17/wipo_ip_cnx_17_3.pdf, [
[12] Helmers, L., Horn, F., Biegler, F., Oppermann, T., & Müller, K. R. (2019). Automating the search for a patent's prior art with a full text similarity search. *PloS one*, *14*(3), e0212103.. https://doi.org/10.1371/journal.pone.0212103
[13] Richmond, K. M., Muddamsetty, S. M., Gammeltoft-Hansen, T., Olsen, H. P., & Moeslund, T. B. (2024). Explainable AI and law: An evidential survey. *Digital Society*, *3*(1), 1., https://doi.org/10.1007/s44206-023-00081-z.
[14] World Intellectual Property Organization. (n.d.). *Index of AI initiatives in IP offices*. https://www.wipo.int/about-ip/en/artificial_intelligence/search.jsp
[15] IBM. (n.d.). *What is text mining?*. https://www.ibm.com/topics/text-mining
[16] Oldham, P. (2022, January 1). *Chapter 7: Text mining*. WIPO Analytics Handbook. https://wipo-analytics.github.io/handbook/textmining.html
[17] MonkeyLearn. (n.d.). *What is text mining? A beginner's guide*. https://monkeylearn.com/text-mining/
[18] Srebrovic, R., & Yonamine, J. (2020, November 21). *How AI improves patent analysis*. Google Cloud Blog.
[19] Krestel, R., Chikkamath, R., Hawel, C., & Risch, J. (2021). *A survey on deep learning for patent analysis*. ResearchGate. https://www.researchgate.net/publication/350523275_A_survey_on_deep_learning_for_patent_analysis
[20] Jang, H., & Yoon, B. (2025). An explainable artificial intelligence–human collaborative model for investigating patent novelty. *Engineering Applications of Artificial Intelligence*, *154*, 110984. https://doi.org/10.1016/j.engappai.2025.110984

[21] [Mann, C. (2022). Integration of Automation in the Patent Process. *LexisNexis Intellectual Property Solutions, Jan*, *19*.

[22] Setchi, R., Spasić, I., Morgan, J., Harrison, C., & Corken, R. (2021). Artificial intelligence for patent prior art searching. *World Patent Information*, *64*, 102021., https://doi.org/10.1016/j.wpi.2021.102021.

[23] Intellectual Property Office. (2022, May 5). *AI-assisted patent prior art searching: Feasibility study*. SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4101202