Patenting Artificial Intelligence in China and South-East Asia

Issues of Patentability, Inventorship and Enforcement

By Fabrice Mattei, Principal with the contributions received from Kin Wah Chow, Principal (Suryomurcito & Co., Member of the Rouse Network - Indonesia); Yen Vu, Principal (Vietnam); Edmund Baranda, Principal (Baranda & Associates, Member of the Rouse Network - Philippines); Jack Liu, Senior Patent Attorney (Lusheng Law Firm, Member of the Rouse Network - China); Thitiya Lueabrassamee, Patent Agent (Thailand); and Vannary Sokunvannary Tep, IP Consultant (Cambodia).

Artificial Intelligence ("AI") is part of our everyday lives. It refers to the ability of machines to exhibit humanlike intelligence to solve a problem, drive a car, play chess, recognize images etc. The AI market is expected to grow from USD 21 billion in 2019 to USD 190 billion in 2025, averaging over 50 % growth per year[1]. It follows that inventions using AI are the desired subject of patent protection from companies investing or developing them. This is particularly true in China and in South-East Asia (ASEAN) where AI is fast booming and new rules and examination guidelines on patenting AI are now flourishing offering new opportunities to applicants of AI inventions. This phenomenon poses new challenges to the traditional paradigm of patentability. Computers already are generating inventions under circumstances in which the computer, rather than a human person, meets the requirements to qualify as an inventor ('computer inventorships')[2]. This article assesses the patentability of AI related inventions in China and South-East Asia, based on country's legislation, local practice and patent examination guideline where available.

1. Rapid growth of AI in ASEAN and China

With almost 25,000 AI-related papers have been published by ASEAN countries since 1985, with Malaysia Singapore and Thailand accounting for 86% of the output[3], there is now a clear shift from theoretical research to the use of AI in commercial products and services. In a recent survey of companies in Southeast Asia, 37% plan to adopt AI technology in the next five years, especially high-tech, telecom, and financial services companies[4]. Hong Leong Bank of Malaysia uses IBM Watson to detect customers' emotions by the way they speak on the telephone[5]. Thai and Malaysian car manufacturer Proton are aiming to introduce Industry 4.0 technologies in their manufacturing plants[6]. For ASEAN businesses, there are lessons to be learned from China's success in embracing AI especially in terms of government support. China's success in AI is due in no small part to strong government support. In July 2017, the State Council of China released a roadmap for the country to become a world leader in AI. This plan includes milestones to develop new technology and standards by 2020, major breakthroughs and economic transformation by 2025, and growth of the industry to approximately USD 150 billion by 2030.

---

[1] https://www.marketsandmarkets.com/PressReleases/artificial-intelligence.asp

[2] Ryan Abbot, I Think, Therefore I Invent: Creative Computers and the Future of Patent Law, Boston College Law Review, Volume 57, Issue 4 pp. 1079-1126.

[3] Artificial Intelligence in Southeast Asia, Clarivate Analytics, available at: https://clarivate.com/wp-content/uploads/2018/02/M287-SAR-Industry-Bytes-Artificial-Intelligence_SellSheetLong_002.pdf

[4]Sachin Chitturu, Diaan-Yi Lin, Kevin Sneader, Oliver Tonby, Jonathan Woetzel Artificial Intelligence And Southeast Asia's Future, McKinsey Global Institute, 2017 available at https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Artificial%20Intelligence/AI%20and%20SE%20ASIA%20future/Artificial-intelligence-and-Southeast-Asias-future.ashx

[5] https://www.hlb.com.my/en/personal-banking/news-updates/ibm-partners-hlb-to-introduce-cognitive-banking.html

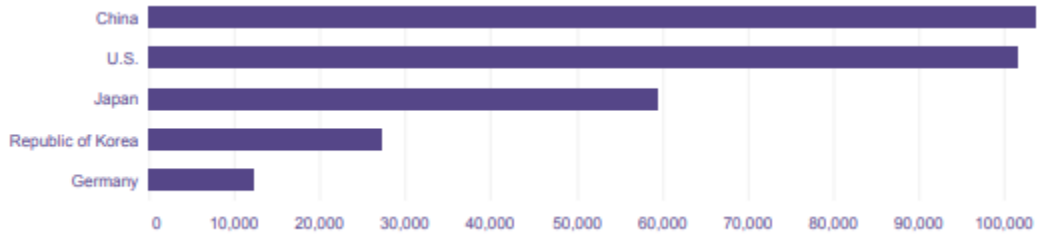
[6] https://theaseanpost.com/article/can-industry-40-revolutionise-manufacturing

2. Patent trends in AI in Asia

WIPO most recent report on Technology Trends shows that the number of AI related patent applications worldwide rose from 18,995 in 2013 to 55,660 in 2017[7]. Two US companies held the largest AI patent portfolios: IBM (8,290) and Microsoft (5,930) followed by a group of Japanese and Korean consumer electronics companies. Scientific publishing about AI started to increase rapidly about a decade before the rise in patenting. The ratio of scientific papers to inventions has fallen from 8:1 in 2010 to 3:1 in 2016, indicating a clear shift from research to the use of AI in business. The top 500 applicants of AI related patents include 167 universities and public research institutions, most of which are from China, the US and South Korea. Only four are in Europe. 434 companies have been acquired since 1998, with more than half the acquisitions took place in the last three years. Top acquirers are Alphabet, Apple and Microsoft.

The key takeaways from WIPO report, as far as Asia is concerned, are summarized below.

China is home to the number one office for first filings of AI patents

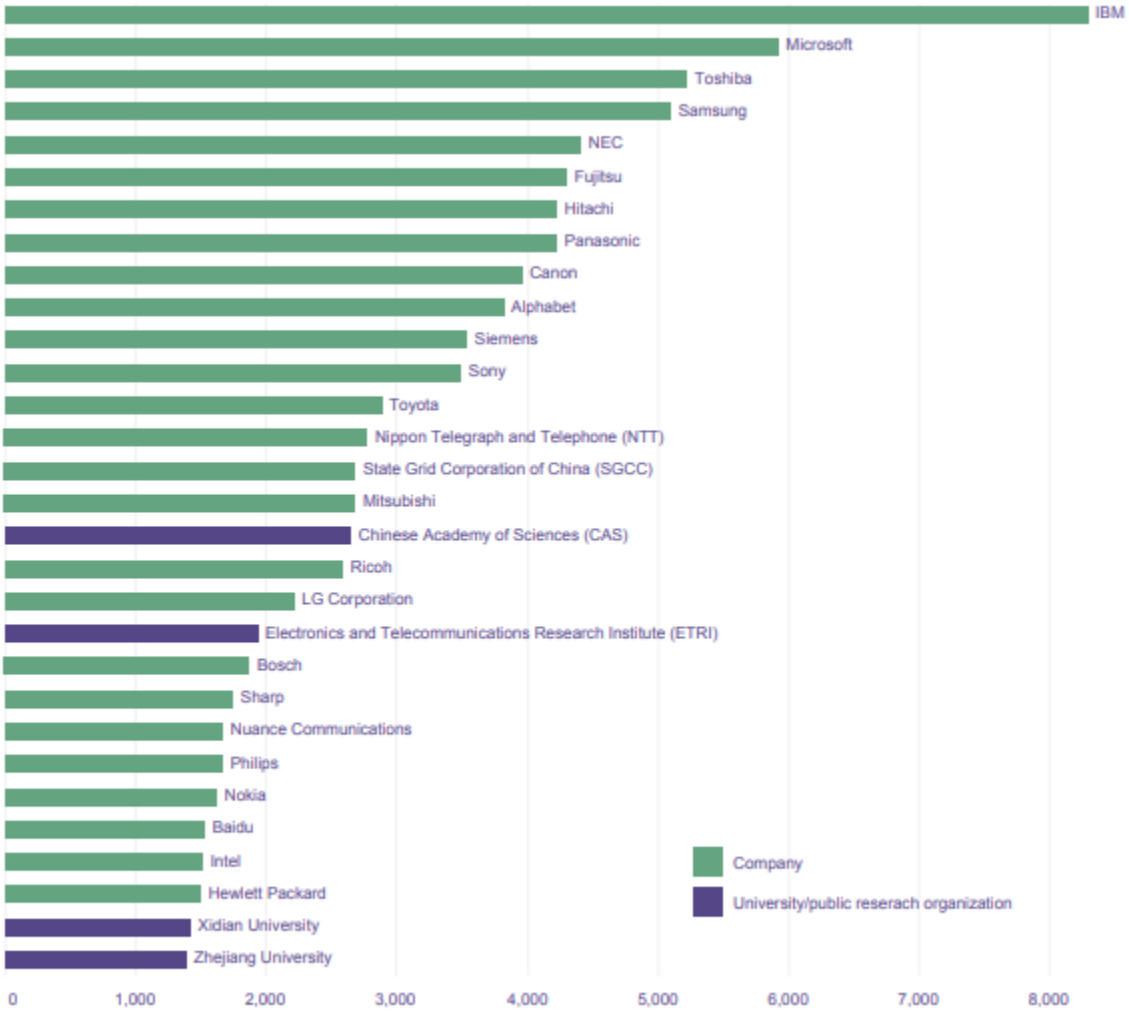


Source: WIPO report on Technology Trends

First patent filings at China's National Intellectual Property office (CNIPA) have grown at an average annual rate of 29% since 2006, and the agency has overtaken the USPTO as the top office for first filings. The Japanese Patent Office is the third most popular, with the top three accounting for 78% of total AI-related patent filings.

[7] WIPO report is available at https://www.wipo.int/publications/en/details.jsp?id=4386

Academic institutions of China are among the top 30 patent applicants of AI

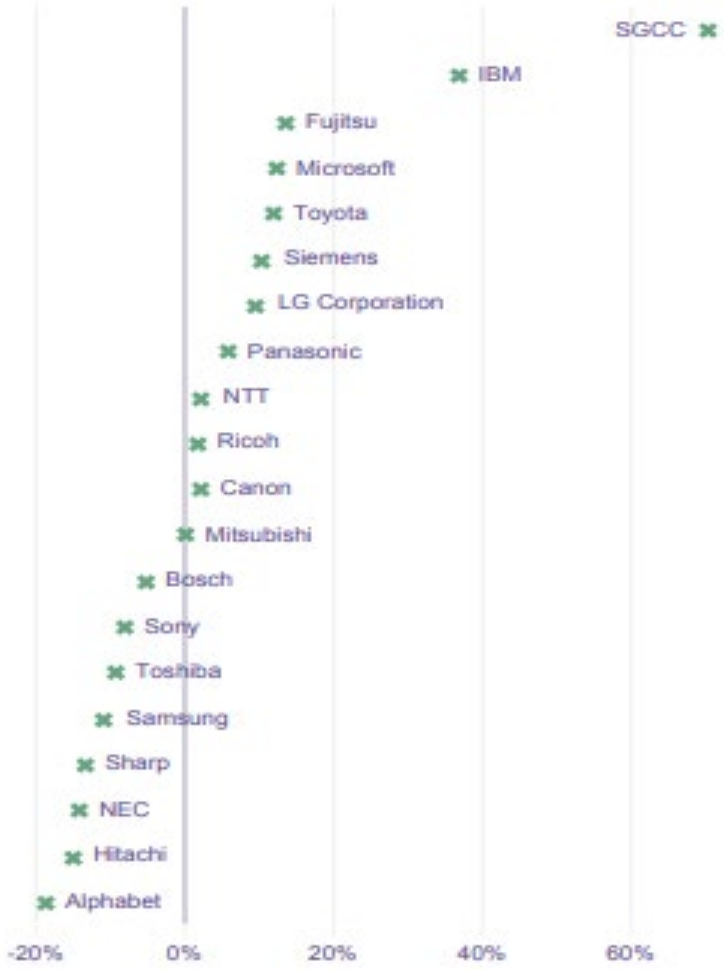


Note: Fujitsu includes PFU; Panasonic includes Sanyo; Alphabet includes Google, Deepmind Technologies, Waymo and X Development; Toyota includes Denso; and Nokia includes Alcatel

Source: WIPO report on Technology Trends

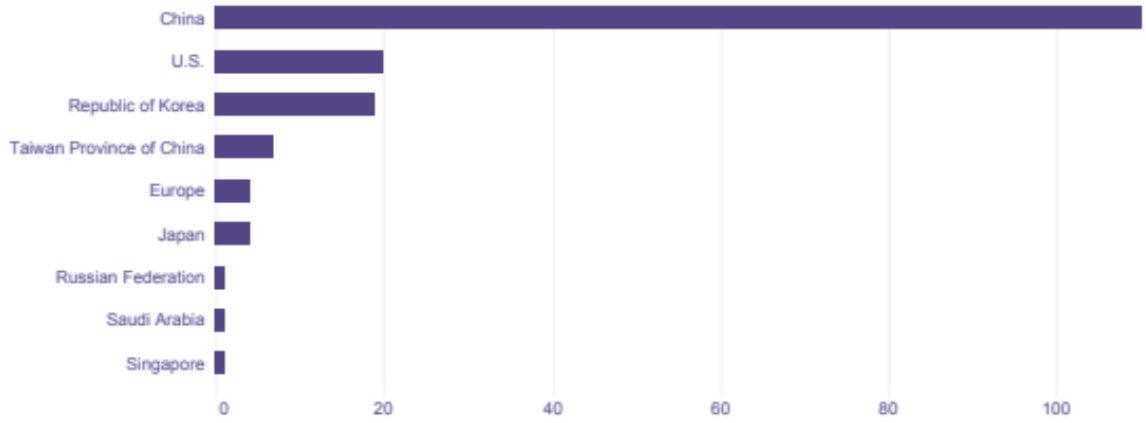
State Grid Corporation of China is in the top 20 list on strong filing levels

The state-owned electric utility company of China, Grid Corporation of China, increased its AI patent filings by an average of 70% annually from 2013-2016. The company has focused its filings on machine learning techniques associated with life sciences.



Source: WIPO report on Technology Trends

Chinese universities and institutes are fast consolidating their position in the AI field



Source: WIPO report on Technology Trends

Chinese Universities and public research organisations represent one-fifth of the top 500 patent applicants, as well as accounting for 17 of the top 20 academic players in AI patenting.

3. Laws and examination guidelines on AI related inventions

3.1 Patent subject-matter eligibility

Most countries have provisions in their patent legislation that expressly exclude computer programs or equivalent subject matters from patentability. One of the few ASEAN countries to have gone against this trend are Singapore and to some extend Cambodia.

Countries	Are computer software/algorithm patentable subject matter?	Legislations
Cambodia	Possible	Under Article 4 of the 2003 Law on Patents, the following inventions are excluded from patentability (i) discoveries, scientific theories and mathematical methods; (ii) schemes, rules or methods for doing business, performing purely mental acts or playing games. The patentability of computer programs is dealt with under the Regulation for implementation of the Law on Patents and Utility Model Certificates and Industrial Designs of 2007. Rule 44(1) of the Regulation provides that the following shall be recognized as inventions […] "(b) product inventions consisting of elements of a computer-implemented invention, including in particular: - machine-readable computer program codes stored on a tangible medium such as a floppy disk, computer hard drive or computer memory; and - a general purpose computer whose novelty over the prior art arises primarily due to its combination with a specific computer program". Rule 44(2) states that 'applicants who have filed patent applications for computer programs and computer-related inventions listed in [Rule 44] paragraph (1) shall be considered as having waived from their right of seeking copyright protection, if available, under article 10(1) of TRIPS Agreement.
China	No	Article 2 of the Patent Law of 2008 defines an invention as 'a new technical solution put forward for a product, method or the improvement thereof'. The Implementing Regulation defines an invention as a "new technical solution relating to a product, a process, or improvement thereof". This has been taken to mean that 'technical nature' is a prerequisite for a patent. Article 25 provides that scientific discoveries, as well as rules and methods for mental activities are not patentable. The 2006 Examination Guidelines states that the followings are considered to be the rules and methods for mental activities under Art. 25.1(2) of the Patent Law and are excluded from patentability "pure rules and methods for mental activities, such as a computer program relating only to an algorithm or rule for mathematical computing rules, or computer programs per se, or computer programs recorded in mediums, or rules or methods for games". If a claim is defined by rules and methods for mental activities in the whole contents, it shall not be granted a patent right. The Guidelines explain that the following categories fall into this exclusion: "methods of examining patent applications; methods of managing

		organization; traffic rules; methods of deduction; rules of classifying books; rules of editing calendar; operating instructions; grammar; computer languages; short-cut arithmetic methods; mathematical theories and methods of conversion; methods of psychological test; methods of teaching; methods of games; methods of statistics; music books, food recipes or chess manuals; methods of keeping fitness; methods of disease survey; methods of presenting information; and computer programs per se".
Indonesia	No	According to Article 4 (d) & Article 9 (c) of the Patent Law 2016 "an invention shall exclude […] (d) rules and methods only containing a computer program"; "An unpatentable Invention shall include: (c) any theory and method in the field of science and mathematics".
Malaysia	No	Although the Patents Act of 1983 does not contain any specific provisions for software, there are general requirements that are pertinent. Section 12(1) of the Patents Act provides that 'an invention means an idea of an inventor which permits in practice the solution to a specific problem in the field of technology'. This is qualified by section 13(1) of the same Act which provides that the following inventions are not patentable: discoveries, scientific theories and mathematical methods; schemes, rules or methods for doing business, performing purely mental acts or playing games. the Patent Examination Guidelines of 2011 indicate that the exclusions from patentability under Section 13(1) "should be regarded as applying only to the extent to which the application relates to the excluded subject-matter as such". Furthermore, the Guidelines state "A computer programme claimed by itself or as a record on a carrier is not patentable, irrespective of its content".
Philippines	No	Section 22 of the IP Code - Non-Patentable Inventions – specifically excludes from patentable subject matter: "22.1 Discoveries, scientific theories and mathematical methods, xxx; 22.2 Schemes, rules and methods of performing mental acts, playing games or doing business, and programs for computers".
Singapore	Possible	The Patent Act was amended in 1995 to delete Section 13(2) of the Patents Act 1994 [UK Patents 1977, Section 1(2)] which declared that certain subject matter such as "a scheme, rule or method for performing a mental act, playing a game or doing business, or a program for a computer", are not inventions for the purposes of the Act and are therefore not patentable. Business methods and computer implemented inventions are therefore patentable subject matters under certain conditions.

Thailand	No	According to Section 9(3) of the Thai Patent Act B.E. 2522 (1979) as amended, "data systems for an operation of a computer (computer program)" are non-patentable subject matter. According to Section 9(2) of the same Act, "scientific or mathematical rules or theories" are also non-patentable subject matter. The exclusion of computer software and mathematical method is broad since it is not qualified or limited to computer program or mathematical method "as such". <u>Business method</u> There is no explicit exclusion from patentability for business methods However, most applications are rejected on the basis that a business method is an abstract idea, not an invention according to Section 3 of the Thai Patent Act "invention means any innovation or invention which creates a new product or process, or any improvement of a known product or process". According to the draft amendments to the Thai Patent Act, business method is a non-patentable subject matter.
Vietnam	No	Clauses 1, 2 and 3 of Article 59 of the Law on Intellectual Property (issued in 2005 and amended/supplemented in 2009 and 2019) (IP Law) state that mathematical methods; methods for doing business; methods for playing games, computer programs, and presentations of information are unpatentable subject-matter.

In recent years, some of the surveyed countries have issued examination guidelines covering the patentability of AI, CII/CDI and/or software showing the level of responsiveness from the Patent Offices. Philippines, Singapore followed by Malaysia and China are leading the way.

Countries	Patent Examination Guidelines on AI/CII/CDI/software
Cambodia	No
China	Partially covering AI related inventions through the 2006 Patent Examination Guideline
Indonesia	No
Malaysia	Partially covering AI related inventions through the Guidelines for Patent Examination of October 2011
Philippines	Yes Philippine ICT/CII Examination Standard (from the ICT and CII Guide issued by IPOPHL)
Singapore	Yes Accelerated Initiative for an Artificial Intelligence programme of 2019
Thailand	Partially covering AI related inventions through the Examination Manual for Patent and Petty Patent B.E. 2562 (2019)
Vietnam	Partially covering AI related inventions through the Guidelines for Examination of Patent Applications

In the surveyed countries that exclude computer programs from patentability, can such programs be patentable when they form part of a wider patentable invention (e.g. a software to control an X-ray machine)?

Countries	Can computer software or algorithm form part of a wider patentable invention?	Legislations
China	Yes	While computer programs "per se" may not be patentable, it is possible for an invention that incorporates a computer program to be patentable subject matter. The 2006 Examination Guidelines stipulate that a computer program may be patentable if 'the combination of software and hardware as a whole can really improve prior art, bring about technical results, and constitute a complete technical solution'. Following Article 2 of the Patent Law and Rule 21 of the Implementing Regulations, an application relating to a computer program is only the subject matter of patent protection if it constitutes a technical solution. To satisfy this requirement, the application must: (i)solve technical problems (ii) use technical measures, and (iii) be capable of producing a technical effect. An application will only constitute a technical solution when it meets all three of these criteria.
Indonesia	Yes	If the computer program is claimed as part of a system interacting with hardware, it may be patentable. In elucidation of Patent Law no 13/2016, Article 4(d) states "a patent may be given to a program as long as it involves characters having technical effect and a function to solve a tangible or intangible problem".
Malaysia	Yes	According to the Patent Examination Guidelines of 2011, a computer programme claimed by itself or as a record on a carrier is not patentable, irrespective of its content. If, however, the subject-matter as claimed makes a technical contribution to the prior art, patentability should not be denied merely on the ground that a computer programme is involved in its implementation. This means, for example, that programme-controlled machines and programme-controlled manufacturing and control processes should be regarded as patentable subject-matter. It follows also that, where the claimed subject-matter is concerned only with the programme-controlled internal working of a known computer, the subject-matter could be patentable if it provides a technical effect.
Philippines	Yes	A claim directed to a computer program 'per se' is an ineligible subject matter under Section 22 of the IP Code. To fall within categories of patentable inventions under Section 21 of the IP Code a claim directed to a computer program should be drafted in manner wherein the program instructions are (e.g. embodied in a tangible computer readable recording medium/data carrier) cooperatively working with a programmable device/hardware.

Thailand	Yes	Given that the exclusion of computer programs is not qualified or limited to computer programs "as such", questions have arisen as to whether section 9(3) also excludes computer related inventions. Commentators have suggested that it does not. It appears that while computer programs per se are excluded, that software-related inventions (such as a business method implemented in a computer) are considered as patentable subject matter.
Vietnam	Yes	According to the Guidelines for examination of patent applications issued by Intellectual Property Office of Vietnam ("IP Vietnam") (the "Guidelines") a computer program, and an invention relating to computer program, is patentable if the claimed subject-matter has a "technical character" and is a technical solution for resolving a technical problem by technical means to create a technical effect. There is no specific guidance on "algorithm" in the Guidelines like computer program. However, algorithms are per se of the mathematical nature, therefore, the Guidelines should also apply to algorithm. Specifically, the Guidelines provides that "method for quick calculation of division is not patentable, however, calculating apparatus designed for implementing such method can be patentable. Method for calculation to design electrical filters is not patentable, however, the electrical filters designed by such method is patentable". For example, the following claim has been accepted by the Patent office "Decoder for decoding a video from a data stream into which syntax elements are coded using binarizations of the syntax elements…".

In conclusion, a computer program/algorithm may be eligible for patent protection in isolation in some countries or if it is used as part of an invention that provides a "technical effect" outside of the algorithm itself. Below are two examples of software with and without a technical effect.

Software with a technical effect	Software without a technical effect
The classification of digital images, videos, audio or speech signals based on specific features (e.g. pixel attributes for images).	The classification of text documents solely in respect of their textual content. The reason for this is that such classification is considered to have simply a linguistic (and not "technical") purpose.

Examples of granted AI related inventions

Indonesia

Application No.	Title	Applicant
P00201503398	Suatu Sistem Untuk Kontrol Lalu Lintas Pintar - Artificial Intelligence Traffic Detection System	Sena Letrik (M) Sdn. Bhd.
SID201706112	Metode Pengendalian Manipulator Paralel Diskrit Berbasis Kecerdasan Buatan - Methods Of Discrete Parallel Manipulator Based On Artificial Intelligence	Universitas Kristen Petra
S00201703160	Metode Publikasi Cetak Dengan Konten Custom Berbasis Komunikasi Jarak Dekat Dan Kecerdasan Buatan - Method Of Print Publication With Custom Content Based On Near Distance Communication And Artificial Intelligence	Pt. Aplikasi Solusi Teknologi

Philippines

Application No	Applicant	Title
1/2015/502595 2014.05.21	Playground Co., Ltd	Electronic Ticket System And Program
1/2015/502225 2014.03.13	Aft Co., Ltd. And Aideal Inc	Foreign Exchange Transaction Apparatus, Foreign Exchange Transaction System, Transmission/Reception Method And Computer Readable Medium
1/2015/501749 2014.01.15	Keycafe Inc.	Methods And Systems For Management Of Key Exchanges

Thailand

No.	Grant No.	Applicant	Title of invention
1	7205	National Science and Technology Development Agency	Process for classifying diseases in orchid (Dendrobium) using a system to support decision
2	13408	MediTech Solutions Co., Ltd.	System to send commands to a computer by tracking movements of eyes staring at a point on computer's monitor
3	68122	Hitachi Ltd.	Data cooperation support system and data cooperation support method
4	62935	Tencent Technology (Shenzhen) Company Limited	Friend recommendation method, apparatus and storage medium
5	70580	IBM	Facilitating communication between isolated memory spaces of a communications environment

Vietnam

No.	Grant No.	Applicant	Title of invention
1	1-0013620-000	Tencent Technology (Shenzhen) Company Limited	Method And Device For Recognizing Picture
2	1-0013998-000	Oath Inc.	Method And Apparatus For Utilizing Social Network Information For Showing Reviews
3	1-0018781-000	Yewon Communication Co., Ltd.	Device And Method For Automatically Identifying A Qr Code
4	1-0017424-000	Playground Co., Ltd.	Electronic Ticket System

3.2. inventorship of AI related inventions

Computers have been autonomously creating inventions since the 20th century. In 1994, Stephen Thaler, a pioneer in the area of AI and the inventor of the "Creativity Machine", US Patent 5,659,666, titled "Device for the autonomous generation of useful information"[8] defines his invention as "the closest yet to emulating the fundamental mechanisms responsible for idea formation"[9]. The "Creativity Machine" can generate new ideas through the use of a software known as artificial neural networks - a collection of on/off switches that automatically connect themselves to form software free from human intervention. Although Dr. Thaler is listed as the patent's inventor, he states that the "Creativity Machine" invented the patent's subject matter (the "Creativity Machine's Patent")[10]. Another computer inventor was the "Invention Machine", US Patent 6847851 titled "Apparatus for improved general-purpose PID and non-PID controllers"[11] which used genetic programming to evolve its own software. The "Invention Machine" produced an antenna that was used by NASA, and devised a method of improving factory efficiency, for which it became the second non-human inventor to create patented subject matter. More recently, Google's Neural Machine Translation ("NMT") system was reported to have developed its own internal language to represent the concepts it uses to translate other languages[12].

The evidence reveals that the technology can function with its own independent mind. AI having capacity to invent has major implications for patents inventorships and ownerships. Should then machine or computer be acknowledged as inventors? Could computers replace the hypothetical Person Skilled in the Art ("PSA"), that courts use to judge inventiveness? With the WIPO defining Intellectual Property as "creations of the mind, such as inventions", creative computers may require a rethinking of the baseline standard for inventiveness, and potentially of the entire patent system. The definition of "mind" in this context is then challenged; whether a human mind or a machine mind?

[8] https://patents.google.com/patent/US5659666A/en
[9] See What Is the Ultimate Idea?, IMAGINATION ENGINES INC., http://www.imagination-engines.com [https://perma.cc/P877-F33B] (last visited Jan. 25, 2016).
[10] See Patent Listing, IMAGINATION ENGINES INC., http://imagination-engines.com/iei_ip.php [https://perma.cc/N79N-NWEF] (last visited Jan. 25, 2016)
[11] https://patents.google.com/patent/US6847851B1/en
[12] https://ai.google/research/pubs/pub45610

If the Patent Offices and courts determine that patent protection will be granted to an AI related invention, who should be awarded inventorship for AI-generated inventions? Can a company, computer or machine be named as inventors? Currently, none of the surveyed countries' patent laws allow them to be named as inventors. Statutory language requiring inventors to be individuals and judicial characterization of invention as a "mental act" present barriers to computer inventorship.

If a company or machine can't be recognized as inventor, then who should then be named as inventor? In contemporary science, computer hardware is required to run the software. One could argue that the hardware is doing the heavy lifting, but the software is engaging in the creative process. For that matter, there may be cases where it's difficult to separate hardware from software. Hardware and software developers should then be co-inventors of AI related inventions? What about experts who provide the data set with known values or otherwise provide input into the development of the AI, and/or those who reviewed the data results? Also, who should be the PSA, a legal fiction who is presumed to know of all the prior art (what came before an invention) in a particular field? AI related inventions suggest a need to have a group of persons to be recognized as a PSA (e.g. hardware, software developers and expert in collecting and reviewing data). This would make it more challenging for inventions to be held nonobvious, particularly in the case of inventions that combine existing elements in a new configuration.

Countries	Is co-inventorships of an invention between software, hardware developers and data collectors possible?	Who will be the Person Skilled in the Art ('PSA')?
Cambodia	Yes	An individual or a group of persons could be recognized as the PSA.
China	Yes	The PSA is a fictional "person" who is presumed to be aware of all the common technical knowledge and have access to all the technical fields to which the invention pertains and have the capacity to apply all the routine experimental means. Therefore, the PSA cannot be a group of persons.
Indonesia	Yes	A group of persons could be recognized as the PSA.
Malaysia	Yes	A group of persons could be recognized as the PSA.
Philippines	Yes	For AI related inventions, PSA/POSITA will have to be a person/a group of persons who fall under the above definition.
Singapore	Yes	A group of persons could be recognized as the PSA.

Thailand	Yes	The Thai Patent Act does not provide a specific definition of the PSA and there is no precedent on this issue in Thailand. The PSA is defined on a case-by-case basis, depending on the technical field(s) of the invention. The PSA could be a group of people from various technical fields.
Vietnam	Yes	"the Person Skilled in the Art" is defined as a person who has ordinary technical practice skills and is acquainted with publicly available general knowledge in art under the IP Law. The PSA may also be a group of persons, for example, a group of researchers or producers.

4. Patent infringement

An AI driven machine is able to self-operate and through its own operation and findings eventually to infringe a third party's patent. The company/operator placing the machine in the field may be unaware of a particular infringing act of the machine which raises the question whether the company/operator could be held liable for indirect infringement and contributory infringement in the surveyed countries?

Countries	Indirect infringement?
Cambodia	There are no specific regulations on liability of an owner of AI machine in this instance. General principles of Tort law may apply.
China	The company/operator could be held liable for indirect infringement ("induce" or "help") if it knows or should know the existence of the patent and knows or should know the machine's behavior will infringe a third party's patent.
Indonesia	Yes, there is no need to prove the company's knowledge.
Malaysia	There are no statutory provisions for contributory infringement in Patents Act. Contributory infringement is governed by the common law position on joint tortfeasorship.
Philippines	Indirect infringement is unlikely since there is the requirement to establish that the company/operator has "actively inducing the infringement of a patent".
Singapore	There are no statutory provision for contributory infringement in Patents Act. Contributory infringement is governed by the common law position on joint tortfeasorship.

Thailand	There are no statutory provisions for contributory infringement in the Patent Act. There is concept of joint tortfeasorship under civil and criminal law. Section 84 of the Penal Code provides that: "Whoever, whether by employment, compulsion, threat, hire, asking as favor or instigation, or by any other means, causes another person to commit any offense is said to be an instigator." Therefore, in the case of criminal proceedings of patent infringement, Section 84 of the Penal Code may be applicable. intention of the company needs to be proven. The company/operator could be liable to pay civil damages because civil infringement requires no knowledge or intention.
Vietnam	There is no concept of "indirect infringement" or "contributory infringement" under Vietnamese laws. It is not clear whether the company/operator could be considered as a direct infringer because it owns the AI machine and AI machine is not a legal entity under Vietnamese laws, therefore it cannot be a direct infringer. To infringe a patent, it requires an active act and intention. Therefore, the company/operator might not be held liable as a direct infringer. If damages are caused as a result of the infringement, the company/operator has an obligation to compensate damages because it is the owner of the AI machine under the Civil Code, though it is unaware of the infringement acts of the AI machine.

Since it is not necessarily visible how the infringing method works, do China and ASEAN provide discovery procedure to reveal the underlying systems? How easy to obtain such court order?

Countries	Is Discovery procedure available?
Cambodia	No, but raid action is available.
China	Evidence Preservation" is available under the Civil Procedural Code which functions similarly to "Discovery".
Indonesia	No discovery
Malaysia	Yes
Philippines	Yes
Singapore	Yes
Thailand	Thailand does not provide discovery system. However, a party may request for court to issue a subpoena ordering the other party to reveal the system in question. This depends on the court's discretion.
Vietnam	Yes