

# Leveraging AI/ML for Managing Patents

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Intellectual Property: The Age of Powerful Techades'



The global IP management software market size was valued around \$7 billion in 2022. It is expected to grow at a CAGR about 13% during 2023-30 to around \$27 billion.

Source: <https://www.verifiedmarketresearch.com/>

The global Enterprise Intellectual Property Management Software market is dominated by players like: Questel, Anaqua, Dennemeyer, PatSnap, Clarivate, Ipan, CPA Global, ORViC Technologies, Ipfolio, Computer Packages Inc, Minesoft, AppColl, O P Solutions Inc., Innovation Asset Group, Gridlogics, Lecorpio, Patrix AB, WebTMS, Inteum, TM Cloud, LexisNexis.

# Leveraging AI/ML for Managing Patents

**1: Prior Art Search**

**2: Patent Drafting**

**3: Patent Classification**

**4: Patent Valuation**

**5: Patent Filing & Prosecution**

**6: Patent Portfolio Management**

**7: Patent Analytics**

**8: Infringement Detection**

**9: Technology Landscape Analysis**

**10: Patent Litigation Support**

## I: Prior Art Search

**Prior Art Search: AI Search Algorithms:** Develop AI-powered search algorithms that can efficiently scan through vast amounts of existing patents and scientific literature to identify relevant prior art: **Topic Modeling , Ranking, Document Similarity, Document Classification, Query Formation and Expansion.**

### Companies/Solutions



### Common AI/ML Algorithms

- Natural Language Processing: Word Embeddings, Text Segmentation, Normalization, Lemmatization, Stemming, Co-occurrences, single and multi-word terms or features, word embeddings, distributional semantics, Jaccard Similarity, Euclidean Distance, Cosine Similarity, Semantic Knowledge, Knowledge Graphs
- Support Vector Machine (SVM)
- Decision Tree
- Random Forest
- Deep Learning
- Neural Networks
- Latent Dirichlet Allocation (LDA)
- Naïve Bayesian Learning
- Generative AI

### Key Metrics Impacted

- Accuracy of Search Results
- Speed and Efficiency of Information Retrieval
- Cost-effectiveness
- Coverage and Exhaustiveness
- False Positive Reduction
- Semantic Analysis
- User Satisfaction
- Innovation Speed
- Quality of Patent Applications
- Strategic Decision-Making

## 2: Patent Drafting

**Patent Drafting:** Use NLP algorithms to assist inventors and patent attorneys in drafting patent applications by suggesting language, identifying relevant sections, and ensuring compliance with legal requirements: **understanding domain and legal requirements, information structuring, generating text and relevant references like prior art, claim generation and translation, language optimization, patent database integration.**

### Companies/Solutions



ClaimMaster



Clarivate™



PATSEER



### Common AI/ML Algorithms

- Natural Language Understanding, Processing and Generation: Word Embeddings, Text Segmentation, Normalization, Lemmatization, Stemming, Co-occurrences, single and multi-word terms or features, word embeddings (Word2Vec, GloVe), distributional semantics, Jaccard Similarity, Euclidean Distance, Cosine Similarity, Semantic Knowledge, Knowledge Graphs, Tokenization, Named Entity Recognition (NER), Parts-of-Speech Tagging, Sentiment Analysis, Term Frequency- Inverse Document Frequency (TF-IDF), Latent Semantic Analysis (LSA)
- Support Vector Machine (SVM)
- Decision Tree
- Random Forest
- Deep Learning
- Neural Networks – Neural Machine Translation (NMT), Statistical Machine Translation
- Latent Dirichlet Allocation (LDA)
- Naïve Bayesian Learning
- Generative AI, Generative Adversarial Networks (GANs) or Variational Autoencoders (VAE)
- Regression Analysis
- K-Means and Hierarchical Clustering

### Key Metrics Impacted

- Time Efficiency (Drafting Time & Effort Reduction)
- Improved Quality (Error Rate or Count Reduction)
- Enhanced Accuracy
- Language Optimization Across Applications
- Consistency Across Portfolios (Portfolio Consistency)
- Cost Savings (Drafting Cost Reduction)
- Legal Compliance
- Reviewer Satisfaction
- Examination Success Rate
- User Adoption and Training Time

### 3: Patent Classification

**Patent Classification:** Implement ML models to classify patents into relevant categories, making it easier to organize and search for patents based on their content: **Text Processing, Tokenization, Tagging, Classification (Legal Model or Domain), Transfer Learning.**

#### Companies/Solutions



#### Common AI/ML Algorithms

- Natural Language Understanding, Processing and Generation: Word Embeddings, word embeddings (Word2Vec, GloVe), distributional semantics, Jaccard Similarity, Euclidean Distance, Cosine Similarity, Sematic Knowledge, Knowledge Graphs, Tokenization, Named Entity Recognition (NER), Parts-of-Speech Tagging, Sentiment Analysis, Latent Semantic Analysis (LSA)
- Support Vector Machine (SVM)
- Decision Tree, Random Forest, Gradient Boosting (Ensemble Methods)
- Deep Learning, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Transformer Models
- Neural Networks – Neural Machine Translation (NMT), Statistical Machin Translation
- Latent Dirichlet Allocation (LDA), Non-Negative Matrix Factorization
- Q-Learning, Deep Reinforcement Learning
- Generative AI, Generative Adversarial Networks ( GANs) or Variational Autoencoders (VAE)
- Bi-Directional Encoder Representation from Transformers (BERT )
- K-Means and Hierarchical Clustering

#### Key Metrics Impacted

- Time Efficiency (Patent Classification Time)
- Scalability (Patents Classification Per Unit Time)
- Enhanced Accuracy & Consistency (Patent Classification)
- Adaptability to Changes (Implementing Classification Rules)
- Enhanced Decision Making
- Cost Savings (Drafting Cost Reduction)
- Legal Compliance
- User Satisfaction
- Search Precision and Recall
- User Adoption and Training Time

## 4: Patent Valuation

**Patent Valuation:** Utilize predictive analytics models to assess the potential value of a patent based on various factors such as market trends, technology landscape, and litigation history: **Predictive Analytics, Commercial Feasibility, Benefit-Cost Analysis, Competitive Analysis, Technical Feasibility, Patent Quality Score**

### Companies/Solutions



### Common AI/ML Algorithms

- Natural Language Understanding, Processing and Generation: Word Embeddings, word embeddings (Word2Vec, GloVe), distributional semantics, Jaccard Similarity, Euclidean Distance, Cosine Similarity, Sematic Knowledge, Knowledge Graphs, Tokenization, Named Entity Recognition (NER), Parts-of-Speech Tagging, Sentiment Analysis, Latent Semantic Analysis (LSA)
- Regression Analysis – Linear , Ridge, LASSO
- Support Vector Machine (SVM)
- Decision Tree, Random Forest, Gradient Boosting (Ensemble Methods)
- Monte Carlo Simulation
- Econometric Models
- Principal Component Analysis (PCA)
- Time Series Analysis – Autoregressive Integrated Moving Average (ARIMA), Seasonal-Trend Decomposition Using LOESS (STL)
- Generative AI, Generative Adversarial Networks ( GANs) or Variational Autoencoders (VAE)
- K-Means and Hierarchical Clustering

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- Cost Savings (Drafting Cost Reduction)
- Legal Compliance
- User Satisfaction
- Search Precision and Recall
- User Adoption and Training Time

## 5: Patent Filing & Prosecution

**Patent Filing and Prosecution:** Implement AI-driven systems to automate the patent filing and prosecution process, reducing manual workload and ensuring compliance with regulatory requirements: **Machine Translations, Predictive Analytics, Classification, Automated Drafting, Image Recognition, OCR, Text Mining and Sentiment Analysis, Sematic Search and Case Based Reasoning.**

### Companies/Solutions



### Common AI/ML Algorithms

- Natural Language Understanding, Processing and Generation: Word Embeddings, word embeddings (Word2Vec, GloVe), distributional semantics, Jaccard Similarity, Euclidean Distance, Cosine Similarity, Sematic Knowledge, Knowledge Graphs, Tokenization, Named Entity Recognition (NER), Parts-of-Speech Tagging, Text Mining and Sentiment Analysis, Latent Sematic Analysis (LSA)
- Regression Analysis – Linear, Ridge, LASSO
- Decision Tree, Random Forest, Gradient Boosting (Ensemble Methods)
- Image Recognition, Optical Character Recognition (OCR)
- Reinforcement Learning
- Generative AI, Generative Adversarial Networks (GANs) or Variational Autoencoders (VAE)
- K-Means and Hierarchical Clustering

### Key Metrics Impacted

- Efficiency Improvement
- Cost Reduction
- Accuracy Enhancement
- Resource Optimization
- Speed of Prosecution
- Quality of Applications
- Compliance and Consistency
- Risk Mitigation
- Workload Balancing
- User Satisfaction
- Adaptability to Changes
- Search and Retrieval Efficiency



## 6: Patent Portfolio Management

**Patent Portfolio Management:** Develop AI-powered decision support systems to assist IP managers in optimizing their patent portfolios, identifying opportunities for licensing, divestment, or acquisition: **Freedom To Operate (FTO), Innovation Alignment, Portfolio Diversification, Portfolio Optimization, Portfolio Cost & Maintenance or Renewals, Portfolio Analysis and Communication.**

### Companies/Solutions



### Common AI/ML Algorithms

- Natural Language Understanding, Processing and Generation: Word Embeddings, word embeddings (Word2Vec, GloVe), distributional semantics, Jaccard Similarity, Euclidean Distance, Cosine Similarity, Sematic Knowledge, Knowledge Graphs, Tokenization, Named Entity Recognition (NER), Parts-of-Speech Tagging, Sentiment Analysis, Latent Semantic Analysis (LSA), Text Extraction, Text Summarization and Patent Categorization
- Decision Tree, Random Forest, Gradient Boosting (Ensemble Methods)
- Deep Learning, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Transformer Models
- Neural Networks – Neural Machine Translation (NMT), Statistical Machin Translation
- Latent Dirichlet Allocation (LDA), Non-Negative Matrix Factorization, Recommender Systems
- Image Recognition , Pattern Recognition
- Network Analysis
- Time Series Analysis
- K-Means and Hierarchical Clustering

### Key Metrics Impacted

- Efficiency Improvement
- Cost Reduction
- Accuracy Enhancement
- Resource Optimization
- Strategic Decision Making
- Risk Mitigation
- Portfolio Management
- Innovation Alignment
- User Satisfaction
- Adaptability to changes
- Search and Retrieval Efficiency
- Portfolio Communication

## 7: Patent Analytics

**Patent Analytics:** Apply ML techniques to mine patent databases for valuable insights, trends, and patterns. Visualization tools can then present this information in a user-friendly format: **Patent & Bibliographic Data Collection, Data Cleaning & Preprocessing, Search & Retrieval, Technology Landscape Analysis, Valuation, Competitor Analysis, Trend Analysis, Infringements detection, Market Intelligence, Litigation Support.**

### Companies/Solutions



### Common AI/ML Algorithms

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- Image Recognition , Pattern Recognition
- Network Analysis
- Time Series Analysis, Predictive Analytics
- K-Means and Hierarchical Clustering

### Key Metrics Impacted

- Efficiency Improvement
- Accuracy Enhancement
- Cost Reduction
- Strategic Decision Making
- Risk Mitigation
- Portfolio Optimization
- Innovation Alignment
- User Satisfaction
- Adaptability to changes
- Search and Retrieval Efficiency
- Cost Per Patent Analyzed
- Technology Trend Identification
- Patent Quality Metrics
- Patent Filing and Grant Metrics
- Collaboration and Partnership Opportunities
- Market Intelligence
- Operational Scalability
- Cost Savings in Patent Litigation

## 8: Infringement Detection

**Infringement Detection:** Implement ML algorithms to detect potential patent infringements by analyzing large datasets, including product descriptions, technical documents, and patent claims: **Freedom to Operate (FTO) Analysis, Patent Claim Analysis, Prior Art Search, Comparative Analysis, Legal Opinions, Risk Mitigations and Enforcement Options.**

### Companies/Solutions



### Common AI/ML Algorithms

- Natural Language Understanding, Processing and Generation: Word Embeddings, word embeddings (Word2Vec, GloVe), distributional semantics, Jaccard Similarity, Euclidean Distance, Cosine Similarity, Sematic Knowledge, Knowledge Graphs, Tokenization, Named Entity Recognition (NER), Parts-of-Speech Tagging, Sentiment Analysis, Latent Semantic Analysis (LSA), Text Extraction, Text Classification, Text Summarization and Patent Categorization
- Supervised and Unsupervised Learning - Decision Tree, Random Forest, Gradient Boosting (Ensemble Methods)
- Deep Learning, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Transformer Models
- Neural Networks – Neural Machine Translation (NMT), Statistical Machin Translation
- Latent Dirichlet Allocation (LDA), Non-Negative Matrix Factorization, Recommender Systems
- Image Recognition , Pattern Recognition
- Network Analysis, Rule Based Analysis
- Time Series Analysis, Predictive Analytics
- K-Means and Hierarchical Clustering, Similarity Matching Algorithms

### Key Metrics Impacted

- Efficiency Improvement (time for analyzing claims & prior art)
- Accuracy Enhancement (minimizing false positives)
- Cost Reduction
- Strategic Decision Making
- Risk Mitigation
- Portfolio Optimization
- Litigation Process Success Rate
- User Satisfaction
- Resource Optimization
- Technology Trend Analysis
- Cost Per Infringement Analysis
- Technology Trend Identification

## 9: Technology Landscape Analysis

**Technology Landscape Analysis:** Use ML-based topic modeling to analyze the technology landscape, identify emerging trends, and evaluate the competitive landscape within specific technology domains: **Identification of technologies, Market & Competitor Analysis, Patent Analysis, R&D Activities, Regulatory and Policy Considerations, SWOT, Market Entry & Expansion, Technology Adoption Lifecycle, Partnership Opportunities.**

### Companies/Solutions



### Common AI/ML Algorithms

- Natural Language Understanding, Processing and Generation: Word Embeddings, word embeddings, distributional semantics, Jaccard Similarity, Euclidean Distance, Cosine Similarity, Sematic Knowledge, Knowledge Graphs, Tokenization, Named Entity Recognition (NER), Parts-of-Speech Tagging, Sentiment Analysis, Latent Semantic Analysis (LSA), Text Extraction, Text Classification, Text Summarization, Patent/Document Categorization, Thematic Analysis,
- Supervised and Unsupervised Learning - Decision Tree, Random Forest, Gradient Boosting (Ensemble Methods)
- Deep Learning, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Transformer Models
- Neural Networks – Neural Machine Translation (NMT), Statistical Machin Translation
- Latent Dirichlet Allocation (LDA), Non-Negative Matrix Factorization, Recommender Systems
- Image Recognition , Pattern Recognition, Associate Rules Mining
- Network Analysis, Rule Based Analysis, Graph Analysis
- Time Series Analysis, Predictive Analytics
- K-Means and Hierarchical Clustering, Similarity Matching Algorithms

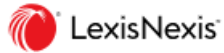
### Key Metrics Impacted

- Efficiency Improvement (time for analyzing patents)
- Accuracy Enhancement (minimizing false positives)
- Comprehensive Coverage
- Innovation Performance Metrics
- Cost Reduction
- Strategic Decision Making
- Risk Mitigation
- Operational Scalability
- User Satisfaction
- Technology Trend Analysis
- Technology Commercialization Analysis
- Collaboration and Partnerships
- Patent Portfolio Management

## 10: Patent Litigation Support

**Patent Litigation Support:** Develop models to predict the likelihood of success in patent litigation cases based on historical data, legal precedents, and case outcomes: **Legal Research and Analysis, Prior Art Search, Technical Analysis, Expert Witness Services, Document Review, Strategic Guidance, Discovery Support, Legal Brief Drafting, Settlement Support.**

### Companies/Solutions



### Common AI/ML Algorithms

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- Supervised and Unsupervised Learning - Decision Tree, Random Forest, Gradient Boosting (Ensemble Methods)
- Deep Learning, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Transformer Models
- Neural Networks – Neural Machine Translation (NMT), Statistical Machin Translation
- Legal Analytics – Rule Based Algorithms
- Image Recognition , Pattern Recognition
- Time Series Analysis, Predictive Analytics
- K-Means and Hierarchical Clustering, Similarity Matching Algorithms

### Key Metrics Impacted

- Efficiency and Time Savings (review large legal documents)
- Faster Case Preparation (prior art extraction)
- Enhanced Document Management
- Improved Legal Research
- Increased Accuracy in Case Assessment
- Cost Reduction
- Enhanced Legal Strategy
- Expertise Augmentation
- Scalability
- Consistency and Objectivity
- Improved Collaboration

# Kanwal Rai

An accomplished professional with over two decades of expertise in Intellectual Property and Software Technologies, he has served clients in patent prosecution, analytics, portfolio management, and innovation. His passion lies in exploring and applying technologies that enhance innovation and intellectual property outcomes. As Vice President at Wells Fargo, he played a crucial role in managing tech start-ups for innovation-led digital transformation. With a background in Infosys, Capgemini, and Wipro, he brings extensive experience in innovation and intellectual property management. He holds an MBA from IIMC and engineering degrees from DCE and BITS Pilani. He has co-authored a compelling book on AHP and its application in decision engineering, published by Springer Verlag, UK, garnering over 1450 citations, as of 2023. As a visiting faculty member, he has also delivered numerous courses on AI/ML.

<https://www.linkedin.com/in/kanwalrai/>

The presentation emphasizes the transformative impact of Artificial Intelligence (AI) and Machine Learning (ML) on patent management. By automating and optimizing various tasks, these technologies enhance efficiency, accuracy, and proactivity in intellectual property management strategies. The applications of AI/ML in patent management include Prior Art Search, Automated Patent Drafting, Patent Classification, Patent Valuation, Automated Patent Filing and Prosecution, Patent Portfolio Management, Patent Analytics, Infringement Detection, Technology Landscape Analysis, Patent Litigation Support, Automated Patent Maintenance, and Collaborative Innovation Platforms. The discussion is centered on how emerging tech start-ups are leveraging AI/ML to develop innovative solutions for these aspects of patent management.

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**THANKS!**

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