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| **Invention Disclosure Form**  EE CS Patent Group  1540 East Front Street, Suite 100  Clayton, NC 27527-5492  <https://www.eecspatentgroup.com/> | | |
| **INSTRUCTIONS:** Fill each blank with the requested information or enter "NONE" as appropriate. For computer-implemented or digital inventions please also complete our Digital Invention Disclosure Addendum beginning with section 18 below. Where space on the form is inadequate, enter "see attached page" and use additional plain pages as needed. When completely executed, this form may become an important legal document. After completing, return in Word format by email to [herb.lacey@eecspatentgroup.com](mailto:herb.lacey@eecspatentgroup.com?subject=Questions%20About%20Invention%20Disclosure%20Form). If you have any questions, please contact us at +1(877) 711-3560. | | |
| **PART I. BASIC INFORMATION** | | |
| **1. INVENTION TITLE:**  (Note: Please enter a *descriptive* title which describes your invention) | | |
| **2. INVENTORS (LEGAL NAME, ADDRESS, TELEPHONE AND EMAIL)** | | |
| Legal Name (Include Middle Initial) | Mailing Address | Telephone & Email |
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| **3. OWNER OF PATENT RIGHTS.** Who will own the patent rights to the invention:     * **Inventor(s).** The inventor(s) identified above own the patent rights (if there are two or more inventors identified, they will have joint ownership – it is recommended to have a company own the patent rights if there are two or more inventors). * **Company.** A company owns the invention and patent rights.      * + Legal Name of Company:      * + State of Organization: * **Obligation to Assign.** Do you have an obligation to assign right in the invention to someone else? For example, if the invention was made while you were working for someone else, or using resources belonging to someone else, they may have rights to the invention. Do you have an agreement with your employer that you will assign any inventions you may make to the employer?   + Legal Name of Employer: * Effective Date of Agreement: * **Consulting Agreement(s).** Was the invention developed in the course of a consulting agreement with someone else? If so, did you agree that any inventions belong to them?      * **Government / University Funding.** Was there any funding of the development of the invention by any party (government agency, school, etc.) who might claim rights in the invention? | | |
| **4. PRIOR USE, SALE OR PUBLICATION.** Identify any past use, sale, display or publication of the invention (include dates). | | |
| **5. RELATED PATENTS OR APPLICATIONS.** List any related patents or patent applications of yours**.** | | |

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| **PART II. DISCLOSURE OF INVENTION** |
| **6. PURPOSE.** State the purpose of the invention. |
| **7. PRIOR EXISTING TECHNOLOGY.** Describe the previous old methods, materials or apparatus used by others to implement features similar to the invention and give their limitations/disadvantages. |
| **8. PHYSICAL STRUCTURE OR IMPLEMENTATION.** Describe the physical structure or implementation of your invention. **Sketches, photos, schematics, block diagrams, process flow charts, or other illustrations should be attached to this form to fully describe and illustrate your invention.** In the description of the physical structure or implementation, use reference characters to refer to components or process steps in attached illustrations. |

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| **9. OPERATION/FUNCTION/USE.** Give a detailed description of the invention's operation, function and use. |
| **10. ALTERNATIVES.** Indicate any alternative methods, materials, or apparatus of the invention. |
| **11. NEW FEATURES.** Identify all of the features of the invention believed to be new or unique. |
| **12. ADVANTAGES.** State the advantages of the invention over the Prior Existing Technology described in paragraph 7. |
| **13. CONCEPTION.** Describe any problems the inventor was trying to solve when the inventor conceived of the invention. |
| **14. STICKING POINTS – REDUCTION TO PRACTICE.** Describe any problems the inventor had to solve in addition to the invention’s conception, to make the invention workable. |
| **15. PROBLEM - SOLUTION.** State the problem(s) the invention solves, and describe how the invention solves the problem(s). |
| **16. COMMERCIAL COMPETITION.** Describe how the inventor might recognize the invention if they saw the invention in a commercially available product or service. |
| **17. COMMERCIALLY VALUABLE CHOKE-POINTS.** Describe the essential invention features, elements, or steps that a competing product or service would need to have to provide the invention’s Problem Solution(s) described in paragraph 15. |
| 1. **Digital Invention Disclosure Addendum**   Disclosing your digital invention in adequate detail will help us make a stronger case for a patent in your application. This Digital Invention Disclosure Addendum can help guide you to providing a useful invention disclosure. Successful patent applications make a case that the point of novelty (PoN) of your invention is patentable. A great patent application may tell a story emphasizing the invention's PoN, the technical effects of the invention and benefits the invention provides. Your invention’s story can begin with a high-level introduction to the PoN.  **What is your invention's PoN**?                        `  **18-A. Very High-level Introduction to PoN**  For this section of your Digital Invention Disclosure please very briefly describe your invention's PoN in two to four sentences emphasizing how your invention is an improved or a different technical solution to a technical problem than previous technology. This introduction should be what you might say or write if you only had thirty seconds to tell an investor or licensee why they should acquire your invention.  For example, **please fill in this example introduction** (repeat if there is more than one PoN or problem / solution):  Conventional \_\_\_\_\_\_\_\_\_ [devices / systems / algorithms / ...] do \_\_\_\_\_\_\_\_\_ by [ sending / … ] \_\_\_\_\_\_\_\_\_ to a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ to obtain a \_\_\_\_\_\_\_\_\_\_\_\_ [prediction / measurement / model / … ] of \_\_\_\_\_\_\_\_\_ using \_\_\_\_\_\_\_\_.  However, obtaining \_\_\_\_\_\_\_\_\_\_ this way results in \_\_\_\_\_\_\_\_\_\_ [error / deficiency / inefficiency / ...] because of \_\_\_\_\_\_\_\_\_\_\_\_\_ .  Our new \_\_\_\_\_\_\_\_\_\_ [device / system / algorithm / ...] prevents this \_\_\_\_\_\_\_\_\_\_ [error / deficiency / inefficiency / ...] by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  The \_\_\_\_\_\_\_\_\_\_\_ [prediction / measurement / model / … ] obtained by our new \_\_\_\_\_\_\_\_\_ [device / system / algorithm / ...] is more [ accurate / smaller / efficient / cost effective / ... ] as a result of our new \_\_\_\_\_\_\_\_ [device / system / algorithm / ...] design that does \_\_\_\_\_\_\_\_\_\_\_ by \_\_\_\_\_\_\_\_\_\_ .  A \_\_\_\_\_\_\_\_\_\_\_\_\_\_ [device / system / algorithm / ...] with our new design may be useful in \_\_\_\_\_\_\_\_\_\_\_\_ [ business / industry / ...] for producing \_\_\_\_\_\_\_\_. |
| Please suggest alternatives to features of the PoN statement you developed above. For example, could one or more operations or devices be different than the examples you provided above? |
| **18-B. Operating Environment and Internal Design**  Please **describe your digital invention's operating environment, internal design and processing**. Structural block diagrams and process flow diagrams are preferred, and swim-lane or ladder diagrams work in some cases, but the best format is whatever would work for you to communicate your new design to engineers tasked with developing your system. Photographs of hand-sketched diagrams drawn on paper or a dry erase board will be fine.  For this section of your Digital Invention Disclosure **please provide**:  **One to three block diagrams** showing the internal structure of the invention, the invention's operating environment, external resources, network connections, client systems and data flow. An internal structure diagram might show logical or functional interfaces between subsystems or components such as data input / acquisition, preprocessing / analysis, caching, trained machine learning models, training data, production algorithms, training algorithms, databases, data types / sources and cloud services.  At least one or two **process flow diagrams** (e.g., flowcharts) depicting your invention's processes and operations that produce outputs from the inputs and different paths or branches through the processes. Different paths or branches through the processes may depend on run-time conditions such as variations in request type, data quality / content or resource availability. Process diagrams with at least one block per stage or operation will be useful as a starting point for your patent professional to ask more questions about your invention. If the operations or processing stages occur on different systems at different times, please number the steps in order and indicate which system or subsystem performs each operation. For example, in some inventions a server process may be more valuable, but a client process may be novel and patentable as well. Showing message flows and processing steps from different points of view may help your patent professional draft claims to protect more than one aspect of your invention.  Here are examples of what useful Operating Environment and Internal Design diagrams might show:   * The types of inputs received by the invention, for example a network packet, a request from a client system, a user interface input, computer vision, image, audio or electronic signal, a detection, a command or sensor data from a user or a physical external system; * Input processing performed by the invention to prepare raw input into a format useful for the invention to produce output or results, for example scaling, filtering, or sampling; * Internal design that causes the invention's effects, such as for example process steps, operations, algorithms or program structure in a computer-implemented system configured to control a machine or a physical process, generate a visualization of a physical system in an augmented reality environment, train a machine learning system or model, associate data from one source with data from another source in response to an external action and cause an effect at particular location and time, or optimize scheduling or allocation of resources across multiple client systems; and * The type of output or results generated by the invention and what the invention affects in the outside world, for example signals, notifications, text, audio, source code, video, image, resource allocation, control outputs directing an external system to perform physical operations, a generated query for input to an external system or a prediction from a machine learning model. |
| **18-C. Machine Learning (ML) Design and Deployment**  Some digital inventions employ ML techniques to provide a technical solution to a technical problem.  When considering patent eligibility of ML innovations, we categorize them as either "core" or "applied" ML. “Core” ML innovations are often mathematical in nature (e.g., a new activation function), and therefore considered abstract and patent ineligible by courts interpreting patent laws around the world. On the other hand, an applied ML innovation will likely be patent eligible if used to solve a technical problem and if either the technical use (“applied” ML innovation) is novel and non-obvious, or the ML component is adapted in a novel and non-obvious way to solve the technical problem.  For this section of your Digital Invention Disclosure please **describe how your invention employs ML techniques**. For example, how does ML work in the PoN statement you developed above? Is the technical solution better because of ML? Is ML essential (that is, is the effect of the invention impossible without your ML design)?  **What are the technical effects of your ML innovation**? For example:   * ML technical effects may result from an improved training process or model structure. Improved training may be faster or result in a more accurate model because of a new model structured to arrange elements for enhanced training. For example, a model having engineered features, scaling or pooling layers may be organized to optimize training and inference operations. Such a design may converge faster during training permitting more rapid iteration over the development cycle, reduce resource requirements and improve energy efficiency. New cost functions or loss functions may reduce overfitting and reduce workload training large models. * ML technical effects may result from improved data processing. Innovative training or production data processing through novel vectorization techniques, for example, may enhance efficiency of training and inference. Such improvements may be more effective on specialized hardware such as GPUs configured in a novel way or with caching arrangements designed to optimize processor utilization for structured data. More accurate and reduced size models may result from new data sources, new techniques for improved labelling for supervised learning or new supervised or pseudo-supervised learning methodologies. Model performance may be increased because of new training data augmentation processes which increase training data size and enable the model to be more effectively trained.   ML technical effects may be found in the following areas, for example:   * Improved control of a technical system or process (robot, car, drone, safer, faster) * Improved processing of data representing a physical system (face recognition / medical analysis, image processing, natural language processing, image / audio / text classification (cat / not cat, spam / not spam, faster, more accurate, more robust against noise) * Improved use of memory or storage capacity * Reduced network or processor bandwidth requirements * Improved measurement accuracy * Reduced I/O bandwidth requirements * Faster / more space efficient training * Producing a new control signal for improved control of a machine * Making a previously known prediction accurately with fewer inputs, missing samples or corrupted data * More accurate detection / prediction (persons, events, conditions in sounds, images, video) * Stronger / faster encryption                                               **What components of your invention's ML implementation are new and/or improved and how does each improved component cause a desirable technical effect**? Your potentially patentable innovations may encompass multiple ML model lifecycle stages, e.g., data collection, preprocessing, training, testing, inference / production and/or maintenance. These different ML model lifecycle stages can be claimed individually. Note that a claim to a process for training a model may be less valuable than a claim to a model used repeatedly to make predictions in production. Think about the portions of the lifecycle of an ML system your invention impacts, to help guide your disclosure. If your innovations encompass a new or improved ML operation or design in any of the following areas, **please describe the innovations in detail and explain the resulting technical effects** (e.g., faster training, reduced bandwidth, improved precision / recall, etc.):   * Training the model (stopping criteria - when is the model good enough?) * Using the model * Pre-processing or creating training data set * Pre-processing production data * Training data set, structure, composition, and labeling * Engineered features * How the ML component interfaces with the enhanced device (for example does the machine learning component have a new device-specific interface layer with e.g., preprocessing, sampling, filtering or safety interlocks) * Does the controlling ML system augment a pretrained model with an application-specific training data or training process? * What data is provided to the ML model during training, for example sensor data from the device or external instruments? (what are the input features?) * What data is provided to the ML model during production? (what are the input features?) * What data is output from the ML model during production? (controls?) * Embeddings (does your algorithm map raw data or engineered features to a vector space to compare with other observations?) * Implementing a basic system with only essential features * Deploying a full-scale system with typical features * Computer program, training process * Computer program, production process * ML model architecture, data path(s), skip connections, data structures, layers and hyperparameters * Data outputs from model to external device or system * Training input data path (from inputs through the model(s) to outputs) * Training output data path (from outputs through training algorithm) * Production input data path (from inputs through the model(s) to outputs) * Production output data path (from outputs through interfaces to external device or system) * Data sources for training / inference * Input data arrangement, representation, encoding and compression * Input data scaling, cleaning, mapping, classification, detection, pooling or filtering * Cost function * Loss function and optimization criterion * Optimization process * Hardware configuration, GPUs, multiple cores, cache arrangement, cache policy, cloud architecture / framework * Applying the trained model to improve a host system (for example to control a robot, operate a windshield wiper, make a more accurate diagnosis, etc.) * Downstream application of the improved host system to another problem or system |
| **18-D. Problem Description**  For this section of your Digital Invention Disclosure please **describe the problem your invention solves for humans**. For example, many inventions are a result of a need. The invention may solve a technical problem with a technical design however the inventor often makes an invention to be useful to a human. How will humans benefit or profit from your invention? Who will benefit or profit from using your invention? Who will your top two to three competitors be? What do you want to prevent your competitors from doing in your problem/solution space?  What solutions were available before your invention? **What are the technical deficiencies, inadequacies and/or shortcomings of the prior art solutions**? For example, technical disadvantages of the prior art may relate to lower speed, high energy consumption, toxic waste, difficult model training, sparse data, high error rate, safety problems, security deficiencies and the like.  **What is the closest prior art to your invention**? Use the search engine you are most familiar with to search keywords typically known in the technical field of your invention, that someone facing a similar problem might search for. Please list the keywords you searched for and pick a few documents from the search results that represent the closest prior art. Please describe the deficiencies of the closest prior art documents you found, in contrast with your invention.  Please **describe your invention's technical solution from the perspective of the user**.  For example, use the questions below for an example invention as a guide to describing your invention's technical solution (this example invention uses an ML system to help a pilot control an airplane).   * Is the controlling ML system adapted to the airplane with an intermediate airplane-specific hardware or software interface layer? * Does the intermediate airplane interface layer include preprocessing, signal sampling, filtering inputs and control output safety interlocks? * Do the safety interlocks include a supervisory ML system? * How is the supervisory system trained and validated? * How was the controlling ML system developed (for example, training method, selection / preparation and organization of the training data set, simulated / injected control input, pre-processing the training data, ML model architecture?) * Does the controlling ML system augment a pretrained model with an application-specific training data or training process? * Are these enhancements specific to the existing airplane infrastructure and/or the custom airplane-specific layer”? * What data is provided to the ML model during training, for example sensor data from the airplane or external instruments (radar, navigation systems, weather data, etc.) * What data is provided to the ML model during production? Sensor data? User control input? User queries? Warning beacon signals? * What data is output from the model during production? Control outputs, warnings, or notifications?   **My invention's technical solution is** \_\_\_\_\_\_\_\_\_\_\_\_. **My invention provides this technical solution by** \_\_\_\_\_\_\_\_\_\_\_. |
| **18-E. Simplest Implementation Guide**  For this section of your Digital Invention Disclosure please **expand on the high-level diagrams you provided in section 18-B above with detailed listings, description or diagrams of all your invention's novel and useful features**. Use as many illustrations as required to explain all of your invention's key steps and parts. Remember to describe different stages or phases separately, for example, training, test, calibration, production and maintenance. Please **write at least one paragraph to explain the result of applying each feature, that is, what the input, output or condition may be before the feature operates, how the feature is implemented to cause the effect or generate the output, what the output or condition may be after the feature operates and how that effect/condition or output is a technical advantage over the prior art**. Some features may work together in combination to create an advantageous technical effect; this is fine.                                                              Please identify and **list a subset of the features that are essential to your invention**. That is, what are the fewest features out of those features you have disclosed, that make your invention an improvement over the prior art. For example, identify features or operations of your invention that are missing or different from the prior art. Please list all of the features in order of their value in creating technical advantages over the prior art. If there are multiple combinations that yield a useful invention, please list each combination separately. |
| **18-F. Detailed Construction Manual**  For this section of your Digital Invention Disclosure please **describe in as much detail as necessary how to make and use your invention, in terms that an engineer of ordinary skill would understand and be able to follow to successful completion**. This is essential to obtain a patent. Assume you hired a recent college graduate with a degree in engineering or computer science and you task them with building a full-scale implementation of your invention while you are away. Provide enough options to get them past any sticking points without unreasonable experimentation. Tell them where to obtain test data, code libraries, off-the-shelf components, hardware, pre-trained models, test frameworks, background information such as tutorials and the like. Your patent professional needs a construction guide to prepare your patent application for the person of ordinary skill. Please provide use cases, user stories, flow diagrams, class diagrams, object models, data sets, code, architecture diagrams, engineered features, hyperparameters and the like. Please **write 2-8 (or more) pages as an assembly, test and deployment manual** directed to a new college graduate who understands relevant background but can't be expected to know advanced details of your specific technical field. Please make sure to **provide at least one full end-to-end use case description of the invention operating in a real-world scenario with realistic data**. |
| **18-G. Conclusion**  For this final section of your Digital Invention Disclosure please **describe how your inventive process departed from the conventional approaches of the prior art designers and how you would detect a competitor using your invention**.  What challenges and problems did you have to solve to create the invention and how did you solve them? Please describe how you would detect the use of your invention. **Please describe what you would do to prove an infringer was using the invention**. Ideally use of the invention is visible or simple to detect, however gaining access to a competitor's internal systems may be difficult or expensive. If possible, identify how to find evidence your invention is in use by a competitor, without requiring analysis of the competitor's proprietary or confidential data or systems. |

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| **PART III. PERSON SUBMITTING FORM** | |
| FULL NAME | DATE |
| MAILING ADDRESS | BUSINESS TELEPHONE |
| E-MAIL ADDRESS | CELL PHONE |
| **Complete Invention Disclosure**  By signing this Invention Disclosure, the person signing this Invention Disclosure agrees this Invention Disclosure provided to EE CS Patent Group includes the full and complete invention disclosure.  Signature | DATE SIGNED |

EE CS Patent Group (01-JAN-2024)