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# ARTIFICIAL INTELLIGENCE AND TRADITIONAL CHINESE MEDICINE IN PORTUGUESE CRIMINAL LAW

## *INTELIGÊNCIA ARTIFICIAL E A MEDICINA TRADICIONAL CHINESA NO DIREITO PENAL PORTUGUÊS*

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**Summary:** 1. Concepts of AI and Robotics 2. Overview of AI Development in TCM 2.1. Partial Autonomous or Non-Autonomous AI 2.2. Fully Autonomous AI? 3. AI, TCM and Pandemic Emergency 4. The Laws regulating TCM in Portugal 5. Criminal Punishment of TCM with AI Technology? 5.1. Partial Autonomous or Non-Autonomous AI? 5.2. Fully Autonomous AI? 6. Conclusion.

**Keywords:** Artificial Intelligence; Robot; Traditional Chinese Medicine; COVID-19; Portuguese Criminal Law.

**Abstract:** The technology is developing in such a way that we cannot imagine normally. Nowadays, Artificial Intelligence [AI], especially when combined with Robotic, plays an important role in many areas of human knowledge, such as in medicine. The combination between AI and Robotic creates the so-called “AI Robot” which can be applied either in conventional medicine or in Traditional Chinese Medicine [TCM]. The AI technology can be fully autonomous or not.

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The former ones act as human beings given that they are able to learn new experiences and knowledge, when the latter ones only follow the programmers or producers' pre-setting and cannot act with autonomous behaviors. This paper analyses the current development of AI in TCM, the important role of intelligent TCM during pandemic emergency, and the criminal punishment of TCM with AI technology in Portugal.

**Sumário:** 1. Conceitos de Inteligência Artificial e Robótica 2. Visão geral do desenvolvimento de Inteligência Artificial na Medicina Tradicional Chinesa 2.1. Inteligência Artificial Parcialmente Autônoma ou Não Autônoma 2.2. Inteligência Artificial Completamente Autônoma? 3. Inteligência Artificial, Medicina Tradicional Chinesa e Emergência Pandêmica 4. Leis que regulamentam a Medicina Tradicional Chinesa em Portugal 5. Punição Criminal da Medicina Tradicional Chinesa com Tecnologia de Inteligência Artificial? 5.1. Inteligência Artificial Parcialmente Autônoma ou Não Autônoma? 5.2. Inteligência Artificial Completamente Autônoma? 6. Conclusão.

**Palavras-chave:** Inteligência Artificial; Robô; Medicina Tradicional Chinesa; COVID-19; Direito Penal Português.

**Resumo:** A tecnologia está a avançar de uma forma que não conseguimos imaginar normalmente. Hoje em dia, a Inteligência Artificial, especialmente quando combinada com a Robótica, desempenha um papel importante em muitas áreas de conhecimento humano, como na medicina. A combinação entre Inteligência Artificial e Robótica cria os chamados “Robôs da Inteligência Artificial” que podem ser aplicados ou na medicina convencional ou na Medicina Tradicional Chinesa. A tecnologia da Inteligência Artificial pode ser autônoma ou não. A primeira atua como seres humanos porque é capaz de aprender experiências e conhecimento novo, enquanto a segunda apenas segue o que os programadores ou produtores tenham definido previamente, não conseguindo atuar com comportamentos autônomos. Este texto analisa o desenvolvimento presente da Inteligência Artificial na Medicina Tradicional Chinesa, o papel importante da inteligente Medicina Tradicional Chinesa durante a emergência pandêmica e o sancionamento criminal da Medicina Tradicional Chinesa com tecnologia da Inteligência Artificial em Portugal.

## 1. Concepts of AI and Robotics

In 1955, JOHN MCCARTHY and MARVIN MINSKY at Dartmouth College Summer Workshop proposed the concept of AI<sup>2</sup>. This concept refers to a system

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<sup>2</sup> CUKIER, KENNETH, *Ready for Robots? How to Think about the Future of AI* (available at <https://www.questia.com/magazine/1P4-2253185611/ready-for-robots-how-to-think-about-the-future-of>, accessed on 27/6/2020).

that should have the ability to learn in a changing environment<sup>3</sup>. In other words, it is “a system that acts intelligently: What it does is appropriate for its circumstances and its goal, it is flexible to changing environments and changing goals, it learns from experience, and it makes appropriate choices given perceptual limitations and finite computation”<sup>4</sup>. With this kind of system, AI can learn and adapt to different situations for which its designer did not provide predefined configuration. This is what has been called as “machine learning”, which refers to a machine that can learn new knowledge and find solutions for new and unexpected situations.

On the other hand, “Robotics” is a term different from AI and many people may confuse one with the other. It is “the science of making and using robots”<sup>5</sup>, and implies “designing, building and programming physical robots which are able to interact with the physical world”<sup>6</sup>. The robots can be artificially intelligent or not. The former ones – AI Robots – are able to act autonomously, while the later ones only act with partial autonomy, or even without autonomy<sup>7</sup>.

Clarifying the two terms – AI and Robotics – is very important because we need to combine them and concentrate on the acts executed by AI Robots, which may be criminally responsible according to the Portuguese Criminal Code. Despite of this, we will also analyze the reasons why we reject criminal punishment of the acts of robots/instruments with partial or without autonomy, as well as the possible criminal liability of the nature person (a user or a programmer of the robots) who dominates them. However, before analyzing the part regarding criminal punishment in this ambit, it is important to overview the AI development in TCM around the world.

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<sup>3</sup> ALPAYDIN, ETHEM, *Introduction to Machine Learning*, 3<sup>rd</sup> ed., London, Cambridge, MIT Press, 2014, p. 3.

<sup>4</sup> POOLE, DAVID/ MACKWORTH, ALAN/ GOEBEL, RANDY, *Computational Intelligence: A Logical Approach*, New York, Oxford University Press, 1998, p. 1. These authors use the expression “Computational Intelligence” as a synonym of “Artificial Intelligence”.

<sup>5</sup> Cambridge Dictionary (available at <https://dictionary.cambridge.org/dictionary/english-chinese-traditional/robotics>, accessed on 29/6/2020).

<sup>6</sup> ALEX, OWEN-HILL, *What's the Difference Between Robotics and Artificial Intelligence* (available at <https://blog.robotiq.com/whats-the-difference-between-robotics-and-artificial-intelligence>, accessed on 29/6/2020).

<sup>7</sup> *Ibidem*.

## 2. Overview of AI Development in TCM

### 2.1. *Partial Autonomous or Non-Autonomous AI*

Given the unceasing development of AI technology, people have been applying it either in conventional medicine or in TCM, even though it has a broader and more mature application in the former one. The application of AI technology in conventional medicine reflects advantages to healthcare professionals, patients and medical students or interns. For instance, *Face2Gene*, a deep learning application with convolutional neural networks, helps healthcare professionals identify rare diseases by identifying facial features with accuracy of 91%, surpassing healthcare professionals<sup>8</sup>. On the other hand, this application, with a better accuracy of identification, also helps patients avoid further confirmation of diseases. Besides, medical students or interns can learn from this application the ways to identify rare diseases by identifying facial features, as like as learning from the experienced healthcare professionals.

Similar to the situation occurring in conventional medicine, TCM also applies the AI technology in certain situations, especially with partial autonomy or non-autonomy. In addition to the medical instruments that people can use at home, such as intelligent wearable devices, smart watch, sleep breathing monitoring equipment, TCM physique identifier, etc., the development and application of AI technology in TCM embrace medical diagnosis, medical treatments, and clinical practice teaching<sup>9</sup>.

Regarding medical diagnosis, TCM doctors use the well-known four ways of diagnosis – inspection, auscultation and olfaction (listening and smelling), inquiring and palpation – and usually combine them to understand patient's condition. "Inspection" implies that the TCM doctors observe the systemic and regional changes of patient's external situation, such as vitality, colour, appearance, secretion and exertions, to know the patient's condition; "auscultation and olfaction" mean that they listen to the voice coming from the patient's body, such as speech, runny nose, breath, cough, etc., and smell patient's odours; "inquiring" refers to the situation where they ask the conditions regarding the illness for understanding better the pathological process; "pulpation" implies feeling the pulse and touch different parts of patient's body in order to understand his or

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<sup>8</sup> GUO, YAN/ REN XUE/ CHEN YU-XIN/ *et al.*, «Artificial Intelligence Meets Chinese Medicine», *Chin J Integr Med*, Vol. 25, No. 9, 2019, pp. 648-653, p. 649.

<sup>9</sup> About these aspects in detail, PAN, LIQUING/ SHEN, XIAODONG, «Robotics technology in the instrumentation of traditional Chinese medicine treatment», *Robot Technique and Application*, No. 1, 2010, pp. 28-30, pp. 29-30.

her condition<sup>10</sup>. In recent years, AI technology has been gradually intervening in the four diagnosis methods. In addition to the early medical instruments for “looking”<sup>11</sup> and “feeling the pulse”<sup>12</sup>, there are medical instruments integrating AI into the four diagnosis methods, such as the instruments *Daosh*<sup>13</sup>, *Zhiyun*<sup>14</sup> and *Wisdom*<sup>15</sup>.

In relation to the medical treatments, *Tui Na*, one of the branches of TCM, has applied the AI technology in recent years. In China, *Tui Na* with AI technology is especially applied for treatments of military training injuries through the so-called “TCM Massage Robot”, which significantly improves the tension of the psoas soft tissue and, consequently, relax completely the waist<sup>16</sup>. However, this kind of robot is not completely autonomous given the necessary intervention of an operator.

Pertaining to clinical practice teaching, as TCM is an empirical medicine and considered as an experience-base discipline, medical experience inheritance is very important for clinical practice teaching or learning. AI technology can optimize experience transmission from famous and experienced TCM doctors to the younger ones and/or to the medical students or interns, by digitalizing clinical experience and wisdom and by constructing a knowledge map from experts<sup>17</sup>. For instance, the multistage analysis method for detection of effective herb prescription from clinical data<sup>18</sup> helps the younger TCM doctors and/or the

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<sup>10</sup> About the four diagnostic methods of TCM, see ZHU BING/ WANG HONGCAI, «Diagnostics of Traditional Chinese Medicine», *People's Military Medical Press*, 2010, p. 14.

<sup>11</sup> Such as the tongue and face imaging instrument. In detail about this kind of instrument, available at <http://www.daosh.com/product-details-2>, accessed on 3/7/2020.

<sup>12</sup> Such as pulse condition analyzer. In detail about this TCM instrument, available at <http://www.daosh.com/product-details-3>, accessed on 3/7/2020.

<sup>13</sup> In detail about the *Daosh* instrument, available at <http://www.daosh.com/product-details-1.html>, accessed on 17/8/2020.

<sup>14</sup> In detail about the *Zhiyun* TCM instrument, available at <https://www.zhiyuntcm.com/product/tech>, accessed on 21/8/2020.

<sup>15</sup> In detail about the *Wisdom* instrument, available at <http://www.wisdomaic.com/en/chineseAi.shtml>, accessed on 18/8/2020.

<sup>16</sup> FANG LIMING/ JIANG JUNYUAN/ HU LEI/ *et al.*, «中医按摩机器人治疗军事训练伤50例分析» («Analysis of 50 Cases of Military Training Injury Treated by TCM Massage Robot»), *People's Military Surgeon*, Vol. 54, No. 7, July 2011, pp. 567-568, p. 568.

<sup>17</sup> YANG, YUN/ ZHONG YI/ YU GUANZHEN/ *et al.*, «人工智能促进中医药传承发展的机遇与挑战» («Opportunities and challenges for artificial intelligence to promote the inheritance and development of Chinese medicine»), *Beijing Journal of Traditional Chinese Medicine*, Vol. 38, No. 8, August 2019, pp. 835-838, p. 836.

<sup>18</sup> YANG K/ ZHANG R/ HE L/ *et al.*, «Multistage analysis method for detection of effective herb prescription from clinical data», *Frontiers of Medicine*, Vol. 12, No. 2, 2018, pp. 206-217.

medical students or interns improve clinical skills through a platform or system that shows automatically the experience of the famous and experienced experts, such as their herb prescriptions and medical records<sup>19</sup>.

## **2.2. Fully Autonomous AI?**

The application of AI technology is more mature and vaster in conventional medicine than in TCM, such as the well-known “surgical robot” that has developed not only with non-autonomous and partial autonomous systems, but also with fully autonomous system, and through the last one the surgical robot can autonomously learn and act beyond programming range<sup>20</sup>. Nonetheless, we may ask if any AI Robot in TCM can think, learn and act autonomously without any intervention of TCM doctors.

For this question, we should incline to give a negative answer considering the current development of AI technology in TCM. There are still many technical problems hindering the development of AI technology to achieve an autonomous level in TCM. Even so, many researchers have been striving for such development. Facing the technical problems like the difficulties to give different treatments for the same disease of different syndrome types and to integrate the TCM principle and its knowledge system into the deep learning process, GUO YAN, *et al.* recently suggest the alleged “Chinese Medicine Symptom-Aware Knowledge Graph” and “Chinese Medicine Rule-Deep Learning Model” to resolve the mentioned problems<sup>21</sup>. As well, ZHANG HONG, *et al.* suggest the so-called “Artificial Intelligence–Based Traditional Chinese Medicine Assistive Diagnostic System” in order to resolve the problem of TCM syndrome prediction for only one disease-type<sup>22</sup>.

Even though nowadays the fully autonomous system of AI technology does not exist in TCM, we cannot ignore its development heading to achieve that level and the potential legal issues in a situation where the AI Robot in TCM is

<sup>19</sup> YANG, YUN/ ZHONG YI/ YU GUANZHEN/ *et al.*, *op. cit.*, p. 836.

<sup>20</sup> HUANG CHENCHEN, «Subject, ownership and realization of criminal responsibility in medical malpractice of surgical robot», *Journal of Chongqing University (Social Science Edition)*, 10 June 2020, (Online First), pp. 1-13, pp. 2-3 (available at <https://kns.cnki.net/kcms/detail/50.1023.C.20200610.1352.004.html>, accessed on 21/8/2020). Doi:10.11835/j.issn.1008-5831.fx.2020.06.003.

<sup>21</sup> GUO, YAN/ REN XUE/ CHEN YU-XIN/ *et al.*, *op. cit.*, pp. 651-652. According to the authors, the first model allows to “give different treatments for the same disease of different syndrome types”, while the second model “effectively supports the inclusion of CM [Chinese medicine] diagnostic rules into the deep learning process, which not only exerts the advantage of deep learning to automatically extract features, but also incorporates the CM knowledge system”.

<sup>22</sup> ZHANG HONG/ NI WANDONG/ LI JING/ *et al.*, «Artificial Intelligence–Based Traditional Chinese Medicine Assistive Diagnostic System: Validation Study», *JMIR Medical Informatics*, Vol. 8, No. 6, e17608, 2020, pp. 1-12.

capable to think, learn and act autonomously without any control or intervention of physical TCM doctors.

### 3. AI, TCM and Pandemic Emergency

After having discussed the development of AI technology in TCM, it is valuable to expose the importance of TCM during the pandemic emergency like the Coronavirus disease 2019 (COVID-19) that we have been facing or other similar events in the future. The COVID-19 – which the World Health Organization [WHO] defines as “the infectious disease caused by the most recently discovered coronavirus”<sup>23</sup> – is a huge challenge that all countries have been trying struggling to. Portugal, even not the one that faces the most serious situation in Europe, is also one of the countries that has been fighting hardly against the COVID-19<sup>24</sup>. Therefore, we may ask what role can TCM plays against this kind of coronavirus disease.

Due to the lack of anti-virus drugs or vaccines for the treatment of this unexpected and fatal disease, at present the ways to improve the symptoms of patient are the supportive care and non-specific treatment, where TCM can intervene as a complementary therapy for COVID-19 patients<sup>25</sup>. Besides, the complementary role that TCM plays against COVID-19 can be reinforced when applied early, given that it can “improve cure rate, shorten the course of disease, delay disease progression and reduce mortality rate”<sup>26</sup>. As the COVID-19 is the category of plague in TCM caused by the epidemic pathogenic factors, the Chinese government issued on 3 March 2020 a Diagnosis and Treatment Protocol for COVID-19, in which many TCM prescriptions are recommended to use in different situations like during medical observation and during clinical treatment

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<sup>23</sup> About this definition, available at <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/q-a-coronaviruses>, accessed on 24/8/2020.

<sup>24</sup> To see in detail how Portugal has been fighting against the COVID-19, RAPOSO, VERA LÚCIA, «Portugal: fighting CoVID-19 in the edge of Europe», *BioLaw Journal*, No. 1S, 2020, pp. 723-730.

<sup>25</sup> YANG YANG/ ISLAM MD SAHIDUL/ WANG JING/ *et al.*, «TCM in the Treatment of Patients Infected with 2019-New Coronavirus (SARS-CoV-2): A Review and Perspective», *International Journal of Biological Sciences*, Vol. 16, No. 10, 2020, pp. 1708-1717, p. 1709. According to these authors, more than 85% of COVID-19 patients in China are receiving TCM treatment.

<sup>26</sup> REN JUN-LING/ ZHANG AI-HUA/ WANG XI-JUN, «Traditional Chinese medicine for COVID-19 treatment», *Pharmacological Research*, Vol. 155, May 2020, 104743, pp. 1-2, p. 2.

of confirmed cases of COVID-19<sup>27</sup>. Therefore, we cannot ignore the important role that TCM plays against COVID-19 or any other potential virus in the future.

On the other side, if AI technology develops well in TCM, it certainly helps TCM struggle against pandemic emergency. We expect that patients can avoid any person-to-person contact by staying at home to receive medical advises and treatments. This is very important to hinder a further virus spread. For instance, telemedicine, if integrated with AI technology and the four diagnosis methods of TCM, is a great way to avoid any cross-contamination for the ones who want to receive TCM advices or prescriptions, because they do not need to go to a clinic or hospital in person for the mentioned purposes. Accordingly, the role that TCM plays, when combined with AI technology, is also very important, especially during a pandemic emergency period.

#### **4. The Laws regulating TCM in Portugal<sup>28</sup>**

However, why is TCM important in Portugal, and not in any other European countries, such as Spain, German, France, etc.? This question is very crucial because, if it were not important in Portugal, we should not have any merit to explore the content above and, especially, analyze the next section regarding the criminal punishment to the acts practiced by AI Robots in TCM or even by the person who behind the robots/instruments controls the operation.

The importance of TCM in Portugal was legally recognized when came into force the Ministerial Ordinance No. 45/2018, 9 of February<sup>29</sup>, which regulates the general requirements that must be satisfied by the bachelor degree in TCM, such as the institutions that can provide the course (Article 3), the components of study plan (Articles 5 to 9), the duration (Article 11), the number of credits (Article 12), the entry condition (Article 13), etc. On the other hand, such importance is significant when Portugal is the only European country that recognizes the bachelor degree of TCM, which implies the attention that the Portuguese government pays to TCM, especially to its complementary role for the Portuguese healthcare system and to its clinical effects that can produce to the Portuguese citizens.

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<sup>27</sup> National Health Commission & State Administration of Traditional Chinese Medicine of the People's Republic of China, *Diagnosis and Treatment Protocol for COVID-19 (Trial Version 7)*, pp. 1-17, pp. 11-16 (available at <https://www.chinadaily.com.cn/pdf/2020/1.Clinical.Protocols.for.the.Diagnosis.and.Treatment.of.COVID-19.V7.pdf>, accessed on 25/8/2020).

<sup>28</sup> In this section, this paper does not repeat the legal documents which can be generally applied either to conventional medicine or to TCM.

<sup>29</sup> About this legal document, available at <https://dre.pt/application/conteudo/114661392>, accessed on 26/8/2020.



Earlier than the mentioned legal document (which regulates the higher education of TCM), the Portuguese law began regulating the professions of non-conventional therapies from 2003, through the Law of Basic Framework for Non-conventional Therapies (Law No. 45/2003, 22 August)<sup>30</sup>. Nonetheless, TCM was not recognized as one of the non-conventional therapies in this law, because they embrace only acupuncture, homeopathy, osteopathy, naturopathy, phytotherapy and chiropractic (Article 3, no. 2). What we can say is that the law regulates only one of the TCM branches, the acupuncture.

The Portuguese legal framework began regulating the profession of TCM when the Law No. 71/2013, 2 September<sup>31</sup>, which regulates the Law No. 45/2003, of 22 August, regarding the professional practice of activities involving the application of non-conventional therapies became effective. With the Law No. 71/2013, non-conventional therapies includes TCM, in addition to the ones mentioned above (Article 2). Therefore, when acupuncture in China is regarded as one of the TCM branches, in Portugal it is legally separated from TCM and considered as one of the non-conventional therapies<sup>32</sup>.

## 5. Criminal Punishment of TCM with AI Technology?

### 5.1. *Partial Autonomous or Non-Autonomous AI?*

As we discussed above (*supra* 3.1), the instruments like *Daosh*, *Zhiyun* and *Wisdom*, as well as the medical instruments that people can use at home, or even other similar instruments, are integrated only with partial autonomous or non-autonomous AI technology. In this circumstance, there is a person, namely a doctor, a programmer or even a user (which normally is a patient), who behind the AI instruments controls at least the partial operation procedure. For us it is very clear that such AI instruments are only objects that are under control by someone, namely a person behind the object.

There is no doubt that an object cannot be subject to any criminal punishment, given that it certainly is not a nature or legal person that the Article 11 of the Portuguese Criminal Code regulates. However, it does not mean an inexistence of a criminal punishment in this context, because the general theory of

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<sup>30</sup> About this legal document, available at <https://dre.pt/pesquisa/-/search/656122/details/maximized>, accessed on 27/8/2020.

<sup>31</sup> About this legal document, available at <https://dre.pt/application/conteudo/499569>, accessed on 27/8/2020.

<sup>32</sup> This separation becomes clearer when the Ministerial Ordinance No. 172-C/2015, 5 June, regulates the general requirements that must be satisfied by the bachelor degree in acupuncture. About this legal document, available at <https://dre.pt/web/guest/pesquisa/-/search/67429782/details/maximized>, accessed on 27/8/2020.

Portuguese Criminal Law is, and should be, applicable to the person behind the object. In this situation, it seems that the person behind the object can be a direct perpetrator, indirect perpetrator, co-perpetrator or an instigator, in terms of the Article 26 of the same code. However, in majority of the cases the person behind the object is a direct perpetrator who negligently executes a crime through the AI instruments. For instance, a TCM doctor, who negligently does not follow the correct procedure of using a “TCM Massage Robot”, fractures a patient’s arm; for example, a programmer of the “TCM Massage Robot”, who negligently sets wrong the program code, causes a fracture in patient’s leg, even though a TCM doctor follows the instruction of using the mentioned robot.

For that reason, we can easily conclude that AI instruments with partial autonomous or non-autonomous technology cannot be criminally punished, as they are not a “person” according to the Portuguese Criminal Law. The only person who should be subject to criminal punishment is the person behind the object (normally the TCM doctor or the programmer of the AI instrument) who execute a crime through the AI instruments against patient’s health.

Nonetheless, the Portuguese legislator should think if it is necessary to create new types of crime for new situations where the users or the programmers of AI instruments or even any other person can commit a crime against patient’s health. For example, do we need to create a type of crime for the situation in which someone intentionally deletes or changes certain data in AI instruments in order to damage patient’s health? Alternatively, the current Criminal Law serves conveniently for this situation? It seems that the Portuguese legislator presently should provide an answer for this question. In our understanding, we incline to create a new type of crime for a new situation only when this situation has its specialties that the current Criminal Law does not cover appropriately. The specialties can be, for instance, a new computing technique that can remotely revise the existing data of an AI instrument and disturb its normal operation procedure executed by a doctor in hospital.

## **5.2. Fully Autonomous AI?**

Some authors defend that the application of AI should satisfy the fundamental interests of people as the principle, so any development and utilization of AI cannot be at the expense of harming the interests of human society<sup>33</sup>. The same authors understand that the main status of doctors should be clear and AI plays an auxiliary role to help doctors in order to improve patient efficiency and quality<sup>34</sup>. Nonetheless, we should oppose to this point of view. On one hand, AI

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<sup>33</sup> HE XINHANG/ HUO ZENGHUI. «Ethical risk preliminary exploration of artificial intelligence in traditional Chinese Medicine», *China Health Law*, Vol. 28, No. 3, May 2020, pp. 835-838, p. 10.

<sup>34</sup> HE XINHANG/ HUO ZENGHUI. *op. cit.*, p. 11.

Robots are fully autonomous, namely can think, learn and act autonomously without any control of nature person, and consequently can harm the interests of human society, such as a bodily harm during medical treatment. Like PEDRO MIGUEL FREITAS *et al.* well pointed in their study, “[p]rovided that AI entities have self-awareness, self-consciousness, free and conscious will, ability to apprehend the (un)lawfulness of their behavior and means to guide themselves by law, the minimum requirements to call forth their blameworthiness and, hence their criminal responsibility are present”<sup>35</sup>. On the other hand, AI Robots can play an independent role, not just a complementary role, for diagnosis and treatments because they have a capacity to complete all the necessary diagnosis or treatment procedure.

Even though nowadays the AI Robots do not intervene maturely in TCM, we cannot ignore the future development tending to achieve the fully autonomous level in this ambit. Therefore, it is also valuable to discuss the possible criminal liability of AI Robots, either in conventional medicine or in TCM, and provide some legislative orientations to the future legislator.

For now, we have a question to be resolved: if an AI Robot can think, learn and act autonomously without any control of physical doctors, should we still consider it as an object or as a legal person, or, alternatively, the Portuguese legislator should create a new legal expression for the mentioned robot? The answer to this question is very important because it will tell us whether the Portuguese legal framework should criminally punish the AI Robots that can autonomously commit a crime against patient’s health.

No one doubts that fully autonomous AI Robot is not, and cannot be, a nature person, because biologically it is not an individual human being. On the other hand, legal persons in the current Portuguese legal framework refer to organizations like associations, foundations and companies (Article 157 of the Portuguese Civil Code). They certainly do not include any AI Robot because it is not an organization where nature persons occupy position of leadership in name of the collective interest. Even though the current legal persons do not include it, it is valuable to ask if the expression “legal persons” in the Portuguese legal framework can include as well AI Robot, or new expression should be created in the Portuguese Law for the same purpose. For this question, we do not reject either the former resolution or the latter one, but we prefer the later one. The reason is very simple! If we admit, at least in the ambit of the secondary criminal law, the legitimacy and possibility of criminal liability of organizations (namely the current legal persons) by recognizing their capacities of action and

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<sup>35</sup> MIGUEL FREITAS, PEDRO/ ANDRADE, FRANCISCO/ NOVAIS, PAULO, «Criminal Liability of Autonomous Agents: From the Unthinkable to the Plausible», *AICOL IV/V 2013, LNAI 8929* (eds. P. CASANOVAS *et al.*), pp. 145-156, p. 154.

guilty through the so-called “analogical model”<sup>36</sup>, we cannot see any reason why we cannot create, through the same model, a new expression that only refers to autonomous robots. We do not prefer enlarging the ambit of “legal persons” or even “entities similar to legal persons” to that the Article 11 of the Portuguese Criminal Code refers because this solution will cause other problems in the legislative technique. For instance, one of the problems refers to a necessary change to the Number 2 of the Article 11 of the same code. This legal norm should include not only the types of crime expressly mentioned in it, but also other types of crime, including the ones that can be committed by nature persons, because an AI Robot can act like a human being. On the other hand, the two requisites in the same legal norm should not be applicable to AI Robots, as they are not organizations where one or some nature persons occupy position of leadership. Hence, if the future legislator chooses to enlarge the ambit of “legal persons” or “entities similar to legal persons”, more attention must be paid to the legislative technique in order to exist coherence or consistency between the norms in the Criminal Law. In conclusion, either enlarging the ambit of “legal persons” or “entities similar to legal persons” or creating a new expression for the same purpose, we do not consider AI Robots as objects, so we defend an availability of criminal punishment of AI Robots in the Portuguese legal framework.

After recognizing such availability of criminal punishment, the legislator will also need to think if the current types of crime in the Portuguese Criminal Code or even in the single laws<sup>37</sup> should be applicable to the acts executed by AI Robots. For instance, it is necessary to confirm if the types of crime regulated by the Cybercrime Law (Law No. 109/2009, 15 September)<sup>38</sup> should be conveniently applicable to the acts carried out by AI Robots. We understand that if an autonomous robot can act as a human being, it can also commit the crimes that the later one commits. Therefore, not only the types of crime in the secondary criminal law (obviously, except the ones that only can be applied to organizations where nature persons are required to occupy position of leadership) can be applicable to AI Robots, but also the primary one if AI Robots can act like a human being.

However, we should resolve another problem in this ambit. Sometimes, a nature person can be criminally punished with fine penalty, but is the same penalty suitable for autonomous robots? Alternatively, should another type of

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<sup>36</sup> About this point in detail, DIAS, JORGE DE FIGUEIREDO, *Direito Penal – Parte Geral – Tomo I – Questões Fundamentais. A Doutrina Geral do Crime*, 2<sup>nd</sup> ed., Lisbon, Coimbra Editora, January 2011, p. 298.

<sup>37</sup> The term “single laws” refers to “leis avulsas” in Portuguese language.

<sup>38</sup> About this legal document, available at [http://www.pgdlisboa.pt/leis/lei\\_mostra\\_articulado.php?nid=1137&tabela=leis](http://www.pgdlisboa.pt/leis/lei_mostra_articulado.php?nid=1137&tabela=leis), accessed on 17/9/2020. This law transposed Council Decision 2005/222/JAI, 24 February, into the internal legal order regarding attacks against information systems, and adapts domestic law to the Convention on Cybercrime of the Council of Europe.

penalty be created only for autonomous robots? These are the questions that the future legislator should provide suitable answers according to the condition and the development of AI technology<sup>39</sup>.

Further, the future legislator also need to think if the current Criminal Procedure Code is applicable to AI Robots, or some mechanisms in it should not be applied to them? Or is it more convenient to create a new special procedure only for AI Robots, except the existing ones like summary procedure, the abbreviate procedure and the simplified procedure? For example, we need to know if the criminal procedures regulated by the Cybercrime Law (Law No. 109/2009, 15 September), especially from its Article 11, are conveniently applicable to AI Robots. These questions are also relevant for the current topic and need further investigations and studies in order to find the suitable answers.

## 6. Conclusion

As we can see above, the AI technology can develop in such a speed that the law cannot catch its steps. We know that a situation should be legally regulated when the necessity of regulation appears in our community. AI technology is the one to which we need to begin paying more attention, especially in the legal ambit. Even though currently AI technology does not achieve a fully autonomous level in TCM and, consequently, the necessity of regulation has not appeared yet, the Portuguese legislator still need to (re)think if the necessary regulation exists for certain acts executed by the person behind the object, such as new types of crime for the situation in which the mentioned person deletes or changes some data in intelligent TCM instruments to damage patient's health. We can predict that, if AI technology achieves a fully autonomous level in TCM, AI robots in TCM can act like a human being and more legal issues will appear. For instance, we need to see if they should be considered as legal person or new legal expression should be created; or if new types of crimes should be created for them; or if all mechanisms in the current Portuguese Criminal Procedure Code are applicable to them; or if new criminal procedure should be established only for them. We expect and believe that the Portuguese legislator will provide suitable solutions for the mentioned legal issues.

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<sup>39</sup> For example, the fine penalty only will be suitable for autonomous robots when they can have capacity to create profit like a human being.