

## Copyright Ownership for Outputs by Artificial Intelligence

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#### One. Introduction

##### I. From Machine Learning to Deep Learning, AI is Thinking

The famous philosopher, mathematician and physicist René Descartes from France in the 17th century said: “Cogito ergo sum”. This is considered a radical skepticism in the context of philosophy. When a philosopher raises the question that how one person can be sure of his/her existence, it is not about the feeling, cognition or experience with the world. Rather, it is about thinking.

Artificial intelligence works like interconnected human neurons, with the logics and algorithms built with codes and processed with high speed. The nutrient it requires is the massive amount of data. In the past, artificial intelligence only works according to the logical setup and instructions from developers. In the era of machine learning today, humans have empowered machines with the capability of processing. This is achieved not by writing comprehensive and exhaustive rules. Rather, it is by making machines able to figure out rules on their own. In other words, all we need to do is to prepare data. Machines can be trained to think and judge. Artificial intelligence will eventually generate its outputs and start to create contents.

Image recognition is a good illustration of how machine learning works, as part of the wider AI. The identification of cats is a classic example. A large number of pictures and photos of cats are provided, with descriptions of features to train machines. The purpose is to train machines into building their own criteria as to what cats are about. According to the Proceedings of the Seventh IEEE International Conference on Computer Vision in 1999, image recognition is processed with the technology similar with neurons for visual recognition by primates[1].

Twenty years on, machine learning (as part of artificial intelligence) has come a long way. The number of neural network models, built on neurons, has grown exponentially[2]. Deep learning has been developed with layers of neurons. There are links only between neighbouring layers to reduce the number of variables and enhance the speed of computing. In the context of machine learning, learning is about the selection of an optimal solution from multiple variables[3]. Big data is fed into the man-made neural networks constructed in the computers so that they are constantly trained and learning. Hung-yi Lee[4], a scholar specialized in artificial intelligence in Taiwan, provides a simple analogy for this technology. Machine learning is like a human brain with one layer of neurons; whilst deep learning works with many neurons and hence can learn on their own, make judgement and establish logics[5]. In other words, artificial intelligence is capable of analysing, identifying and decision-making on its own, and human is becoming less relevant in this process. Artificial intelligence is able to think. This is not only a factual description, but also a trigger to fundamentally change the legal institution of nations.

##### II. Who Owns the Outputs Generated with Thinking?

Over the long run, whether the legal institution and the society are ready to give artificial intelligence “quasi” right of personality is a topic worth exploring. In the immediate term, what normative models should be used to define the ownership of copyrights for the outputs and creations by artificial intelligence?

The decision on copyright ownership has always been a hot topic in the field of intellectual property. The legal system in the U.S. describes the protected entity for copyright as “the fruits of the intellectual labor”. Article 798 of the Civil Code in Taiwan says, “Fruits that fall naturally on an adjacent land are deemed to belong to the owner of such land, except if it is a land for public use”. The fruit, i.e. outputs generated by artificial intelligence, also falls into the society of rules governed by rights and obligations. Of course, it is necessary to first define and regulate the entity that owns the rights. This begs many fundamental questions in the context of copyright laws. Who owns the rights? The developers (perhaps on a pro-rata basis), data owners, or the companies that provide infrastructure to developers? Once the boundary of imagination and reality is pushed further, the ownership of rights is no longer limited to human creators and may be extended to artificial intelligence. Moreover, it is possible for governments to insist that copyrights are only for human creations and the intellectual property created by artificial intelligence may fall into the public domain and hence fall unprotected legally, given the significance of public interest involved.

This paper explores the copyright ownership for the outputs generated by artificial intelligence by systemically observing the real-life cases in the industry. This is followed with an analysis on the perspectives from the European Union, the United Kingdom and the United States. The purpose is to examine the contexts and normative models of artificial intelligence and copyrights and finally develop a preliminary framework for the regulation of artificial intelligence now and the future.

#### Two. Creativity Capability of Artificial Intelligence Is a Reality

With artificial intelligence and Big Data driving the development of industries, the exploration with the construction and normative models of the legal system should start with the reflection of social values, so as to achieve the purpose of social order with laws and regulations.

The construction of the legal system for technology should be anchored on the observation of facts, given the rapid advancement and evolution of emerging technologies. The fact today is that artificial intelligence is being used for art creations such as musical composition, poetry and painting. Developers train artificial intelligence with massive data and enable deep learning to grasp the essence of artworks in order to generate outputs. Whether the ultimate purpose is commercial profitability or not, most of these outputs have reached a certain level

of quality. Below is a brief introduction of creative techniques and new business models of artificial intelligence in music composition, poetry writing, painting and news writing.

## **I. Original Music Generated with Deep Learning: Fast and User-friendly**

The vibrant development of the Internet has created an online celebrity economy. Youtubers, Internet personalities, cyberstars, Wanghong (or internet fame in Mandarin) produce films or release podcasts to attract the audience for direct/indirect and commercial/non-profit-seeking purposes. The production of such films and live broadcasting, or the creation of original online or PC games creates the demand for background music or sound effects. Ed Newton-Rex, who earned a bachelor of arts degree in music from University of Cambridge, founded JukeDeck[6] after he went to a computer science class in Harvard University. JukeDeck is an online music generator, developed with deep learning(as part of artificial intelligence). This paper believes that JukeDeck meets the industry demand with two offerings[7]:

### **(I) JukeDeck**

#### **1. Rapid generation of pleasant and unique music with deep learning**

The algorithm design by Ed Newton-Rex with artificial intelligence is different from the generation of background music and other music by the websites that use loop audio files. JukeDeck generates music pleasing to the ears with one tone at a time and avoids repetitions by analyzing musical forms, harmonies and tones with deep learning, so that the users in pursuit of originality and unique can acquire the musical materials within approximately 30 seconds, without worrying that they sound similar with others[8].

#### **2. Greater flexibility in length to create bespoke styles and feelings**

JukeDeck offers flexibility in the length of music, up to five minutes depending on the preference of users. An extension is possible by mixing up different fragments. It is also possible to define musical styles and formats, e.g. piano, folksongs, electro and ambient music[9], as well as the feelings to be aroused, such as uplifting and melancholic. The music generated by deep learning is different from the free or paid music databases which use the so-called canned music and suffer the problems of mismatches between the film length and music length[10].

### **(II) Amper Music**

Amper Music was founded by the Hollywood songwriter Drew Silverstein (founder/CEO), Sam Estes and Michael Hobe[11] with the ambition to take a step further from music generation by artificial intelligence. In the spring of 2018, the company raised another \$4 million for the development of music composition with artificial intelligence, the expansion of international markets and the recruitment of more talents. In the press release, Drew Silverstein said, "Amper's rapid growth is a testament to how the massive growth of media requires a technological solution for music creation. Amper's value stems not only from the means to collaborate and create music through AI, but also from its ability to help power media at a global scale." [12]

Similar with JukeDeck's appeal to the public, Amper Music's artificial intelligence allows users with no musical experience to create real-time and order original music[13]. It supports all the media formats. All is required is the choice for rhythms, styles and musical instruments desired[14]. Meanwhile, Amper Music posits that its music is royalty free, and comes with a global, perpetual license when synced to the outputs. In other words, users do not have to worry about legal procedures or financial costs[15].

## **II. Writing Pens Take Flight: A Challenge to the Fundamental of Literary Creation and Trigger for Labor Transformation**

Neuhumanismus (or Neohumanism) is about the achievement of self-mastery and humanity ideals through the study of classics. Compared with humanism, neohumanism places a greater focus on emotional expression and artistic creation. It also emphasizes the importance of language learning to self-realization of individuals.[16] After studying the works of 519 contemporary poets in the Chinese society, artificial intelligence has published modern poetry and made successful inroads to the world of literature traditionally driven by emotions and imaginations. In fact, it has posed a credible challenge to the human-centric humanism where only humans are endowed with the gift of artistic creativity. Artificial intelligence has been nominated for literary awards, evidenced of the quality of outputs generated by deep learning. With the support of massive data and analytics, it is only a matter of time for artificial intelligence to possess the literary creativity comparable to humans.

However, the concern for originality in literature and the issues surrounding plagiarism and copyrights are the key determinants that influence of literary creation by artificial intelligence. This begs the questions about the ethics of literary creation. It is necessary to start with an understanding of how artificial intelligence creates, before the analysis of ethical and regulatory frameworks.

### **(I) Xiaoice's Collection "Sunshine Misses Windows"**

Xiaoice is the chatbot launched by Microsoft's Software Technology Center Asia (STCA) in China in 2014. In 2017, Xiaoice published her collection of poems "Sunshine Misses Windows"[17], written by looking at pictures. The deep learning algorithms behind were co-developed by Wu Zhao-Zhong and Cheng Wen-Feng, two students in the Graduate Institute of Networking and Multimedia, National Taiwan University.

The artificial intelligence writes poetry with the following methodology[18]:

1. Use of image recognition technology to identify the keywords in the pictures: The adoption of image recognition technology developed by Microsoft's Software Technology Center Asia (STCA) to identify the nouns in the pictures such as the bridge, skies and trees and the adjectives that express feelings such as beautiful or annoying.
2. Matching of keywords from the training database: The training data for the matching of keywords and poetry database was the works of a total of 519 contemporary poets since the 1920s. The purpose was to fill in the gap between keywords and training data.
3. Generation of poems: deep learning trained in the language model with keywords to create poems
4. Improvement of poems: literary professionals and readers invited to give ratings. Submission of writings as an anonymous author to improve Xiaoice's capability.

The above is a summary of Xiaoice's creative journey. Microsoft claims that the collection of poems was 100% written by Xiaoice, and it is the first collection of poems 100% written by artificial intelligence in history. The poems were not edited by humans and wrong characters were maintained as they were. The title "Sunshine Misses Windows" was also named by Xiaoice herself[19]. Despite all these, the originality and even the most fundamental "literality" of these poems are still questioned.

At the end of 2018, the Research Institute for Humanities and Social Sciences, Ministry of Science & Technology and National Taiwan University organized the forum "Culture and Technology II: AI's Literature Dream — Sunshine Misses Windows. Does Humanity Have a Boundary?" The professor in the Department of Chinese Literature, National Taiwan University and the poet Tang Juan discussed Xiaoice's works[20] and commented as a critic of contemporary poetry. Xiaoice uses extensively the same vocabulary (such as the beach). Unable to use punctures, she can only break sentences and lines. Most importantly, her writings do not reflect our times and real experience. In other words, Xiaoice's poems do not possess the unique perspective and soul of poets and literary characters. This may be the outcome of her reading of works from 519 poets from the 1920s. As a result, she is not able to connect with our times and real life and finds it difficult to resonate the shared emotions of people today. Tang Juan's comment is more than just about literature. It is also about the selection and sourcing of training data, a prerequisite for the development of artificial intelligence, as well as the cost and consideration for copyright licensing.

The research and development by corporates in artificial intelligence requires the corresponding and suitable training materials, particularly in the domain of literature. As commented by the poet Tang Juan, it requires extensive sources of contemporary works. It means the increasing difficulty to circumvent the works still protected by copyrights. If this cost consideration remains a hurdle, it is impossible to make improvements in further research. Put differently, the composition of training data is potentially a cost concern for copyright licensing. Before the legal system becomes well-developed and the establishment of consensus on the issues concerning training data, the possible infringement is an absolutely necessary balancing act for any robust developers and companies involved in artificial intelligence.

### **(II) Yuurei Raita's "The Day A Computer Writes A Novel"**

In 2013, Nikkei started to offer the Nikkei Hoshi Shinichi Literary Award to outstanding short Si-Fi novels, as a tribute to the late science fiction writer Hoshi Shinichi[21]. Three years later, Yuurei Raita's "The Day A Computer Writes A Novel" appeared on Nikkei's list of acceptance for competition. Miss Yoko is the leading character in this 2000-character short sci-fi novel[22]. Raita-kun is in fact an artificial intelligence team "Wagamama artificial intelligence as a writer" led by Hitoshi Matsubara, President of the Japanese Society of Artificial Intelligence and a professor in Future University[23]. Below is a description of their deep learning techniques[24]:

#### 1. Analysis of writing styles from training data:

The team provides training data as the learning basis for artificial intelligence. (For this competition, the data is approximately 1,000 short stories written by Hoshi Shinichi.) The purpose is to analyze the frequently used words, novel structures and characters.

#### 2. Resource integration by the team:

The team integrates the analyzed data with online information, storyline programs, human emotions and settings, and decides on characters, contents and plots[25]. Researchers provide three instructions, i.e., when, the weather, doing what so that artificial intelligence automatically generates detailed and tangible contents.

#### 3. Automatic generation of new works:

Artificial intelligence refines the details and polishes the texts, to generate the new story by Hoshi Shinichi with fragments such as: "The same temperature and humidity in the room is maintained as usual. Yoko sits idly on the sofa, dishevelled and playing a dull game uninterested."

The procedures of novel contents generation described above indicate that artificial intelligence still relies on humans for setups and assistance. In contrast with the claim by the Microsoft team that Xiaoice is 100% artificial intelligence, the team in Japan confessed that artificial intelligence writing is still in a nascent stage.

At least in literature types such as novels, artificial intelligence still needs appropriate guidance from humans for necessary writing elements, in order to generate and connect fragments to establish the finalized pieces. In general, artificial intelligence can only be held responsible for 20% of work[26]. However, the development of technology continues at its pace. When it is no longer easy to differentiate a piece of creative writing is by humans or by machines, the limitation of copyright protection to human's creative works will be an obsolete approach.

### **(III) Tencent: Robot "Dreamwriter"**

The above two AI writing teams focus on creative literature. In China, Tencent has developed Dreamwriter to rapidly generate news products. In the 2018 International Media Conference in Singapore[27] hosted by the East West Center, a think tank in the U.S. at the end of June 2018, Tencent demonstrated its translation engine. Speakers spoke in Chinese and the engine did simultaneous translation into English shown on the projector screen[28].

Tencent's artificial intelligence "Dreamwriter" project started as a push engine for news flashes such as sports events. It later extended into financial and economic data and reporting, a field with extensive data and conducive to AI development and ML acceleration[29]. Dreamwriter only takes half to one second to generate a piece of news. It can generate approximately 5,000 articles per day, equivalent to the output of 208 journalists. This implies a transformation of labor requirements in journalism. Human reporters will be involved in in-depth coverage that requires creativity, industry knowledge and judgement[30], whilst basic and factual reporting will be completed by artificial intelligence.

## **III. Brave New Work for Paintings: Rights Ownership in the Presence of Sophisticated Deep Learning**

In the autumn/winter of 2018, the Paris-based AI team Obvious presented "Portrait of Edmond Belamy"[31] in Prints & Multiples auction

in New York. This painting was sold for a surprising high price of [32] \$432,000 (or over NT\$13 million)[33], as the first AI-generated painting being auctioned. The Obvious team focuses on Generative Adversarial Network (GAN)[34], a hot topic for the development of deep learning.

### **(I) Technique to Improve Deep Learning: Generative Adversarial Network (GAN)**

The GAN technique was developed by Ian Goodfellow[35] in 2014 to promote and enhance deep learning by massively reducing the amount of training data required and cutting down on human intervention, assistance and involvement[36].

The GAN method can be illustrated in a high level by referring to the classical example of the image recognition for cats previously mentioned. The neural network model (as a deep learning technique) enables artificial intelligence to learn how to identify cats from a massive volume of pictures of cats. However, it is necessary for humans to train the machine by providing signs and feature descriptions for each picture. In contrast, the GAN technique is about the training of two competing networks,[37] i.e., a generative network and a discriminant network[38]. The generative network is responsible for generating the pictures that resemble real cats (i.e. made-believe cats) and the discriminant network reviews and determine whether the pictures are authentic. The two networks enhance capabilities by competing with each other. The idea is to improve the learning and competence of deep learning[39].

### **(II) Application in the Art of Paintings**

The GAN method can be used to generate paintings such as "Portrait of Edmond Belamy". It can also identify fake paintings. Founder/CEO Jensen Huang of Nvidia, a leading artificial intelligence company, said in a forum that the GAN technique allows one neural network to paint the pictures in the Picasso style and the other network to identify images and paintings with unprecedented discriminant capabilities[40]. The seventh year of the Lumen Prize gave the biggest award to a nude portrait generated with the GAN technique[41]. The GAN applications have been mushrooming – turning a scribble into an art, a low-definition picture into a high-definition one, an aerial graph into a photo[42].

Below is a brief description of the concepts and procedures for the Obvious research team's completion of "Portrait of Edmond Belamy"[43]:

1. Analysis of portraits from training data: A total of 15,000 portraits from the 14th century to the 20th century as the training data
2. Generative network vs. discriminant network: The generative network generates paintings on the basis of training data. The discriminant network seeks to identify the difference from human-created paintings in order to improve the capability of the generative network. This process continues until the discriminant network is no longer to tell a machine-created painting from a human-created painting.

### **(III) Ownership of Rights to High Economic Value of Artworks**

The winning of the Lumen Prize in the UK by the nude portrait generated by artificial intelligence and the surprisingly high auction price paid for Portrait of Edmond Belamy are the testimony of the artificial intelligence's creative capability. The ownership of the right to the monetary value of these artworks is a topic worthy of exploration.

"The development team 'Obvious' for 'Portrait of Edmond Belamy' posits that if the author is the person who paints the painting, it is artificial intelligence. If the author is the person who seeks to convey a message, it is us[44]. The human's role is being undermined as deep learning technology becomes increasingly sophisticated. Going forward, can artificial intelligence become the owner of rights? What should be the regulatory framework for now? At this juncture, this paper conducts an international comparison by examining how different governments consider the emerging legal issues.

## **Three. Copyright Ownership of Works Created by Artificial Intelligence**

The explanatory ruling by the Copyright Division, Intellectual Property Office, Ministry of Economic Affairs issued in 2018[45] has expressed the Taiwan government's stance on the issue of whether the outputs generated by artificial intelligence can enjoy copyrights. Below is the summary:

1. Presumption: Article 10 and Article 33 of the Copyright Law[46] stipulates that only natural persons or legal persons can be the owner of rights and obligations pertaining to creative works and enjoy the protection of copyrights.
2. Positioning and logics: The outputs generated by artificial intelligence are the intellectual results expressed by machines created by humans. Machines are neither natural persons or legal persons and hence do not attract copyrights.
3. Proviso: If the results are created with participation of natural/legal persons and the machines are being operated for analytics, the copyright of the results expressed should belong to the natural/legal persons concerned.

The above explanatory ruling seems to position artificial intelligence completely as a tool. However, the above example suggests an obvious trajectory for the creative journey for deep learning as an artificial intelligence technique. In the current stage and the foreseeable future, the description that robot analytics are straight mechanical operations is completely obsolete given that artificial intelligence is being applied in industry with dramatically reduced (or even completely without) human intervention and participation.

It is a worthwhile exercise to explore the international thinking regarding how the legal framework should address the ownership of rights for outputs generated with deep learning as an artificial intelligence technique and the derived services/products by either opening up new legal structures or simply extending on the existing system.

### **I. European Union**

#### **(I) European Parliament: Establishment of Electronic Personhood?**

The European Parliament's Committee on Legal Affairs (JURI) passed a report on January 12, 2018 to provide suggestions to the Civil Law Rules on Robotics and urge the European Commission to set up laws and regulations governing robots and artificial intelligence by defining electronic personhood, similar with legal personhood for corporates as litigation entities for any issues associated with rights and obligations of artificial intelligence[47].

## **(II) Court of Justice of the European Union: Only Works Accomplished by Humans Eligible for Protection**

The Court of Justice of the European Union's landmark case *Infopaq International A/S v. Danske Dagbaldes Forening*[48] suggests that copyrights are only applicable for original works, with originality reflecting the "author's own intellectual creation." The general interpretation is that such works should reflect the author's personality. Hence, only human authors meet this criterion[49]. The third paragraph of Article 1 of the Directive 2009/24/EC also clearly states that only works that are the authors' own intellectual creation enjoys eligibility for protection[50].

## **(III) Data Protection: GDPR and Declaration of cooperation on Artificial Intelligence**

The General Data Protection Regulation (GDPR) in European Union attracted significant attention among the companies active in the EU market in 2018. In fact, the GDPR provides comprehensive and representative regulations that have direct influence on technological development of artificial intelligence training, as well as legal protection and right construction on data, the crude oil for deep learning.

Below are a few examples:

### 1. Article 20 on data portability:

The data subject has the right to receive his/her personal data from the data controller in a structured, commonly used and machine-readable format. This helps the industry to establish metadata and forms the basis of the database for artificial intelligence training. The consistency of metadata will enhance the training.

### 2. Article 22 on automated individual decision-making

The data subject has the right not to be subject to a decision based solely on automated processing. The data controller must lay down suitable measures to safeguard the data subject's rights.

### 3. Article 35 on data protection by design and by default

This article provides the legal protection of large-scale and systematic monitoring of public and open areas with artificial intelligence and strikes a balance between the use of personal data and the interest of data subjects.

On top of the GDPR, the 24 member states of the European Union signed the Declaration of Cooperation on Artificial Intelligence in 2018, in order to enhance access to public sector data for the digital single market.

## **II. United Kingdom**

### **(I) Copyright Law: Source of Laws for Program Developers to Obtain Copyrights**

The copyright laws are stipulated in the Copyright, Designs and Patent Act (CDPA) 9 (3)[51]. It forms the source of the laws that grant copyrights to the developers of computer-generated works. Article 178 of the CDPA defines computer-generated works as the outputs generated by machines without human authors[52].

In contrast with the Court of Justice of the European Union's decision that only human authors are eligible for copyright protection, the UK government opens up another door by specifying that program designers can obtain copyrights even if creative sparks come from machines[53]. This system is considered the most efficient because it enhances incentives for investments[54].

### **(II) Public Sector: Open up Government Data**

The UK government also opens up its data by posting all the official statistics on the website [www.data.gov.uk](http://www.data.gov.uk). The Digital Economy Bill provides the legal framework for government agencies to use each other's data for the benefit of the public, so as to effectively address the issues surrounding frauds and debts and improve the real-timeliness and accuracy of national statistics.

As part of the Brexit preparation, the UK government has created its own GDPR (2018) to ensure the continued smooth cross-border operations of companies after Brexit. As it offers higher protection of consumers' data and information, it is worthwhile to refer to the UK GDPR as a template for legal systems and rights frameworks.

## **III. United States**

### **(I) U.S. Copyright Office: Only Intellectual Achievements of the Human Mind Eligible for Protection**

The case law originated in 1991—*Feist Publications v. Rural Telephone Service Company*[55] confirms that copyrights protect the creative powers of the mind. In the *Naruto v. Slater* (2016)[56] case, the court determines that the photos taken by a monkey are not eligible for copyright protection. Article 313.2 of the implementation guidelines of the Copyright Act issued by the U.S. Copyright Office specify that the works created without human authors are not protected by the Copyright Act. The amendment to Article 313.2 in 2017 states clearly that the U.S. Copyright Act only protects the intellectual achievements of the human mind[57]. The U.S. Copyright Act 503.03(a), titled "Works-not originated by a human author" also states that only works created by a human author can register for copyrights[58].

### **(II) Employment Principle: Enhanced Incentives and Investment Willingness**

The above court judgements and the implementation guidelines of the U.S. Copyright Act indicate that the U.S. Copyright Office does not confer non-human copyright[59]. However, the U.S. judicial rulings have allowed "the work made for hire provision" as exception to the creative authors, in order to encourage corporate investments. The 1909 amendment to the U.S. Copyright Act included the hired employees as authors. Unless otherwise agreed, "the author or proprietor of any work made the subject of copyright by this Act, or his executors, administrators, or assigns, shall have copyright for such work under the conditions and for the terms specified in this Act". A typical example is the news agency's employment of full-time journalists to produce editorials. The works by employees are a company's key copyright assets[60].

### **(III) Employment/Sponsorship Principle if Realized in Taiwan: Companies Investing in Works to Obtain Copyright Protection**

Article 11 of the R.O.C. Copyright Act stipulates the ownership of the right to the works of employees on a case-by-case and factual basis. The decision is based on the nature of work, e.g., completion under the employer's instructions or planning, the use of the employer's budgets or resources. It is not necessarily related to the work hours or locations. In principle, the employee is the author of the

works completed by him/her on the job. However, the employment contract supersedes if it specifies that the employer is the author. On the other hand, if the employee is the author, the intellectual property belongs to the employer. The contract supersedes if it specifies that the employee enjoys the intellectual property. Article 12 is about sponsorship and commissioning. Unless specified by the contract, the sponsored owns the intellectual property of his/her works and the sponsor has the right to use such intellectual property[61]. In sum, the ownership of the right to the outputs generated by artificial intelligence is similar with the employment/sponsorship principle. It is not set in the vacuum of legal contexts.

Therefore, the scholar in Taiwan Lin Li-Chih suggests that the employment principle in the U.S. may be adopted. She posits that when certain conditions are met, artificial intelligence may be treated as the author, so that the outputs generated by artificial intelligence can be protected and the investing research institutes or corporates can own the works[62]. As both legal persons and natural persons can be authors in Taiwan, Lin Li-Chih proposes this approach to resolve disputes given the massive value to be created by artificial intelligence for different applications and the potential lengthy legislative process or laws disconnected from industry expectations. The idea is to avoid the human author requirement from hindering industry investments and innovations for works generated by artificial intelligence[63]. According to the employment/sponsorship principle, deep learning as an artificial intelligence method can be inferred to as the author and then teams and companies that develop the algorithms should own the intellectual property of the works. This will serve as the legal foundation for intellectual property protection.

#### **Four. Conclusion: Legal System and Policy Framework for Emerging Technologies**

##### **I. Construction of Laws and Regulations on a Rolling Basis According to the Reality of Emerging Technologies**

Every law has its purpose, and the contents of laws depend on their regulatory objectives. However, such contents should be anchored on facts, in order to align the intended purposes. This is particularly the case for the laws and regulations governing emerging technologies because such laws and regulations should capture the fact of technological developments. The most straightforward and fundamental approach to relax the control of the existing legal mechanism is via communication, coordination and understanding. It can be initiated with more dialogues between the government agency responsible for the construction of the legal environment and the industries and the public as subjects of the laws and regulations.

Regulators may wish to come up with dedicated laws for the comprehensive coverage of emerging technologies given the lack of understanding about the technology and the sweeping effects of the technology. However, not all technologies require special legislations. According to Frank H Easterbrook's article "Cyberspace and the Law of the Horse" published by the University of Chicago's legal journal, it is advised to properly categorize and analyze existing laws and regulations and apply the suitable ones to new technologies for issues surrounding intellectual property, contracts and torts, as if from the Law of the Horse to the Law of Cyberspace[64]. Similarly, the ownership of copyrights associated with artificial intelligence and the governance of emerging technologies such as autonomous driving and robots may be dealt in this way.

The above analysis on the legal regimes in the European Union, the United Kingdom and the United States highlights two issues concerning the regulation of artificial intelligence and the development of legal environments.

1. The growing sophistication of deep learning will enhance the capability of artificial intelligence in thinking, analysis and creation, with human intervention expected to be reduced to almost zero.
2. The legal regime governing emerging technologies cannot stand in the way of technological and industry development or incentives for investment, as originally intended by the intellectual property laws. A balancing act is required.

This paper thus suggests two models:

##### **1. Forward-looking approach to label rights ownership with legal articles**

This is the route taken by the UK government, by directly amending the intellectual property laws to specify that intellectual property of artificial intelligence belongs to program developers. It is the most efficient approach of paving the way for technological development by providing incentives to companies and developers.

##### **2. Adoption of the employment/sponsorship principle in conjunction with safe harbor clauses**

Another approach is without touching on the sensitive issue of law amendments. Judicial rulings or administrative interpretations by competent authorities are gradually released in the context of existing laws. A temporary solution is introduced with the adoption of the employment/sponsorship principle with corresponding templates and references for contract construction in the industry. This can work in conjunction with safe harbor clauses in the long run, by slowly converging the diversity of opinions and perspectives from corporates, government agencies and academic/research institutions. Adjustments by tightening or loosening on a rolling basis should be made in order to work out the optimal boundary and establish the basis for legislation in the next stage.

##### **II. Data as a Prerequisite for Artificial Intelligence Training**

In Taiwan where the legal environment is not yet ready or clear, the ownership of intellectual property for outputs generated by artificial intelligence also involves the potential licensing royalties for the sourcing of training data.

It is worth noting that the use of data for artificial intelligence may affect the basic human rights due to discrimination or bias resultant from training data or algorithms. Therefore, it is necessary to enhance transparency and the protection of human rights conferred by the constitution with corresponding legal systems and ethical frameworks such as due process and fairness principle[65]. The other critical issue is the training database required for artificial intelligence applications. The government should provide more open data as a policy to support technology development in the corporate world or at research organizations. It is also necessary to make government information the structured metadata in order to enhance the efficiency and quality of research outputs. This is to facilitate added value by private sectors with data as an infrastructure provided by the government. Put differently, the government opens up structured data to empower the research and development of artificial intelligence; whilst the private sectors offer professional technology and development capabilities.

In terms of promoting data openness and applications, the government assumes greater accountability in the balancing between data use and data protection, the two equally important public interests. As an island of technology, Taiwan should look beyond the horizon of skies and oceans in the era where information and data flows without borders. The Taiwan government should establish the capability in data openness, protection and control by joining international forums. For instance, the government can apply with the APEC to join the Cross-Border Privacy Rules System in order to encourage regional collaborations in data control and construct datasets with the resources of the country. It is important to focus on the process of data collection, processing, analysis and utilization and ensure policies are implemented with the protection of civil and human rights such as the Right to Know, the Right to Withdraw and Citizen Data Empowerment.

[1] David G. Lowe, Object Recognition from Local Scale-Invariant Features, Proceedings of the Seventh IEEE International Conference on Computer Vision, <https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=790410> (last visited Dec. 27, 2018) excerpt from “These features share similar properties with neurons in inferior temporal cortex that are used for object recognition in primate vision”.

[2] AI Lesson 101: Illustration of 27 Neural Network Models, Tech Orange, January 24, 2018, <https://buzzorange.com/techorange/2018/01/24/neural-networks-compare/> (last visited on December 27, 2018)

[3] Chen Yi-Ting (Bachelor’s Degree from Department of Physics, National Taiwan University, currently a PhD candidate in Department of Applied Physics, University of Stanford), Artificial Intelligence Starts with Neurons, May 3, 2018, <https://case.ntu.edu.tw/blog/?p=30715> (last visited on December 27, 2018)

[4] Hung-yi Lee’s personal profile at <http://speech.ee.ntu.edu.tw/~tlkagk/>. Currently teaching in Department of Electric Engineering, National Taiwan University; previously a guest scientist in MIT’s Computer Science and Artificial Intelligence Laboratory (CSAIL); specialization in machine learning and deep learning

[5] Chen Yan-Cheng, Who Is Likely to Lose Jobs in the Era of Artificial Intelligence? Experts Explains the Professional Skills in Demand for Deep Learning, December 26, 2018. <https://www.managertoday.com.tw/articles/view/56859> (last visited on December 27, 2018)

[6] Details available on JukeDeck’s official website at <https://www.jukedeck.com/> (last visited on January 11, 2019)

[7] In addition to the leverage of two key features of artificial intelligence, JukeDeck is also very friendly to creative teams in need of musical materials in terms of royalties, fee structures, UI/UX design. The company offers free downloads to non-commercial users. An individual or a small group (of fewer than 10 people) can enjoy five free downloads each month and pay \$6.99 per song for the sixth download and above. Large groups (of ten people or more) should pay \$21.99 for each download.

[8] DIGILOG Authors, “A Nightmare for Musicians? AI Online Music Composer System – JukeDeck, DIGILOG, June 2, 2016, <https://digilog.tw/posts/668> (last visited on January 2, 2019)

[9] Laird Studio, Let the Online Music Composer Jukedeck Produce Unique Background Music for Your Films or Games! March 8, 2016, <https://www.laird.tw/2016/03/jukedeck-jukedeck-bgm.html> (last visited on January 10, 2019)

[10] As above.

[11] Amper Music’s official website at <https://www.ampermusic.com/> (last visited on January 10, 2019)

[12] GlobeNewswire, Amper Music Raises \$4M to Fuel Growth of Artificial Intelligence Music Composition Technology, March 22, 2018, <https://globenewswire.com/news-release/2018/03/22/1444796/0/zh-hant/Amper-Music%E7%B1%8C%E8%B3%87400%E8%90%AC%E7%BE%8E%E5%85%83%E4%BB%A5%E6%8E%A8%E5%8B%95%E4%BA%BA%E5%B> (last visited on January 10, 2019) . This round was led by Horizons Ventures, with Two Sigma Ventures, Advancit Capital, Foundry Group and Kiwi Venture Partners. This brings the company’s total investment to \$9 million.

[13] GlobeNewswire, same as above

[14] Smart Piece of Wood, Free Online Composer Enabled by AI, Amper Music, March 1, 2017, Modern Musician · <https://modernmusician.com/forums/index.php?threads/%E5%85%8D%E8%B2%BB%E7%B7%9A%E4%B8%8A%E5%B9%AB%E4%BD%A0%E4%BD%9C-%E7%B7%A8%E6%9B%B2%E7%9A%84%E4%BA%BA%E5%B7%A5%E6%99%BA%E8%83%BD%EF%BC%9Aamper-music.225650/> (last visited on January 10, 2019)

[15] GlobeNewswire, same as Note 12

[16] Fang Yung-Chuan, Neohumanism, National Academy for Educational Research, <http://terms.naer.edu.tw/detail/1312151/> (last visited on January 10, 2019) . Neohumanism emerged in Europe in the 18th and 19th century, against rationalism and utilitarianism advocated by the enlightenment movement. Neohumanism argues that the value of things is not hinged on practicality. Rather, it stems from the things themselves. Humanity is precious not because of rationality, but resultant from emotional satisfaction in life. Cultures are originated by the spontaneous activities of humanity, on the basis of emotions and imaginations.

[17] Synopsis by books.com.tw, who sells online Xiaoice’s “Sunshine Misses Windows”, the first collection of poems generated by artificial intelligence in history, August 1, 2017, China Times Publishing Co. <https://www.books.com.tw/products/0010759209> (last visited on January 13, 2019)

[18] Wong Shu-Ting, AI Talents in Taiwan Find Stage in China: NTU Students Participate in R&D That Empowers Microsoft’s Xiaoice to Write Poetry by Looking at Pictures, BusinessNext, June 6, 2017, <https://www.bnext.com.tw/article/44784/ai-xiaoice-microsoft> (last visited on January 10, 2019)

[19] Synopsis by books.com.tw, same as Note 17

[20] The organizer did not provide handouts from the speakers. The summary was based on the author’s note.

[21] Lin Ke-Hung, “More Than Playing Chess. AI Writes Novels Too. AI Novel Passes Preliminary Screening for a Novel Award! Reading at Frontline, <https://news.readmoo.com/2016/03/25/ai-fictions/> (last visited on January 10, 2019)

- [22] Ou Tzu-Jin, "2,3,5,7,11..? AI-written Novel in Japan Nominated for a Literary Award, April 7, 2016, The News Lens , <https://www.thenewslens.com/article/38783> (last visited on January 10, 2019)
- [23] TechBang, AI Team in Japan Develops Robots That Write Short Stories and Participates in Literary Competitions, TechNews, March 28, 2016, <http://technews.tw/2016/03/28/ai-robot-novel-creation/> (last visited on January 10, 2019)
- [24] Ou Tzu-Jin, same as Note 20
- [25] TechBang, same as Note 21
- [26] Lin Ke-Hung, same as Note 19
- [27] The title of the forum was "What is News Now?". It attracted over 300 journalists and media experts from the U.S. and Asia Pacific to discuss media phenomena today. Detailed agenda available at East West Centre's official website at <https://www.eastwestcenter.org/events/2018-international-media-conference-in-singapore> (last visited on January 10, 2019)
- [28] Jason Liu, "Robot Writer, Transformation of South China Morning Post, State Monitoring, International Media Conference Day 1, China, Medium, June 25, 2018, <https://medium.com/@chihhsin.liu/%E5%AF%AB%E7%A8%BF%E6%A9%9F%E5%99%A8%E4%BA%BA-%E5%8D%97%E8%8F%AF%E6%97%A9%E5%A0%B1%E8%BD%89%E5%9E%8B-%E5%9C%8B%E5%AE%B6%E7%9B%A3%E6%8E%A7-%E5%9C%8B%E9%9A%9B%E5%AA%92%E9%AB%94%E6%9C%83%E8%AD%B0day1-%E4%B8%AD%E5%9C%8B-c9c20bd00d75> (last visited on January 10, 2019)
- [29] Jason Liu, same as above
- [30] Jason Liu, same as above
- [31] First Time Ever in the World ! AI-Created Portrait, Sold at Christie's Auction for NT\$13.34 Million, Liberty Times, October 26, 2018, <http://news.ltn.com.tw/news/world/breakingnews/2592633> (last visited on January 10, 2019)
- [32] The selling price is 40x higher than the expected price. The buyer's identity is unknown. Chang Cheng-Yu, "First Time Ever! AI-Created Portrait Auctioned at Christie's for NT\$13.34 Million, October 26, 2018, LimitlessIQ · <https://www.limitlessiq.com/news/post/view/id/7241/> (last visited on January 10, 2019)
- [33] Lin Pei-Yin, Does the NT\$10m Worth AI Portrait Have Intellectual Property?" Apple Daily, Real-Time Forum, November 29, 2018, <https://tw.appledaily.com/new/realttime/20181129/1475302/> (last visited on January 10, 2019)
- [34] Jamie Beckett, What Are Generative and Discriminant Networks? Hear What Top Researchers Say, Nvidia, May 17, 2017, <https://blogs.nvidia.com.tw/2017/05/generative-adversarial-network/> (last visited on January 10, 2019)
- [35] Jamie Beckett, same as above. Ian Goodfellow is currently a Google research scientist. He was a PhD candidate in the Université de Montréal when he came up with the idea of generative adversarial networks (GAN).
- [36] Jamie Beckett, same as above
- [37] Jamie Beckett, same as above
- [38] Chang Cheng-Yu, same as Note 32
- [39] Jamie Beckett, same as Note 34
- [40] Video for the speech: GTC 2017: Big Bang of Modern AI (NVIDIA keynote part 4), link at <https://www.youtube.com/watch?v=xQVWEmCvzoQ> (last visited on January 10, 2019)
- [41] Wu Chia-Zhen, AI-Generated Nude Portrait Beats Real People's Works by Claiming the UK Art Award and Prize of NT\$120,000, LimitlessIQ, October 15, 2018 <https://www.limitlessiq.com/news/post/view/id/7070/> (last visited on January 10, 2019)
- [42] Jamie Beckett, same as Note 34
- [43] Chang Cheng-Yu, same as Note 32
- [44] Chang Cheng-Yu, same as Note 32
- [45] The explanatory ruling by the Copyright Division, Intellectual Property Office, Ministry of Economic Affairs, Email 1070420, issued on April 20, 2018, <https://www.tipo.gov.tw/ct.asp?ctNode=7448&mp=1&xltem=666643> (last visited on January 2, 2019) . The discussion was in response to the training outcome of voice recognition patterns based on analytics of the 1999 Citizen Hotline voice data.
- [46] According to Article 10 of the Copyright Law, authors enjoy copyright at the time of the work completion. Article 33 stipulates that copyright for legal-person authors lasts 50 years after the first publication of the work concerned.
- [47] Yeh Yun-Ching, Birth of New Type of Legal Right/Liability Entity – Possibility of Robots Owning Copyrights According to 2017 Proposal from European Parliament, IP Observer - Patent & Trademark News from NAIP Issue No. 190, July 26, 2017 [http://www.naipo.com/Portals/1/web\\_tw/Knowledge\\_Center/Laws/IPNC\\_170726\\_0201.htm](http://www.naipo.com/Portals/1/web_tw/Knowledge_Center/Laws/IPNC_170726_0201.htm) (last visited on January 2, 2019)
- [48] C-5/08 Infopaq International A/S v. Danske Dagbaldes Forening.
- [49] Andres Guadamuz, Artificial Intelligence and Copyright, WIPO MAGAZING, October 2017, [https://www.wipo.int/wipo\\_magazine/en/2017/05/article\\_0003.html](https://www.wipo.int/wipo_magazine/en/2017/05/article_0003.html) (last visited on January 19, 2019).
- [50] The article indicates that "A work should be protected in "the sense that is the authors' own intellectual creation. No other criteria shall be applied to determine its eligibility for protection".
- [51] Excerpt from the original legal article: in case of a literary, dramatic, musical or artistic work which is computer-generated, the author shall be taken to be the person by whom the arrangements necessary for the creation of the work are undertaken.
- [52] Excerpt from the original legal article: generated by computer in circumstances such that there is no human author of the work.
- [53] Andres Guadamuz, *supra* note 49.
- [54] *Id.*
- [55] Feist Publications v. Rural Telephone Service Company, Inc., 499 U.S. 340 (1991). **"the fruits of intellectual labor that are founded in the creative powers of the mind."**



[56] *Naruto v. Slater*, 2016 U.S. Dist. (N.D. Cal. Jan. 28, 2016).

[57] The 2014 version of Article 313.2 provides a list of the examples not eligible for the U.S. Copyright Act protection. These include the works generated by the nature, animals or plants and the works purely generated by machines or machinery at random, without any creative inputs or intervention from humans. The examples given are photos taken by a monkey and murals painted by an elephant. The 2014 version establishes that works not created by humans are not eligible for copyright protection. The 2017 version takes a step further with more specific and straightforward wording.

[58] Copyright Act 503.03(a): **Works-not originated by a human author.**

**In order to be entitled to copyright registration, a work must be the product of human authorship. Works produced by mechanical processes or random selection without any contribution by a human author are not registrable.** Thus, a linoleum floor covering featuring a multicolored pebble design which was produced by a mechanical process in unrepeatable, random patterns, is not registrable. Similarly, a work owing its form to the forces of nature and lacking human authorship is not registrable; thus, for example, a piece of driftwood even if polished and mounted is not registrable.

[59] Andres Guadamuz, *supra note* 49.

[60] Lin Li-Chih, An Initial Examination of Copyright Disputes Concerning Artificial Intelligence — Centered on the Author's Identity, *Intellectual Property Rights Journal*, Volume 237, September 2019, pages 65-66

[61] The legislative rationale for Article 12 of the R.O.C. Copyright Act: The sponsor and the sponsored are typically in a more equal position for the works completed with sponsorship. It is different from the situation where the works are completed by an employee by using the hardware and software offered by the employer and receiving salaries from the employer. Therefore, the ownership of copyrights depends on the contract between the sponsor and the sponsored regarding the investment and sponsorship purposes. Unless otherwise specified by the contract, the sponsor typically provides funding because of his/her intention to use the works completed by the sponsored. Therefore, the intellectual property should belong to the sponsored.

[62] Lin Li-Chih, same as Note 60, pages 75-76. Further reference of the principle used in the U.S. system: Annemarie Bridy (2016), *The Evolution of Authorship: Work Made by Code*, *Columbia Journal of Law*, [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2836568](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2836568). Also the same author (2012), *Coding Creativity: Copyright and the Artificially Intelligent Author*, *Stanford Technology Law Review*, [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1888622](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1888622).

[63] Lin Li-Chih, same as Note 60, page 76

[64] Frank H Easterbrook, *Cyberspace and the Law of the Horse*, 1996 U. CHI. LEGAL F. 207.

[65] Please refer to *State v. Loomis*, 317 Wis. 2d 235 (2016).

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