Patents and Artificial Intelligence
What’s next?
• Vanessa Bailey (Intel)
• Kate Gaudry (Kilpatrick Townsend)
• Lili Wu (Hankun Law)
• John Brunner (Carpmaels & Ransford)
Content

• AI Perspectives from Industry

• AI and Patents
  – Policy Considerations
  – Jurisdictional Specific Considerations
    o China
    o US
    o Europe
  – Worked Example

• USPTO Request for Comments

• Discussion
AI Patent in China

Lili Wu

September, 2019
What are AI Invention Applications?

1. Data collection
2. Sample data selection
3. Feature selection

Training data

AI Model

1. Structure of Model change
2. Combination of Algorithms
3. Training method

.....

Actual data

Actual implementation

1. Data collection
2. Sample data selection
3. Feature selection
4. AI implementation

.....
Agenda

- AI Patents in China
- Key Legal Issues in AI Patent Prosecution
Computer vision and image process are now hot fields.

Chinese companies filed a lot of AI applications.

ICT companies are main applicants in computer vision and image process

<table>
<thead>
<tr>
<th>Rank</th>
<th>Applicant</th>
<th>Number of application publications</th>
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<tbody>
<tr>
<td>1</td>
<td>Chinese Academy of Science</td>
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Universities are main applicants in fundamental AI inventions

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<td>South China University of Technology</td>
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<tr>
<td>10</td>
<td>Tianjing University</td>
<td>293</td>
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</table>

Market value of Sensetime is over 7 billion USD!

Number of invention applications

- 2013: 4
- 2014: 15
- 2015: 38
- 2016: 108
- 2017: 199
- 2018: 284

Intelligent city
Intelligent finance
Intelligent shop
Face ID
Sense AR
AI Patents have the similar deficiency distribution to cases in other technical areas


- Inventive step: 51%
- Clearness: 26%
- Others: 15%
- Novelty: 5%
- Unpatentable: 3%

Top 3 prosecution pitfalls:
1. Patentable subject matter
2. Inventiveness
3. Sufficient disclosure

Source: CNIPA website, incopat, with key word “machine learning”, “deep learning” and “neural network”
Two hurdles for AI patentability

- First hurdle: Mental Activity (Article 25, Patent Law)
  - Pure Algorithm

- Second hurdle: Definition of Invention (Article 2, Patent Law)
  - Three technical elements test
First hurdle: Mental Activity (Article 25, Patent Law)

- Pure Algorithm

(Not patentable) An optimization method for convolutional neural network, characterized in that comprising the following steps:

step 1: Input L*K samples through a computer, wherein L is the number of samples, K-1 is the number of input vectors, and Column K is the output vector;

step 2: Process said samples, and delete the gross error with HBFCM;

step 3: Perform the clustering with the input column as the basic unit according to the correlation distance algorithm;

step 4: Construct the convolutional neural network model for the subsequent training;

step 5: Train said convolutional neural network model with said L*K samples, and further verify such training result;

step 6: Input the data to be evaluated after training said convolutional neural network model, and said data to be evaluated is the normalization processed data;

Step 7: Evaluate said data with said convolutional neural network model, and output the result.
First hurdle: Mental Activity (Article 25, Patent Law)

- Still pure Algorithm even if the preamble has the specific scenario that the algorithm is used

(Not patentable) An optimization method for convolutional neural network which is used in error calculation for an image processing, characterized in that comprising the following steps:

step 1: Input L*K samples through a computer, wherein L is the number of samples, K-1 is the number of input vectors, and Column K is the output vector;

step 2: Process said samples, and delete the gross error with HBFCM;

step 3: Perform the clustering with the input column as the basic unit according to the correlation distance algorithm;

step 4: Construct the convolutional neural network model for the subsequent training;

step 5: Train said convolutional neural network model with said L*K samples, and further verify such training result;

step 6: Input the data to be evaluated after training said convolutional neural network model, and said data to be evaluated is the normalization processed data;

Step 7: Evaluate said data with said convolutional neural network model, and output the result.
Second hurdle: Definition of Invention (Article 2, Patent Law)

- Three technical elements test
  - Technical problem, technical means, technical effect

Pitfall

- Look at the function of the features to see if they contribute/link directly to the technical effect
AI Patentability in the Second Hurdle

- Categories that are usually regarded as eligible subject matters under the definition of invention
  - AI inventions used in industries such as manufacturing, measuring etc.
  - AI inventions used in processing external data (video, audio etc.)
  - AI inventions used in processing internal data to improve computer performance

Source: Examination Guidelines: Part II, Chapter 9 regarding software related invention examination
Example of eligible subject matter

- AI inventions used in processing external data (video, audio etc.)

(Patentable) An optimization method for convolutional neural network, characterized in that comprising the following steps:

step 1: Input L*K samples of image data, wherein L is the number of samples, K-1 is the number of input vectors, and Column K is the output vector;

step 2: Process said samples, and delete the gross error with HBFCM;

step 3: Perform the clustering with the input column as the basic unit according to the correlation distance algorithm;

step 4: Construct the convolutional neural network model for the subsequent training;

step 5: Train said convolutional neural network model with said L*K samples, and further verify such training result;

step 6: Input an image data to be evaluated after training said convolutional neural network model, and said data to be evaluated is the normalization processed data;

Step 7: Evaluate said image data with said convolutional neural network model, and output the result.
### Allowable Claim Types for AI Invention

<table>
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<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Method</td>
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<tr>
<td>Apparatus comprising:</td>
<td>✓</td>
</tr>
<tr>
<td>means for ...</td>
<td>✓</td>
</tr>
<tr>
<td>Device comprising:</td>
<td>✓</td>
</tr>
<tr>
<td>processor + hardware (other than memory)</td>
<td>✓</td>
</tr>
<tr>
<td>Device comprising:</td>
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<tr>
<td>memory + processor + instructions stored in memory and executed by processor</td>
<td>✓</td>
</tr>
<tr>
<td>Computer readable medium having instructions stored thereon</td>
<td>✓</td>
</tr>
<tr>
<td>Computer programs</td>
<td>×</td>
</tr>
<tr>
<td>Signal, Data structure, Energy</td>
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</table>
Invalidation appeal regarding AI invention between Shanghai Zhizhen and Apple (2012-now, retrial in the Supreme Court in China) (“SIRI”)

Claim 1: a chatting robot system, comprising at least:

a user, and a chatting robot having an artificial intelligence (AI) server with an AI and information service function and a corresponding database, the chatting robot also having a communication module, the user performing various conversations with the chatting robot through an instant communication platform or SMS (Short Message Service) platform,

characterized in that the chatting robot further has a query server, a corresponding database, and a game server, and the chatting robot is provided with a filter for distinguishing whether user sentences received by the communication module are formatted sentences or natural language, and forwarding the user sentences to the corresponding server based on a distinguishing result, the corresponding server including the AI server, the query server or the game server.

Court opinion:

− However, the description only recites there is a game server and mentions a concept of realizing interactive games, but it does not recite at all how to connect the game server with other components of the chatting robot.

− Hence, the description of the subject patent fails to sufficiently disclose how to realize the game function defined in claim 1 of the subject patent and therefore, the subject patent shall be announced as being invalid.
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This document should not be relied on as legal advice or regarded as a substitute for detailed advice in individual cases. If you have any further questions or need professional legal services or support, please feel free to contact us.
AI Patenting Considerations in the United States

Kate Gaudry
Kilpatrick Townsend
What to patent?
Possible claim focuses

• Generate this type of solution for this type of problem
• Use ML to address this type of problem to generate this type of target solution
• Use any of these listed types of ML to address this type of problem to generate this type of target solution
• Use ML to address this type of problem to generate this type of target solution with one or more of these:
  – Data source(s), preprocessing, de-identification approaches, security measures, target metrics, training structure, validation approaches, (fixed) hyperparameters and/or post-processing
• Use this type of ML to address this type of problem to generate this type of solution
• Learned parameters / trained model
• Outputs of trained model for particular use case
What to patent?
Possible claim focuses

• **Generate this type of solution for this type of problem**

• **Use ML to address this type of problem to generate this type of target solution**

• **Use any of these listed types of ML to address this type of problem to generate this type of target solution**

• **Use ML to address this type of problem to generate this type of target solution with one or more of these:**
  – Data source(s), preprocessing, de-identification approaches, security measures, target metrics, training structure, validation approaches, (fixed) hyperparameters and/or post-processing

• **Use this type of ML to address this type of problem to generate this type of solution**

• **Learned parameters / trained model**

• Outputs of trained model for particular use case

**LEGEND:**

<table>
<thead>
<tr>
<th>Possible Prior-Art Difficulties</th>
<th>Possible Eligibility Difficulties</th>
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<tbody>
<tr>
<td>Possible Disclosure Difficulties</td>
<td>May require claiming the training</td>
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Patenting Prospects of Software/A.I. Innovations has been Volatile in the U.S.

*Alice Electric Power Group Revised PTO Guidance*


Raw data from LexisNexis® PatentAdvisorSM
Europe - Patenting AI Innovation

- Key Considerations:
  1. Technical Character (c.f. EPO Guidelines for Examination G-II, 3.3.1)
     - AI *per se*?
     - Is it a pure mathematical method?
     - Is what is being claimed an abstract models devoid of technical character?
     - Technical use / purpose
  2. Novelty / Inventive Step
     - Closest prior art – which technical field?
     - The skilled person – a team?
  3. The Importance of Language – Article 52(1), (2) and (3) EPC
  4. Sufficiency
  5. Claim Categories
Europe – Areas of Focus

1. Core AI Technology
   - Technical character: define technical use / purpose
   - Novelty / IS: if ML technique is truly new, then may be relatively easy
   - Sufficiency: will need to disclose computational model

2. Application of AI to specific fields and sectors
   - Technical character: define technical use / purpose
   - Novelty / IS: may be difficult
   - Sufficiency: may not need to disclose computational model in detail if known
Europe – Areas of Focus

3. Use of Particular Training Data
   - Can you define the nature of the training data sufficiently broadly?
   - **Technical character**: define technical use / purpose
   - **Novelty / IS**: possibly ok depending on the nature of the particular training data utilised
   - **Sufficiency**: need to disclose how the computational model trained with the particular data achieves the desired technical use / purpose – provide results/evidence?

4. Use of Trained AI / Trained AI Devices / Products
   - Claim categories: can you claim the trained model sufficiently broadly?
   - **Technical character**: define technical use / purpose
   - **Novelty / IS**: possibly ok depending on the nature of the particular training data utilised
   - **Sufficiency**: provide results/evidence?
Worked Example 1

- Alzheimer's disease (AD) - a devastating and debilitating neurodegenerative condition.
- A known characteristic of an AD patient is a propensity to pace or wander.
- Research suggests that small amounts of atypical pacing may be an early stage indicator of AD.
- With current smart devices, it is possible to detect small localized pacing movements via location determination and positional sensors without any patient interaction.
- The detection of this atypical pacing can constitute a “digital biomarker” for AD.
Worked Example II

• Diagnosis
  • Detection of pacing
  • Creation of the “intelligent” AI to perform early stage diagnosis
  • Use of the intelligent AI to perform early stage diagnosis

• Treatment
  • Determination of appropriate drug dosing using AI and pacing detection
  • Dosing Variability
  • Medical Use Claims based on AI Determined Dosing
Diagnosis - Detection

- A system for determining early stage indicators of one or more neurological disorders, comprising:
  - a movement detector configured to detect movement of a user and generate movement data of the user;
  - a communications interface for transmitting the movement data to a processor
  - a processor configured to receive the movement data and analyse the movement data according to process X, Y, Z / utilizing a patient diagnostic model (PDM) along with user health data A, B, C and provide an indicator of the early stage presence of the one or more neurological disorders.
Treatment - Dosing

• A computer-implemented method for using artificial intelligence to process movement data, the method including:
  • accessing a trained machine-learning model that includes a set of parameters set to values learned as a result of a training process;
  • generating an input data set to include:
    • one or more first data elements representative of a dosing of composition A corresponding to a subject; and
    • one or more second data elements corresponding to measurements collected by a movement detector on a device worn by the subject;
  • processing the input data set using the trained learning model to generate a result that corresponds to a dosing regimen; and
  • outputting the result.
USPTO Request for Comments

1. What are elements of an AI invention?

2. Ways natural person can contribute to conception of an AI invention and be eligible to be a named inventor?

3. Inventorship where entity other than a natural person contributed to the conception of an invention

4. Should an entity or entities other than a natural person, or company to which a natural person assigns an invention, be able to own a patent on the AI invention?

5. Are there any patent eligibility considerations unique to AI inventions?

6. Are there any disclosure-related considerations unique to AI inventions?

7. How can patent applications for AI inventions best comply with the enablement requirement, particularly given the degree of unpredictability of certain AI systems

8. Does AI impact the level of a person of ordinary skill in the art? If so, how? For example: should assessment of the level of ordinary skill in the art reflect the capability possessed by AI?

9. Are there any prior art considerations unique to AI inventions?

10. Are there any new forms of intellectual property protections that are needed for AI inventions, such as data protection?
Discussion / Questions
Thanks for your attention!
3 AREAS MAKE AI POSSIBLE TODAY: BIG DATA, COMPUTE AND CONNECTIVITY

The Big Data Explosion

1.5 GB PER DAY
4,000 GB PER DAY
40,000 GB PER DAY
1,000,000 GB PER DAY

The Compute Explosion

New processors custom-designed for deep learning, will deliver a 100X reduction in time to train over current processors by 2020.

The Connectivity Explosion

50B by 2020 connected devices

THE DELUGE OF DATA

DAILY BY 2020

AVG. INTERNET USER 1.5 GB
AUTONOMOUS VEHICLE 4 TB
CONNECTED AIRPLANE 5 TB
SMALL FACTORY 1 PB
CLOUD VIDEO PROVIDER 750 PB

BUSINESS INSIGHTS
OPERATIONAL INSIGHTS
SECURITY INSIGHTS
Chart 3.5  Annual Artificial Intelligence Revenue by Technology, World Markets: 2016-2025

(Source: Tractica)
AI SOLUTIONS ARE TRANSFORMING INDUSTRIES

**AGRICULTURE**
Achieve higher yields & increase efficiency

**ENERGY**
Maximize production and uptime

**EDUCATION**
Transform the learning experience

**GOVERNMENT**
Enhance safety, research, and more

**FINANCE**
Turn data into valuable intelligence

**HEALTH**
Revolutionize patient outcomes

**INDUSTRIAL**
Empower truly intelligent Industry 4.0

**MEDIA**
Create thrilling experiences

**RETAIL**
Transform stores and inventory

**SMART HOME**
Enable homes that see, hear, and respond

**TELECOM**
Drive network and operational efficiency

Source: www.intel.ai

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INTEL AI TECHNOLOGY FIGHTING ILLEGAL POACHING WITH PURPOSE BUILT AI CAMERA

Smart cameras with Intel AI technology can help protect endangered wildlife from poachers by triggering a real-time alert system when the camera's AI algorithms detect humans within captured photos. The Intel® Movidius™ Myriad™ 2 vision processing unit (VPU) powers the TrailGuard AI® vision processing and on-camera inference—all while operating at very low power to enable an estimated year-long battery life.

The TrailGuard AI performs on-camera inference to identify people, animals, and objects.
The Wheelie is the first AI driven program that uses facial gestures to help wheelchair users gain autonomy and feel more independent, and can be customized based on their needs.
• Siemens Healthineers and Intel are working to accelerate AI for real time MRI cardiac diagnosis using 2nd Generation Intel® Xeon® Scalable processors with Intel® Deep Learning Boost and Intel® Distribution™ of OpenVINO™ toolkit.

• Brainiak (Brain Imaging Analysis Kit) is a SW library for analyzing neuroimaging data using AI, Intel’s first open source contribution to the neuroscience community. It is primarily aimed at functional magnetic resonance imaging (fMRI), a non-invasive technology often preferred for cognitive neuroscience research.
Intellectual Property: Patents

Patents were designed to motivate an inventor. Is such motivation still needed if an AI is the inventor?

If an AI invents something, is it patentable? If so, who owns the patent?

How do we enable a claim if we do not know why an AI made its' decision?

If an AI can be an inventor, can it also be an infringer?

What remedies are appropriate?

Are there aspects of AI that should be accessible to all?

What risks exist if someone can control key AI technologies?

Is AI patentable or is it just an algorithm that is a law of nature?

Intellectual Property: Copyright

Can an AI's original works be copyrighted? If it is SW written by humans, should receive copyright protection.

Is an AI like an animal? The US courts have held that no one owns a monkey’s selfie.

Who is the author of the inputted data? Trained model? Is there sufficient originality? Originality has a low bar.

Who is the author of outputted data?

Intellectual Property: Trade Secrets

Can an AI's original works be a trade secret?

Good alternative if can enforce the secrecy (e.g. by contract)

Can fail you: sometimes testing can identify the underlying AI model

Are there uses for which transparency should matter?

If so, how do we audit what may not be well understood by humans?
USPTO has seen a 500% increase in the past 5 years in the numbers of issued patents on AI data processing systems!

Source: the index was generated by Hoffman Warnock based on AI related search terms from published abstracts at the USPTO.
AI IP POLICY ISSUES

• Lots of data needed to train the AI model = privacy concerns

• AI and section 103 obviousness: Who is the person of ordinary skill in the art (POSITA)? A skilled AI programmer?

• Some AI “inventions” are using AI to do wonders, i.e., the invention does not focus on the novelty of AI itself, but rather on the usage of AI to do something, like detect and treat a patient

• Are AI usage inventions patentable b/c the novelty does not appear to lie in the AI algorithm itself, instead, it is about the novel usage.

• Detecting others usage of your AI: AI invention is often proverbial “black-box.” Without clear detectability or explainability of an AI invention, its value may be marginalized compared with patent costs

• AI needs access to government and public data to train the AI model

• Sui generis rights in AI or to the data used in AI is not necessary. Industry should be allowed to develop in the current legal landscape.
USPTO REQUEST FOR COMMENTS ON PATENTING AI INVENTIONS

1. What are elements of an AI invention?

2. Ways natural person can contribute to conception of an AI invention and be eligible to be a named inventor?

3. Inventorship where entity other than a natural person contributed to the conception of an invention

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9. Are there any prior art considerations unique to AI inventions?

10. Are there any new forms of intellectual property protections that are needed for AI inventions, such as data protection?
Policy: U.S. government should help build on the U.S. innovation and technology leadership by committing to a National AI Strategy that advances its industrial competitive advantage, improves quality of life for the population, and maintains the nation’s AI technology leadership on the world stage by:

1. Committing funding and resources for AI R&D and Gov’t implementation of AI
2. Making government data available for use in AI
3. To direct a study of the impact of AI on the US workforce and implement programs to develop an AI workforce and
4. Remove regulatory and policy barriers to AI and ensure that new legislation does not impede the development or implementation of AI.