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AI Patent Eligibility: Processing the USPTO's New Guidance

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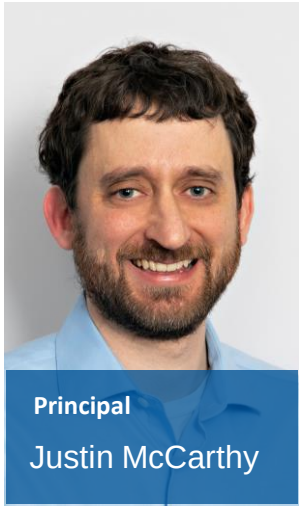

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Episode Overview

- Guidance
- Examples
- Submitted Comments Review
- PTAB Decisions
- Drafting Tips

Guidance

Guidance Overview

The guidance, published in July 2024:*

1. *reaffirms that the existing patent eligibility guidance ("PEG") framework applies to claims across all fields of technology, and thus include AI-related inventions;*

2. *highlights the potential for "practical applications" of AI; and*

3. *was accompanied by new examination guidance examples (Examples 47-49).*

**2024 Guidance Update on Patent Subject Matter Eligibility, Including on Artificial Intelligence*

Notable Statements in Guidance

*"Many claims to AI inventions are **eligible as improvements to the functioning of a computer or improvements to another technology or technical field**."*

*"AI inventions may provide a particular way to achieve a desired outcome when they claim, for example, a **specific application of AI to a particular technological field** (i.e., a particular **solution to a problem**)."*

*In these situations, the claim is **not merely to the idea of a solution** or outcome and amounts to more than merely 'applying' the judicial exception or generally linking the judicial exception to a field of use or technological environment.*

*In other words, the claim **reflects an improvement in a computer or other technology**."*

Leveraging Specific Wording from Guidance

- When **preparing a new AI-related patent application**
    - Define the technological field and explain the technological problem/s experienced in the field.
    - Include sufficient detail about how the invention solves the specific technological problem/s. Explain how an AI-related or AI-driven advancement is being used in the solution.
- When **responding to a subject matter rejection**
    - Point to the discussion of the technological field and problem in the specification.
    - Explain how the claim recites a specific application of AI to this field/problem as opposed to a general use of AI.
    - Link the claim language with the AI-related or AI-driven solution/improvement discussed in the specification.

Examples

Example 47 Anomaly Detection

- Claim 1: An ASIC for an artificial neural network comprising neurons organized in an array (with registers, microprocessors, inputs) and synaptic circuits with memory for storing weights
- **Eligible**: Falls within statutory category and does not recite any judicial exceptions

- Claim 2: A method of using an ANN including receiving/discretizing training data, training the ANN using backpropagation and gradient descent, detecting anomalies, analyzing them, and outputting anomaly data
- **Ineligible**: Recites judicial exceptions (abstract ideas) and does not integrate them into practical application or provide significantly more

- Claim 3: A method of using an ANN to detect malicious network packets, including training the ANN, detecting anomalies in network traffic, determining malicious packets, detecting source addresses, dropping packets, and blocking traffic
- **Eligible**: While reciting judicial exceptions, integrates them into practical application by improving network security

Example 47 Anomaly Detection

Judicial exceptions:

- Mathematical concepts in the discretizing and training steps
- Mental processes in the discretizing, detecting, and analyzing steps

Additional elements in Claim 2 that did not integrate the judicial exceptions into a practical application:

- Receiving data and outputting results were mere insignificant extra-solution activity
- Using a computer and trained ANN were just instructions to "apply it" with a generic computer
- The limitations amounted to necessary data gathering and outputting

Key additional elements in Claim 3 that Claim 2 lacked:

- Detecting source addresses associated with malicious packets in real time
- Automatically dropping malicious packets in real time
- Blocking future traffic from the source address

Example 48 Speech Separation

- Claim 1: A speech separation method comprising receiving mixed speech signal, converting to spectrogram using Fourier transform, and using DNN to determine embedding vectors
- **Ineligible**: Recites mathematical concepts and does not integrate them into practical application or provide significantly more

- Claims 2: The method of claim 1 plus partitioning vectors into clusters, applying binary masks, synthesizing speech waveforms, combining waveforms excluding target source, and transmitting
- **Eligible**: While reciting judicial exceptions, integrates them into practical application by improving speech separation technology

- Claim 3: Computer-readable medium with instructions for speech separation including receiving mixed signal, using DNN for embeddings, clustering, masking, converting to time domain, and producing transcript
- **Eligible**: While reciting judicial exceptions, integrates them into practical application by improving speech-to-text technology

Example 48 Speech Separation

Claim 1 was found ineligible because It recited judicial exceptions (mathematical concepts):

- Converting mixed speech signal to spectrogram using Fourier transform
- Using DNN to determine embedding vectors based on a mathematical formula

Its additional elements did not integrate the exceptions into a practical application:

- Receiving mixed speech signal was mere data gathering/insignificant extra-solution activity
- Using a DNN was just instructions to "apply it" without meaningful limitations

The claim lacked any technological improvement

Example 48 Speech Separation

Claim 2 was found eligible because it added specific elements that Claim 1 lacked, including additional elements that integrated the judicial exceptions into a practical application:

- Synthesizing speech waveforms from masked clusters
- Combining speech waveforms to generate a mixed speech signal excluding target source

These elements reflected a concrete technological improvement in speech separation by solving the problem of separating speech from different sources belonging to the same class

The claim demonstrated improvement to speech-separation technology by:

- Not requiring prior knowledge of number of speakers
- Not requiring speaker-specific training
- Converting clusters into separate speech waveforms
- Generating a new mixed speech signal without unwanted sources

Example 48 Speech Separation

Claim 3 was found eligible because it added specific elements that Claim 1 lacked, including additional elements that integrated the judicial exceptions into a practical application:

- Converting masked clusters into N separate speech signals
- Extracting spectral features from a target source
- Generating sequence of words to produce a transcript

The claim demonstrated improvement to speech-to-text technology by:

- Using both temporal and spatial features of speech signals
- Deriving embeddings based on global properties of input signal
- Reducing transcription performance gap for accented speakers
- Making individual transcription of separated speech signals possible

Example 49: Fibrosis Treatment

Claim 1: A post-surgical fibrosis treatment method comprising collecting/genotyping patient sample, identifying high-risk patients using weighted polygenic risk score generated by AI model, and administering treatment.
Ineligible: Recites judicial exceptions and does not integrate them into practical application or provide significantly more.

Claims 2: The method of claim 1, wherein the treatment is specifically Compound X eye drops.
Eligible: While reciting judicial exceptions, integrates them into practical application through particular treatment for specific patient population.

Examples 47-49: Key Takeaways

The new examples 47-49 serve to demonstrate the analytical framework and key principles that can be applied across different technologies and fact patterns. For instance:

- The improvements consideration can be demonstrated in various ways (e.g., network security, speech processing, and medical treatment), and requires an evaluation of the specification and the claim to ensure that a technical explanation of the asserted improvement is present in the specification, and that the claim reflects the asserted improvement.
- Integration into practical applications can take different forms (technological improvements, particular treatments)

Therefore, while the specific outcomes in the examples are tied to their particular fact patterns, the analytical approach they demonstrate is meant to be broadly applicable across different technologies and fact patterns, serving as guidance rather than rigid templates.

Submitted Comments

Submitted Comments (Summary)

- Mental Processes
  - Some commentators challenged the USPTO's finding that many of the steps in the examples were mere **mental processes**. They argued that the true test was whether it can be "practically" performed by a human mind and that AI/ML cannot be practically performed by a human. (AIPLA, IBM, SankerIP)
  - One commentator argued that a claim is not a mental process unless it achieves the limitation's purpose in real circumstances. (IBM)
  - One commentator indicated that it was not clear why some elements were labelled as mental processes, while others were not. (High Tech Inventors Alliance)

Just How Long Would It Take to do This in Your Head?

What is an estimate for the number of calculations that are run for a single word query on GPT-4.

4. Conclusion:

For a single word (or token) query in GPT-4, it's likely that on the order of **10-50 billion FLOPs** (floating-point operations) are executed in the forward pass, with the exact number depending on the model's specific size and configuration.

This is a rough estimate and assumes that the model is running in a highly optimized environment, such as specialized hardware (e.g., TPUs or GPUs) designed for matrix multiplication and other parallel operations used in transformers.

Making some reasonable estimates for human calculation speed, how long would it take a human to perform the same calculations

Just How Long Would It Take to do This in Your Head?

Human Calculation Rate Estimate:

For simplicity, let's assume that a human can perform **1,000 basic operations per second** (which is an optimistic estimate, considering it's hard to replicate highly parallelized tasks like matrix multiplication and attention computation). This could be a mix of simple arithmetic operations, but complex operations, such as matrix multiplications, would take longer.

- This is about **1,000 operations per second**, or **1 operation every millisecond**.

Step 4: Conclusion

So, it would take a human about **0.8 years** (roughly **9-10 months**) to manually perform the equivalent of the calculations GPT-4 executes for a single word query, assuming the human could perform 1,000 operations per second and the operations involved were basic arithmetic.

Just How Long Would It Take to do This in Your Head?

Lets assume the human can only do 1 operation every 3 seconds

Summary:

- **For one token**, a human performing **1 operation every 3 seconds** would take about **2,383 years** to manually compute the same operations that GPT-4 does in a fraction of a second.

This gives a strong sense of how much faster modern AI models like GPT-4 are compared to human capabilities for performing complex calculations!

Submitted Comments (Summary)

- Mathematical Formula
  - Some commentators were concerned over the labelling of some recitations in the claims as **mathematical formulas;** (SankerIP) “If the examiner must read between the lines to find the judicial exception, then the claim does not “recite” the judicial exception.” (IBM)
  - Some were concerned with the tension introduced in the USPTO’s examples between not being specific enough – and being a mere mental process – and being too specific and being labelled as a mathematical algorithm (AIPLA, Pindrop Security, IPO).
  - Some commentators flat out rejected the idea that a mathematical process was per-se ineligible (AUTM)
  - At least one commentator pointed out that the Examples encouraged an illogical result – e.g., by *broadening* the claims by removing the backpropagation and gradient descent recitations that the claim would be eligible AND would have a greater pre-emptive effect. (Anonymous).
  - According to one commentator “The Office is taking a dim and improper view towards AI/ML innovation as nothing more than math.” (Pindrop Security)

Submitted Comments (Summary)

- Some commentators condemned the double standard that they argue exists between hardware-based and software-based neural networks. (AUTM, SankerIP)
- Some commentators pointed out the inconsistencies between Example 39 and Example 47 (Keim, Pindrop Security)
- Many argued for legislative fixes such as the Patent Eligibility Restoration Act (Council for Innovation Promotion, Neo IP, AIPLA)
- Some commentators indicated that the Examples really didn't address what specific improvements in AI would confer eligibility. They noted that the elements in the Examples that "overcame" the 101 issues were not with the AI themselves, but other activity. (AIPLA, Pindrop Security).

PTAB Decisions

Ex parte SHAWN HENRY – Appeal 2019-000362

- Claimed invention covers receiving electronic messages, computing semantic representations for each message, computing a context vector and quantizing it into a hash vector, selecting a resource using the hash values, and transmitting information about the resource to a user.

- Examiner rejected claims on the ground that the claimed invention was directed to an abstract idea. PTAB reversed the decision. PTAB found the claims to be eligible because they recited recite a **specific ordered combination of computational steps** that provided a **technological improvement**.
- Takeaways for practitioners and inventors:
  - Claim concrete steps that go beyond conventional/generic computing practices.
  - Highlight the technological problem and technological solution.
  - Ensure that the technological solution, as described in the specification, is reflected in the claims.

KEY PATTERNS IN PTAB REVERSALS in (2024 =12 Decision Reversals/4 AI related, 2023 = 40+ Decision Reversals/ 3 AI related)

1. Most cases were reversed at Step 2A Prong 2, with the Board finding integration into practical applications through technological improvements.

2. Example technological improvements included:
    - Neural network training optimization
    - Specialized data structures
    - Process control and monitoring systems
    - Manufacturing and equipment optimization

3. The Board consistently found claims patent eligible when they:
    - Solved computer-specific problems
    - Provided specific implementations rather than abstract results
    - Demonstrated concrete technological improvements
    - Contained steps too complex for mental processes

4. Step 2B analysis was typically not reached because claims were found eligible at Step 2A Prong 2

2024 Reversals: Case Name	Step 2A Prong 1	Step 2A Prong 2	Step 2B	PEG Examples Cited	Reason for Reversal
Ex parte Das	Found claims did not recite mental processes since training neural networks cannot be practically performed in human mind	Not reached	Not reached	Example 39	Claims focused on improving computer technology (training neural networks) rather than abstract idea
Ex parte Nair	Found claims did not recite mental processes since calculations at precision below 2^-24 cannot be performed in human mind	Not reached	Not reached	None cited	Claims provided technological improvement to computer operations through specific data structure for neural network training
Ex parte Helenius	Recited mental processes and mathematical concepts for product path generation	Found integration into practical application through ordered combination of trained models	Not reached	None cited	Claims integrated abstract idea into practical application through specific implementation of ML models
Ex parte Holtmann-Rice	Recited mathematical concepts but not mental processes due to complexity	Found integration into practical application through improvement to kernel-based machine learning technology	Not reached	None cited	Claims provided specific improvement to computer technology through unbiased estimators for gaussian kernels

2023 Reversals: Case Name	Step 2A Prong 1	Step 2A Prong 2	Step 2B	PEG Examples Cited	Reason for Reversal
Ex parte Martin	Mathematical concepts and mental processes	Integrated practical application - bifurcated memory structure enabled mobile AI operation and reduced data requirements for overtraining detection	Not reached	None cited	Claims integrated abstract idea into practical application by providing technical improvement to memory structure that enabled AI on mobile devices
Ex parte Altman	Email fraud detection using keyboard distance calculations recited mental processes and mathematical concepts	Integrated practical application - solved computer-specific problem of detecting fraudulent emails that did not exist pre-internet	Not reached	None cited	Claims provided technical solution to technical problem rooted in computer technology (email fraud detection)
Ex parte Adachi	Mental processes and mathematical concepts	Integrated practical application - improved neural network operation to provide reliable confidence levels efficiently	Not reached	None cited	Claims focused on improvement to neural network technology itself to provide faster estimation results with reliable confidence levels

Key Integration into Practical Applications in Above

Neural Network & ML Improvements

- Unbiased gaussian kernel estimators reducing memory/processing time
- Training with varied input precisions for efficiency
- Structured orthogonal random features optimization

Mobile & Edge Computing

- Bifurcated memory enabling mobile AI benefits
- Overtraining detection on mobile fitness devices

Security & Data Processing

- Email fraud detection via keyboard distance analysis
- Multi-model product recommendation combining:
  - Propensity models
  - Reinforcement learning

Technical Benefits

- Reduced memory requirements
- Improved processing efficiency
- Enhanced accuracy
- Mobile operation without constant connectivity

Ex parte Das (Appeal 2024-000821)

Summary of Claimed Invention

- Neural network training system that accounts for different precisions of input samples
- Determines losses of samples within input volume, groups samples into subsets based on losses
- Assigns subsets to different precision operands in neural network

PTAB Decision Overview

- Examiner rejected as mental processes for "determining losses" and "grouping samples"
- PTAB reversed: Training neural networks **cannot be practically performed in human mind**
- Found claims focused on **improving computer technology** rather than abstract idea

Practical Takeaways

- Emphasize technical complexity that makes mental performance impractical
- Detail specific hardware/computational requirements in specification
- Connect claims to technical improvements in neural network training

Ex parte Nair (Appeal 2024-000911)

Summary of Claimed Invention

- Neural network training using flexible floating point tensors
- FP16 numbers sharing common exponent to enhance speed/accuracy
- Dynamic precision adjustment to avoid overflow/underflow

PTAB Decision Overview

- Examiner rejected as mental processes and mathematical concepts
- PTAB reversed: **Calculations at precision below 2^-24 cannot be mental**
- Found claims provided **specific hardware-based improvement**

Practical Takeaways

- Detail technical precision requirements that exceed human capability
- Describe specific hardware structures and their advantages
- Link data structure improvements to concrete technical benefits

Ex parte Helenius (Appeal 2024-000079)

Summary of Claimed Invention

- Product recommendation system using dual ML models
- Trained propensity model generates purchase likelihood values
- Reinforcement learning model optimizes product sequences

PTAB Decision Overview

- Examiner rejected as mental processes for generating product paths
- PTAB reversed: Found practical application **through ordered combination**
- Specific implementation of multiple ML models working together

Practical Takeaways

- Detail how multiple models interact to achieve improvements
- Emphasize ordered combinations that provide technical benefits
- Connect model interactions to concrete system improvements

Ex parte Holtmann-Rice (Appeal 2024-000046)

Summary of Claimed Invention

- Kernel-based machine learning classifier improvements
- Novel data structure for processing feature vectors
- Matrix transformations for enhanced classification

PTAB Decision Overview

- Examiner rejected as mathematical concepts
- PTAB reversed: Found specific **improvement to computer technology**
- Technical advance in kernel-based machine learning

Practical Takeaways

- Focus claims on specific technical improvements
- Detail how data structures enhance system functionality
- Connect mathematical operations to concrete technical benefits

Ex parte Martin (Appeal 2023-001622)

Summary of Claimed Invention

- Fitness tracker with bifurcated memory structure for mobile AI analysis
- Memory divided into latent data (demographic/historical) and current data (heart rate)
- Neural network analyzes data to detect overtraining conditions in mobile environment

PTAB Decision Overview

- Examiner rejected as abstract for mental processes and organizing human activity
- PTAB reversed: Claims provided **technical improvement to memory structure**
- Found bifurcated memory enabled AI operation on mobile devices with reduced data requirements

Practical Takeaways

- Detail specific technical improvements that enable AI in resource-constrained environments
- Explain how memory/data structures overcome limitations of conventional approaches
- Connect claims to solving technical problems in mobile AI implementation

Ex parte Altman (Appeal 2023-003788)

Summary of Claimed Invention

- Email fraud detection using machine learning optimization
- Analyzes keyboard distances between characters in email prefixes
- Classifies emails as suspicious based on normalized distance calculations

PTAB Decision Overview

- Examiner rejected as mental processes and mathematical concepts
- PTAB reversed: Claims **solved computer-specific problem**
- Found solution was necessarily rooted in computer technology

Practical Takeaways

- Focus on technical problems unique to computer/internet environment
- Detail specific technical solutions that address those problems
- Show how ML/AI provides novel approach to computer-specific issues

Ex parte Adachi (Appeal 2023-003642)

Summary of Claimed Invention

- Neural network with integrated dropout layer
- Performs estimation process to obtain confidence intervals
- Combines dropout and fully connected layers for weight computation

PTAB Decision Overview

- Examiner rejected as mathematical concepts and mental processes
- PTAB reversed: Claims **improved neural network functionality**
- Found technical improvement in providing reliable confidence levels

Practical Takeaways

- Detail specific improvements to neural network architecture
- Explain technical benefits of architectural modifications
- Connect claims to enhanced performance/reliability of AI system

5. Recent European case

EPO Board of Appeals Case T 1669/21

- Decision turned on Article 83 of European Patent Convention, which requires a patent application disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

- The Board found that the patent application failed to meet this requirement, particularly concerning the machine learning aspects of the claimed invention. The patent was found to have insufficient detail regarding model architecture, parameter selection, training data, etc.

- Takeaways for practitioners and inventors:
  - Explain the relevant model's architecture (e.g., topology and nodes)
  - Clearly define input and output variables
  - Describe parameter selection and training procedures
  - Provide examples of training data sources and characteristics

Questions

Are there some trends that can be drawn from these examples?

What are some criticisms of this guidance?

What practice tips can we provide based upon this guidance?

How will Kathi Vidal's departure affect this issue?

Thank you for your interest.

Questions?

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