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## EUROPEAN UNION LAW PERSPECTIVE ON THE INTELLECTUAL PROPERTY PROTECTION OF ARTIFICIAL INTELLIGENCE SYSTEMS<sup>1</sup>

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### **Bohatchuk D.P. European Union Law perspective on the intellectual property protection of artificial intelligence systems.**

The paper analyzes possible ways of protecting artificial intelligence systems and their elements with the help of intellectual property law from the perspective of European Union law. This paper deals with copyright law, patent law and *sui generis* database protection in relation to artificial intelligence systems.

The paper begins with an analysis of whether and how an artificial intelligence can be protected by means of copyright. The author analyzes the European Union's copyright *acquis* and concludes that the elements of the AI system, as well as the entire artificial intelligence system, that are implemented in software, can be protected by copyright as a computer program if the originality requirements are met. However, the originality requirement is unlikely to be met in all cases in this context. The same issue with the originality requirement applies to potentially possible copyright protection of artificial intelligence systems as databases. Therefore, it is concluded that the fulfillment of copyright requirements for protection of an artificial intelligence system must be established in each particular case.

The author also considers whether patent law is applicable to protect artificial intelligence systems. For this purpose, the provisions of the patent law of the European Union, in particular, of the European Patent Convention, are analyzed. The author concludes that the artificial intelligence system may be patentable as a "computer-implemented invention" in case all the requirements for patent protection are met.

*Sui generis* database protection is also considered as an additional possibility for legal protection of artificial intelligence systems, taking into account that its applicability is limited to the European Union. Whether *sui generis* database protection is applicable to the artificial intelligence system should be decided on a case-by-case basis.

**Key words:** European Union Law, artificial intelligence, copyright law, patent law, *sui generis* database protection, intellectual property law

### **Богатчук Д.П. Право Європейського Союзу з точки зору перспектив захисту прав інтелектуальної власності на системи штучного інтелекту.**

У статті проаналізовано можливі способи захисту систем штучного інтелекту та їхніх елементів за допомогою права інтелектуальної власності з точки зору права Європейського Союзу. Стаття торкається авторського права, патентного права та захисту баз даних *sui generis* відносно систем штучного інтелекту.

Стаття починається з аналізу того, чи може штучний інтелект бути захищений авторським правом, і якщо так, то яким чином. Автор аналізує авторське право Європейського Союзу і робить висновок, що елементи системи штучного інтелекту, а також вся система штучного інтелекту, які реалізовані засобами програмного забезпечення, можуть бути захищені авторським правом як комп'ютерна програма, якщо дотримані вимоги щодо оригінальності. Разом з тим, вимога оригінальності навряд чи

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може бути дотримана у всіх випадках в цьому контексті. Та ж проблема з вимогою щодо оригінальності стосується і потенційно можливого захисту авторським правом систем штучного інтелекту як баз даних. Тому зроблено висновок, що відповідність вимогам авторського права для захисту системи штучного інтелекту має встановлюватися в кожному конкретному випадку.

Автором також розглядається питання про те, чи може патентне право застосовуватись для захисту систем штучного інтелекту. Для цього проаналізовано положення патентного права Європейського Союзу, зокрема Європейської патентної конвенції. Автор приходить до висновку, що система штучного інтелекту може отримати патентну охорону як «computer-implemented invention», якщо дотримані всі вимоги патентоздатності.

Захист баз даних *sui generis* також розглядається як додаткова можливість правового захисту для систем штучного інтелекту, беручи до уваги, що його застосування обмежується Європейським Союзом. Питання про те, чи може захист баз даних *sui generis* бути застосований до системи штучного інтелекту, має вирішуватися в кожному конкретному випадку окремо.

**Ключові слова:** право Європейського Союзу, штучний інтелект, авторське право, патентне право, *sui generis* захист баз даних, право інтелектуальної власності

**Introduction.** Artificial intelligence (AI) is developing rapidly, and AI systems are being used in more and more fields, including the judiciary and law enforcement. At the same time, the issue of legal protection of AI systems has not been comprehensively resolved. Although the topic of intellectual property (IP) protection of AI systems has been studied by renowned legal scholars, in particular, by Alfred Früh, Peter R. Slowinski, Jean-Marc Deltorn, Matt Hervey, Virginia Driver, Tom Woodhouse, Reto M. Hilty, and others, the question of how to protect IP rights in AI systems and their elements still requires legal solutions for a comprehensive answer. **The purpose of this paper** is to analyze the possible means of the legal protection of intellectual property on the AI systems from the perspective of the law of the European Union namely, from the perspective of copyright law, patent law and *sui generis* database protection.

**Main body.** Before we analyze the issue of IP protection of AI systems, it is necessary to clarify some terms and to make some distinctions.

AI system can be defined as “a machine-based system designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments” [1]. The following types of AI systems can be distinguished: (1) classification models, in which the training yields the ML model’s so-called classifier, a mathematical function that assigns an output value or output category to any given input and allows a trained AI system to classify data [2, p. 1, 20, 21] into categories [3, p. 12]; (2) forecast (regression) models, which work on numerical values [4] and are based on learning from historical data [4]; (3) Clustering Models, which nest data together by common attributes, group objects with shared characteristics or behaviors and plan strategies for each group at a larger scale; (4) Outlier Models, that analyze abnormal or outlying data points and (5) Time Series Models, evaluating a sequence of data points based on time [4]. The aim of these types of AI is to predict and forecast future outcomes and results for new data on the basis of historical and existing data [4].

An AI application is most often created and trained in an environment called ‘framework’ [5, p. 347]. The AI Systems, which are most often developed within such a framework, consist of three core features: (1) an architecture, (2) a learning and training method and (3) input data that is used for training in supervised and unsupervised learning [2, p. 1, 8, 9, 14, 15, 19].

The developer needs to set up a model architecture, which provides the general structure for the machine learning application [5, p. 343]. With regards to the learning and training method, two subcategories of Machine Learning can be distinguished [6, p. 6]: (1) supervised learning, when the agent observes input-output pairs and learns a function that maps from input, such as an image, to output which is called a label, and on the basis of the feedback, that provides the correct answer for the labeled training example inputs, predicts the appropriate label (classification, regression models and other types of the above-mentioned AI Systems, except clustering) [7, p. 670, 671, 732, 826; 8, p. 289]; (2) unsupervised learning, when the agent learns patterns of unlabeled input examples without any explicit feedback (clustering as an example) [7, p. 671, 827]. Both subcategories may be combined in semi-supervised learning, when there are input and output for some part of the data, while for other parts only input is available [6, p. 6]. There is also a third, very special subcategory of ML models, namely reinforcement learning, in which no training data is available [8, p. 289] and a decision-making agent learns from a series of reinforcements: rewards and punishments

that provide some indication of the quality of its behavior [7, p. 671, 834]. When AI is trained on data, the performance of the AI system's output improves with higher quality and/or quantity of the training data [9, p. 12]. Once a model meets the expected objectives in the result of the training process, it is a trained model, which can be deployed in the real world, accept previously unseen input and operate independently from its training pipeline [10, p. 87-88].

After a short introduction on some basic aspects of AI, let's analyze the possible means of IP law for the protection of AI systems and peculiarities of implementation thereof. There is a whole range of IP rights that might apply to AI [11, p. 241]. This paper covers copyright law, patent law and *sui generis* database protection in respect of the AI systems.

**Copyright Law.** Further we will focus on copyright first. The InfoSoc Directive defines the exclusive rights of copyright holders [12]. The Rental and Lending Directive determines the following right holders, whom the exclusive right to authorise or prohibit rental and lending belongs to: the author in respect of the original and copies of his work; the performer in respect of fixations of his performance; the phonogram producer in respect of his phonograms; the producer of the first fixation of a film in respect of the original and copies of his film [13].

In general, the rights of an author of a literary or artistic work shall run for the life of the author and for 70 years after his death, irrespective of the date when the work is lawfully made available to the public [14], subject to certain exceptions [11, p. 322].

Computer programs or software can be protected by copyright [5, p. 349]. Article 10(1) of Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement) envisages that "Computer programs, whether in source or object code, shall be protected as literary works under the Berne Convention (1971)" [15]. Article 4 of the World Intellectual Property Organization Copyright Treaty (WCT) also stipulates that computer programs are protected as literary works under the Berne Convention [16]. Accordingly, Article 1 (1) of the Directive 2009/24/EC of the European Parliament and of the Council of 23 April 2009 on the Legal Protection of Computer Programs (Software Directive) stipulates that "Member States shall protect computer programs, by copyright, as literary works" [17]. The Software Directive envisages a rather open definition [10, p. 92] in its preamble: "the term 'computer program' shall include programs in any form, including those which are incorporated into hardware. This term also includes preparatory design work leading to the development of a computer program provided that the nature of the preparatory work is such that a computer program can result from it at a later stage" (recital 7) [17]. Article 1(3) of the Software Directive further specifies that "a computer program shall be protected if it is original in the sense that it is the author's own intellectual creation" [17]. As the Court of Justice of the European Union (CJEU) established in its jurisprudence, "(...) As regards the parts of a work, they are protected by copyright since, as such, they share the originality of the whole work (...) It is only through the choice, sequence and combination of those words that the author may express his creativity in an original manner and achieve a result which is an intellectual creation" (para 1, 45) [18]. In the view of the CJEU, "(...) an intellectual creation is an author's own if it reflects the author's personality (...) That is the case if the author was able to express his creative abilities in the production of the work by making free and creative choices (...) By making those various choices, the author (...) can stamp the work created with his 'personal touch'" (para 88, 89, 92) [19].

According to Recital 8 of the Software Directive, "no tests as to the qualitative or aesthetic merits of the program should be applied" [17]. Article 1(3) of the Software Directive also states: "A computer program shall be protected if it is original in the sense that it is the author's own intellectual creation. No other criteria shall be applied to determine its eligibility for protection" [17].

At the same time, according to recital 11 of the Software Directive, "it has to be made clear that only the expression of a computer program is protected and that ideas and principles which underlie any element of a program, including those which underlie its interfaces, are not protected by copyright under this Directive" [17]. The ECJ explicitly states that "(...) neither the functionality of a computer program nor the programming language and the format of data files used in a computer program in order to exploit certain of its functions constitute a form of expression of that program and, as such, are not protected by copyright in computer programs (...) to accept that the functionality of a computer program can be protected by copyright would amount to making it possible to monopolise ideas, to the detriment of technological progress and industrial development" (para 40, 46) [20].

Copyright protection also covers databases. According to Article 1(2) of the Directive 96/9/EC of the European Parliament and of the Council dated 11 March 1996 on the legal protection of databases (Database Directive), a database is "a collection of independent works, data or other materials arranged in a systematic

or methodical way and individually accessible by electronic or other means” [21]. Article 3(1) of the Database Directive establishes that “databases which, by reason of the selection or arrangement of their contents, constitute the author’s own intellectual creation shall be protected as such by copyright. No other criteria shall be applied to determine their eligibility for that protection” [21]. At the same time, “[t]he copyright protection of databases provided for by this Directive shall not extend to their contents and shall be without prejudice to any rights subsisting in those contents themselves” (Article 3(2)) [21].

Further in this paper the issue whether and how an AI System and its elements can be protected by means of copyright under the EU law is addressed.

The architecture of an AI system as a structure or the AI system as a whole, as well as the training data for the AI system, may be considered as a database in the meaning of the Database Directive [21]. However, in view of the case law developed by the CJEU, which established that the elements of a database must have “autonomous informative value” [23; 24] an AI System can be considered a database not in all instances [10, p. 96]. Thus, it is questionable whether, for example, an individual weight of a neural network model is only meaningful within the architecture of the network and does not have a value independently thereof [10, p. 96] or the neural network’s functions contained in the neurons and embedded in the ML algorithm can be individually accessed and have independent informative value [25, p. 19]. It may be established that the elements in certain categories of models, for instance, support vector machines, are representatives of the training set and have intrinsic ‘independent’ informational content and, thus, their collection qualifies as a database in the sense of the Database Directive [10, p. 98].

In addition, in the *Football Dataco* decision, the CJEU ruled that “...as regards the setting up of a database, that criterion of originality is satisfied when, through the selection or arrangement of the data which it contains, its author expresses his creative ability in an original manner by making free and creative choices ... and thus stamps his ‘personal touch’ ... By contrast, that criterion is not satisfied when the setting up of the database is dictated by technical considerations, rules or constraints which leave no room for creative freedom” (para 39) [22]. According to the CJEU, “the fact that the setting up of the database required, irrespective of the creation of the data which it contains, significant labour and skill of its author (...) cannot as such justify the protection of it by copyright under Directive 96/9, if that labour and that skill do not express any originality in the selection or arrangement of that data” (para 42) [22].

It could be questionable whether selection or arrangement of data (both architecture elements and training data) for AI system is the expression of the author’s creative ability in an original manner, as such selection and arrangement in respect of AI are most likely dictated by technical considerations [25, p. 6], meaning that the requirements of Article 3(1) of the Database Directive are not met. Although, for example, in some situations, the creative choices might play a role in the selection and arrangement of data for training of AI Systems, in general, such selection and arrangement are predominantly motivated by functional and technical considerations, so the originality criterion is not easily met [25, p. 6].

In respect of the learning and training method of the AI system, it should be mentioned that algorithms *as such* cannot acquire copyright protection [26, p. 59-60; 27, p. 247, 250; 17]. At the same time, as some scholars conclude, the term “computer program” “seems naturally to cover any instructions executed by a computer to perform AI-related functions” [11, p. 303]. The logic involved in the transformation between inputs and outputs within a neural network, for instance, is represented as a set of simple instructions (functions) which could be considered a form of “computer program” [10, p. 92 - 93].

Thus, elements of the AI system such as the training and learning method, as well as the entire result of training, that are implemented in software, could get copyright protection as computer program in case the originality requirements are met.

In this context, it shall be mentioned that the “choices, sequence and combination” (as ruled in *Infopaq* decision) [18] of the instructions within the AI model result directly from associations induced by the algorithm during the learning process and are dictated by the functional constraints to be met during an optimization process, but not by the author as such [10, p. 93]. Therefore, if the expression of the components of the AI model (the weights assigned to each inter-neuron connection) depends only on their technical function (minimising an error during training), the criterion of originality is not met [10, p. 93].

**Patent Law.** Now let’s consider whether **patent law** can be applicable for protection of the AI systems.

According to Article 52(1) of the European Patent Convention (EPC) European patents are granted “for any inventions, in all fields of technology, provided that they are new, involve an inventive step and are susceptible of industrial application” [28]. Article 52(2) of the EPC states that “[t]he following in particular shall not be regarded as inventions [...] mathematical methods [...] programs for computers [...] presentations



of information” [28]. At the same time, the EPC excludes the patentability of the said subject-matter or activities only to the extent to which a European patent application or European patent relates to such subject-matter or activities *as such* (Article 52(3) of the EPC) [28].

However, according to the Guidelines for Examination in the European Patent Office (EPO) and the examination guidelines that derive from case law, this exclusion does not apply to computer program when the computer program has a technical character [5, p. 351 with further references], so when there is the computer-implemented invention which covers patent claims that “involve computers, computer networks or other programmable apparatus, whereby at least one feature is realised by means of a program” [29].

The case law of the EPO Technical Boards of Appeal has established two situations where a mathematical method may contribute to a technical character of an invention: “technical application” or a “technical implementation” [30; 11, p. 253]. In other words, the technical character of the trained AI model can be established either based on the specific technical purpose of the model or through its adaptation to a specific hardware [10, p. 102]. Whether the mathematical method serves a technical purpose is determined by the direct technical relevance of the results it can provide [30; 11, p. 259 with further references]. As proceeds from the EPO Guidelines for Examination [31], the use of a neural network in a heart monitoring apparatus for identifying irregular heartbeats makes a technical contribution [31], a computer implemented method with AI algorithms for classifying digital images, videos, audio or speech signals is considered to have technical purpose and is patentable [31; 32]. However, for example, a computer implemented method with AI algorithms for classifying text documents solely in respect of their textual content is considered by the EPO Board of Appeal to have linguistic purpose, without technical contribution, and is not patentable [31; 32; 33]. Beyond the specific application, technical character of the trained AI model would also result from its technical adaptation to the computer or its operation [10, p. 103]. Thus, the EPO Boards of Appeal has concluded that “in general, a method involving technical means is an invention within the meaning of Article 52(1) EPC” [34]. The EPO Guidelines also envisage that “[a] computer-implemented data structure or data format embodied on a medium or as an electromagnetic carrier wave has technical character as a whole and thus is an invention”; “[t]his may happen if the data structure or format is functional data, i.e. if it has a technical function in a technical system, such as controlling the operation of the device processing the data” [35].

There are a number of complicated issues regarding the patentability of AI to be considered, including the issues of reproducibility and plausibility of AI models [10, p. 104, 105].

The EPO Guidelines for Examination clearly state that “Artificial intelligence and machine learning are based on computational models and algorithms (...) such computational models and algorithms are per se of an abstract nature, irrespective of whether they can be ‘trained’ based on training data” [31]. Thus, the AI systems, if claimed *as such*, are excluded from patent protection [25, p. 16; 5, p. 355]. At the same time, the AI algorithms and/or AI models can be patented as elements within the inventions where they are applied in a technical use [25, p. 16]. In such a case, the AI System can be considered as a computer implemented invention and, thus, become patentable, if all the requirements for patent protection are met.

The claimed AI-related features as such are not deemed to be technical (being mathematical in nature) and are considered for an inventive step only if they support a technical effect or technical purpose [32]. At that, the patentability requirements of “novelty and inventive step can only be established on the basis of the technical features of the invention” [35]. The arguments that a trained model is functionally equivalent to pre-existing model sharing the same architecture or the only difference with the prior art lies in the choice of hyperparameters could constitute a case against its non-obviousness [10, p. 104]. At the same time, an argument in favor of inventive contribution may be found in demonstrating unexpected effects or advantages in the properties of the resulting product or in the operation of a trained model [10, p. 104 with further references].

There is also an additional option of ***sui generis* database protection**, which, however, is limited to the EU and thus may be of limited use within a global IP strategy [11, p. 330].

The Database Directive establishes a *sui generis* right for databases: “a right for the maker of a database which shows that there has been qualitatively and/or quantitatively a substantial investment in either the obtaining, verification or presentation of the contents to prevent extraction and/or re-utilization of the whole or of a substantial part, evaluated qualitatively and/or quantitatively, of the contents of that database” (Article 7(1)) [21]. The *sui generis* right can provide a protection even if a database does not meet the condition of originality [10, p. 96] and this protection shall apply irrespective of the eligibility of the database for protection by copyright or by other rights (Article 7(4) of the Database Directive) [21].

According to Recital 40 of the Database Directive, the *sui generis* right shall protect the rightholder's "investment in obtaining, verifying or presenting the contents of a database for the limited duration of the right" [21]. Said investment may "consist in the deployment of financial resources and/or the expending of time, effort and energy" [21].

At the same time, it should be noted, that according to the case-law of the CJEU, database contents which evidence a substantial investment in creation of data rather than in its obtainment are excluded from *sui generis* right protection [10, p. 97]. Thus, according to judgment of the CJEU of 9 November 2004 in case C-203/02 (the British Horseracing Board Ltd and Others v William Hill Organization Ltd.), "[t]he expression 'investment in ... the obtaining ... of the contents' of a database in Article 7(1) of the directive must be understood to refer to the resources used to seek out existing independent materials and collect them in the database. It does not cover the resources used for the creation of materials which make up the contents of a database" (para 42) [36], "[t]he purpose of the protection by the *sui generis* right provided for by the directive is to promote the establishment of storage and processing systems for existing information and not the creation of materials capable of being collected subsequently in a database" (para 31) [36].

Although there is no clear distinction between the notion of "creation" and "obtaining", the investments related to the calculation of the final values of the weights of the trained AI model in most instances could be considered as a "creation" process and would not justify *sui generis* protection [10, p. 97]. At the same time, compliance with the criteria of qualitative and/or quantitative substantial investment in the respective AI system or its parts according to the Database Directive and the relevant case-law should be determined individually in each case.

There are also proposals on creation of a special *sui generis* right for the AI models which require a significant effort to create. [37, p. 2, 27]

**Conclusion.** Patent law, copyright law and *sui generis* database protection under the EU law can potentially provide intellectual property rights protection for AI systems if the relevant requirements for protection established by law are met. Whether such requirements are met depends on the individual case of the AI system and must be determined on a case-by-case basis. The use of intellectual property law to protect AI systems can be beneficial to the implementation of transparency in the field of AI.

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