

A Rule-Based Framework for Assessing Industrial Applicability

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Abstract: Patent searches are conducted in multiple independent databases. In addition, it is necessary to mention that patent search identifies the novelty and inventive step criteria among the criteria of patentability. Hence, the model of patent search cannot define the industrial application criterion. As can be seen, the proposed structure clearly illustrates how the industrial applicability evaluation may be performed based on a series of predefined rules. In contrast to machine learning algorithms, which require large amounts of data, the offered approach may rely solely on legal and scientific criteria already used by patent offices in practice. The proposed framework enables different types of automation in conducting patent evaluations: Fully Automated systems; Semi-Automated systems; Partially automated systems. Using rule-based algorithms enables providing an explanation for each step made by the system.

Keywords: Patentability, industrial application, artificial intelligence, patentability evaluation, automation, system modeling

1.Introduction

The patent search in the Patent and Trademark Center of the Intellectual Property Agency of the Republic of Azerbaijan is carried out in several independent databases. These databases are the Azerbaijani Patent Database, FIPS, EAPATIS, PATENTSCOPE, Espacenet, USPTO, and Google Patents, among others [1], [2], [3], [4], [5], [6], [7]. Each database is to be accessed individually, and the search query has to be formulated and executed individually for each database. But it also needs to be noted that patent search only finds novelty and inventive step as criteria of patentability.

Analysis of patent applications usually presupposes checking compliance with three main requirements for the patentability of inventions: industrial applicability, novelty, and inventive step. In relation to the latter two requirements, much effort has been put into studying the potential for automating the search for relevant prior art using methods such as artificial intelligence, machine learning, natural language processing, and information retrieval systems. Nevertheless, there has not been so much attention paid to the problem of automation of industrial applicability analysis.

Industrial applicability is one of the basic patentability requirements in many countries, among which there is the Republic of Azerbaijan. Typically, before considering novelty and inventive step, patent examiners assess whether the claimed invention may be produced or applied in some area of industry. The task involves technical knowledge and reasoning about how the invention works. Existing patent search automation systems primarily focus on information retrieval and prior-art identification. Such systems assist examiners in finding relevant documents but generally do not evaluate whether an invention is capable of

industrial application. As a result, industrial applicability assessment remains largely dependent on human expertise.

In this paper, we present a rule-based approach to the evaluation of industrial applicability of inventions. The proposed rule-based approach is formulated as a decision support system that can be included in the automated/semi-automated systems of patent examination. Contrary to machine learning algorithms, our approach uses explicit rules based on patent legislation, scientific knowledge, and patent examination processes. The purpose of our rule-based system is to assist patent officers in determining the industrial applicability of inventions. The goal of the research is to construct the methodological basis for industrial applicability evaluation that can be used in the process of patentability examination under Azerbaijani patent legislation.

2. Literature review

Under the patent law of Azerbaijan, three types of patentable subject matter are recognized: inventions, utility models, and industrial designs. In the context of inventions, three fundamental patentability requirements are set. First, the requirement of novelty indicates that the subject matter of the invention should not be part of the prior art. Second, the invention should represent an inventive step, which indicates that the invention should not be obvious to a person skilled in the art. Third, the invention should be capable of industrial application, meaning that the invention can be produced or used in industry or in any other sector of the economy [8]. Utility models also have similar legislation. However, they can only be devices and require two criteria of patentability. These are industrial application and novelty [8].

A similar framework is in place in the Russian Federation. According to their Civil Code, patent protection is granted for inventions, utility models, and industrial designs [9]. The patentability criteria for an invention in the Russian Federation are similar to those in Azerbaijan, i.e., novelty, inventiveness, and industrial applicability. Similarly, in the Russian Federation, utility models can also only be devices and require two criteria of patentability: industrial application and novelty [8].

Under the current system of examination, the search for prior art documents is conducted based on combinations of IPC codes and keyword searches. Once the potentially relevant documents are identified, the impact of these documents on patentability is evaluated, and a conclusion is drawn. In most cases, the results of the evaluation are of three types: the documents do not influence patentability; the documents indicate a lack of inventive step; or the documents indicate a lack of novelty [10]

The methodology adopted in the present study is based on the above principles but aims at incorporating automation in the evaluation process. It is based on the patent databases currently in use and thus depends on the structure of these databases. The evaluation methodology is restricted to mechanical inventions, specifically device-related patents, in order to limit the scope of evaluation and make the results consistent. To make the evaluation methodology more formalized, three classes of documents are defined: A (generally relevant documents), Y (documents indicating lack of inventive step), and X (documents indicating lack of novelty) [10].

Moreover, the model includes a keyword similarity component based on synonyms. This can be achieved by a structured database in which terms are provided with similarity weights. In such a system, for instance, semantically related terms such as different technical terms can be connected in a table of similarity, thus facilitating a more flexible matching in the search procedure [10].

For a semantic-based retrieval system, the proposed system provides a patentability analysis using a three-stage process of query refinement. In the first stage, it identifies technical entities that are represented in noun-based keywords. In the second stage, it extends these keywords to include descriptive modifiers that identify attributes of an invention. In the third stage, it extends these keywords to include configuration-related expressions that identify relationships between various components of an invention, which are often logical in nature as found in patent claims [10].

The thresholds can be set based on expert opinion or by deriving them empirically. One such method of deriving thresholds could be by aggregating the opinions of patent experts and then normalizing the scale to obtain an average threshold based on the actual examination procedure [10]. The problem here is that the model finds novelty and inventive step. The model still lacks industrial application evaluation. Hence, using a framework for industrial application evaluation would be required.

Another paper discusses types of automation that could be deployed for patentability evaluation. The paper discusses the three main types of automation: fully automated, semi-automated, and partially automated systems. Where fully automated system doesn't need human examiner input, semi-automated system requires human examiner validation, and partially automated system automates the process based on examiner input [11]. Although the authors describe the algorithms for patentability evaluation and mention the model would check industrial application, the framework of evaluation of the said criterion is not mentioned [11].

3. Methodology

- General framework for evaluating industrial application:
- The proposed framework consists of four primary stages: Claim analysis; Technical domain identification; Rule-based industrial applicability assessment; Human examiner verification.
- The framework is intended to function as a component of an automated patentability examination system. Its purpose is not to replace patent examiners (depending on the type of automation) but to provide preliminary assessments that can support examination procedures.
- Stage 1: Claim Analysis: The system receives input from patent documentation, including: Claims; Description; Drawings; Abstract.
- Natural language processing techniques may be utilized to identify technical features, technical effects, structural components, and functional relationships described in the invention or utility model. For example, if an application describes a hydraulic turbine, the system would identify features such as blades, rotor, shaft, fluid flow, and power generation. Based on that, the system might also flag unrelated keywords based on IF-THEN rules and the type of automation.
- Stage 2: Technical Domain Identification: After extracting technical features, the system determines the relevant technological domain through IPC classification. The system would check if technical terms match the IPC codes. For example, an IPC code could be F16H 1/02 - Toothed gearing for conveying rotary motion, without gears having orbital motion [12]. However, the application could be in the field of chemistry. Therefore, the system would flag it and, based on the automated system deployed (described in [11]), would determine industrial application. The identified domain determines which scientific and technical rules will be applied during industrial applicability assessment.
- Stage 3: Rule-Based Assessment: The proposed system utilizes a knowledge base containing legal rules, technical rules, and scientific rules.

Examples of legal rules include:

Rule 1:

IF the application contains identifiable technical features
THEN continue examination.

Rule 2:

IF the application lacks sufficient technical disclosure

THEN request clarification from the applicant.

Examples of scientific rules include:

Rule 3:

IF the application violates established laws of physics

THEN industrial applicability = NO.

Rule 4:

IF the application requires perpetual motion without an external energy source

THEN industrial applicability = NO.

Rule 5:

IF the application cannot be reproduced using the disclosed information

THEN industrial applicability = NO.

Examples of technical rules include:

Rule 6:

IF the application contains identifiable components, operational mechanisms, and expected technical effects

THEN industrial applicability = YES.

Rule 7:

IF the application can be manufactured using existing or reasonably foreseeable technologies

THEN industrial applicability = YES.

Rule 8:

IF the application can be repeatedly utilized within an industrial environment

THEN industrial applicability = YES.

Knowledge Base Structure:

The knowledge base is made up of: Scientific databases; Technical standards; Patent databases; Engineering sources; Legal regulations; Rules generated by examiners.

The system may employ specialized knowledge depending on the IPC classification detected at Stage 2.

Stage 4: Verification by Humans. Please note that this stage will not be considered for an entirely automated system.

The final decision will always remain with the patent examiner. The system supplies: Activations of rules; Evidence; Rationale behind decisions.

4. Findings and Results

As one can see from the proposed framework, industrial applicability assessment can be expressed via a certain set of rules. In contrast to machine learning methods, which need to work on large amounts of data for learning purposes, the proposed solution can be developed based on the current set of requirements and laws applied by patent examiners.

There are different types of patent examinations that can be automated using the proposed framework: Fully automated systems; Semi-automated systems; Partially automated systems. One of the major advantages of

the proposed method is that the use of rules allows providing explanations for each decision made. It is very important because any legal decision has to be accompanied by an appropriate justification.

It is also possible to apply specialization based on the technical field of interest using the proposed framework. For example, linking industrial applicability rules to IPC classes will enable applying scientific knowledge specific to a certain domain.

The analysis of perpetual motion devices proves that the proposed framework can be really useful for patenting. Indeed, such devices break physical laws, and thus the lack of industrial applicability can be recognized without making a patent search.

5. Limitations

- Several considerations should be mentioned here. First, evaluation of applicability in industry is based on complex scientific and technical considerations, which are not necessarily represented by pre-defined rules and may necessitate constant growth of the knowledge base.
- Second, applicability assessment is dependent on the quality of patent documents; incomplete information can cause an error in assessment.
- Third, the scientific knowledge base changes over time. Thus, the rules need to be regularly updated according to new discoveries in science and technology.
- Fourth, there might be situations when a certain degree of subjectivity is needed. Thus, the proposed framework should not be taken as a substitute for a patent examiner, but rather as an advisory tool.
- And finally, at the moment, this study presents only a theoretical model, without extensive empirical validation using real data from patents. Future research could provide such validation.

Author Contributions

The sole author is responsible for conceptualizing, collecting, and analyzing data, and writing and editing the manuscript

Conflict of Interest

The authors declare no conflicts of interest

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