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ARTIFICIAL INTELLIGENCE (AI) BOOT CAMP

Patenting of AI/ML Inventions in Europe

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David V. Sanker, Ph.D. and Alexandra Koseva

Host

Andrew J. Gray IV

Presenters

David V. Sanker, Ph.D.

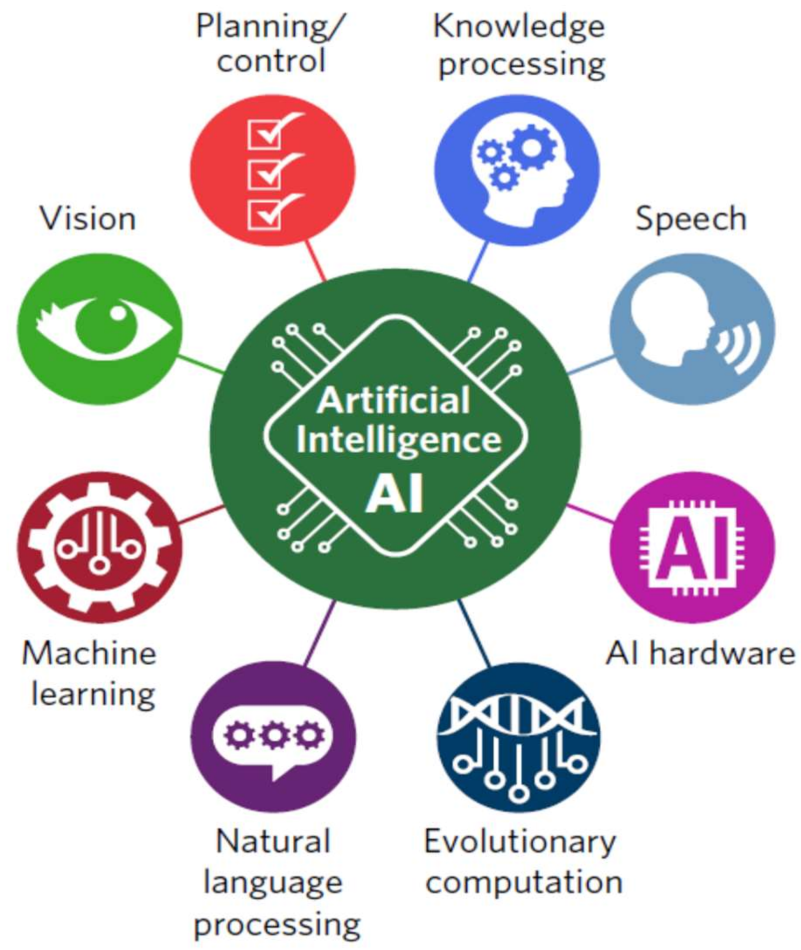
Alexandra Koseva

Morgan Lewis

Background in Artificial Intelligence

The term "Artificial Intelligence" is very broad.

Most inventions that use AI are using **machine learning**.



Patenting of AI/ML inventions generally

- Look for inventiveness in something other than the Artificial Intelligence; and/or

- Modify the Artificial Intelligence itself (e.g., the training process).

Patenting of AI/ML inventions in the United States

- Subject Matter Eligibility under § 101
  - Provide enough technical disclosure in the specification and claims
  - Focus on the technical innovation instead of just "applying AI"

Patenting of inventions created by AI systems

- In some cases, autonomous AI systems are “inventing” new products and systems.
- If an invention is created entirely by AI, then it is not patentable in the United States.
- If an invention is created entirely by AI, then it is not patentable in the United Kingdom.
- The same result is expected in Europe generally.

Patenting of AI/ML inventions in Europe

- Areas of innovations in AI/ML that are worth exploring for patenting
- Review of EPO's Guidelines
- Case Law by EPO's technical board of appeal
  - Example cases with technical and non-technical *applications*
  - Examples cases of technical *implementations*
  - Example cases of non-enablement
- Practical tips

Machine Learning

- Machine learning techniques are used for problems that cannot be solved efficiently or effectively in other ways
  - Problems that resist logical or procedural solution
  - Ineffective to write if-then statements to perform a task (e.g., spam classification)
- Constructing a computer program that learns by itself from experience
- ML is a multidisciplinary - computer science, statistics, mathematics, and engineering

Machine Learning

- "A computer program is said to learn from experience **E** with respect to some class of tasks **T** and performance measure **P**, if its performance at tasks in **T**, as measured by **P**, improves with experience **E**."
- In the spam/non-spam example
  - examples (E) are emails we have collected.
  - the task (T) is a decision problem (called classification) of marking each email as spam or not
  - performance measure (P) would be something like accuracy as a percentage (correct decisions divided by total decisions made multiplied by 100) between 0% (worst) and 100% (best).

ML Model vs. ML Algorithm

- An "**algorithm**" in machine learning is a procedure that is run on data to create a machine learning "model," for example:
  - Classification, e.g., k-nearest neighbors
  - Regression, e.g., linear regression
  - Clustering, e.g., as k-means
- A "**model**" in machine learning is the output of a machine learning algorithm run on data, for example:
  - The linear regression algorithm results in a model comprised of **a vector of coefficients with specific values**
  - The neural network / backpropagation / gradient descent algorithms together result in a model comprised of **a graph structure with vectors or matrices of weights with specific values**
  - Libraries with machine learning alrgorithms – e.g., scikit-learn library

Areas of innovations in ML to consider for patenting

- **Unique model design**
  - topology, activation functions, end conditions
- **Selecting and/or generating the training data**
  - E.g, data augmentation
- **Training of the model using the selected/generated training data**
  - How to reduce variance or bias
- **Deploying the model on a target hardware/device**
  - Tranforming or adapting the trained model to be run on specific hardware
- **Post-deployment processing**
  - Making a prediction for new data using the deployed model
  - Using the prediction to take an action in the computer or physical environment

Patentable Inventions – Art. 52(1) EPC

- any inventions, in all fields of **technology**
- **Exclusions**
  - (a) discoveries, scientific theories and **mathematical methods**;
  - (b) aesthetic creations;
  - (c) schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers;
  - (d) presentations of information.
- **Excluded** only **"as such"**
- Like Step 1 of **Alice's** two-part framework for patent eligibility in the US

Software Patents – "Two Hurdle" Approach at the EPO

1. **Patent-eligibility**: a single technical feature in the patent claim is enough – any hardware, even trivial, passes this hurdle (**T 0258/03)**
2. **Inventive step:** only the technical features can establish non-obviousness
   - Examiner ignores non-technical features even if not found in the prior art
   - A "**further technical effect**" is required - beyond the "normal" physical interactions between the program (software) and the computer (hardware) on which it is run
   - Like Step 2 of Alice's framework

EPO’s practice for examining AI-related inventions

- No guidance prior Nov. 2018 edition of EPO’s Guidelines - **Chapter G-II, 3.3.1**
- Inventions relating to AI/ML are examined in the same way as inventions involving **mathematical methods**
  - “Artificial intelligence and machine learning are based on computational models and algorithms for **classification**, **clustering**, **regression** and **dimensionality** reduction…[that] are per se of an abstract mathematical nature, irrespective of whether they can be "trained" based on training data”
  - Features such as "**support vector machine**", "**reasoning engine**" or "**neural network**" are thus presumptively non-technical and cannot alone support inventive step
- **Two safe harbors** –
  - (1) **Technical Implementation**
  - (2) **Technical Application**

Safe harbor (1) - Technical Implementation – G-II 3.3

- ML model design, training, and/or deployment specifically adapted to underlying hardware or internatal funcitioning of a computer
- Example **EP1569128B1**
  - System and method for accelerating and optimizing the processing of machine learning techniques using a graphics processing unit
  - details of how a central processing unit (“CPU”) interacts with a graphics processing unit (“GPU”) to perform a machine learning technique, and specified various types of data that are communicated between the CPU and GPU

Safe harbor (2) - Technical Application – G-II 3.3

- **Specific** technical purpose required
  - "Controlling a technical system" not specific enough
- The **claim is to be functionally limited** to the technical purpose, either explicitly or implicitly
  - Linking the mathematical method causally to a technical effect
- Defining nature of the input data is not enough to confer technical character
  - Technical data not enough, must be used for technical purpose
- Valuable mathematical properties (e.g., robustness) of the alrorithm not enough to confer technical character

Safe harbor (2) - Technical Application

- Examples in EPO's Guidelines
  - controlling a specific technical system or process, e.g., an X-ray apparatus or a steel cooling process
  - **digital audio, image or video enhancement or analysis**, e.g., de-noising, detecting persons in a digital image, estimating the quality of a transmitted digital audio signal
  - **separation of sources in speech signals**; **speech recognition**, e.g., mapping a speech input to a text output
  - determining the energy expenditure of a subject by processing **data obtained from physiological sensors**; deriving the body temperature of a subject from data obtained from an ear temperature detector
  - providing a genotype estimate based on an analysis of DNA samples, as well as providing as providing a confidence interval for this estimate so as to quantify its reliability
  - providing a medical diagnosis by an automated system processing physiological measurements
  - encrypting/decrypting or signing electronic communications; generating keys in an RSA cryptographic system
  - optimising load distribution in a computer network

Technical Application – Case Law

- The classification of digital images, videos, audio or speech signals based on low-level features (e.g., edges or pixel attributes for images) are further typical technical applications of classifiction algorithms (**G-II, 3.3.1**)

- The gist of the invention was essentially to increase the diversity of exemplar images used to train a semantic classifier by systematically altering an exemplar colour image to generate an expanded set of images with the same salient characteristics as the initial exemplar image (**T1286/09**)

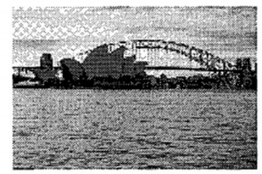


FIG. 6(a)

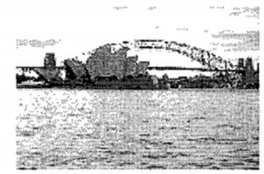


FIG. 6(b)

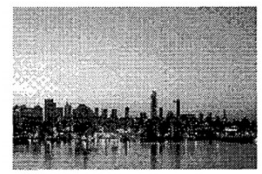


FIG. 6(c)

FIG. 6(d)

FIG. 6(e)

FIG. 6(f)

T1286/09 – Method using image recomposition to improve scene classification

(a) providing an exemplar colour image;

(b) systematically altering the exemplar colour image to generate an expanded set of images,

- wherein systematically altering the exemplar colour image comprises:

i) **spatially altering** the exemplar colour image to generate an expanded set of spatially altered images,

wherein spatially altering the exemplar colour image comprises:

- **horizontally mirroring** the exemplar colour image, thereby doubling the number of images in the expanded set of images, or
- **systematically cropping** the edges of the exemplar colour image from one or more sides of the exemplar colour image, thereby increasing the number of images in the expanded set of images; and/or

ii) **temporally altering** the exemplar colour image to generate an expanded set of temporally altered images,

whereby the images in the expanded set simulate the appearance of capturing an image earlier or later in time,

wherein temporally altering the exemplar colour image comprises:

- **systematically shifting the colour distribution** of the exemplar colour image, thereby increasing the number of images in the expanded set of images, or
- **systematically shifting the illuminant quality** of the exemplar colour image, thereby increasing the number of images in the expanded set of images; and

(c) **using a semantic** classifier and the expanded set of images **to determine an image classification** for the exemplar colour image;

(d) **wherein the expanded set of images are used to train the classifier in step (c), thereby providing an improved classifier.**

T 0598/07 – Using neural network to identify arithmia

- Use of a neural network in a heart monitoring apparatus for the purpose of identifying irregular heartbeats (**G-II, 3.3.1**)
- Technical Application not questioned in the decision
- Distinguishing features over the closest prior art
  - the formed n dimensional (four-dimensional) vector representative of each pulse is first compared with a irregular heartbeat n dimensional volume and subsequently with a regular heartbeat n dimensional volume;
  - data processing is carried out by **Kohonen neural network** means

Non-technical Applications of Classification

- **Classification of text documents** (T 1358/09)
  - Whether two text documents in respect of their textual content belong to the same "class" of documents is not a technical issue
  - The mere fact that an algorithm leads to reproducible results does not imply that it makes a technical contribution
- **Utilizing a probalistic classifier to detect "junk" email** (T 022/12)
  - Classification of messages as a function of their content is not technical…immaterial whether the messages are electronic
  - De-automatation by having a human perform steps is not technical
  - A support vector machine is a mathematical methods and does not provide TE
  - Reducing complexity of an algorithm is not necessarily technical
    - Could be technical if motivated by internal workings of the computer

Non-technical Applications of Classification

- **Classification of search engine resources (e.g., as spam/non-spam) using deep learning** (T 0874/19)
  - Spam classification is a non-technical problem
  - Automatic classification of resources into categories is a non-technical task
  - Recommending data items to a human in response to a query does not serve a technical purpose
- **Scoring concept terms for online advertising using deep learning** (T 0872/19)
  - Classifying features of a web page to improve the placement of advertisements is not technical
  - the "relevance" of the advertisement to a web page is generally based on semantic content or visual attractiveness, and it does not confer technical character

Summary

- **ML algorithm/model even if new and non-obvious could be regarded as a mathematical method that lacks the technical features needed to support an inventive step**
- **Take advantage of either safe harbor if you can -> but be wary it sacrifices scope of protection**
- **The safe harbors need to be disclosed in the spec**
- **You only need one of the safe harbors**

Other problematic areas

- **Recommender systems**
  - *"Selection of an item, for example a song, for recommendation to a user does not qualify as a technical purpose. From a technical point of view, it is irrelevant what songs are recommended to a user."* (T 306/10)
- **Natural language processing**
  - Speech recognition is explicitly recognized as technical
  - Machine translation problematic
    - *"Features or aspects of the method which reflect only peculiarities of the field of linguistics, however, must be ignored in assessing inventive step" (T 1177/97)*

Sufficiency of the Disclosure

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Sufficiency of the Disclosure – Art. 83 EPC

- **The European patent application shall disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art**
  - Not sufficiently disclosed if a skilled person has to carry out a research programme based on trial and error to reproduce the results of the invention, with limited chances of success. (F-III 3; T 38/11)
- **How much disclosure is sufficient?**

T 0161/18 – Training of ANN insufficiently disclosed (decided May 2020)

- Using ANN to transform a blood pressure curve measured at the periphery into equivalent aortic pressure for the purposes determining cardiac output non-invasively (e.g., what volume of blood does the hear pumps out)
- With respect to training of the ANN, the spec only disclsoses that the input data should cover a broad spectrum of patients of different age, gender, constitutional type, health condition and the like
- No disclosure of what input data is suitable for training the ANN, or at least **what data record is suibale for solving the underlying problem**
- The claimed ANN was not adapted for the specific claimed application
- Issue was raised by the appeal board
- Enablement was not raised in corresponding US

T 1191/19 – Safely Guiding Interventions in Procedures the Substrate whereof is neuronal plasticity (decided April 2022)

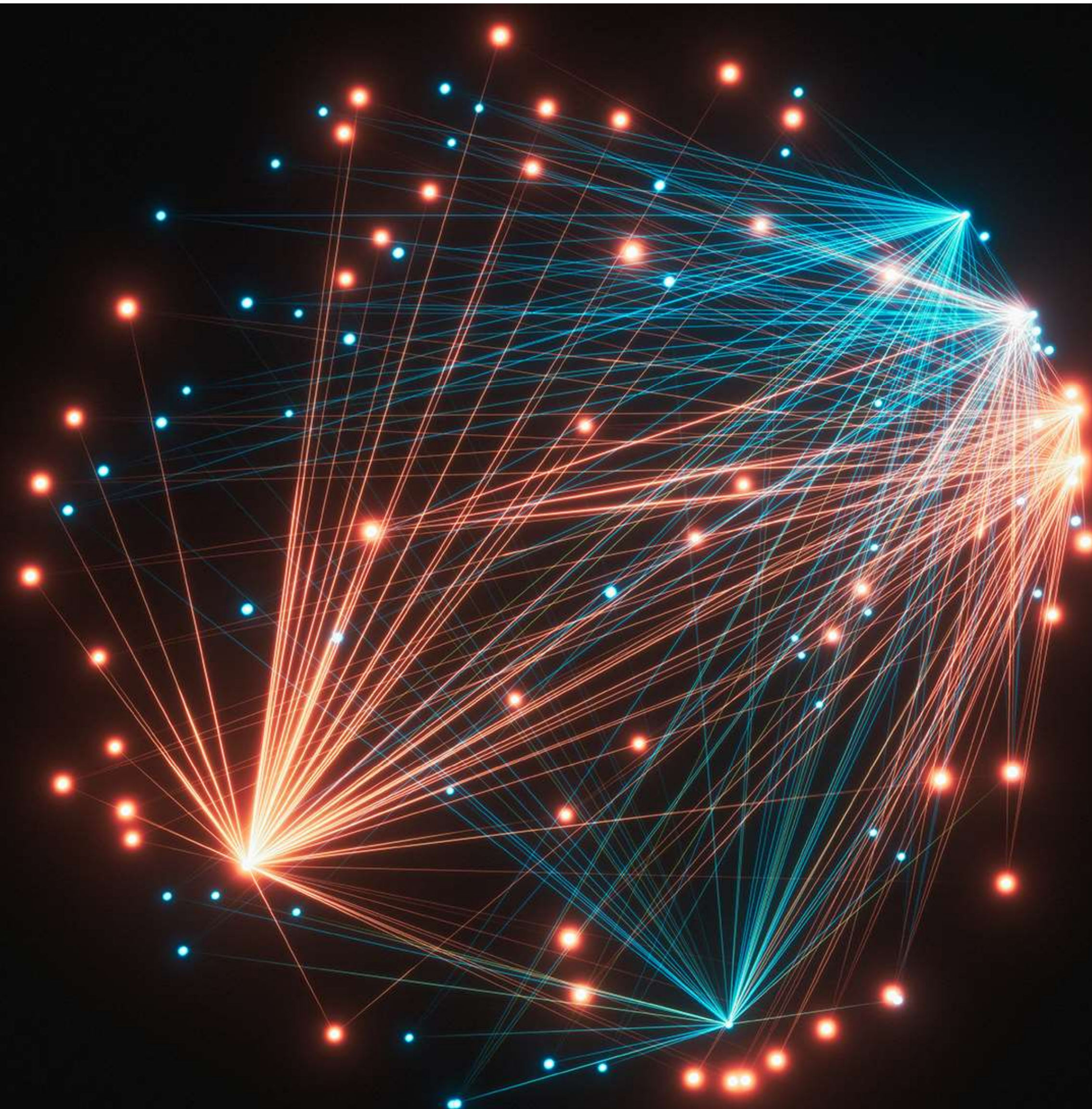
- Not disclosed **how the meta-learning scheme** of AX1 **was applied to the problem at hand** in a manner sufficiently clear and complete
- No disclosure of **example set of training and validation data**, which the meta-learning scheme requires as input
- The application does not even disclose the **minimum number of patients** from which training data should be compiled to be able to give a meaningful prediction and the set of relevant parameters
- The **structure of the ANN** used as classifiers, their **topology**, **activation functions**, **end conditions** or **learning mechanism**
- The available disclosure is more like an **invitation to a research programme**

Summary

- EPO appears to require
  - description of what training data is suitable; and/or
  - at least one example set of suitable training data
- The mere idea of applying machine learning to a known problem (with no further detail on how the model is used, implemented, or trained) is unlikely to lead to a patent

Practical Tips and Considerations

- Trade Secret vs. Patent?
- Who you target as a potential infringer?
  - Different entities can train and use the model
- Focus on the how and why (**be specific**)
- Describe potential technical implementations
  - Is the design of the model framework motivated by internal funcitioning of the computer beyond mere programming?
- Describe potential technical applications
  - avoid things related to advertising, methods of doing business, financial applications, games, etc.
  - Descibe how the input, output, training, and/or model design serve a technical prupose
  - avoid relying on subjective user preferences (e.g., positioning of an ad on a web page, or relevance of search results)
- Sufficiently of disclosure much more demanding in Europe compared to US
  - Balance between disclosing enough to meet EPO requirements and protecting commercially valuable information



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Coronavirus COVID-19 Resources

We have formed a multidisciplinary **Coronavirus/COVID-19 Task Force** to help guide clients through the broad scope of legal issues brought on by this public health challenge.

To help keep you on top of developments as they unfold, we also have launched a resource page on our website at **www.morganlewis.com/topics/coronavirus-covid-19**

If you would like to receive a daily digest of all new updates to the page, please visit the resource page to **subscribe** using the purple "Stay Up to Date" button.

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Biography

David V. Sanker, Ph.D.
Silicon Valley
+1.650.843.7260
david.sanker@morganlewis.com

Drawing on 12 years of experience in software development and database architecture, David V. Sanker, Ph.D., works with clients to build strong patent portfolios in a variety of areas, including artificial intelligence (AI), machine learning, natural language processing, data visualization software, large-scale database architecture and storage infrastructure, data analytics software, and touchscreen technology. As AI tools have become widely available, inventions that use AI have become an increasing portion of his work, including inventions in industrial automation and life sciences.

Biography

Alexandra Koseva
Silicon Valley
+1.650.843.7211
alexandra.koseva@morganlewis.com

As a qualified US and European patent attorney, Alexandra Koseva brings a cross-jurisdictional approach to her intellectual property (IP) practice. With a B.S. in computer science, Alexandra focuses primarily on software patent prosecution. She has worked on matters involving a range of technical fields, including artificial intelligence and machine learning, Internet technologies, mobile applications, databases, computer architecture, computer user interfaces, data visualization, and data analytics software. Alexandra is fluent in Bulgarian.

Biography

Andrew J. Gray IV
Silicon Valley
+1.650.843.7575
andrew.gray@morganlewis.com

Serving as the leader of the firm's semiconductor practice and as a member of the firm's fintech and technology industry teams, Andrew J. Gray IV concentrates his practice on intellectual property litigation and prosecution and on strategic IP counseling. Andrew advises both established companies and startups on AI, machine learning, Blockchain, cryptocurrency, computer, and Internet law issues, financing and transactional matters that involve technology firms, and the sale and licensing of technology. He represents clients in patent, trademark, copyright, and trade secret cases before state and federal trial and appellate courts throughout the United States, before the US Patent and Trademark Office's Patent Trial and Appeal Board, and before the US International Trade Commission.

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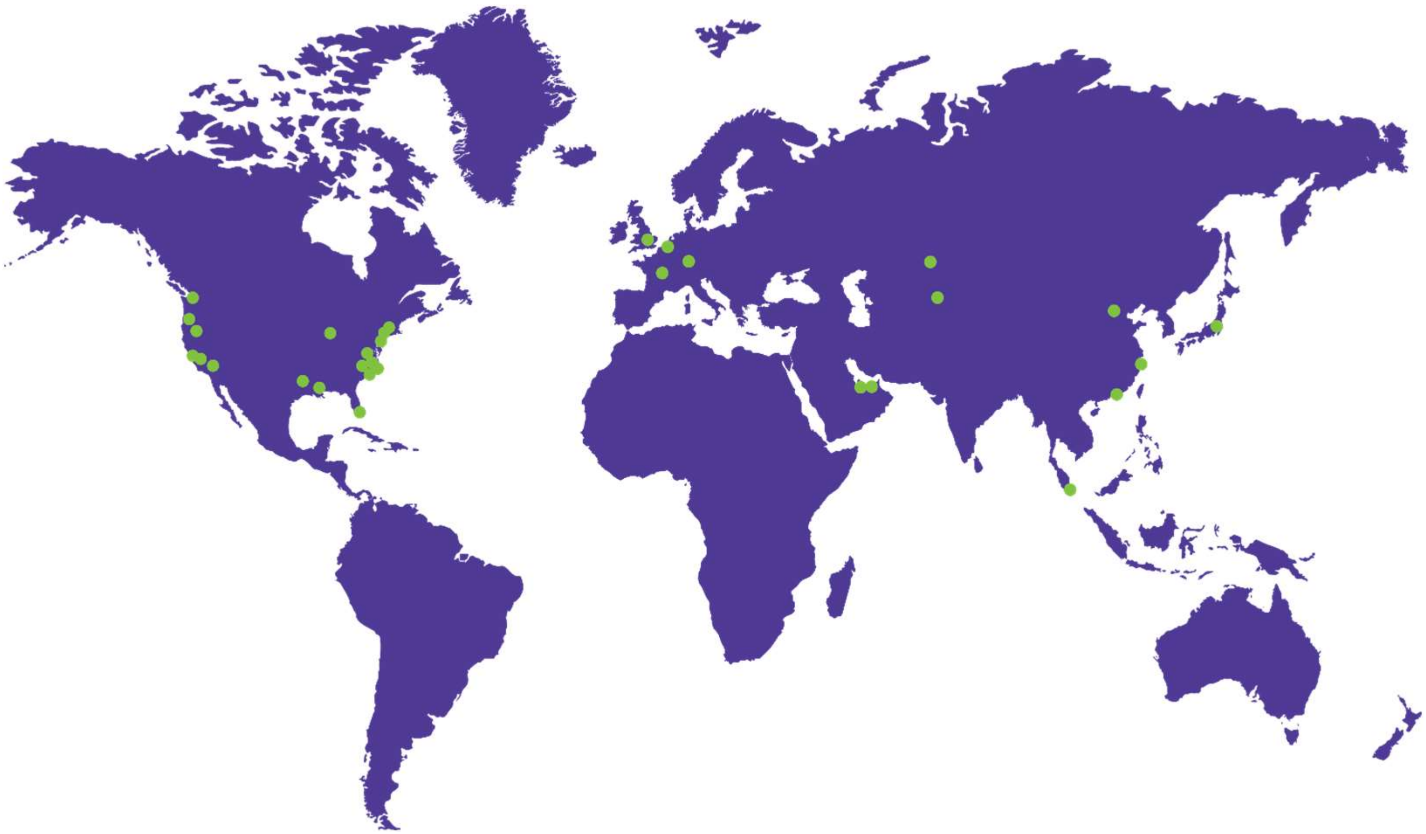

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