Patent Examination Process through AI and its Challenges in India, EU and the US

Surya Mani Tripathi

Shibaji Ghosh*

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Abstract

The role of Artificial Intelligence (AI) in the patent examination for the United States Patent and Trademark Office (USPTO), European Patent Office (EPO), and Indian Patent Office (IPO) is under development. Traditional patent examination systems currently encounter increasing difficulties in managing rising worldwide patent applications. The combination of machine learning (ML) technology with natural language processing (NLP) simplifies prior art research while improving patent classification methods and claims examination, thus enhancing patent examination effectiveness and precision. The USPTO uses similarity search as an AI tool and EPO utilises AI-PreSearch for automated classification and prior art identification tasks. The integration of AI in India focuses on modern process implementation to handle increasing numbers of patent applications and corresponding examination delays. The article shows how AI can reinvent global patent examination through specific recommendations for its future development.

Introduction

Patent rights provide legal protection for inventions which give inventors rights to exclusive use of their inventions for 20 years from the initial filing date.[1] Through patent exclusivity, inventors can fully gain profit from their creations while stopping unauthorised production or sale activities involving patented inventions. The core mission of patent law motivates inventors to spread their inventions to society by granting them exclusive rights in exchange for temporary protection.[2] A patent extends legal protection to different inventions, including mechanical devices, chemical mixtures, biological technology products, software, and business operation approaches. Getting a patent grant requires a prolonged process where a patent office must examine the invention to verify that it meets three essential requirements known as novelty, non-obviousness, and industrial applicability.[3]

A patent examination traditionally proceeds through multiple stages, beginning with filing an application and continuing to formal examination steps that involve invention classification and prior art search for patentability that is novelty, non-obviousness, and industrial applicability. To determine novelty and non-obviousness examiners analyse a combination of published patent applications and patents, academic research and technical reports, and public disclosures.[4] The current requirement for extensive patent examination extends due to rising worldwide patent submissions each year. WIPO reported a global total of 3.2 million patent applications were filed in 2019 and showed ongoing growth according to statistics.[5] The growing number of patent applications leads to extensive delays as well as backlogs throughout patent offices of different countries which may cause innovation delays in the fields of new technological areas. Intellectual property offices throughout the world have now started doing research on how artificial intelligence (AI) can strengthen different points within their patent inspection operations. The automatic processing of prior art searches and patent classification, along with patent application assessments, is achievable by utilising machine learning (ML) and natural language processing (NLP) based AI tools. AI technologies will enhance patent examination efficiency together with precision and standardisation, thus enabling patent offices to manage their rising application numbers better.[6]

AI provides its most significant benefit through its automated system, which finds prior art during the patent examination process. The prior art describes all public information that helps to examine whether an invention demonstrates novelty and inventiveness. The main sources of information analysed by AI for patent examination include previous patents, scientific papers, technical reports, and other disclosures that were available before patent application filing dates.[7] Thorough prior art searches serve as a main pillar of patent examination yet require examination of major amounts of records. The analysis of extensive databases of prior art using AI tools operates at a rate that exceeds human capabilities for

* Surya Mani Tripathi is at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Greater Hyderabad, Telangana- 502 324, India. Shibaji Ghosh is at Central Salt and Marine Chemicals Research Institute (CSIR), Gijubhai Badheka Marg, Bhavnagar 364002, Gujarat, India.

[1] Patents, available at: *www.wipo.int/patents/en/*.

[2] C.N. Saha and S. Bhattacharya "Intellectual property rights: An overview and implications in pharmaceutical industry" (2011) 2(2) J Adv Pharm Technol Res 88–93. *doi:10.4103/2231-4040.82952*.

[3] 35 U.S.C. §101, 102, 103; European Patent Convention, Pt-II, Ch.I, art.52.

[4] Manual of Patent Examining Procedure (MPEP), Ch.2100, S.2103, available at: *https://www.uspto.gov/web/offices/pac/mpep/s2103.html*.

[5] World Intellectual Property Indicators 2020, available at: *https://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2020.pdf*.

[6] Xin Ouyang, Zhen Sun, Xinzhen Xu, "Patent system in the digital era–Opportunities and new challenges" (2022) 1(3) *Journal of Digital Economy* 166–179.

[7] Rossitza Setchi, Irena Spasic, Jeffrey Morgan, Christopher Harrison, Richard Corken, "Artificial intelligence for patent prior art searching" (2021) 64 *World Patent Information* 102021.

patent examination. The development of ML algorithms has enabled the identification of appropriate documents by comparing their contents to target patent applications, thus enhancing prior art search efforts.[8] AI is not only used for prior art searches but also used to identify patent classification. AI can segregate patents through technological field-based definitions known as patent classification systems, such as the International Patent Classification (IPC) system. An effective method to improve patent examination involves classification because it assists examiners in finding relevant prior art alongside determining invention patentability based on appropriate technological fields. The content evaluation of patent applications through AI tools leads to automatic classification by establishing matching classification categories. The automated system improves the classification speed while simultaneously minimising errors that human operators would make.[9]

The patent examination process faces potential positive outcomes from AI implementation but needs some obstacle solutions. The main difficulty with AI models relates to their not understandable nature. Deep learning and various other AI algorithms demonstrate "black box" operations because their decision sequences remain untraceable to human understanding. The absence of a clear explanation regarding decision-making processes creates difficulties during patent examination. The ability of patent applicants to evaluate the fairness and accountability of AI-driven examination becomes uncertain because they cannot understand the reasons behind AI tool's decisions. At present, patent offices need to guarantee their AI systems provide interpretability, which generates outputs understandable to patent examiners and applicants.[10] The main obstacle in implementing AI systems starts from their capability to develop biased algorithm outputs. AI systems need extensive training through large sets of data. The AI system develops biased outcomes when the training datasets possess biases caused by historical inequities as well as incomplete data or alternative unfounded factors. The examination process may show bias against particular patent inventions and their applicants. An AI tool learns from particular patent data when these patents originate from particular industries and countries. The system will demonstrate reduced success when evaluating applications that do not belong to those industries or geographical areas it was previously trained to understand. Patent offices need to keep watch over data used for AI training because they need to establish methods to find and solve potential biases detected in AI algorithms.[11] The current legal system involving AI in patent examination is encountering multiple regulatory hurdles. Most jurisdictions have not amended their patent laws to account for the AI-driven patent examination. Most countries maintain an ongoing uncertainty regarding patent eligibility for AI-generated inventions. Under traditional patent law, a human must be the inventor, while new technological developments may require a review of this human requirement because AI systems independently create inventions. DABUS AI system made two inventions in 2019, and its developer filed patent applications that named the AI as an inventor. The EPO, USPTO, and other patent offices, rejected both patent applications because AI cannot qualify as an inventor at present, thus causing worldwide discussion about AI's patent system role.[12]

The implementation of AI for patent examination faces both ethical obstacles in addition to legal hurdles. Automation represents an ethical problem because it creates job loss potential in workplaces. AI tools present challenges because they demonstrate the growing ability to perform examination activities that human patent examiners used to do, which raises concerns about their job security. New technologies should maintain human supervision because they boost patent examination capabilities but also require human expertise to stay at the forefront of the assessment process. AI tools should be considered instruments that enhance patent examination instead of replacing the essential work of patent examiners with their legal judgment and first-hand experience.[13]

Data privacy, together with security, represent vital issues when utilising AI technology for patent examination. Patent applications include technical information that needs complete security from unapproved access or disclosure. The security design of AI systems processing patent data needs to implement robust protective measures because they must protect data from breaches and meet the requirements of the General Data Protection Regulation (GDPR) in the European Union. The process of patent data handling by AI systems requires patent offices to maintain open communication regarding their data processing methods alongside the protection of applicants' rights.[14]

The obstacles AI faces in implementing patent examination do not weaken the numerous advantages that can emerge from its application. AI technology enables patent offices to perform automated tasks and conduct precise prior art searches while analyzing patent applications through its assistance for better time

[8] Farag Saad, Andreas Nürnberger, "Overview of prior-art cross-lingual information retrieval approaches" (2012) 34(4) *World Patent Information* 304–314.
[9] Farag Saad, Andreas Nürnberger, "Overview of prior-art cross-lingual information retrieval approaches" (2012) 34(4) *World Patent Information* 304–314; Bernd Wolter, "It takes all kinds to make a world–Some thoughts on the use of classification in patent searching" (2012) 34(1) *World Patent Information* 8–18.
[10] World Intellectual Property Indicators 2020, available at: *https://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2020.pdf*; D. Gala, H. Behl, M. Shah, and A.N. Makaryus, "The Role of Artificial Intelligence in Improving Patient Outcomes and Future of Healthcare Delivery in Cardiology: A Narrative Review of the Literature" (2024) 12(4) *Healthcare (Basel)* 481.
[11] Z. Chen, "Ethics and discrimination in artificial intelligence-enabled recruitment practices" (2023) 10 *Humanit Soc Sci Commun* 567.
[12] Trevor F. Ward, "DABUS, An Artificial Intelligence Machine, Invented Something New and Useful, but the USPTO is not Buying It" (2023) 75 Me. L. Rev. 71; The Artificial Inventor Project (n.d.) "Patent", available at: *https://artificialinventor.com/patent/* for details of DABUS patent application proceedings.
[13] World Intellectual Property Indicators 2020, available at: *https://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2020.pdf*.
[14] General Data Protection Regulation (GDPR), available at: *https://gdpr-info.eu/*.

management of growing application amounts. AI enhances patent examination quality through two benefits: first, it decreases human mistakes, and second, it delivers modern tools to handle complicated inventions.[15]

Traditional Patent Examination Process

Examination of patent applications proceeds in a multi-step manner at patent offices to determine if inventions satisfy the necessary requirements for patent protection. The patent examination starts after the filing of the patent application. The examiners of the patent offices perform prior art searches to investigate novelty and inventive steps along with industrial applicability aspects.[16] The claim analysis of patent applications is important. This is performed by the examiners against published patents and other accessible information to establish patent eligibility. If it is found that the claimed invention lacks novelty, inventiveness, and industrial applicability, the patent grant is rejected by the examiner.[17]

The manual examination of patent applications is a proven method and its efficiency has deteriorated because of the rapid increase in worldwide patent application submissions. According to the World Intellectual Property Organisation (WIPO) the number of patent applications filed throughout the world has increased significantly. The patent offices in the United States, the European Union and India currently face major delays and extended times for issuing patent grants since they process a high volume of patent applications.[18]

Integration of AI in Patent Examination

The rising number of patent applications at patent offices has led them to implement AI since it solves operational speed problems. Through its AI technology, particularly ML and NLP, patent examination procedures bring efficient tools that boost patent examiner decision-making abilities.[19] The main application of AI in patent examination involves the use of technology for prior art searches. In past practices patent examiners used their manual research skills to examine huge amounts of patent database information with scientific literature and multiple external sources. Large datasets are processed better and with enhanced accuracy by AI systems than by human examiners. AI applications expose ML algorithms to patent application entries along with current prior art documents to enable streamlining efficient search processes. AI-powered automated tools for identifying relevant documents can identify documents that would escape human examination by analysing technical concepts in addition to keywords and phrases.[20]

Worldwide many patent offices have started using AI technology for their operations. The USPTO works with private-sector companies as they develop AI-powered systems for prior art search applications. One type of AI tool assists patent examiners in analysing big volumes of patent literature and non-patent documents to detect prior art occurrences, thus boosting search accuracy while reducing duration.[21] Prior art searches at the EPO became faster and more efficient due to the implementation of AI tools, according to a report.[22] AI systems operate as assistants to patent examiners by helping them validate patent applications when assessing both innovative features and new concepts. The application of AI creates recommendations about invention novelty through an analysis of patent claims with prior art documents. The technology detects possible problems or inaccuracies in patent applications so patent examiners can dedicate their attention to complex decision-making activities. The increased efficiency combined with better decision accuracy emerges from the implementation of this technology.[23]

Challenges of AI Integration

AI brings several advantages to patent examinations while creating various implementation problems in this process. The main problem with AI models lies in their difficulty in interpreting their function. Most AI systems function as "black boxes", and it is difficult for a human to understand their internal decision-making system. These concerns arise regarding the accessibility, responsibility, and transparency of AI-based decisions when a patent application gets rejected.[24] Moreover, data privacy issues, along with other major challenges, exist in this process. Patent applications require the protection of their technical data because this information remains sensitive to unauthorised users. Both data security and compliance with privacy regulations become the responsibilities of patent offices in their evaluation of AI systems.[25] Legal

[15] Patent Office Sustainability and the Role of Artificial Intelligence by Kathy Van Der Herten, available at: *https://www.wipo.int/wipo_magazine_digital/en/2023/article_0001.html*.
[16] 35 U.S.C. §101, 102, 103; European Patent Convention, Pt-II, Ch.I, art.52; Guidelines for search and examination of patent applications by Indian patent office, available at: *https://ipindia.gov.in/writereaddata/Portal/IPOGuidelinesManuals/1_34_1_guidelines-draftSearch-examination-04march2015.pdf*.
[17] Thomas N. Duening, Robert D. Hisrich, Michael A. Lechter, "Protecting Your Intellectual Property", Eds: Thomas N. Duening, Robert D. Hisrich, Michael A. Lechter, *Technology Entrepreneurship*, 3rd Edn (Academic Press, 2021), pp.81–124.
[18] World Intellectual Property Indicators 2020, available at: *https://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2020.pdf*.
[19] K. Van Der Herten, "Patent Office Sustainability and the Role of Artificial Intelligence" (2023), *https://www.wipo.int/wipo_magazine_digital/en/2023/article_0001.html*.
[20] Rossitza Setchi, Irena Spasic, Jeffrey Morgan, Christopher Harrison, Richard Corken, "Artificial intelligence for patent prior art searching" (2021) 64 *World Patent Information* 102021.
[21] Rossitza Setchi, Irena Spasic, Jeffrey Morgan, Christopher Harrison and Richard Corken, "Artificial intelligence for patent prior art searching" (2021) 64 *World Patent Information* 102021; AI and Emerging Technology Partnership engagement and events, available at: *https://www.uspto.gov/initiatives/artificial-intelligence/ai-and-emerging-technology-partnership-engagement-and-events*.
[22] K. Van Der Herten, "AI proves effective at improving patent office efficiency and application timeliness" (2023), *https://www.cas.org/resources/cas-insights/ai-proves-effective-improving-patent-office-efficiency*.
[23] Rossitza Setchi, Irena Spasic, Jeffrey Morgan, Christopher Harrison, Richard Corken, "Artificial intelligence for patent prior art searching" (2021) 64 *World Patent Information* 102021.
[24] World Intellectual Property Indicators 2020, available at *https://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2020.pdf*.
[25] Z. Chen, "Ethics and discrimination in artificial intelligence-enabled recruitment practices" (2023) 10 *Humanit Soc Sci Commun* 567.

and ethical complications exist regarding how patent systems should handle definitions of inventions made by AI software. The recognition of AI-made inventions for patent eligibility remains unclear to many countries across the globe. The human requirement for inventorship in patent laws appears prone to change because AI systems now show the capacity to produce inventions independently.[26]

AI in Patent Examination: US Perspective

The United States leads the world in integrating AI into multiple sectors, including the patent examination process within the legal and administrative domains. The USPTO remains committed to studying AI applications for patent examination procedures because the number of annual patent submissions continues to rise while their complexity increases. AI integration strategy development aims to keep U.S. innovation competitive but also protects thorough, accurate, consistent patent examinations.[27] In October 2022, the USPTO launched an AI-based similarity searching capability inside their Patents End-to-End (PE2E) search platform. The examiners utilise this tool to input application details with specifications which prompts AI models to produce lists of relevant domestic and international patent documents.[28]

Growing Need for AI in Patent Examination

The rising number of patent applications in the United States creates substantial workload pressure on the USPTO to meet deadlines without compromising assessment quality. Since 2013 the United States has seen more than 600,000 patent applications filed annually for utility design and plant patents.[29] The manual examination of innovative technologies in the fields of biotechnology, quantum computing, and AI requires excessive time and workforce usage, resulting in processing delays.

Table 1: U.S. Patent Statistics for the year 2019-2024

Year	Number of Serialised Patent Applications	Number of Patents Granted
2024	466,079	327,405
2023	462,215	346,152
2022	457,510	361,435
2021	450,457	374,006
2020	450,910	399,055
2019	447,992	370,423

It is observed that around 450,000 (serialised number) patent applications are filed to the USPTO every year (Table 1).[30] Moreover, the unexamined patent application inventory number of new patent applications is huge, which is 796,958 as per the July 2024 data, and this number excludes the new filing applications of the last three preceding months. The unexamined patent applications are in the processing queue and are awaiting a First Office Action by a patent examiner. This total also includes continuation, continuation-in-part, and divisional applications. It would not be possible to clear the backlog of patent applications by relying only on the human examiner.[31]

AI solutions should be implemented together with a substantial increase in the examiner workforce to solve these issues. AI presents a viable option for solving present examination problems. ML and NLP technologies from AI have capabilities to automate time-consuming requirements like prior art searches, patent classification and claims examination tasks. The USPTO can boost examination quality and expand its processing capacity for patent applications through AI technology implementation.[32]

The USPTO has created partnerships with multiple private sector firms to build and execute ML solution platforms that handle big datasets among patent and non-patent written works. The AI systems are trained to detect the most relevant prior art records through their capability to compare similarities between patent applications and existing documents. AI automation of this procedure helps patent examiners maintain a high standard of quality because it prevents them from missing important prior art references during examinations.[33]

The USPTO operates with the Cooperative Patent Classification (CPC) system, which consists of more than 250,000 categories within its framework. AI demonstrates significant progress in this field which represents another very important area. Patents must be sorted into particular technical groups through the process of patent

[26] Trevor F. Ward, "DABUS, An Artificial Intelligence Machine, Invented Something New and Useful, but the USPTO is not Buying It" (2023) 75 Me. L. Rev. 71; The Artificial Inventor Project (n.d.) "Patent", available at: *https://artificialinventor.com/patent/* for details of DABUS patent application proceedings.
[27] AI and Emerging Technology Partnership engagement and events, available at: *https://www.uspto.gov/initiatives/artificial-intelligence/ai-and-emerging-technology-partnership-engagement-and-events*.
[28] US Patent Statistics Chart, available at: *https://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm*.
[29] U.S. Patent Statistics Chart, available at *https://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm*.
[30] Performance and Accountability Report, FY 2021, USPTO, available at: *https://www.uspto.gov/sites/default/files/documents/USPTOFY21PAR.pdf*; Agency Financial Report, FY 2022, USPTO, available at: *https://www.uspto.gov/sites/default/files/documents/USPTOFY22AFR.pdf*; Agency Financial Report, FY 2023, USPTO, available at: *https://www.uspto.gov/sites/default/files/documents/USPTOFY23AFR.pdf*; USPTO Workload Tables, FY 2023, available at: *https://www.uspto.gov/sites/default/files/documents/USPTOFY23WorkloadTables.xlsx*; Agency Financial Report, FY 2024, USPTO, available at: *https://www.uspto.gov/sites/default/files/documents/USPTOFY24AFR.pdf*.
[31] Patents Production, Unexamined Inventory and Filings Data July 2024, available at: *https://www.uspto.gov/dashboard/patents/production-unexamined-filing.html*.
[32] World Intellectual Property Indicators 2020, available at: *https://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2020.pdf* .
[33] AI and Emerging Technology Partnership engagement and events, available at: *https://www.uspto.gov/initiatives/artificial-intelligence/ai-and-emerging-technology-partnership-engagement-and-events*.

classification. The accurate classification of patents serves both to improve the search efficiency of the prior art and to assess invention validity.[34]

USPTO examiners use the potential of AI to help analyse patent claims during their research. The examination process heavily depends on patent claims since it is the scope of the protection. The examination process compares the claims statements to existing prior inventions to confirm the invention's novelty and inventiveness. AI tools that use NLP methods help patent examiners to analyse patent claims by scanning their language along with previous inventions. This technology helps experts find essential technological components and monitor claim similarity to existing patents while warning about possible patentability issues. AI can assist patent examiners in analyzing complicated examination subjects while thoroughly evaluating claims.[35]

The Future of AI in the USPTO

The upcoming years indicate favourable developments in AI adoption at the USPTO for the patent examination process. The USPTO understands AI's central position in influencing future intellectual property developments and, therefore, created multiple initiatives to examine its potential additional uses. USPTO's AI and emerging technology partnership unites academic professionals, industrial representatives, and public sector officials to evaluate the patent examination capabilities of AI systems.[36]

AI in Patent Examination: EU Perspective

AI integration into European Union (EU) patent analysis and examination systems continues to advance while the organisation understands how AI technology delivers operational efficiency together with improved accuracy and handling of rising patent applications. The EPO, which supervises European patent applications, has taken leadership in testing AI to assist its growing demands of patent examiners. The EPO created a Data Science team in 2019 to use AI and ML techniques to improve patent grant procedures as well as increase quality and efficiency. Six data scientists work together in the core team, but they are supported by DG 1 patent examiners who contribute necessary technical information while offering business understanding. Three essential AI initiatives of NLP, Computer Vision, and Machine Translation enable the team to enhance crucial patent procedure areas such as classification, search and translation. The EPO's draft strategic plan indicates how AI and automation systems will strengthen both patent examination effectiveness and leadership position in the world.[37]

The Need for AI in the EU Patent Examination Process

The patent application numbers at European offices experienced rapid growth as new technologies, including AI, biotechnology, and green technologies, expanded. The EPO processed 199,275 patent applications in 2023 as their numbers expanded by +2.9% compared to past years (Table 2).[38] The volume of filed patent applications has resulted in a substantial rise in work for patent examiners of EPO. The EPO decided to employ AI in patent examinations because patent reviews demand the handling of massive data quantities. During the patent review process, examiners must examine both new patent applications along with all available prior art documents, starting from patents, scientific reports, and technical documentation. These documents are sometimes complex in nature, and the number of these documents is increasing. This can be managed better by AI technology, which supports the patent examination procedure, especially through its capabilities in prior art and patent classification search. As a requirement for efficient, high-quality patent examinations at the EPO, it is essential to develop AI capabilities that automate essential patent examination workflows.[39]

Table 2: EPO Patent Statistics for the year 2019–2023

Year	Number of Patent Applications	Number of Patents Granted
2023	199,275	104,609
2022	193,627	81,754
2021	188,809	108,799
2020	180,417	133,715
2019	181,532	137,784

AI for Prior Art Searches

AI integration at the EPO takes place in the prior art search phase which stands as a vital component of patent examination protocols. The examination of patents requires examiners to review scientific documents as well as published patents and existing technical information to assess novelty and non-obvious characteristics of

[34] Tisiano Montecchi, Davide Russo, Ying Liu, "Searching in Cooperative Patent Classification: Comparison between keyword and concept-based search" (2013) 27(3) *Advanced Engineering Informatics* 335–345; Cooperative Patent Classification (CPC), available at: *https://www.epo.org/en/searching-for-patents/helpful-resources/first-time-here/classification/cpc*.
[35] Valentin J. Schmitt, Lothar Walter, Frank C. Schnittker, "Assessment of patentability by means of semantic patent analysis–A mathematical-logical approach" (2023) 73 *World Patent Information* 102182.
[36] Rossitza Setchi, Irena Spasić, Jeffrey Morgan, Christopher Harrison, Richard Corken, "Artificial intelligence for patent prior art searching" (2021) 64 *World Patent Information* 102021; AI and Emerging Technology Partnership engagement and events, available at: *https://www.uspto.gov/initiatives/artificial-intelligence/ai-and-emerging-technology-partnership-engagement-and-events*.
[37] AI in EPO Tools, under Artificial intelligence, available at: *https://www.epo.org/en/news-events/in-focus/ict/artificial-intelligence*.
[38] Granted Patents, available at: *https://www.epo.org/en/about-us/statistics/data-download*; Patent Index 2023, available at *https://www.epo.org/en/about-us/statistics/patent-index-2023*.
[39] Patent Index 2023, available at: *https://www.epo.org/en/about-us/statistics/patent-index-2023*.

inventions. Patent examiners routinely spent large amounts of time performing this work traditionally through manual operations.[40] Computerised tools with ML algorithms help shorten prior art search durations because they automatically find appropriate documents. These ML tools evaluate enormous databases to find technical connections between new patent applications compared to existing prior art documents. The tool enables examiners to locate necessary prior art documents while they focus their professional analysis on making high-level technical and legal assessments.[41]—AI-PreSearch made its debut at EPO in August 2023 as a tool that utilises AI to upgrade patent examination efficiency. The system provides examiners with an automated solution for locating suitable prior art documents with high accuracy. The EPO processed its entire prior art document collection by vectorisation while creating an immense vector-based database that contains hundreds of millions of vectors. The launched program brought about EP-RoBERTa, which served as a patent-specific language model during CPC automation processes. AI-PreSearch made the patent examination process more efficient through automated basic job execution and improved searching abilities. AI-driven systems operated by the EPO read patent application texts to automatically classify them into proper CPC categories. The automated classification process cuts down human effort, so patent examiners can devote their time to assessing novelty and inventive steps of inventions.[42]

AI for Claims Analysis and Examination

The EU implemented AI technology for patent claim examination in addition to classification work as well as prior art searches. Within the patent examination procedure, patent claim analysis stands as the most crucial step to determine the scope of the protections that the applicant/inventor seeks. Combining NLP with semantics, AI provides assistance to examiners in examining patent claims with prior art documents and existing patents. The AI systems detect language problems and unexplained areas that demonstrate potential overlaps between new patent claims and previous patent documents. AI applications developed by EPO search for essential technical parts in patent claims and recommend additional review areas according to their analysis. The examination process becomes faster and more accurate because patent examiners can dedicate their efforts to concentrating on challenging legal aspects of the applications.[43]

AI in Patent Examination: Indian Perspective

The rapidly growing Indian technology sector has begun to understand how AI can transform its intellectual property landscape, including patent examination. The Indian Patent Office (IPO) under the Department for Promotion of Industry and Internal Trade (DPIIT) started implementing several initiatives through which it optimises the patent examination process by introducing AI solutions to manage increasing patent applications.[44]

The Growing Demand for AI in Patent Examination in India

The patent filing activity in India has grown substantially over 10 years due to rising research and development activities in different sectors, such as computer science and electronics at the forefront alongside mechanical and electrical domains. Annual reports from the IPO show the number of patent applications filed in India rose to 82,811 during 2022–2023, representing a substantial 24.64 percent increase from the previous year, as per Table 3.[45] Numerous patent applications filed in recent times create significant examination system pressures and challenge examiners due to pending applications along with shortages of skilled patent examiners.[46]

The Indian government promotes AI adoption for patent examination because it intends to decrease processing times and improve assessment precision while upholding patent quality standards. AI provides benefits to examination processes by taking over human work due to its speed in performing prior art searches, patent classification, and claims analysis, and its ability to minimise mistakes. The Indian Patent Office implements the IP chatbot and search module to improve examination efficiency and decrease review process variation.[47]

Table 3: India Patent Statistics for the year 2019–2023

Financial Year (1 April to 31 March)	Number of Patent Applications	Number of Patents Granted
2022–23	82,811	34,134
2021–22	66,440	30,073
2020–21	58,503	28,385
2019–20	56,267	24,936
2018–19	50,659	15,283

[40] Artificial Intelligence at the EPO, available at: *https://www.wipo.int/edocs/mdocs/globalinfra/en/wipo_ip_itai_ge_18/wipo_ip_itai_ge_18_p8.pdf*.
[41] Artificial Intelligence at the EPO, available at: *https://www.wipo.int/edocs/mdocs/globalinfra/en/wipo_ip_itai_ge_18/wipo_ip_itai_ge_18_p8.pdf*.
[42] Revolutionising Patent Examination, available at: *https://www.richardt.eu/en/news/detail/revolutionising-patent-examination/*.
[43] Artificial Intelligence at the EPO, available at *https://www.wipo.int/edocs/mdocs/globalinfra/en/wipo_ip_itai_ge_18/wipo_ip_itai_ge_18_p8.pdf*; Ali, Amna, Ali Tufail, Liyanage Chandratilak De Silva, and Pg Emeroylariffion Abas. "Innovating Patent Retrieval: A Comprehensive Review of Techniques, Trends, and Challenges in Prior Art Searches" (2024) 7(5) *Applied System Innovation* 91.
[44] Press Release, available at: *https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2056435*.
[45] Annual Report 2022–23, available at: *https://ipindia.gov.in/writereaddata/Portal/IPOAnnualReport/1_114_1_ANNUAL_REPORT_202223_English.pdf*.
[46] Xin Ouyang, Zhen Sun, Xinzhen Xu, "Patent system in the digital era-Opportunities and new challenges" (2022) 1(3) *Journal of Digital Economy* 166–179.
[47] Annual Report 2022–23, available at: *https://ipindia.gov.in/writereaddata/Portal/IPOAnnualReport/1_114_1_ANNUAL_REPORT_202223_English.pdf*.

AI for Prior Art Searches and Patent Classifications

AI has found its vital application in the Indian patent examination process by performing prior art searches. The examination of prior art relates to all existing knowledge that pertains to previous inventions or patents which might affect a new invention being patented. Extensive prior art searches form an essential part of the patent examination because they evaluate the novelty and obviousness of inventions. Indian patent examiners formerly performed manual searches through extensive records of patents and technical documents along with non-patent literature until 2017. Computers enhanced by AI technology show promise in running automatic searches to detect important prior art. By using AI algorithms and ML technology patents get analysed for matching against established databases based on their technical content and keywords. Using AI reduces the time needed for prior art research while increasing the chances of detecting all applicable documents.[48]

The Indian Patent Office looks into AI solutions to enhance patent classification practices. The proper examination of patent applications depends on accurate classification because it decides the correct field of technology and directs searches for relevant existing ideas. Indian Patent Office operates through the International Patent Classification (IPC) system for patent organisation based on technical content in inventions.[49]

AI for Claims Analysis and Examination

Patent claims establish the scope of protection that an applicant/inventor desires through them and constitute a vital component in patent applications. During claims analysis, examiners evaluate the clarity and conciseness of claims supported by the example and/or description and test for overlap with existing prior art. The Indian Patent Office (IPO) investigates AI technology applications throughout the examination framework to handle increasing numbers of patent applications. AI-based systems can fulfil India's intellectual property requirements by supplying products that handle patent research and data analytics along with technology and competitor monitoring while enabling IP collaboration. AI tools hold a critical position in workflow optimisation and patent examination efficiency improvement.[50]

The Future of AI in Patent Examination in India

The Indian patent examination system shows positive signs for AI application despite existing difficulties. The Indian government exhibits substantial dedication to using AI throughout the intellectual property sphere as well as other sectors. The Indian government included AI through its 2018 National Strategy for Artificial Intelligence to boost public service performance with emphasis on Intellectual Property sector. Strengthening of the IP system by the Indian Government continues as authorities use precise patent laws to cover AI technologies due to their specific development requirements. Building effective AI models depends highly on data engagement as a primary issue. IP facilitation centres serve as the recommended solution to solve existing challenges by connecting legal practitioners to AI developers. Complete training programs are necessary for IP authorities and both judiciary and tribunals to properly handle intellectual property matters involving AI technologies.[51] The Indian Patent Office seeks to develop AI-based tools through international collaborations involving WIPO as well as other national patent offices to exchange best practices. The Indian patent examination procedure can achieve greater global competitiveness by learning from worldwide AI advancements and using results from other nations that demonstrate success.[52]

Future of AI in Patent Examination & Policy Recommendations

Future of AI in Patent Examination

Patent examination through AI developments will transform worldwide intellectual property offices into modern systems for handling rising patent application numbers. AI technologies, specifically NLP and ML systems, will retain their critical position for patent examination automation through prior art search, patent classification, and claims analysis. AI systems will advance to offer better decision quality in addition to shorter examination periods and standardised patent approval procedures in future developments. Various obstacles, such as AI interpretation problems, potential biases in AI-delivered results, and unclear regulations, need to be solved. The fundamental requirement for a fair examination of patents requires balanced use of automation with human surveillance throughout regional patent systems.

[48] Clever design, protected intelligently: How AI tools are shaping India's patent and IP decisions, available at: *https://www.firstpost.com/tech/how-ai-tools-are-shaping-indias-patents-and-ip-decisions-13764253.html*.
[49] Farag Saad, Andreas Nürnberger, "Overview of prior-art cross-lingual information retrieval approaches" (2012) 34 *World Patent Information* 304–314; Bernd Wolter "It takes all kinds to make a world–Some thoughts on the use of classification in patent searching" (2012) 34 *World Patent Information* 8–18.
[50] Clever design, protected intelligently: How AI tools are shaping India's patent and IP decisions, available at: *https://www.firstpost.com/tech/how-ai-tools-are-shaping-indias-patents-and-ip-decisions-13764253.html*.
[51] National Strategy for Artificial Intelligence, Government of India, available at: *https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf*.
[52] Artificial Intelligence Tools and Applications at WIPO, available at *https://www.wipo.int/web/ai-tools-services*.

Policy Recommendations

The following policy guidelines should be adopted to enhance AI benefits for patent examination together with risk reduction:

Regulatory Frameworks for AI Transparency and Accountability

Patent examination that relies on AI needs clear direction from authorities to maintain open approaches when making decisions.

Observation of patent examiners should be maintained over AI assistance patent examination to minimise reliance on automated systems.

New technology should incorporate explainable AI (XAI) algorithms for AI-generated patent examination results to become easily understandable by both examiners and applicants.

International Collaboration and Data Sharing

Patent offices should work together on AI examination tools to establish common standards of advancement as well as best practices.

WIPO, USPTO, EPO, and IPO should unite to establish standardisation guidelines for AI software used in patent examination.

Collaborative data exchange agreements should be established between countries because they improve the quality of AI training datasets and enhance worldwide patent search systems.

Measures to tackle AI biases and ethical problems

AI models should contain built-in bias detection systems that stop discriminatory or untrustworthy examination results from occurring.

Patent offices should build training datasets that will represent the complete spectrum of technological development across different populations.

Patent offices should perform scheduled reviews and evaluations of their AI examination tools to protect ethical values.

Capacity Building and Examiner Training

Specialised training about AI operating systems should be available to patent examiners to make better use of AI tools within their examination tasks.

Create an examination technique combining computer-driven analytical insights with authentic human experience to make better decisions.

Examiners should receive ongoing learning opportunities that train them to adopt new AI techniques and technological advances.

Public Engagement and Stakeholder Involvement

Prepare AI policies involving participants from industry experts, academics, and legal professionals.

Patent applicants should have access to venues that allow them to share their views on AI examination procedures.

AI-based examination methodologies must become accessible to the public so they can review and discuss.

Conclusion

AI has transformed intellectual property management throughout different jurisdictions quickly. The USPTO, EPO, and IPO implemented AI-powered tools because they accelerated operations and shortened processing delays while establishing standardised patent assessment methods. ML operates together with NLP as AI tools that automate prior art search tasks and claim assessment to boost both examination efficiency and accuracy. AI performs better in complex biotechnology, AI and quantum computing technology searches than traditional examination due to rapid technological advancements.

AI systems produce significant developments and create several substantial barriers simultaneously. Trustworthy AI decisions need the resolution of transparency and bias problems together with interpretability solutions to ensure fairness. AI algorithms create uncertainty about patentability outcomes because examiners and applicants often find it difficult to understand the reasons that explain AI system outputs.

AI systems require human examination participation during their assistance in patent review activities. Performance improvement is the main function of AI technology, yet human decision processes should serve as the fundamental core of examination procedures. The patent examination process requires human examiners because AI operates as an assistant rather than a decision-making authority.

The patent offices together with private sectors and regulatory bodies need to develop international networks which allow them to share knowledge about AI development methodologies and procedures. The partnership between experts from policy makers, innovators, and law will lead to managing AI adoption, which produces fair and dependable patent examination that works effectively. Proposed policy recommendations will enable patent offices to achieve the best AI benefits along with human evaluation judgment that produces better and quicker worldwide patent examination results. AI usage within patent examinations will become more probable for future adoption but its accomplishment depends on developing suitable relationships between technology developments, legal structures, and policy frameworks.

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