The protection of AI-generated pictures (photograph and painting) under copyright law

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1. INTRODUCTION

Artificial intelligence (AI),[1] especially deep learning technologies,[2] is increasingly used by AI artists in various artistic fields.[3] Among its many possible uses in the arts (for example, in the creation of music, poems, screenplays, and many others),[4] AI can generate new pictures or transform them[5] through generative adversarial networks (GANs), among other generative models,[6] which fall under the rubric of algorithmic art.[7]

However, the creation or transformation of pictures with GANs also raises questions in the area of copyright, especially when it comes to using pictures as "inputs" to train GANs and the protection of AI-generated "outputs." This contribution concentrates on copyright, with a particular focus on the analysis of the criterion of originality, and on other intellectual property rights (IPR) (such as trade secrets and unfair competition), but leaves aside other legal aspects, such as ethics, privacy, and data protection (for example, when traditional cultural expressions or an individual's image are used). The analysis herein is from a comparative law perspective without focusing on a specific jurisdiction and applicable law, as legal regimes vary from one

[1] Nilsson Nils J., The Quest for Artificial Intelligence: A History of Ideas and Achievements, New York (Cambridge University Press), 2010, p.13: "AI is that quality that enables an entity to function appropriately and with foresight in its environment. According to that definition, lots of things—humans, animals, and some machines—are intelligent."

[2] According to Goodfellow Ian, Bengio Yoshua, Courville Aaron, Deep Learning, Cambridge (MA) (The MIT Press), 2016, pp.1 and 2, deep learning is the solution that allows computers to learn from experience and understand the world in terms of a hierarchy of concepts that enables the computer to learn complicated concepts by building them out of simpler ones and to avoid the need for human operators. See also Foster David, Generative Deep Learning: Teaching Machines to Paint, Write, Compose and Pay, Sebastopol, CA (O'Reilly), 2019, p.31, who explains that deep learning uses multiple stacked layers of processing units to learn high-level representations from unstructured data, which refers to any data that is not naturally arranged into columns of features, such as images, audio, and text.

[3] https://aiartists.org/.

[4] Ibid.

[5] In the framework of this contribution, we rely on the definitions of the online Cambridge dictionary (https://dictionary.cambridge.org/), which provides that a photograph is "a picture produced using a camera," whereas a picture is defined more broadly as "a drawing, painting, photograph, etc."

[6] Foster David, Generative Deep Learning: Teaching Machines to Paint, Write, Compose and Pay, Sebastopol, CA (O'Reilly), 2019, p.1, defines a generative model as follows: "A generative model describes how a dataset is generated, in terms of a probabilistic model. By sampling from this model, we are able to generate new data."

[7] Bridy Annemarie, The Evolution of Authorship: Work Made by Code, Colum. J.L. & Arts, Vol.95, 2016, p.397. Other models have since appeared with similar attributes to GANs but GANs are still one of the best performing generative models for picture generation.

jurisdiction to another. However, particular attention is given to US and EU law, given their influence beyond borders and the fact that they represent two typical different legal regimes (common and civil–continental law).

2. TECHNOLOGICAL CONSIDERATIONS

2.1 What Is a Generative Adversarial Network (GAN)?

In 2014, Goodfellow et al. proposed a new framework for estimating generative models[8] via the adversarial GAN process, which involves the simultaneous training of two models. It became one of the best structures for picture generation.

A GAN can be seen as a non-cooperative game[9] between two neural networks, trained together in competition with each other.[10] On one side, the generator network (the art forger)[11] learns to generate plausible samples[12] from random noise[13] and is trained to fool the discriminator network (the art expert)[14] into believing its outputs are real data.[15] On the other side, the discriminator learns to distinguish the generator's fake, that is, generated data from real data[16] but as the generator's training progresses over time, the accuracy of the discriminator decreases and it gets worse at telling the difference between the two.[17] The networks that represent the generator and the discriminator are typically implemented by multi-layer networks consisting of convolutional layers,[18] which are extremely well suited to picture data, and/or

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[8] Goodfellow Ian J., Pouget-Abadie Jean, Mirza Mehdi, Xu, Bing, Warde-Farley David, Ozair Sherjil, Courville Aaron, Bengio Yoshua, Generative Adversarial Nets, 2014. Available online at: https://papers.nips.cc/paper/2014/file/5ca3e9b122f61f8f06494c97b1afccf3-Paper.pdf. Foster, p.1, defines a generative model as follows: "A generative model describes how a dataset is generated, in terms of a probabilistic model. By sampling from this model, we are able to generate new data." See also Goodfellow et al., p.1: "The generative model can be thought of as analogous to a team of counterfeiters, trying to produce fake currency and use it without detection, while the discriminative model is analogous to the police, trying to detect the counterfeit currency. Competition in this game drive bother teams to improve their methods until the counterfeits are indistinguishable from the genuine articles."

[9] Salimans Tim, Goodfellow Ian, Zaremba Wojciech, Cheung Vicki, Radford Alec, Chen Xi, Improved Techniques for Training GANs, 10 June 2016, p.2. Available online at: https://arxiv.org/pdf/1606.03498.pdf.

[10] Creswell Antonia, White Tom, Dumoulin Vincent, Arulkumaran Kai, Sengupta Biswa, Bharath Anil A., Generative Adversarial Networks: An Overview, April 2017, p.1.
Available online at: https://arxiv.org/pdf/1710.07035.pdf

[11] Creswell et al., p.1.

[12] See Google, Overview of GAN Structure provided by Google, April 29, 2019.
Available online at: https://developers.google.com/machine-learning/gan/gan_structure.

[13] Creswell et al., p.8.

[14] Ibid, p.1.

[15] Salimans et al., p.1. See as well Goodfellow, On Distinguishability Criteria for Estimating Generative Models, 21 May 2015, p.1. Available online at: https://arxiv.org/pdf/1412.6515.pdf.

[16] Salimans et al., p.1.

[17] Overview of GAN Structure provided by Google, 29 April 2019. Available online at: https://developers.google.com/machine-learning/gan/gan_structure.

[18] As explained by Gatys Leon A., Ecker Alexander S., Bethge Matthias, A Neural Algorithm of Artistic Style, 2 September 2015, p.2. Available online at: https://arxiv.org/pdf/1508.06576.pdf: "(c) onvolutional neural networks consist of layers of small computational units that process visual informa-

fully connected layers used by the first GAN architectures and applied to relatively simple picture datasets.[19]

During the training process, the generator has no direct access to real pictures and only learns through its interaction with the discriminator, whereas the latter has access both to the synthetic sample provided by the generator and to the samples drawn from the stack of real pictures.[20] The generator is deemed optimal when the discriminator can no longer distinguish real samples from fake ones.[21] In the end, where the discriminator is optional, it may be discarded to focus solely on the generator.[22] This sort of "non-cooperative game"[23] will ultimately lead to the creation of a new picture, the output.[24]

2.2 Different Steps of a GAN

In this part of our contribution, we describe in simple terms how to generate new pictures with GANs by highlighting key steps that will be useful for our legal analysis.[25] The first three stages are grouped under the more global term of "input," while the fourth stage constitutes the "output" stage.

The first step focuses on the selection, loading, and processing of pictures, mostly photographs (*selection phase*). For this first step, a training dataset[26] is identified and downloaded, for instance from a website or a repository.[27] This dataset comprises multiple examples, called

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tion hierarchically in a feed-forward manner. Each layer of units can be understood as a collection of image filters, each of which extracts a certain feature from the input image. Thus, the output of a given layer consists of so-called feature maps: differently filtered versions of the input image."

[19] Creswell et al., p.3. For an explanation on fully connected layers, see Ramsundar Bharath, Zadeh Reza Bosagh, TensorFlow for Deep Learning, March 2018, O'Reilly Media, Inc., Chapter 4. Available online at: www.oreilly.com/library/view/tensorflow-for-deep/9781491980446/ch04.html. As explained, a fully connected neural network consists of a series of fully connected layers where each output depends on each input dimension, or in other words, every neuron in one layer is connected to every neuron in the previous or next layer.

[20] Creswell et al., p.1.

[21] Ibid, p.6.

[22] Ibid, p.1.

[23] Jiwoong Im Daniel, Dongjoo Kim Chris, Jiang Hui, Memisevic Roland, Generating images with recurrent adversarial network, p.2. Available online at: https://arxiv.org/pdf/1602.05110.pdf.

[24] Overview of GAN Structure provided by Google, 29 April 2019.
Available online at: https://developers.google.com/machine-learning/gan/gan_structure.

[25] Please note that the objective of this description is not to provide a detailed understanding of the function of GANs models but rather to focus on keys steps. The order of the different steps is based on the description provided by Foster, pp. 33–58.

[26] Shrestha Anish, Generating Model Art using Generative Adversarial Network (GAN) on Spell, November 13, 2019. Available online at: https://towardsdatascience.com/generating-modern-arts-using-generative-adversarial-network-gan-on-spell-39f67f83c7b4. The author suggests using a dataset available on the WikiArt website: https://www.wikiart.org/. To see more about their copyright policy: www.wikiart.org/en/about. See also Radford et al., 2016, p.4, who used dbpedia (https://www.dbpedia.org/) to scrape "images faces from random web images queries of people names. The people names were acquired from dbpedia, with a criterion that they were born in the modern era."

[27] https://github.com/cs-chan/ArtGAN/tree/master/WikiArt%20Dataset. In his book, Foster suggests using the CIFAR-10 dataset, a collection of 60,000 32x32 pixel color images. The dataset is available at www.cs.toronto.edu/~kriz/cifar.html and is also mentioned in Goodfellow et al, p.6 and Salimans et al, pp.1 and 6. See also the MNIST database available at http://yann.lecun.com/exdb/

samples, which can range from pictures of animals[28] to street numbers, airplanes, automobiles,[29] house numbers,[30] and more (the *image data*). As for the processing of image data, the data engineer[31] would need, for instance, to resize the data to feed it into the GAN.[32]

The second step focuses on programming and consists of building the neural network model using Keras,[33] for instance, which is a high-level Python library for building neural networks (*programming phase*).[34] At this stage, the software engineer or programmer[35] will set up the architecture of the neural network without confronting it with the picture data.[36]

The third step is dedicated to the training of the neural network (*training phase*) by machine learning engineers,[37] where the data is shown to the neural network.[38] Thus, the neural network will be trained with the picture data, which will be passed through several times.[39] During the training phase, the picture data is gradually transformed by the neural network.[40]

The final stage is the generation of the output (*generation phase*), where new pictures are generated by the neural network, which combines the possible creative choices of the designers, that is, the data engineer, the software engineer and the machine learning engineer, at the selection phase and the programming phase, as well the work of the neural network.[41] In addition, the user[42] can have an important impact on the final output of a neural network as they can, for instance, choose the picture and the filter to apply.[43]

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mnist/, mentioned also in GOODFELLOW et al., p.7 and SALIMANS et al., pp.1 and 7, which also mentions the SVHN dataset (The Street View House Numbers Dataset), available at http://ufldl.stanford.edu/housenumbers/ on pp.1 and 7, "a real-world image dataset for developing machine learning and object recognition algorithms with minimal requirement on data preprocessing and formatting […]. SVHN is obtained from house numbers in Google Street View images." See also ImageNet, available at: www.image-net.org/about.php where it is clearly stated: "ImageNet does not own the copyright of the images. ImageNet only compiles an accurate list of web images for each synset of WordNet. For researchers and educators who wish to use the images for non-commercial research and/or educational purposes, we can provide access through our site under certain conditions and terms." More information at: www.image-net.org/download.

[28] http://vision.stanford.edu/aditya86/ImageNetDogs/.

[29] https://www.cs.toronto.edu/~kriz/cifar.html.

[30] http://ufldl.stanford.edu/housenumbers/.

[31] See ANDERSON Jesse, Data engineers vs. data scientists, 11 April 2018. Available online at: www.oreilly.com/radar/data-engineers-vs-data-scientists/.

[32] FOSTER, pp.35–7.

[33] https://keras.io/.

[34] FOSTER, p.34.

[35] The "programmer" is also called "data engineer" or "software engineer" and has a programming background. For more, see note 33.

[36] FOSTER, p.43.

[37] See note 37.

[38] FOSTER, pp.43 and 44.

[39] Ibid.

[40] https://developers.google.com/machine-learning/gan/applications. If we take for instance the example of "Progressive GANs," the generator's first layers produce very low-resolution images, and subsequent layers add details.

[41] For interesting visual examples, see https://developers.google.com/machine-learning/gan/applications. The functioning of Deep Dream Generator is explained in section 2.3.

[42] We refer to "the user" to define the person who will use a platform that allows the use of a neural network, such as a GAN, to generate or transform pictures.

[43] This is typically the case with Deep Dream Generator: https://deepdreamgenerator.com/. This example is further explained in section 2.3.

2.3 Examples of GANs and Related Models

Since their creation in 2014[44] many popular deep learning models for picture generation have used GANs architecture, even though, as we will see, other models exist. For this contribution, we introduce a few examples and use some of them to illustrate our legal analysis.

Among some of the best-known early GAN models is Pix2Pix, an image-to-image translation using conditional GANs that can convert black-and-white images to colour images, or Google Maps to Google Earth images.[45] In 2015 Google researchers created one of the flagship visualization tools, DeepDream,[46] which uses a convolutional neural network (CNN)[47] to create unique pictures by transforming pre-existing ones. In the framework of this project, Google trained an artificial neural network by showing it millions of examples. The researchers explained the functioning of the 10–30 stacked layers of artificial neurons where "Each image is fed into the input layer, which then talks to the next layer, until eventually the 'output' layer is reached. The network's 'answer' come[s] from this final output layer."[48]

More importantly in terms of the decision-making process of the neural network, the researchers purposefully let the network decide which feature it wanted to amplify in the image; this led to an unpredictable result. The researchers explained that instead of prescribing exactly which feature they wanted the network to amplify, they let the network make that decision.[49] They started with an existing image, gave it to the neural network, and asked it what it saw. Thus, if a neural network is mostly trained on images of animals, it will naturally tend to interpret shapes of animals in any subsequent image it is given. For instance, if an image of a cloud looks like a bird, the network will reinforce this aspect.[50]

In June 2017 researchers from the Art & AI Laboratory at Rutgers University proposed a new system for generating art, built over GANs, entitled creative adversarial networks (CANs), whose goal is to "investigate a computational creative system for art generation without involving a human artist in the creative process, but nevertheless involving human

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[44] See note 8.

[45] Isola Phillip, Zhu Jun-Yan, Zhou Tinghui, Efros Alexei A., Image-to-Image Translation with Conditional Adversarial Networks. Available online at: https://arxiv.org/pdf/1611.07004.pdf.

[46] https://deepdreamgenerator.com/.

[47] Guadamuz Andres, Do Androids Dream of Electric Copyright? Comparative Analysis of Originality in Artificial Intelligence Generated Works, Intellectual Property Quarterly, 2017, Vol. 2, p.3. Available online at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2981304. See also Barua Sukarna, Monazam Erfani Sarah, Bailey James, FCC-GAN: A Fully Connected and Convolutional Net Architecture for GANs, May 27, 2019, p.1. Available online at: https://arxiv.org/pdf/1905.02417.pdf. The authors explain the connection between GANs and CNNs as follows: "GAN models for image synthesis have adopted a deep convolutional network architecture, which eliminates or minimizes the use of fully connected and pooling layers in favor of convolutional layers in the generator and discriminator of GANs."

[48] Mordvinstev Alexander, Olah Christopher, Tyka Mike, Inceptionism: Going Deeper into Neural Networks, June 17, 2015. Available online at: https://ai.googleblog.com/2015/06/inceptionism-going-deeper-into-neural.html.

[49] Ibid.

[50] Ibid. The researchers end this contribution by stating: "It also makes us wonder whether neural networks could become a tool for artists—a new way to remis visual concepts—or perhaps even shed a little light on the roots of the creative process in general."

creative products in the learning process."[51] It was followed in 2018 by the development of StyleGAN,[52] created by Nvidia[53] researchers, which allows for a finer control of images and for the generation of new pictures, such as portraits of human beings[54] but also pictures of animals, for example cats,[55] and many more.[56] Nowadays, GAN applications can range from anime character generation, 3D object generation, image editing, and face aging[57] to the colourization of pictures.[58] One of the latest models created by OpenAI,[59] DALL·E, a transformer language model, was trained to create images from text descriptions using a dataset of text–image pairs that allows the manipulation of visual concepts through language.[60]

As we can see, GANs have undergone significant developments since their creation in 2014. However, given the similarities between these examples in terms of the general functioning of GANs in the main steps,[61] we only use a limited number of these examples to illustrate our legal analysis from the input to the output stage.

3. LEGAL ANALYSIS: USING IMAGE DATA AS INPUTS AND AI-GENERATED OUTPUTS UNDER COPYRIGHT LAW

3.1 Input

In this section, we first focus on the legal protection when it comes to using image data as inputs, in particular in each phase of the GANs, that is, the selection, programming, and training phases.

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[51] Elgammal Ahmed, Liu Bingchen, Elhoseiny Mohamed, Mazzone Marian, CAN: Creative Adversarial Networks, Generative "Art" by Learning About Styles and Deviating from Style Norms, June 21, 2017, pp.1 and 2. Available online at: https://arxiv.org/pdf/1706.07068.pdf.

[52] Karras Tero, Laine Samuli, Aila Timo, A Style-Based Generator Architecture for Generative Adversarial Networks, 29 March 2019. Available online at: https://arxiv.org/pdf/1812.04948.pdf.

[53] www.nvidia.com/.

[54] See for instance https://portraitai.com/, which precises that "art generated by portraitai.com is completely free to use for any purpose," or https://generated.photos/, which displays "unique, worry-free model photos" and underlines that "all images can be used for any purpose without worrying about copyrights, distribution rights, infringement claims, or royalties." See also note 52.

[55] https://thesecatsdonotexist.com/.

[56] https://github.com/ak9250/stylegan-art.

[57] https://github.com/nashory/gans-awesome-applications#real-time-face-reconstruction.

[58] https://github.com/hindupuravinash/the-gan-zoo.

[59] https://openai.com/blog/dall-e/.

[60] As explained on https://openai.com/blog/dall-e/, DALL· E uses both GPT-3, an unsupervised learning algorithm using GAN, which "showed that language can be used to instruct a large neural network to perform a variety of text generation tasks," and Image GPT, which "showed that the same type of neural network can also be used to generate images with high fidelity."

[61] See section 2.2.

3.2 Selection Phase

In the selection phase, copyright may protect copyrighted data (such as text, pictures, music) with sufficient originality (*copyrighted data*).[62] The originality standard usually requires a certain threshold or degree of creativity, which may vary from one jurisdiction to another.[63]

Consequently, when copyrighted data are used in the selection phase, such use may trigger copyright protection, at least according to a strict interpretation of the reproduction right, which covers in most jurisdictions identical, partial, direct, or indirect act of reproduction by any means, in whole or in part.[64]

Copyright may also protect compilation of data (for example, public or private repository, dataset or database), if their selection or arrangement is original (*copyrighted dataset*),[65] even when the individual data lacks copyright protection (for example, because it is not original or is a public domain work). Eligibility for copyright protection may be difficult, however, as the

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[62] In international law, see article 2 (1) of the Berne Convention for the Protection of Literary and Artistic Works (as amended on September 28, 1979) ("*literary and artistic works shall include every production in the literary, scientific and artistic domain, whatever may be the mode or form of its expression*"). In EU law, see Gervais Daniel, Exploring the Interfaces Between Big Data and Intellectual Property Law, JIPITEC Vol.10, No.1, 2019, N 8 ff. In Swiss law, see article 2 (1) of the Swiss Copyright Act ("*Works are literary and artistic intellectual creations with an individual character, irrespective of their value or purpose*"); de Werra Jacques, Benhamou Yaniv, Kunst und geistiges Eigentum, in Mösimann / Renold / Raschèr (ed.), Kultur, Kunst Recht: Schweizerisches und internationales Recht, Basel, 2020, 707 ff.

[63] In EU law, see Margoni Thomas, The Harmonisation of EU Copyright Law: The Originality Standard, May 25, 2016. Available online at: http://eprints.gla.ac.uk/129447/. In Swiss law, see de Werra / Benhamou (n 62), p.710. See section 3.2.1.

[64] See in EU law, article 2 of the Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonization of certain aspects of copyright and related rights in the information society (hereinafter: Copyright Directive 2001/29/CE) ("exclusive right to authorise or prohibit direct or indirect, temporary or permanent reproduction by any means and in any form, in whole or in part"). For alternative approaches, see Benhamou Yaniv, Big Data and the Law: A Holistic Analysis based on a Three-step approach—Mapping Property-like Rights, Their Exceptions and Licensing Practices, RSDA 2020, 405, with references to case-law and suggesting shifting from this broad interpretation of the reproduction right to a perceptibility approach (that is, copyright does not apply to most text and data mining activities, as the input is not recognizable in the output) or an economic approach (that is, copyright does not apply to text and data mining activities, as the initial input is not used *per se* but only for its informational content).

[65] See article 10 (2) of the World Trade Organization's Agreement on Trade-Related Aspects of Intellectual Property Rights (hereinafter : TRIPS Agreement) ("*Compilations of data or other material, whether in machine readable or other form, which by reason of the selection or arrangement of their contents constitute intellectual creations*"). In Switzerland, such databases can be protected as collected works defined at article 4 (1) Swiss Copyright Act ("*creations with individual character with regard to their selection and arrangement*"). In the EU, article 3 (1) of the Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases (hereinafter : Database Directive) ("*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*"). In the US, Title 17 USC s. 101 Copyright Act protecting compilation (defined as "*work formed by the collection and assembling of pre-existing materials or of data that are selected, coordinated, or arranged in such a way that the resulting work as a whole constitutes an original work of authorship*").

level of investment is irrelevant for the originality[66] and the simple collection of data unaltered for a new database may be insufficient for the threshold of originality.[67] Moreover, copyright protection usually requires an intellectual human intervention and the consciousness of achieving a result, which excludes databases automatically created by an algorithm.[68]

Consequently, the careful original selection of pre-existing data or databases may qualify as copyrighted dataset, and hence be protected (an example might be the most representative images of a collection). However, the random selection of pre-existing data or the automatic selection used solely for training purposes may lack copyright protection, as the selection may not meet the condition of originality with respect to the condition of human intervention. It is specified that, generally, the more image data processed, the better the GAN works, so that the GAN mostly selects and loads as much data as possible, at least from one style or one author, instead of carefully selecting specific image data of one type. In other words, selections of image data are often based on technical considerations rather than creative choices,[69] and it could be demonstrated that these selections were not merely technical considerations but rather free and creative choices.[70]

3.3 Programming Phase

With respect to the programming phase, copyright may protect elements of the software that are original (such as original source code, object code and associated documentation). Again, the originality standard varies from one jurisdiction to another, with certain jurisdictions requiring a very low level of creativity for software protection or even assuming a protection

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[66] For instance, in Switzerland copyright protection has been denied, despite investments made, for a compendium of drugs, a telephone directory, and logarithmic tables (case-law quoted by Gilliéron Philippe, in de Werra / Gilliéron (ed.), Commentaire Romand de la Propriété intellectuelle, Basel 2013, N 6 *ad* article 4). In the EU, see article 3 (1) of the EU Database Directive. In the US, see Feist Publications, Inc., v Rural Telephone Service Co, 499 U.S. 340 (1991), 344 (hereinafter: Feist Publications).

[67] Maier Robert / Sibble Joshua, Big Data Handbook: A Guide for Lawyers, Wolters Kluwer Legal & Regulatory, May 2018, p.23.

[68] Case C-604/10, Football Dataco Ltd and Others v Yahoo! UK Ltd and Others, [2012] ECLI:EU:C:2012:115 (hereinafter: Football Dataco), par.38. It is however important to distinguish between works created with the assistance of a computer (that is, regular works just like books created with the assistance of a pen, or movies created with the assistance of a camera) and computer-generated works (CGW) (that is, works generated by computer in circumstances such that there is no human author of the work).

[69] See for instance Jones Kenny, GANGogh: Creating Art with GANs, June 18, 2017. Available online at: https://towardsdatascience.com/gangogh-creating-art-with-gans-8d087d8f74a1. The author explains that the researchers had to choose an appropriate dataset of paintings which was a crucial decision. They first experimented with using a dataset of paintings that were only from one artist: Monet. However, after a few initial tests, they found that their "models on this dataset were converging poorly as the dataset with only 1200 paintings was too small." They choose to use the Wikiart database instead, which is a collection of more than 100,000 paintings.

[70] Football Dataco, par.38. See also Feist Publications, 348, which provides that the criterion of originality is satisfied when the "choices as to selection and arrangement, so long as they are made independently by the compiler an entail a minimal degree of creativity, are sufficiently original that Congress may protect such compilations through the copyright laws." See as well Case Football Dataco, par.38: "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 choice."

by default.[71] Copyright only applies to the original form of expression, not the idea or simple information embedded in a creative work, so that the underlying software is more likely to receive copyright protection than the individual data or database itself.[72]

3.4 Training Phase

With respect to the training phase, distinction is made depending on whether it relates to copyrighted data (for example, original image data or database) or non-copyrighted data (for example, pure technical training data or public domain work).

When the input is a copyrighted data or dataset,[73] its use in connection with the GAN triggers the right of reproduction and requires in principle the authorization of the rights owner, whether the input is simply used as training data (such as in the case of StyleGAN, which allows for the generation of portraits of human beings or animals[74]) or is recognizable in the output (such as an AI-generated painting in which one of the works used in the input could be recognized).[75] This is linked to the broad interpretation of the reproduction right.[76]

Moreover, copyright protection may be claimed in relation to the modification of certain pictures within the neural network, as the moral right of integrity includes the right to authorise or prohibit modification of the work by third parties and as certain images may be transformed during the "training phase."[77] This being said, the moral right of integrity could be difficult to claim. The scope of this moral right of integrity varies from one jurisdiction to another. In certain jurisdictions, it applies only to changes prejudicial to the honor or reputation of the author or is even non-existent in other jurisdictions, so that the changes in images may never

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[71] For instance in Swiss law, certain courts assume a software protection by default, the burden of proof belonging to the party denying software protection: see DE WERRA / BENHAMOU (note 62), p.710 and references made.

[72] See for instance article 9 (2) TRIPS Agreement ("*Copyright protection shall extend to expressions and not to ideas, procedures, methods of operation or mathematical concepts as such*"). See however SCASSA Teresa, Data Ownership, in: CIGI Papers, No 187, September 2018, p.9, who considers that the idea/expression dichotomy (according to which copyright protection extends to the expression of ideas only) may be blurred. For instance, where the expression of a fact or an idea merges with that fact or idea (for example, where there is only one or a very limited number of ways to express it), there can be no copyright protection since the practical result of any such protection would be to give a monopoly over the fact or idea.

[73] Above, section 3.1.1; also note 63.

[74] Above, section 2.3.

[75] In EU law, see article 2 Copyright Directive 2001/29/CE (the reproduction right covers the "*exclusive right to authorise or prohibit direct or indirect, temporary or permanent reproduction by any means and in any form, in whole or in part*"); Case C-5/08, Infopaq International vs Danske Dagblades Forening, [2009] ECLI:EU:C:2009:465 (hereinafter: Infopaq), par. 51; see STROWEL (note 2), p.12, indicating that the reproduction right may also apply, when the use relates to raw data embedded in a copyrighted file, as the underlying raw data often overlaps, if not merges, with the embedding copyrighted file for which copyright protection applies. In Swiss law, see article 10 (2) let. a Swiss Copyright Act (the reproduction right covers the right to "*produce copies of the work, such as printed matter, phonograms, audiovisual fixations or data carriers*"); see DE WERRA / BENHAMOU (note 62), p.753, giving the example of the Edmond de Balamy portrait based on 15,000 preexisting portraits or Google Dream trained on open access images.

[76] Above, section 3.1.1.

[77] Above, section 2.2.

be sufficiently prejudicial to trigger the moral right.[78] Even in jurisdictions applying the moral right to any changes, whether prejudicial or not, whether substantial or not (including copies with minor changes), such right is usually attached to the personality of the author. With the changes in images being made only within the neural network for pure training purposes and being not visible or even non-existent in the output data, the author will have difficulty in claiming that their personality is infringed.

To overcome these legal barriers, most copyright laws provide limitations and exceptions, such as the fair use exception in the United States and the specific European exception of text and data mining (TDM). This TDM exception is however subject to important restrictions: (i) it is limited to "scientific research" (which excludes primarily commercial purposes); (ii) the data shall be accessible (which excludes data or databases protected by TPM, or possibly by contract); (iii) it is often limited to the reproduction right (which excludes the communication of the results, at least when the input is reproduced in the output).[79]

When the input is not copyrighted data or a copyrighted dataset, such as technical data or public domain works, it is in principle freely usable. However, use of such input can be limited in certain situations. First, data producers can impose contractual restrictions or TPM, creating a kind of data exclusivity.[80] They can also claim their data to be a trade secret when the data meet the standards of trade secret protection, that is, when the data: (1) is secret; (2) has commercial value because it is secret; and (3) has been subject to reasonable steps by the rightful holder of the information to keep it secret (such as through confidentiality agreements

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[78] See Benhamou, Posthumous replications, p.151.

[79] For example, in EU law, the Directive (EU) 2019/790 of the European Parliament and of the Council of 7 April 2019 on copyright and related rights in the Digital Single Market and amending Directive 96/9/EC and 2001/29/EC (hereinafter : DSM Directive) introduces two mandatory TDM exceptions: an TDM exception for scientific research (article 3) and a TDM for any purposes (article 4), it being specified that their implementation into national laws is still ongoing and that differences in transposition laws (for example, as to the beneficiaries and as to the validity of general terms and conditions restricting TDM) could hamper cross-border text and data mining activities. In US law, TDM seems justified by the fair use doctrine (§ 107 Copyright Act): see the decision Google Books, Supreme Court, 16 October 2015 where short extracts have been considered as "highly transformative," it being specified that it remains to be seen how this case-law will apply to TDM activities, as shown in the decision News Network, LLC v TVEyes, Inc., 7 March 2017, where the indexing by TVEyes of all programs (including those of Fox News) and the possibility to view extracts of 10mn have not passed the criteria of te fair use doctrine. For an overview of the TDM exceptions in different jurisdictions, Benhamou (note 64), p.405.

[80] Such contractual restrictions have been considered as valid by the CJUE in the Ryanair v PR Aviation decision (Case C-30/14, Ryanair v PR Aviation, [2015] ECLI:EU:C:2015:10), Recital 39: "*it is clear from the purpose and structure of Directive 96/9 that Articles 6 (1), 8 and 15 thereof, which establish mandatory rights for lawful users of databases, are not applicable to a database which is not protected either by copyright or by the sui generis right under that directive, so that it does not prevent the adoption of contractual clauses concerning the conditions of use of such a database*"); de Werra Jacques, Patents and Trade Secrets in the Internet Age, in: RDS, 2015, p.173. RDS, 2015, p. 173. See however the decision Google v Oracle, 5 April 2021, where the US Supreme Court held that the use of Oracle's Java API by Google for Android was a fair use and did not violate copyright laws, although the companies did not agree on the terms of use. This decision suggests that in the US it may be difficult for companies to impose contractual restrictions on publicly available data (such as open data, APIs). For an analysis of open data and open licenses applicable to AI (including ownership and liability), see Benhamou Yaniv, Intelligence artificielle: licence libre et gouvernance collective des données à travers l'altruisme des données et les data trusts, RSDA 2021, 419.

and/or physical and technical restrictions on access).[81] This could even be the case of trivial data, which might gain value through the new data analysis tools that find patterns and accordingly propose ads or services, and thus may qualify for trade secret protection.[82] Eligibility for trade secret protection may however be difficult. First, the concept of accessibility (or non-accessibility) is affected when the information may be easily accessed by using Internet search tools and technologies.[83] Second, the standard of reasonableness may also be affected in the digital environment, where information is mostly stored electronically, either in-house or in the cloud, with a risk of data leakage, so that the information may not be considered reasonably protected.[84] Third, trade secrets are only legally protected in instances where someone has obtained the confidential information by illegitimate means (such as through spying, theft, or bribery).[85] A trade secret holder has only a right to prohibit certain behaviours (unlawful acquisition, use, or disclosure of the secret), but no exclusive rights, unlike IPR that grant exclusive rights that are legally enforceable.[86] Therefore, the trade secret holder cannot prevent competitors from copying and using the same solutions, or reverse engineering (that is, the process of discovering the technological principles of a device, object, or system through analysis of its structure, function, and operation).

Moreover, even when the data are publicly accessible (such as images taken from Facebook or Google), they may be protected through unfair competition laws in many countries,[87] or by

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[81] In international law, see article 39 TRIPS Agreement, which identifies the standards generally applicable. In Swiss law, see DE WERRA (note 80), p.164. In EU law, see article 2 (1) Directive 2016/943 of the European Parliament and of the Council of 8 June 2016 on the protection of undisclosed know-how and business information (trade secrets) against their unlawful acquisition, use and disclosure (hereinafter: Trade Secret Directive). Also, data that have not been yet disclosed may be protected by confidential agreements or, in the absence of a specific clause, by confidentiality undertakings provided by specific rules (for example, labor law sometimes provides an obligation to keep information secret), see BENHAMOU (note 64), p.399.

[82] STROWEL, p.23, referring to the Recital 14 of the Trade Secret Directive that states that the protection applies to information that "*should have a commercial value, whether actual or potential.*" Data out of which relevant trends are extracted by big data tools, although trivial as such, can have a potential value.

[83] See article 39 (2)(a) of the TRIPS: information not "*generally known among or readily accessible to persons within the circles that normally deal with the kind of information in question.*" See Sasqua Gr., Inc. v Courtney and Artemis, No. CV-10–528, 2010 WL 3613855 (E.D.N.Y. Aug. 2, 2010); DE WERRA (note 80), 176.

[84] See article 39 (2)(c) of the TRIPS Agreement; DE WERRA (note 80), p.176.

[85] DEBUSSCHE / CÉSAR, p.58.

[86] Under the Trade Secret Directive, the trade secret protection is seen "*as a complement or as an alternative to intellectual property rights*" (Recital 2) which "*in the interest of innovation […] should not create any exclusive right to know-how or information*" (Recital 16). See however STROWEL (note 2), p.23, indicating that the contractual practice in certain countries relating to trade secrets shows a stronger association with property (for example, common law countries using terms such as "assignment," "sale," or "asset transfers" for trade secrets) and that the Trade Secret Directive has the remedial aspect of a property-like protection (largely built on the IPR civil enforcement measures).

[87] In Switzerland, databases may be protected in certain circumstances by the Swiss Act against Unfair Competition (UCA), in particular article 5 let. c UCA prohibiting the reuse of third-party work by technical processes without corresponding investments, see DE WERRA Jacques / BENHAMOU Yaniv, Propriété intellectuelle et concurrence déloyale. Analyse du droit suisse et perspectives de droit allemand, in: PUTTEMANS / GENDREAU / DE WERRA (ed.), Propriété intellectuelle et concurrence déloyale: les liaisons dangereuses? Brussels, 2017, pp.183–208, p.185. See below section 2.2.2.2.

a *sui generis* database right in the EU, in particular when they consist of a dataset.[88] Eligibility for unfair competition protection is however excluded, in particular when the third party user (*repreneur*) has made substantial investment or when the data producer covered his/her investments made,[89] and the *sui generis* database protection when only insubstantial parts of a database are used.[90]

To overcome these barriers, other data access flexibilities can be found in certain jurisdictions. This is particularly the case in Europe with sector-specific or horizontal instruments that aim to grant greater access to data, in particular with the free flow of non-personal data, the non-protection of public sector information (such as geographical information, statistics, weather data, data from publicly funded research projects, and digitized books from libraries), and government access to privately held data (such as machine-generated data with the Internet of Things (IoT)).[91] Finally, to ensure the effectiveness of these exceptions, some jurisdictions provide a "no-contractual-override" provision (that is, unenforceability of contrary contractual provisions that circumvent the safeguards provided by these exceptions).[92]

Public domain works (that is, copyrighted works for which the protection has expired) are usually not protected by copyright and can be in principle reused freely. That is why the Digital Single Market (DSM) Directive provides in article 14 that any act of reproduction of a visual public domain work is not subject to copyright or related rights, considering that visual public domain works contribute "to the access to and promotion of culture, and the access to cultural heritage" and that the protection of such reproductions in the digital environment would be "inconsistent with the expiry of the copyright protection of works."[93] Therefore, thanks to this provision, all users will be able to disseminate copies of visual public domain works with full legal certainty.[94] However, article 14 of the DSM Directive leaves open the possibility of protecting these works if "the material resulting from that act of reproduction is original in the sense that it is the author's own intellectual creation."[95] Moreover, in certain

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[88] Article 7 (1)–(2) of the Database Directive. The EU *sui generis* database right was developed to protect data producers' investments and to prevent free-riding on somebody else's investment in creating the database; see Strowel (note 2), p.15.

[89] de Werra / Benhamou (note 62), N 119 ff.

[90] There is no definite answer as to how much data exactly constitutes a "whole or substantial part" of the database and answering this question will require a qualitative and quantitative analysis in each situation. See however, Strowel (note 2), p.15, indicating that repeated and systematic "pumping" of individual data (which do not qualify as substantive part) could in certain conditions be prohibited under the database right (article 7 (5) Database Directive).

[91] Benhamou (note 64), p.405 and the several references made.

[92] Ibid.

[93] Recital 53 of the DSM Directive. See also European Parliament legislative resolution of 26 March 2019 on the proposal for a directive of the European Parliament and of the Council on copyright in the Digital Single Market (COM(2016)0593 – C8-0383/2016 – 2016(0280(COD)), P8_TA-PROV(2019)0231, pp.51 and 116.

[94] European Commission, Questions and Answers—European Parliament's vote in favour of modernized rules fit for digital age, 26 March 2019, Brussels.

Available online at: https://ec.europa.eu/commission/presscorner/detail/en/MEMO_19_1849: "For instance, anybody will be able to copy, use and share online photos of paintings, sculptures and works of art in the public domain when they find in the internet and reuse them, including for commercial purposes or to upload them in Wikipedia."

[95] Recital 53 of the DSM Directive, indicating that cultural heritage institutions should not be prevented from protecting postcards for instance.

jurisdictions, non-original photographs are protected by copyright or related rights, so that in these jurisdictions photographs of any kinds are subject to copyright or related rights and shall not be used in the absence of an exception or the permission of the right owners.[96]

3.5 Output

In this section, our analysis first focuses on the criterion of originality in the scope of AI-generated pictures. It is followed by an analysis of the creative choices made both by the designers and the users involved throughout the creative process up to the generation of the output (generation phase).

3.5.1 The criterion of originality in the scope of AI-generated pictures

The first ground-breaking decision of the Court of Justice of the European Union (CJEU) to clarify the contours of the EU originality standard was the *Infopaq* ruling,[97] in which the CJEU held that the protection of works such as computer programs, databases, or photographs presupposes that they are the "author's own intellectual creation."[98] In doing so, the CJEU refers to article 1(3) of Directive 91/250, article 3(1) of Directive 96/9,[99] and article 6 of Directive 2006/116,[100] which provide that computer programs, databases, or photographs are protected by copyright "only if they are original in the sense that they are their author's own intellectual creation."[101]

In *Painer*,[102] the CJEU further elaborated the concept of "author's own intellectual creation" in relation to portrait photographs. Thus, the CJEU held that, as regards a portrait photograph, "The photographer can make free and creative choices in several ways and at various points in its production"[103] and that consequently, a portrait photograph can be protected by copyright if such photograph is "an intellectual creation of the author reflecting his personality and expressing his free and creative choices in the production of that photograph."[104] However, in the context of the analysis of the criterion of originality of a database, the CJEU underlined

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[96] See for instance in Switzerland, article 2 al.3 bis of the Swiss Copyright Act ("Photographic depictions and depictions of three-dimensional objects produced by a process similar to that of photography are considered works, even if they do not have individual character").

[97] See note 95.

[98] Infopaq, par.34.

[99] Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases.

[100] Directive 2006/116/EC of the European Parliament and of the Council of 12 December 2006 on the term of protection of copyright and certain related rights (hereinafter: Directive 2006/116/EC). Article 6 provides that "(p)hotographs which are original in the sense that they are the author's own intellectual creation shall be protected in accordance with Article 1. No other criteria shall be applied to determine their eligibility for protection. Member States may provide for the protection of other photographs." Recital 16 of the said Directive further explains that a photographic work within the meaning of the Berne Convention is deemed original if it displays the author's own intellectual creation reflecting his personality. No other criteria such as merit or purpose shall being considered.

[101] Infopaq, par.35.

[102] Case C-145/10, Eva-Maria Painer v. Standard VerlagsGmbH, Axel Springer AG, Süddeutsche Zeitung GmbH, Spiegel-Verlag Rudolf Augstein GmbH & Co KG, Verlag M. DuMont Schauberg Expedition der Kölnischen Zeitung GmbH & Co KG, [2011] ECLI:EU:C:2011:798 (hereinafter: Painer).

[103] Painer, par.90.

[104] Ibid, par.94.

that the criterion was not satisfied when "The setting up of the database is dictated by technical considerations, rules or constraints which leave no room for creative freedom."[105]

Consequently, if we apply the criteria developed by the CJEU to portraits of human beings generated by StyleGANs[106] or similar models, it is necessary to determine whether at various points in the production of the picture with the neural network, the author[107] was able to make free and creative choices and create their own intellectual creation reflecting their personality. Nonetheless, the necessary originality will be absent if the features of a work are predetermined by its technical function,[108] that is, if the GAN automatically generates a picture without any creative choice made by the author throughout the process.

In the USA, the advent of photography confronted judges with a novel technology capable of operating with less human oversight[109] and led the US Supreme Court, in the 1884 case *Burrow-Giles Lithographic Co. v Sarony*, to extend copyright protection to photography for the first time.[110] The camera used to capture a picture of the writer Oscar Wilde was regarded by the US Supreme Court as a tool that aided the author in creating an original work of art,[111] even though it was first said that "The photograph is the mere mechanical reproduction of the physical features or outlines of some object […] and involves no originality of thought or any novelty in the intellectual operation connected with its visible reproduction in shape of a picture."[112] The US Supreme Court ruled in favor of the photographer, who depicted his

> own original mental conception to which he gave visible form by posing the said Oscar Wilde in front of the camera, selecting and arranging the costume, draperies, and other various accessories in said photograph, arranging the subject so as to present graceful outlines, arranging and disposing the light and shade, suggesting and evoking the desired expression, and from such disposition, arrangement, or representation.[113]

The US Supreme Court concluded that photographs could be protected by copyright "as far as they are representatives of original intellectual conceptions of the author."[114]

However, these fairly demanding requirements diminished considerably[115] with *Feist*,[116] a landmark case in which the US Supreme Court held that originality, "the bedrock principle of copyright,"[117] means only "that the work was independently created by the author (as opposed

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[105] Case C-604/10, Football Dataco Ltd and Others v Yahoo! UK Ltd and Others, 1 March 2012, par.39. ECLI:EU:C:2012:115. See also Opinion of Advocate General Mengozzi delivered on 15 December 2011, par.40. ECLI:EU:C:2011:848.

[106] See note 52.

[107] On the various actors involved in the creation of a picture generated by GANs, see section 3.2.2.

[108] Case C-393/09, Bezpečnostní softwarová asociace, [2010] ECLI:EU:C:2010:816, par.49.

[109] Available online at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3032076.

[110] Burrow-Giles Lithographic Co. v Sarony, 111 U.S. 53, 58-59 (1884).

[111] For more, see Hristov Kalin, Artificial Intelligence and the Copyright Dilemma, The IP Law Review, Vol.57, No.3, 2017, p.435.

[112] See note 110.

[113] Ibid, 55.

[114] Ibid, 58.

[115] Sobel Benjamin, A Taxonomy of Training Data in: Hilty / Lee / Liu, Artificial Intelligence and Intellectual Property (Reto eds), Oxford University Press, 2021. Draft available online at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3677548

[116] Feist Publications, 349.

[117] Ibid, 347.

to copied from other works), and that it possesses at least some minimal degree of creativity."[118] The requisite level of creativity is therefore extremely low, which means that even a slight amount of creative expression will suffice.[119] Therefore, "the vast majority of works make the grade quite easily, as they possess some creative spark" but the author's expression cannot be "so mechanical or routine as to require no creativity whatsoever."[120] In addition, a work that it is "entirely typical," "garden-variety," or "devoid of even the slightest traces of creativity" does not satisfy the originality requirement.[121]

In 2001, the US Court of Appeals for the Third Circuit held in *Southco I* that even though the standard in *Feist* was not stringent, there is "a narrow category of works in which the creative spark is utterly lacking or so trivial as to be virtually nonexistent."[122] It concluded that Southco's part numbers fit within this "narrow category of works" that are incapable of sustaining a valid copyright given the fact that the numbers generated by Southco's system were the mere result of a mechanical application rather than creative thought.[123] The appellate body in *Southco II* concurred, underlining that the Southco product numbers were not original because they were dictated by the inflexible rules of the system.[124]

In Canada, the landmark Supreme Court of Canada case *CCH Canadian Ltd v Law Society of Upper Canada*,[125] reached a similar conclusion where it held that "(t)he exercise of skill and judgment required to produce the work must not be so trivial that it could be characterized as a purely mechanical exercise." As further explained, "(f)or example, any skill and judgment that might be involved in simply changing the font of a work to produce 'another' work would be too trivial to merit copyright protection as an 'original' work."[126]

In view of the foregoing, if one adheres to the criteria developed by the US Supreme Court, the US Court of Appeals for the Third Circuit, and the Supreme Court of Canada, it is required to demonstrate that the picture generated by GANs and similar models is hardly the result of a simple mechanical application but rather the expression of the author's creative thought and that it possesses a minimal degree of creativity. This could be argued if the GAN, like a camera or a pen, remains a tool of creation that could leave room for the author to express their creativity,[127] unless those choices are proven to be dictated by mechanical requirements.

Therefore, even though the assessment of the originality criterion varies across jurisdictions, ranging from the "author's own intellectual creation" in the EU to the USA's "minimal degree of creativity" test, we can note that from the point of view of both the judges of the CJEU and

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[118] Ibid, 345 (1991). 17 U.S. Code §102 lit. a provides that "(c)opyright protection subsists, in accordance with the title, in original works of authorship."

[119] Feist Publications, 345.

[120] Ibid, 362. See as well United States Copyright Office, Compendium of U.S. Copyright Office Practices, Third edition, January 2021, Section 308, pp.8–9.

Available online at: www.copyright.gov/comp3/docs/compendium.pdf (hereinafter: Compendium of US Copyright Office Practices, 2021).

[121] Feist Publications, 362. See also the Compendium of US Copyright Office Practices, 2021, section 308.2, p.9.

[122] Feist Publications, 359.

[123] Southco, Inc. v Kanebridge Corp., 258 F.3d 148 (2001), 153 and 156.

[124] Southco, Inc., Appellant v Kanebridge Corporation, 390 F.3d 276 (3d Cir. 2004).

[125] CCH Canadian Ltd. v Law Society of Upper Canada, [2004] 1 S.C.R. 339, 2004 SCC 13.

[126] Ibid, par.16.

[127] Find Hedrick Samantha, I "Think," Therefore I Create: Claiming Copyright in the Outputs of Algorithms, in: NYU Journal of Intellectual Property & Entertainment Law, Vol. 8 No.2, 2019.

the North American courts there is a clear exclusion of, respectively, "technical" or "mechanical" considerations, which further reinforces the need for creativity to be clearly expressed by the author. However, given the diversity of actors involved in the creation of a neural network such as a GAN,[128] the major challenge will be to identify the creative choices, if any, made by various actors throughout the process and displayed in the output.[129]

Interestingly, some authors have debated the creative choices made by neural networks themselves. On one side, authors such as Guadamuz say that rather than being another technical advance, with the use of creative neural networks for creative purposes "(w)e are getting to the point at which vital creative decision are not made by humans, rather they are the expression of a computer learning by itself based on a set of parameters pre-determined by programmers."[130] Taking the opposite view, Ginsburg et al. argue that any "apparent creativity" in a machine's output is nothing more than the result of human decisions and is directly attributable either to the code written by the programmers who designed and trained the machine, or to the instructions provided by the users who operate the machine.[131] Along the same lines, other authors have contested the idea that neural networks can create visual works by pointing out the lack of perceptual abilities of these processes.[132] In fact, DeepDream researchers themselves have stated that neuronal networks are tools that could be used by artists,[133] which suggests a human prerogative over creative choices.

Therefore, if one adopts the latter approach, the focus should be on the creative choices made by human beings. In the following section, we analyze precisely these choices made by various actors, divided between the designers on one side and the users on the other, reflected in the output.

3.5.2 Creative choices of the designers and the users

As a matter of principle, copyright protects creative works of the human mind[134] and, therefore, the question is to determine whose (human) creativity infuses the output. Indeed, as we

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[128] See section 2.2.

[129] See section 2.2.2.

[130] Guadamuz, pp.1, 3 and 4. The author states: "(t)he next generation of artificial intelligence artists are based on entirely different advances that make the machine act more independently, sometimes even making autonomous creative decisions." See also Kasap Atilla, Copyright and Creative Artificial Intelligence (AI) Systems: A Twenty-first Century Approach to Authorship of AI-Generated Works in the United States, Wake Forest Journal of Business and Intellectual Property Law, Vol.19, No.4, 2019, p.348: "Some Skeptics take the position that even advanced programs are primarily confined to the possibilities already established in rules implemented by the original programmer."

[131] Ginsburg Jane C., Budiardjo Luke Ali, Authors and Machines, Berkeley Technology Law Journal, Vol.34, 2019, p.402. Available online at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3233885.

[132] Heath Derrall / Ventura Dan, Before A Computer Can Draw, It Must First Learn to See, Proceedings of the Seventh International Conference on Computational Creativity, June 2016, p.172. Available online at: www.computationalcreativity.net/iccc2016/wp-content/uploads/2016/01/Before-A-Computer-Can-Draw-It-Must-First-Learn-To-See.pdf.

[133] Mordvinstev et al.: "It also makes us wonder whether neural networks could become a tool for artists—a new way to remix visual concepts—or perhaps even shed a little light on the roots of the creative process in general."

[134] Ginsburg Jane C., Overview of Copyright Law, in: Dreyfuss / Pila (eds), Oxford Handbook of Intellectual Property Law, Oxford University Press, 2018. Available online at: https://scholarship.law.columbia.edu/faculty_scholarship/1990

have seen,[135] several actors can come into play and can make creative choices and influence the output from the conception to the deployment of the GAN. Therefore, the objective here is to highlight the actors who could claim copyright on various creative contributions throughout the making of AI-generated pictures.

Under the collective designation of "designers,"[136] we can mention first the figure of the data engineer who compiles individual data or databases, which, as we have seen, may be protected under copyright law if the selection or arrangement of individual data is original, even when the individual data lacks copyright protection (for example, because it is not original or is a public domain work).[137] In such case, the careful original selection of pre-existing data or databases may be protected and reflect itself in the final output (for example if the selection focuses on a specific painter, such as in the case of the Next Rembrandt[138]). However, it is unlikely that this selection alone could contribute to the originality of the output.

Second, we can also consider that the programmer (or software engineer), whose code can be protected under copyright law,[139] could, in the words of the CJEU, express "his free and creative choices in the production"[140] of the picture generated by a GAN. To illustrate this point we can evoke the famous painting created by Obvious Art, *Edmond de Belamy*,[141] which was created thanks to a GAN trained on a database of 15,000 portraits painted between the fourteenth and the twentieth centuries.[142] In this case, if we put aside the analysis of the originality of the code itself,[143] we can analyze which of the programmer's creative choices are actually reflected in the final output and therefore contribute to its originality.[144] In any case, we cannot exclude that "creative coding"[145] specifically designed to generate art could participate in the originality of the output if it can be shown that it reflects the programmer's intellectual creativity.

Insofar as there is no further intervention from users of GANs, the designers, or in other words those who formulate a creative plan manifested in the machines' algorithms and processes that will lead to the creation of expressive content,[146] can claim authorship of the resulting outputs. Ginsburg et al. explain as follows:

> The lack of a direct connection between the designers' minds and the expressive aesthetic content of the fully-generative machines' output does not destroy the designers' authorship claims any more

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[135] Above, section 2.2.

[136] Ginsburg, Budiardjo, p.379.

[137] Above, section 3.1.1.

[138] www.nextrembrandt.com/.

[139] Whose source code and object code are protected under copyright law, as explained in section 3.1.2 of this contribution.

[140] Painer, par.94.

[141] See Christie's, Is artificial intelligence set to become art's next medium? 12 December 2018. Available online at: https://obvious-art.com/portfolio/edmond-de-belamy/.

[142] See www.christies.com/features/A-collaboration-between-two-artists-one-human-one-a-machine-9332-1.aspx.

[143] Above, section 3.1.2.

[144] See note 143. Artist Mario Klingemann, who used GANs to generate new pictures, stated: "Part of my work is technological research. The results of which are usually not artistic but can have use in an artistic context."

[145] See for instance the work of UC Santa Cruz Creative Coding Lab: https://creativecoding.soe.ucsc.edu/news.php.

[146] Ginsburg, Budiardjo, p.379.

> than the lack of a direct connection between the nature photographers' minds and the expressive aesthetic content of their works destroys those photographers' ability to claim authorship over their images. The designer of the fully-generative machine thus meets the "conception" requirement of authorship.[147]

Thus, if the output is not further modified by a third-party user, the analysis of the originality criterion should be limited to the designer's free and creative choices.

However, the "user," who can create new pictures thanks to GANs and similar models, may contribute in different ways. Indeed, if we take the example of Deep Dream Generator, the user has an important role in the process of creation insofar as they will upload a picture[148] and then select the type of filters they wish to apply (deep style; thin style; deep dream).[149] In this case, we will be in the category of generative machines that are "partially generative," whose output reflects the creative contributions of both the designer and the user.[150] Interestingly, Deep Dream Generator's terms and conditions provide that the platform does not claim ownership of any content posted on or through it by the users. Instead, the user grants a "non-exclusive, fully paid and royalty-free worldwide license" to use the user's content to show them on different places on the website (home page, latest feeds, some of their social networks, and so on).[151]

There are also instances where the user contributes to the creation of new pictures to a lesser extent. For instance, in the case of Generated Photos,[152] the platform provides a tool whereby the users, without providing a picture beforehand, will have either the possibility to "browse photos," that is, to choose pictures in the website database by selecting different characteristics such as head pose, sex, age, ethnicity; or instead to "generate a photo," in which case, the user will generate a new picture with a broader and finer range of features, in terms namely of emotion, skin tone, or hair length.[153] Therefore, the user might, at best, display their creative choices by using the features available on the platform to generate a picture. Whether the picture is browsed or generated by the user, the website provides that "permission is granted to download one copy of the materials (information or software) on Generated Photos' web site for personal, non-commercial usage only."[154] A paid license grants the licensee the ability to use the materials for commercial purposes.[155]

Therefore, in the case of Deep Dream Generator, the website provides that it is the user who grants a "non-exclusive, fully paid and royalty-free worldwide license" to use their content,[156] whereas with Generated Photos it is the platform that grants to the user either "permission" to

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147 Ibid, p.414.

148 See the terms of use: https://deepdreamgenerator.com/terms. See the part entitled "Rights," par.4: "You represent and warrant that: (i) you own the Content posted by you on or through the Service or otherwise have the right to grant the rights and licenses set forth in these Terms of Use; (ii) the posting and use of your Content on or through the Service does not violate, misappropriate or infringe on the rights of any third party, including, without limitation, privacy rights, publicity rights, copyrights, trademark and/or other intellectual property rights."

149 https://deepdreamgenerator.com/.

150 Ginsburg, Budiardjo, p.418.

151 https://deepdreamgenerator.com/terms.

152 https://generated.photos/.

153 https://generated.photos/face-generator/new.

154 https://generated.photos/terms-and-conditions.

155 Ibid.

156 https://deepdreamgenerator.com/terms.

download one copy of materials created on their platform for personal usage or a paid licence to use the materials for commercial purposes. Consequently, when we compare both licensing regimes, we see that in the first case it is the user who grants a license whereas in the second case, it is the platform. We can thus wonder if this aspect could not be used in favor of the user of Deep Dream Generator, who could argue that their creative choices contribute to a greater extent to the originality of the output and could thereby justify that authorship be granted to them.

In sum, we see that the particularity of using AI tools lies in the number of creative choices that can be made at different stages of the process by different actors and reflected in the final output. We may therefore wonder how the development of AI-generated art works, including AI-generated pictures, can impact the analysis of the criterion of originality.

4. SHOULD THE ANALYSIS OF THE CRITERION OF ORIGINALITY BE ADAPTED TO APPLY TO AI-GENERATED PICTURES?

In the section relating to input, we discussed the legality of using individual data and datasets, including the possibility to reverse the strict interpretation of the reproduction right towards an economic approach of the reproduction right. In the section relating to output, we considered the variety of actors involved in the creation of an AI-generated picture.

In the following section, we discuss the need to extend our understanding of the analysis of the originality requirement to integrate AI-generated pictures. Indeed, even though digital pictures are not new, the creation process of AI-generated pictures is very different from the one described in *Painer*, where the CJEU relies on a variety of "creative choices made by a photographer (e.g. the background, the subject's pose and the lighting, the framing, the angle of view and the atmosphere created, and the developing techniques used)."[157]

Therefore, if we compare the creative choices made by a photographer, as described in *Painer*, with those made by a user of Generated Photos,[158] the processes and the choices are significantly different. However, as discussed before,[159] the threshold of originality is quite low in various jurisdictions, including the USA and the EU, so that it cannot be ruled out that such a selection may constitute a sufficient creative contribution that would reach the threshold of originality. It seems to us, however, that users who create pictures simply by pressing a "generate" button on a website,[160] without selecting any preset features, should not benefit from copyright protection for the generated work given the complete lack of creative choices. Inversely, when users have an important part in the process of creation, they shall benefit from copyright protection for the generated work.

Thus, the question regarding AI-generated pictures is what is ultimately required of an author in order for them to benefit from copyright protection of their work. Therefore, rather than accommodating the analysis of the criterion of originality to integrate AI-generated pic-

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[157] Painer, par.91.

[158] As described above in section 3.2.2.

[159] See sections 3.1.2 and 3.2.1.

[160] Which is also a possibility offered by the Generated Photos website. For more, see https://generated.photos/.

tures, the key question will be to determine the authorship and allocate the copyright between the variety of actors involved in the creation, such as between the data engineer (who compiles individual data or databases), the programmer (who codes the algorithm), and the user (who can contribute to a picture in different ways). The allocation of copyright between all actors will depend on their creative contribution and their level of coordination.[161]

5. CONCLUSION

In the context of this contribution, we have focused our legal analysis on the criterion of originality both at the input and output stages of the process of picture generation with GANs and similar models.

With respect to input, we have proposed a step-by-step analysis of the selection, programming, and training phases. As regards the selection phase, copyright may protect individual data with sufficient originality as well as compilation data if their selection is original. As regards the programming phase, copyright may protect elements of the software that are original. As regards the training phase, when the input is copyrighted data, its use in connection with the GAN triggers the right of reproduction and requires in principle the authorization of the rights owner, whether the input is simply used as training data or is recognizable in the output. However, in our view the moral right of integrity could be difficult to claim, especially when the changes in images within the neural network are done for pure training purposes and are not visible in the output data. In terms of what happens when the input is non-copyrighted data, we have discussed technical data and public domain works, and we have also presented other avenues of legal protection such as contractual restrictions, trade secrets, and unfair competition.

As for the output, we contend that human beings can only make creative choices insofar as they have expressed creative choices reflected in the output that exceed simple technical or mechanical applications. In this perspective we have distinguished the choices made on one side by the designers, more specifically the data engineer and software engineer, and on the other side by users. However, given the diversity of actors involved throughout the creation of a GAN and, by extension, the creation of the output, it remains difficult to distinguish in the result the creative choices made by each party. This will undoubtedly further complicate the issue of authorship, which will have to be determined on the basis of the analysis of the creative contributions made from the input to the output.

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[161] E.g. in American law, see Ginsburg, Budiardjo, p.444; Shunling Chen, Collaborative Authorship: From Folklore to the Wikiblog, Journal of Law, Technology & Policy 2011, 132 ss.140. In Swiss law, see Benhamou, RSDA 2021, 423 (recalling that there is joint authorship when there is a certain level of coordination between the participants, irrespective of whether each author's part is separable or not).