Patent (and Other) Protection Available for Artificial Intelligence (AI) - Related Inventions

January 7, 2022

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Massachusetts Institute of Technology
What’s Ahead...

• What is AI?

• Challenges and Alternatives to Patenting AI

• Examples of AI Patents

• Who is the Inventor?
Enormous Economic Benefits From AI Are Expected

- Global GDP is expected to grow by $13 trillion to $16 trillion by 2030

- An additional 1.2% annual growth in GDP is expected from AI
  
  - 0.3% annual growth in the 1800s for the steam engine
  
  - 0.4% annual growth in the 1990s for robotics
  
  - 0.6% annual GDP growth in the 2000s for the spread of IT

Sources: © PricewaterhouseCoopers PwC’s Global Artificial Intelligence Study: Exploiting the AI Revolution
© McKinsey Global Institute. Notes from the AI frontier: Modeling the impact of AI on the world economy
AI Patents are Rapidly Increasing

Patent Families by AI Technology

<table>
<thead>
<tr>
<th>Technology</th>
<th>0</th>
<th>50,000</th>
<th>100,000</th>
<th>150,000</th>
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<tbody>
<tr>
<td>Logic programming</td>
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<td>Fuzzy logic</td>
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<tr>
<td>Ontology engineering</td>
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<td>Probabilistic reasoning</td>
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AI Patent Families by Application

(Source: WIPO Technology Trends 2019 - Artificial Intelligence)
Top Patenting Universities and Public Labs in AI

How Does Machine Learning Work?

• Train with data
• Verify with new data
• Use with real world data
• Continue to learn from the real-world data

Source: University of Cincinnati
Example – Recognizing a Blueberry Muffin
Muffin or Puppy?

- **Preprocessing** - analyze the blueberries/eyes/nose:
  - How many?
  - How circular?
  - How equilateral?
  - How uniform?
  - How specular?

• Brain
  • Roughly 200 billion neurons
  • Several hundred trillion synapses
  • 2.5 million gigabytes of storage

• Typical Neural Net
  • 1000 nodes/layer
  • One million connections/layer
  • 10 – 100 hidden layers
  • 100 million synapses
  • 0.4 gigabytes of storage
Bagel or Puppy?

Towel or Shar-Pei?

Saruman the White of Middle Earth or Afghan?

What to patent?

- The trained classifier as a black box?
- New inventions in the classifier?
- The features used?
- The entire system?

Source: University of Cincinnati
Challenges in Patenting AI Inventions in the US

• Evolving in the broader context of §101 and *Alice v. CLS Bank*
  • Claims may not be directed to a “Judicial Exception” (“JE”)
    • Laws of nature, natural phenomena, *abstract ideas*
    • Often summarized as “An algorithm [or software] isn’t patentable.”
  • Claims strategy since *Alice*: tie the abstract concept to something tangible – mixed and inconsistent success

• *USPTO 2019 Revised Patent Subject Matter Eligibility Guidance*
  • “a claim that recites a JE is not ‘directed to’ the JE if the JE is integrated into a practical application of the JE”
  • *This has changed the game*

Challenges in Patenting AI Inventions in Europe

• List of “exclusions” from patent eligible subject matter includes
  • “Programs for computers”
  • Mathematical methods

• The EPO issued new guidelines in 2018 affecting patenting AI and ML
  • “…it must be taken into account whether the method, in the context of the invention, serves a technical purpose”; e.g.
    • Controlling a specific technical system or process, e.g. an X-ray apparatus or steel cooling process
    • Providing a medical diagnosis by an automated system processing physiological measurements
  • Claim tangible result or technical implementation specific to the anticipated use

Other Challenges in Patenting AI Inventions

• But AI faces additional challenges unique to the field
  • § 101 Patentable subject matter
  • § 102 Novelty
  • § 103 Not obvious to one skilled in the art
  • § 112 Enablement
  • Detection of infringement
  • Inventorship and ownership

• Culture of sharing permeates research community

• Questionable relevancy of the technique by the time a patent issues
An Alternative to Patenting AI Inventions

• A very valuable machine learning implementation may not be patentable
  • Use of a commercial machine learning package isn’t novel
  • Input may be obvious; e.g. temperature, heart rate, blood pressure, oximetry,…
  • Training method or feature extraction is knowhow rather than invention

• But data may be the thing of value
  • Access to millions of users’ internet activity; e.g. Google or Facebook or Amazon
  • Human medical data
  • Geographically dispersed or wildly different formats
Alternatives to Patenting

• Protect Data as a Trade Secret
  • Pros
    • Nothing taught to competitors
    • Immediate competitive advantage with known bounds
  • Cons
    • No legal barrier to competition
    • Data can be replicated by others if the market justifies the cost
    • Investors may be less familiar with copyrights and trade secrets
    • Does the owner really own the data?

• License the research code under a copyright license
  • Provides head start via knowhow
  • Provides short term competitive advantage
  • Advantage quickly fades over time.
  • Equity-only license often used
What to patent?

- The trained classifier as a black box?
- New inventions in the classifier?
- The features used?
- The entire system?

Source: University of Cincinnati
Example of Claims on Deep Learning Structure (pre-Alice)
Example of Claims on Deep Learning Structure (pre-Alice)

For example, the foregoing tables of parameter values are given by way of illustration and not limitation. Other parameter values are suitable.

What is claimed is:

1. An artificial visual recognition system comprising:
   a digital processor; and
   a model that effectively replicates a visual cortex, the model executed by the digital processor and having a loose hierarchy of layers, each layer, from a lowest hierarchy level to a top level, providing increasing selectivity and invariance of an input image such that model output produces feature recognition and classification of an object in the input image, the hierarchy allowing bypass routes between layers, at least one bypass route from a layer at one level to a higher layer enabling increased selectivity and decreased invariance to the input image at the higher layer relative to a layer at a hierarchy level succeeding the one level, the at least one bypass route corresponding to a direct projection in the visual cortex.

2. A system as claimed in claim 1 wherein at one or more layers selectivity is learned in an unsupervised manner.

3. A system as claimed in claim 2 wherein selectivity is learned from a data set of natural images.

4. A system as claimed in claim 2 wherein the layer at the top level in the hierarchy is task dependent and undergoes supervised learning.
What to patent?

- The trained classifier as a black box?
- New inventions in the classifier?
- The features used?
- The entire system?

Source: University of Cincinnati
Example of Claims on Entire System

(12) United States Patent
(10) Patent No.: US 9,867,573 B2
(45) Date of Patent: Jan. 16, 2018

Giancarlo et al.

(54) APPARATUS AND METHOD FOR SOFT TISSUE FUNCTION CHARACTERIZATION

(71) Applicant: Massachusetts Institute of Technology, Cambridge, MA (US)

(72) Inventors: Lucy Giancarlo, Dedham, MA (US); Alvaro Sanchez-Feito, Cambridge, MA (US); Ian Butterworth, Cambridge, MA (US); Carlos Sanchez Mendoza, Storrs (US)

(73) Assignee: Massachusetts Institute of Technology, Cambridge, MA (US)

(51) Int. CL: A61B 5/00 (2006.01)

(52) U.S. CL: 616/1597; 2013.01; 616/5/128 (2011.01); 616/5/092 (2013.01)

(56) References Cited

U.S. PATENT DOCUMENTS

WO 2011/087960 A2 7/2011
WO 2012/090021 A2 9/2012

FOREIGN PATENT DOCUMENTS

WO 2013717532 A2 7/2013
WO 2013715352 A2 9/2013

OTHER PUBLICATIONS

Primary Examiner — Air T Nguyen

Attorney, Agent, or Firm — Will, Ganzfield & Nicks, PLC

(57) ABSTRACT

Analysis of kinematic dynamics performed by an individual can be used for estimation and monitoring of the individual's motor function. Kinematic events related to a near-panning or near-jabbing motion on a keyboard or mouse on a computer can be analyzed to assess distributions of kinematic event metadata. The plurality of distributions may be used to identify one or more features indicative of variability among the distributions and
Example of Claims on Entire System

FIG. 1
Example of Claims on Entire System

FIG. 2
Example of Claims on Entire System

21. A method of characterizing motor function of a user by analyzing an input by the user to a user interface of at least one computing device, the method comprising:
receiving a sequence of keystroke events indicating that the user pressed at least a portion of the user interface over a time duration;
determining a plurality of biosignatures indicative of the user’s motor function at different times by determining, for a biosignature of the plurality of biosignatures, a plurality of distributions of keystroke event intervals over at least some of the time duration, wherein each distribution of the plurality of keystroke distributions corresponds to a portion of the time duration; and
monitoring motor function in the user by tracking a condition of the user’s motor function over time based on comparing a first biosignature of the plurality of biosignatures with a second biosignature.

22. The method of claim 21, further comprising:
identifying impairment in the user’s motor function over time based on monitoring the user’s motor function; and
comparing a characterization of the user’s motor function to characterizations of motor function associated with a plurality of conditions and, when the characterization of the user’s motor function matches a characterization associated with a condition, storing an indication that the user may have the condition.

23. An electronic device comprising:
a tactile interface for receiving a plurality of keystrokes,
New in Patent Law – Who is the Inventor when AI Invents?

• Possible “inventors” include

  • Programmer
  • Researcher working with programmer to solve problem
  • Data provider
  • AI entity itself
New in Patent Law – Who is the Inventor when AI Invents?

- The DABUS ("Device for Autonomous Bootstrapping of Unified Sentience") AI Engine
  - Multiple neural networks designed to feed off of and play against each other to improve the output to create something new. ("Generative Adversarial Network")
  - Patent applications filed in the UK, EU, and the US claiming DABUS as the sole inventor:
    - Improved interlocking food container
    - Flashing light that mimics neural activity so it is more noticeable.

- Is DABUS the inventor? If not, who is?

• Stephen Thaler, creator of DABUS, filed two US patent applications July 29, 2019.
  • In an Application Data Sheet, Thaler identified the inventor’s given name as DABUS and stated that the inventions were generated by AI through a “Creativity Machine”.
  • Opined that Congress has not “seriously considered autonomous machine invention”.
  • The applications included an assignment of ownership ostensibly by DABUS to Thaler with both signature lines signed by Thaler.

• USPTO issued “Notice to File Missing Parts”, noting the absence of a human inventor.

• Thaler instead filed a petition restating his position and asking the USPTO to vacate its “Notice to File Missing Parts”.


- USPTO denied request for reconsideration on December 17, 2019,
  - Cited the Patent Act of 1790 and subsequent case law
  - “Inventor” must be an individual human

- Thaler as Plaintiff brought suit against the USPTO as Defendant in the US District Court for the Eastern District of Virginia.

- Court forcefully and clearly ruled for the USPTO, saying, “The plain meaning of ‘Individual’ is ‘Human Being’.”

- Nonetheless, the USPTO continues to study the question and solicit public comment.

- Act of Congress would be required to redefine “Inventor”
Thank You – Questions?

Can’t we just use artificial intelligence to manage our sales funnel for us?

I found four places that sell funnel cakes fairly close to you.