

Finding a Balance Between Legal Possibility  
and Algorithmic Opportunity\*

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**SUMMARY:** 1. The techno-human condition. – 2. Examples of applications of Artificial Intelligence in the medical field. – 3. The paradigmatic case of Ginger.io. – 4. Medical research in the “land of algorithms”. – 5. The reserve of humanity as the guiding principle of technological evolution in the medical field.

**ABSTRACT:**

L'articolo affronta il tema dell'introduzione dell'intelligenza artificiale all'interno dell'ambito medico. Le opportunità offerte dalla tecnologia possono migliorare e rendere più efficienti le prestazioni sanitarie; al contempo, l'utilizzo dell'IA deve inserirsi nell'amministrazione della tutela della salute attraverso il rispetto dell'ordine costituzionale.

Il saggio approfondisce il rapporto uomo-macchina mediante una riflessione che insiste sulla necessità di costruire sistemi di IA che siano di supporto al medico, così da poter configurare una relazione positiva tra innovazione tecnologica e il ruolo dell'agente umano.

L'assunto di fondo dello scritto si basa sull'esigenza di sviluppare sistemi di IA a vocazione antropocentrica affinché siano tutelata la dignità umana e la capacità decisionale del personale sanitario. Inoltre, si attenziona anche la specialità dell'amministrazione sanitaria, le cui peculiarità spiegano l'avversione nei confronti della *black box* algoritmica e la propensione verso sistemi di IA spiegabili

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e comprensibili.

Infine, dopo aver esaminato alcuni esempi di IA applicata nel comparto medico, l'analisi descrive la condizione-tecno-umana e il ruolo fondamentale delle scienze umane, prima fra tutte il diritto, nella gestione del fenomeno della rivoluzione digitale.

*The article addresses the introduction of artificial intelligence within the medical field.*

*The opportunities offered by technology can improve and make health care delivery more efficient; at the same time, the use of AI must fit into the administration of health protection through respect for the constitutional order.*

*The essay delves into the human-machine relationship through a reflection that insists on the need to build AI systems that are supportive of the physician, so that a positive relationship can be configured between technological innovation and the role of the human agent.*

*The underlying assumption of the paper is based on the need to develop anthropocentric AI systems so that the human dignity and decision-making ability of health care personnel are protected.*

*It also attends to the specialty of healthcare administration, whose peculiarities explain the aversion to the algorithmic black box and the propensity toward explainable and understandable AI systems.*

*Finally, after reviewing some examples of applied AI in the medical field, the analysis describes the techno-human condition and the fundamental role of the humanities, foremost among them law, in managing the phenomenon of the digital revolution.*

## 1. The techno-human condition

The hype caused by Artificial Intelligence in every branch of human action in which it is employed, it is a datum drawn from the media and scientific attention reserved for the new technologies that invest (and invade) contemporary society<sup>1</sup>. Confirming this statement are the journalistic relevance that it engulfs and the reflections that the doctrine has promptly reserved for the introduction of the *Artificial Intelligent Act*<sup>2</sup>, as the first regula-

<sup>1</sup> See. P. ZELLINI, *La dittatura del calcolo*, Milano, 2018. A. It considers the success of algorithms to be the result of the fact that they are a synthesis between theoretical and applied science, between foundational research and computational technique. In fact “se le ricerche fondazionali mirano a un concetto astratto di calcolabilità effettiva, le scienze applicate cercano piuttosto l'efficienza algoritmica come connotazione naturale e immancabile di qualsiasi processo di calcolo” (p. 12). Of inescapable fascination are the considerations of A. Regarding the success of the algorithms: “se un secolo fa le incertezze e le discordanze sulla natura del calcolo avevano scatenato una profonda insicurezza e una crisi dei fondamenti, ora analoghe incertezze sulla natura degli algoritmi e sul controllo computazionale dell'intero universo sembrano sfumare, nella migliore delle ipotesi, in forme di utopia e di palingenesi ... Queste sono avvertite più come un elemento di forza e di propulsione scientifica che non come un limite di conoscenza... Ne escono rafforzati la credibilità e, insieme, il carattere virtualmente dispotico degli algoritmi”, (p. 14). From Zellini's reflections, it can be deduced that algorithms, especially those of artificial intelligence, should not be conceived as infallible, since they are subsumed to an efficiency logic and, therefore, not based on foundational research. If this assumption is not clear, the risk of uncritically and recklessly relying on the result generated by the machine is real and could, reasonably, make current the potential risks of distortions, discrimination and incontestability of the outputs generated by the intelligent agent, neglecting, precisely, the ontological connotation of possible fallibility.

<sup>2</sup> See. C. NOVELLI, *L'“Artificial Intelligence Act” (AIA) Europeo: alcune questioni di implementazione*, in *federalismi.it* 2/2024, pp. 95-113; A. ALAIMO, *Il Regolamento sull'Intelligenza Artificiale: dalla proposta della Commissione al testo approvato dal Parlamento. Ha ancora senso il pensiero pessimistico?*, in *federalismi.it* 25/2023, pp. 133-149; D. PIANA-G. VICICONTE, *La “governance” pubblica fra il prossimo regolamento UE sull'intelligenza artificiale e il codice dei contratti*

tory reference of a Euro-unitary matrix aimed at regulating and dictating rules on the licit or prohibited use of Artificial Intelligence tools.

Our life *onlife*, echoing the famous locution of Luciano Floridi<sup>3</sup>, allows us to detect in every disquisition about Artificial Intelligence a relevance in the most disparate fields of knowledge, on the basis of the consubstantial universality of AI as a characteristic feature of the digital-algorithmic revolution underway.

In this paper we intend to interpret this polysemic palingenesis of society through an analysis of the impact of AI on healthcare administration. Rather than from the medical point of view that glimpses the potential of such a technological epiphany<sup>4</sup>, The perspective adopted is that of the juris-publicist whose objective is the preservation of the *constitutional asset* and the preservation – albeit dynamic – of the rules of administration.

The fascination that atomistically hides any reflection on *algorithmically poietic* reality is inevitably enriched when the state system, in its constitutional, political, executive guise, and the technological impulses that strongly stress the *public pars*, are compared.

To this must be added the characteristics of the health administration, a special part of the public administration by reason of its object (the protection of the good of health), for the constitutional repercussions inherent in the legislation and the organization *ratione materiae*, as well as for the innate transversality of the subject.

On the one hand, the algorithmic dimension has been described as the most complex challenge of switching the public administration from analog to digital<sup>5</sup>, *mutatis mutandis* the relationship between health and AI is equally and differently marked by significant criticalities.

Without claiming to exhaust the boundless theme of AI, my reflections start from the observation of the abnormality of the substantial and social switching in place, eloquently described by Roberto Finelli as a phase in which “l’artefatto tecnologico non sembra più presentarsi come strumento, com’è stato tradizionalmente concepito, ma diventa una sorta di ‘soggetto macchinico’”<sup>6</sup>.

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*pubblici. Scenari attuativi ed esigenze di controllo a fronte dell’evoluzione dell’IA*, in *Rivista della Corte dei Conti*, 4/2023, 1, pp. 30-42; F. BAGNI, *The Regulatory Sandbox and the Cybersecurity Challenge: from the Artificial Intelligence Act to the Cyber Resilience Act*, in *Rivista italiana di informatica e diritto*, 2/2023, pp. 201-217.

<sup>3</sup> “L’infosfera sta progressivamente assorbendo ogni spazio” and at the same time “le ICT non stanno soltanto ricostruendo il mondo: lo stanno riontologizzando”, thus L. FLORIDI, *La rivoluzione dell’informazione*, trad. it., Torino, 2012, p. 20.

<sup>4</sup> In the health field, for example, a self-learning system in the field of radiology is well developed, through the replacement of the doctor with the machine, relegating human *control* only ex post. See U. RUFFOLO, *L’Intelligenza artificiale in sanità: dispositivi medici, responsabilità e “potenziamento”*, in *Giurisprudenza italiana*, 2021, 2, pp. 502-508.

<sup>5</sup> Authoritative doctrine makes a distinction between the algorithmic dimension and the more general digital administration, recognizing that “il fenomeno più problematico dal punto di vista costituzionale, infatti, non è soltanto quello della ‘digitalizzazione’ della Pubblica Amministrazione, bensì quello della amministrazione digitale algoritmica”. In these terms A. SIMONCINI, *Amministrazione digitale algoritmica. Il quadro costituzionale*, in R. CAVALLO PERIN - D.U. GALETTA (curated by), *Il diritto dell’amministrazione Pubblica Digitale*, Torino, 2020, p. 4.

<sup>6</sup> R. FINELLI, *Filosofia e tecnologia. Una via di uscita dalla mente digitale*, Torino, Rosenberg & Sellier, 2022.

The learning algorithm experience<sup>7</sup>, through the *machine learning* system or in its most opaque and advanced guise of *deep learning* through deep learning neural networks<sup>8</sup>, It upsets the relationship of instrumentality with respect to man that has always been attributed to the machine, incapable of thinking, planning and, as far as we are concerned, of caring for human beings.

Rather than following a Manichean approach that substitutes the natural-artificial binomial for the good-evil dichotomy as a synopsis of the clash or at least of the dialectic between man and τέχνη, Paolo Benanti's thought about the techno-human condition reveals a degree of refinement and a theological and scientific mixture of a very different conceptual tenor that we want to include in our discourse, to the extent that it does not express any distinction but a physiological – as well as historically rooted – mixture between human and technology<sup>9</sup>.

Acknowledging the disputed distinction between the two worlds, that of the artificial proper to technology and the natural one, whose figure is entirely human, careful doctrine has identified the semantic *deficit* of algorithmic power<sup>10</sup> the explanation of certain exegesis

<sup>7</sup> G. SARTOR - F. LAGIOIA, *Le decisioni algoritmiche tra etica e diritto*, in U. RUFFOLO (curated by), *Intelligenza artificiale. Il diritto, i diritti, l'etica*, Milano, 2020, pp. 69-71, They dwell on the variety of machine learning method. In the field of machine learning, there are three main approaches: supervised, reinforcement, and unsupervised. Supervised learning learns through "supervision" or "teaching", i.e. on the basis of a training set, i.e. a large set of (probable) correct answers to the task assigned to it. In particular, the training set consists of pairs, each of which links the description of a case to the correct answer. The system learning algorithm (trainer) uses the training set to build a computational model, the answers to which are generally referred to as "predictions". Reinforcement training assumes that the system learns from the results of its own or others' actions: it is able to discern between success and failure. In supervised training, the system learns without receiving instructions or guidance from the outside.

<sup>8</sup> G. PASCERI, *Intelligenza artificiale, algoritmo e machine learning, La responsabilità del medico e dell'amministrazione sanitaria*, Milano, 2021, pp. 38-39, He explains in detail the possible differences between these learning systems: "Nel sistema di deep learning i dati vengono processati tramite una successione cosiddetta "profonda" in modo che l'apparecchiatura sia in grado di riconoscere autonomamente un valore (immagine, documento, suono). Successivamente, l'addestratore confermerà o negherà il risultato... Caratteristica tipica del deep learning è rappresentata dal fatto che l'algoritmo utilizzato, se esposto a diverse situazioni o differenti modelli di dati, si adatta automaticamente, riuscendo a valutare nei dati inseriti anche caratteristiche che l'addestratore non ha mai programmato specificamente. In altri termini l'apprendimento mediante deep learning permette all'algoritmo e all'agente intelligente di auto apprendere (c.d. self learning)". A. then proceeds to the examination of machine learning qualified as "un processo di apprendimento che si basa sull'inserimento di una grande quantità di informazioni. Sarà poi l'algoritmo a classificare i dati immessi (input) attraverso il riconoscimento di modelli preordinati... Nell'apprendimento mediante machine learning l'accuratezza nell'identificazione di determinati oggetti, immagini, suoni, dipenderà dalla quantità dei dati inseriti e dalla capacità di elaborazione dell'apparecchiatura".

<sup>9</sup> Therefore, "parlare dell'uomo attraverso gli artefatti tecnologici e la tecnica-tecnologia ci consente di investigare la natura umana superando una certa dicotomia tra naturale e artificiale", P. BENANTI, *La condizione tecno-umana. Domande di senso nell'era tecnologica*, II ed., Bologna, 2022, p. 24.

<sup>10</sup> The reference is to the interesting contribution by I. CONSOLATI, *Per una semantica del potere algoritmico. Prospettive e problemi*, in *Filosofia politica*, Fascicolo 2, 2023, p. 331. A. It makes a reference, pertinent to our discussion, to the thesis that there is a split between facts and values caused by a "categorical defect" whose causes can be traced back to the history of the link between the concepts of nature, technology and science. On this point, A. refer to the contributions of C. GALLI, *Tecnica e politica: modelli di categorizzazione*, in Id., *Modernità. Categorie e profili critici*, Bologna, Il Mulino, 1988, pp. 79-106; R. BODEI, *Dominio e sottomissione. Schiavi, animali, macchine, intelligenza artificiale*, Bologna, Il Mulino, 2019; E. SCHATZBERG, *Technology. Critical History of a Concept*, Chicago, The University of Chicago Press, 2018.

that “nella tecnologia individuano l’ambito dei meri fatti, distinto da quello dei valori che hanno sempre un’origine non tecnologica, bensì spirituale e umana, e che sulla tecnologia devono venire eventualmente proiettati affinché si fermi la sua marcia disumanizzante, portata all’estremo nell’ambito dell’intelligenza artificiale che minaccia di espropriare l’ultimo possesso esclusivo dell’individuo, vale a dire il suo stesso pensiero”.

The introduction of AI in the public and health sector involves a series of profiles relating to the relationship between citizen protection and public power: the epitome of this tension is the opacity of the *algorithmic* black box<sup>11</sup>, supinely accepted in relationships between platforms and individuals, in which the user barter (and sells off) data and information for immediate and poor quality services<sup>12</sup>, An inadmissible relational model in the administrative action that has made transparency<sup>13</sup> The characteristic feature of modern administration as *a glass house*<sup>14</sup> “all’interno della quale cioè tutto è sempre e costantemente visibile”<sup>15</sup>.

<sup>11</sup> The achievement of explainability standards for A.I. systems is an ambition, from a technical point of view, which presupposes an enormous technical effort, to which the studies on *explainable AI are dedicated*. On this subject, compare the contributions of S. WACHTER - B. MITTELSTADT - C. RUSSEL, *Counterfactual Explanations Without Opening the Black Box: Automated Decisions and the GDPR*, in 31 *Harvard J. L. & Tech.*, 841 (2018); W. SAMEK - T. WIEGAND - K.R. MÜLLER, *Explainable Artificial Intelligence: Understanding, Visualizing, and Interpreting Deep Learning Models*, in *ITU Journal: ICT Discoveries*, 2017, 1, 1.

<sup>12</sup> In a recent essay by G. SGUEO, *Il divario. I servizi pubblici tra aspettative e realtà*, Milano, 2022, A disconnect between citizens’ expectations with respect to the expected level of performance of the Public Administration and that materially found was well represented: if by now the habit of speed and immediacy has become the essential feature of private services, this explains the acrimony and dissatisfaction with the slowness of administrative action. The duty paid to obtain such fast, immediate and “free” services is the low quality of the same, tolerated on the basis of the speed of execution. On the other hand, public action consists of a genetic complexity and unknown peculiarities in relations between private individuals, conditions that preclude the downward simplifying option practiced in the business-to-consumer relationship. Citizens cannot be considered mere consumers of public services, since they “use” these services, organized in compliance with rules different from the private dynamic, even if experiments and policies of corporatization of the administration have brought the two branches closer together. The speciality of administrative law See. R. FERRARA, *La pubblica amministrazione fra autorità e consenso: dalla “specialità” amministrativa a un diritto amministrativo di garanzia?*, in R. FERRARA - S. SICARDI (curated by), *Itinerari e vicende del diritto pubblico in Italia, amministrativisti e costituzionalisti a confronto*, Padova, 1998, pp. 131 ss. e ID., *Introduzione al diritto amministrativo. Le pubbliche amministrazioni nell’era della globalizzazione*, Roma-Bari, 2014, pp. 3 ss.

<sup>13</sup> On the subject of administrative transparency, reference should be made to a recent and interesting essay by E. CARLONI, *Il paradigma trasparenza. Amministrazioni, informazione, democrazia*, Bologna, 2022. The Author vigorously extols the value of transparency as a “condizione di garanzia di diritti, parte della buona amministrazione, pilastro dell’anticorruzione, componente di un’amministrazione aperta, presupposto della partecipazione del cittadino” as well as how to “tessera fondamentale nel disegno di un’amministrazione democratica e costituzionale” (p. 12).

<sup>14</sup> “Dove un superiore pubblico interesse non imponga un momentaneo segreto, la casa dell’amministrazione dovrebbe essere di vetro”, thus F. TURATI, *Atti del Parlamento italiano*, Camera dei Deputati, sessione 1904-1908, 17 giugno 1908. In a critical sense, with respect to an excess of transparency, See. E. CARLONI, *La “casa di vetro” e le riforme. Modelli e paradossi della trasparenza amministrativa*, in *Dir. pubbl.*, 2009, 806. About the excess of transparency, the notations of M. D’ARIENZO, *Diritto alla trasparenza e tutela dei dati personali nel d.lgs. n. 33/2013, con particolare riferimento alla disciplina dell’accesso civico*, in *Diritto e processo amministrativo*, n. 1/15, according to which “se si guarda all’esperienza maturata in ormai oltre venti anni, è piuttosto agevole constatare che il principio di trasparenza è stato progressivamente dilatato e che, nelle pieghe degli interventi legislativi che si sono susseguiti, si annidava il germe di un nuovo diritto di accesso civico che, benché “necessitato” per l’esigenza di garantire la massima applicazione ed attuazione del principio *de quo*, disvela numerose insidie che neanche i migliori intendimenti potrebbero dissipare”.

<sup>15</sup> SO, M. CLARICH, *Trasparenza e diritti della personalità amministrativa*, in <http://www.giustiziaamministrativa.it>.

If the gap between public and private is in fact burdened by the osmosis grafted between technology and society with the advent of AI, the arduous task of the jurist stands out on the search for guidelines to make possible a commendable synthesis between the contribution of the machine and the human factor. This yearning, moreover, aims to elide radically conservative positions, the cause of an undesirable excess of precaution in the face of the progress of the algorithmic revolution.

One of the postulates of speculation on the relationship between man and machine, here taken in its health declination, can be found in the rejection of a distorted “alterazione radicale della natura dell’uomo, sino alla totale artificializzazione dell’umano sostituendo corpo e mente con sussidi meccanici ed informatici”<sup>16</sup>.

Denial of transhumanism<sup>17</sup> and aware of the dangers associated with the use of weapons of mathematical destruction<sup>18</sup>, We are called to a heuristic challenge that requires the jurist to broaden methodological horizons and postulates the willingness to intersect with other disciplines, not only with the hard sciences but also with philosophy, political science and theology.

The Fourth Revolution<sup>19</sup> it’s the time of the state in the age of Google<sup>20</sup>, of surveillance capitalism<sup>21</sup>, of technological hope and analog nostalgia<sup>22</sup>, of robotic care, of the efficient

<sup>16</sup> This ominous prospect is opposed by Mons. A. RASPANTI- L. PALAZZANI, *Intelligenza artificiale e intelligenza umana: contributi della teologia cristiana e della filosofia della persona*, in *BioLaw Journal - Rivista di BioDiritto*, n. 4/2022, p. 466.

<sup>17</sup> See. M. O’CONNELL, *To Be a Machine: Adventures Among Cyborgs, Utopians, Hackers, and the Futurists Solving the Modest Problem of Death*, Doubleday, 2017.

<sup>18</sup> Eloquent are the punctuations of C. O’NEILL, *Weapons of math destruction: how big data increases inequality and threatens democracy*, New, York, 2016, p. 16, which argues that in the ‘algorithmic arcana’ can be formed “armi di distruzione matematica”: “un algoritmo elabora un sacco di statistiche e ne estrae una probabilità che una certa persona possa essere una cattiva assunzione, un mutuatario rischioso, un terrorista, o un insegnante scadente. Questa probabilità è distillata in un punteggio, che può sconvolgere la vita dell’interessato. E tuttavia quando la persona reagisce, prove in contrario, meramente ‘evocatrici’, semplicemente non funzionano. La contestazione deve essere inoppugnabile. Le vittime umane delle armi di distruzione matematica [...] sono tenute a uno standard di prova molto più alto rispetto agli stessi algoritmi”.

<sup>19</sup> L. FLORIDI, *La quarta rivoluzione. Come l’infosfera sta trasformando il mondo*, Milano, 2017. The A. explains the concept of hyperhistory, as a step after history, itself taking the place of prehistory; In particular, the transition between prehistory and history took place when they were “diventati disponibili sistemi per registrare eventi, accumulare e trasmettere informazioni per un futuro consumo, le lezioni apprese dalle generazioni passate hanno iniziato a evolvere esponenzialmente, in maniera debole o lamarckiana, e così l’umanità ha fatto ingresso nella storia” (p. 1). The transition to hyperhistory takes place when ICT takes over reality, i.e. when the ability to instruct the machine, to raise the quantity and quality of data, connectivity and memory of systems will have reached a level that will supplant the offline world: according to the authoritative scholar, “l’iperstoria è una nuova era nello sviluppo umano, ma non trascende le coordinate spazio-temporali che hanno regolato la nostra vita su questo pianeta” (p. 26).

<sup>20</sup> The phrase takes up the title of the essay by L. CASINI, *Lo Stato nell’era di Google. Frontiere e sfide globali*, Mondatori, Università, Firenze, 2020 which speaks of a profound crisis of the State – more precisely of the very concept of the State – “messo a dura prova dalle nuove tecnologie”.

<sup>21</sup> The reference is to the work of S. ZUBOFF, *Il capitalismo della sorveglianza. Il futuro dell’umanità nell’era dei nuovi poteri*, Roma, 2023.

<sup>22</sup> “È possibile che nei prossimi anni l’innovazione tecnologica prenda il posto della globalizzazione, della geopolitica e persino dell’immigrazione come fonte principale di sentimenti nostalgici”, thus E. CAMPANELLA - M. DASSÙ, *L’età della nostalgia. L’emozione che divide l’Occidente*, Bocconi Editore, 2020, p. 49.

detachment between patient and doctor in the maze of telemedicine<sup>23</sup>, of the responsibility of data and with a marked emphasis on health data, of the defense of *privacy* and of the specular hunger for *input* to be included in *the software* so as to train the new means of production, the electronic computers<sup>24</sup>, which, thanks to their outputs, can both lead to an improvement in the state of collective well-being and to unraveling.

For this reason, the investigation into the reflections, potential, and limits of the use of the tools offered by AI in the health sector is a valuable opportunity to reflect downstream on the real benefits to be derived within this use and, in an ascending analysis, verify its legal viability, constitutional contradictions.

This speculation is an opportunity to probe what remains of the human factor in the particular ravine of personal care crossed by AI: after all, every discourse on technology is a discourse on man<sup>25</sup>.

## 2. Examples of Artificial Intelligence applications in the medical field

The healthcare sector has always been a testing ground for technological innovations<sup>26</sup>, from computed axial tomography (CT) to nuclear magnetic resonance imaging (MRI), from the use of ultrasound (ultrasound) to laparoscopic techniques, so that these innovations have rightly represented a “cambiamento di paradigma”<sup>27</sup>.

<sup>23</sup> There is plenty of scientific literature on the subject. *Ex multis*, please refer to the recent contributions by A. MAZZA LABOCETTA, *Telemedicina: sfide, problemi, opportunità*, in *federalismi.it*, 22/2023, pp. 135-182; R. SENIGAGLIA, *Telemedicina ed essenza fiduciaria del rapporto di cura*, in *Persona e Mercato*, 3/2023, pp. 470-483; G. LOFARO, *Piattaforma di Telemedicina e Fascicolo Sanitario Elettronico: il raccordo dei flussi informativi per i servizi sanitari digitali alla luce delle nuove linee guida*, in *Amministrativ@mente*, 2/2023, pp. 892-918; L. FERRARO, *La telemedicina quale nuova (e problematica) frontiera del diritto alla salute*, in *Il Diritto dell'informazione e dell'informatica*, 4-5/2022, pp. 837-866.

<sup>24</sup> Reference to V. VISIONE, *Contributo allo studio della dimensione algoritmica della funzione amministrativa*, Editoriale Scientifica, 2023. On the operation of the self-learning algorithmic mechanism, it was pointed out there that machine learning systems, which are based on a learning mechanism, maximize-even qualitatively-their capacity for abstraction and adherence to the optimal solution through 'training' on a dataset, the breadth and completeness of which also determine the success of the robotic output with respect to the reality to which it refers (pp. 157-158).

<sup>25</sup> On the subject, P. BENANTI, *La condizione tecno-umana. Domande di senso nell'era tecnologica*, cit., p. 139, remarked that “l'artefatto tecnologico, e il mondo della tecnica-tecnologia di conseguenza non sono... un disperato tentativo di sopravvivenza di un uomo impreparato a stare al mondo...ma proprio l'epifenomeno della sua essenza, il luogo esistenziale, la condizione tecno-umana in cui si mostra la grandezza della sua vocazione nella fragilità della sua costituzione”.

<sup>26</sup> There are many studies on the use of technologies in the medical field. See, among others, to D. AMRAM - A. CIGNONI - T. BANFI - G. CIUTI, *From P4 medicine to P5 medicine: transitional times for a more human-centric approach to AI-based tools for hospitals of tomorrow*, *Open Res Europe 2022*, 2:33. Available at: <https://doi.org/10.12688/openreseurope.14524.1>; V. DE BERNARDIS, *L'impiego delle nuove tecnologie in medicina*, in G. ALPA (curated by), *Diritto e intelligenza artificiale*, Pisa, 2020, 489-501; C. CASONATO - S. PENASA, *Intelligenza artificiale e medicina del domani*, in G.F. FERRARI (curated by), *Le Smart Cities al tempo della resilienza*, Milano, 2021, pp. 553-586.

<sup>27</sup> T.S. KUHN, *The structure of scientific revolutions*, Chicago, 1962.

One of the fields of choice for the application of AI in its generative declination is the field of diagnostics since it is able to analyze huge amounts of data so as to identify *patterns* or anomalies that could be indicative of a specific disease or condition<sup>28</sup>. A generative AI model can be trained on a large *dataset* of skin lesion images or X-rays and then used to generate new images that represent possible cases of specific injuries or conditions, or to create simulation models of organs or biological systems.

As significantly highlighted by the doctrine, the advantages of such technological applications suffer from a danger of “hallucinations”: the “*AI Hallucination State*” is a phenomenon that occurs when *the generated output* is false, i.e. it is not based on the *dataset* on which it was trained nor is it predicted by the model with which it was created<sup>29</sup>. In other words, “nello stato di allucinazione, pur ottenendo una risposta efficace, esaustiva, logica, questa risulta essere completamente inventata. Nel settore medico il problema è particolarmente rilevante: si pensi, fra tutti, al caso di una AI generativa che produce come *output* l’immagine di una mano a sei dita”<sup>30</sup>.

In the field of prevention, cc.dd. *wearable devices* or Internet of *Things* (IoT) devices, called, in this specific context, *Internet of Medical Things* (IoMT) represent tools capable of detecting physical and mechanical parameters in real time; the input of the information collected by these devices into predictive *software* allows AI to process specific *outputs* and automate risk or probability analyses<sup>31</sup>.

Another possibility of obtaining benefits from technological innovation is found in the care of the elderly, the disabled or people with cognitive problems<sup>32</sup>; in this way, the help of generative AI facilitates the monitoring of the subject<sup>33</sup>, improving the provision of care

<sup>28</sup> By way of example, think of the benefits that AI tools already have today in the field of radiomics or dermatology, automated mechanisms based on algorithms capable of “reading” and “recognizing” images that allow the diagnosis of diabetic retinopathy and that of dermatological tumors, of the exocrine glandular system, of the nervous system or of other organs with speed, accuracy and precision.

<sup>29</sup> C. CILARDO, *Ma perché i chatbot hanno (così tante) allucinazioni*. Available at: <https://www.agendadigitale.eu/cultura-digitale/anche-i-chatbot-hanno-le-allucinazioni-cosasignifica-e-perche-avviene/>.

<sup>30</sup> C. D’ELIA, *Gli strumenti di intelligenza artificiale generativa nel contesto sanitario: problemi di ottimizzazione delle risorse e questioni di spiegabilità*, in *Rivista Italiana di Medicina Legale (e del Diritto in campo sanitario)*, fasc.2/2023, p.345.

<sup>31</sup> In this sense, AI can contribute to prevention, classification and stratification “delle condizioni del paziente – riducendo l’incertezza diagnostica –; nel comprendere perché e come i pazienti sviluppano le malattie – riducendo l’incertezza fitopatologica –; nel considerare quale trattamento sarà più appropriato per loro – riducendo l’incertezza terapeutica –; nel prevedere se si riprenderanno con o senza un trattamento specifico – riducendo l’incertezza prognostica e incremento della predizione della insorgenza o evoluzione delle patologie”, thus CNB - CNBBSV, *Intelligenza artificiale e medicina: aspetti etici*, 29 maggio 2020, p. 7. In this regard, it should be noted that tools are already available that, by detecting certain values, can act accordingly: implantable *continuous glucose monitoring* (CGM) systems, equipped with alarms that are also predictive for glucose levels outside the desired ranges and capable of sending data to a smartphone, are an example of this.

<sup>32</sup> See. E.A. FERIOLE, *Digitalizzazione, Intelligenza artificiale e Robot nella tutela della salute*, in A. D’Aloia (curated by), *Intelligenza artificiale e diritto. Come regolare un mondo nuovo*, Milano, 2020, pp. 423-450.

<sup>33</sup> In this way, moreover, through the availability of numerous and extensive information on the patient, AI systems can contribute to the definition of increasingly personalized care pathways: N. RAJAM, *Policy strategies for personalising me-*



and rehabilitation pathways to the patient in terms of speed and efficiency. In particular, robots for sociotherapeutic assistance or for mental degeneration make it possible to generate attention maintenance paths, dialogues, stimuli for the recovery of speech adapted/adaptable in real time to the needs and *input* of patients.

Algorithmic applications that are based on the prediction and processing of a large amount of data correlated with the sensitivity of health information are, of course, one of the points of contradiction in the plausible use of *machine learning* in the medical sector.

On this point, it is appropriate to refer to the c.d. *Federated learning*<sup>34</sup>, that is, a *machine learning technique* capable of exploiting the knowledge of different datasets without the need for them to be transferred so as to combine the different instances of *privacy* and technological development in medicine. The idea behind this practice is in fact to allow the subjects who own the data (in this specific case, health data) to create a federation in which the information exchanged does not include the personal information used for the training of the models, but only the parameters learned by the trained models on the data stored by the individual subjects<sup>35</sup>. This system allows individual health facilities, or research centers, to start their own local algorithm model to be trained with the (previously anonymized) health data collected by each of them and that, only once the training is completed, the results of the analyses are merged, necessary in order to create a single artificial intelligence model, without in any way compromising the confidentiality of patients' personal information<sup>36</sup>. Although in a prospective key, the use of the so-called "S.S. *Federated Learning* has been hailed with great favor in the medical field<sup>37</sup>, This innovation, however, has critical profiles, since federated learning – as a valid alternative to that of the so-called synthetic data<sup>38</sup> – “sotto il profilo della tutela dei dati personali presenta anch'esso alcuni aspetti critici: basti pensare a quelli legati all'architettura centralizzata del

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*dicine "in the data moment", in Health Policy and Technology, 3, 2020, pp. 379-383 and also E. COLLETTI, Intelligenza artificiale e attività sanitaria. Profili giuridici dell'utilizzo della robotica in medicina, in Riv. dir. econ. trasp. e ambiente, 2021, pp. 201 ss.*

<sup>34</sup> M. ALDINUCCI – B. CASELLA – R. ESPOSITO - G. MITTONE – M. POLATO, *Federated Learning, come coniugare intelligenza artificiale e privacy*. Available on: <https://www.agendadigitale.eu/sicurezza/privacy/federated-learning-coniugare-machine-learning/>.

<sup>35</sup> See. B. MCMAHAN - D. RAMAGE, *Federated Learning: Collaborative Machine Learning without Centralized Training Data*. Available on: <https://ai.googleblog.com/2017/04/federated-learning-collaborative.html>.

<sup>36</sup> Please refer to the contribution of C. RUDIN, *Stop explaining black box machine learning models for high stakes decisions and use interpretable models instead*, in *Nature Machine Intelligence*, 2019;1(5), pp. 206-215.

<sup>37</sup> See. J. HATHERLEY - R. SPARROW - M. HOWAR, *The Virtues of Interpretable Medical AI*, in *Cambridge Quarterly of Healthcare Ethics*, 2023, pp. 1-10.

<sup>38</sup> See. G. BRIGANTI - O. LE MOINE, *Artificial Intelligence in Medicine: Today and Tomorrow*, Front Med (Lausanne), 2020 Feb 5;7:27. doi: 10.3389/fmed.2020.00027. eCollection 2020; J. KALRA - Z. RAFID-HAMED - P. SEITZINGER, *Artificial Intelligence and Humanistic Medicine: A Symbiosis*, in *Advances in Human Factors/Ergonomics*, luglio 2021.

server, il cui potenziale attacco potrebbe, ad esempio, comportare rischi e problematiche per l'intero sistema (e, dunque, per tutte le federazioni che ne fanno parte)”<sup>39</sup>.

Even during the Covid 19 pandemic, technology has been useful in bridging the population's information gap about the development of the virus. Just think of the RITA project, created specifically to meet the needs of the pandemic, which aimed to release information on the guidelines contained in the Prime Ministerial Decree of 11 March 2020 #IoRestoaCasa; The analysis of interactions between users and RITA showed that the system developed 157,698 conversations in 3 months; responded to 385,392 messages in 3 months; and reached the percentage of 88.27% of correct answers given by the virtual assistant to users' questions. Along the lines of the above, the NICOLE Project, developed in France, provided information on the coronavirus disease, on the activities allowed and prohibited in the reference territory as well as updated news on national economic measures to support companies. These programs are based on machine learning and the use of NLP (*Natural Language Processing*) technology, which makes it possible to understand users' questions, process them and release up-to-date information on the basis of conversations with users; If the virtual assistant is unable to answer, the system learns from the experience so that it can fully answer the same question in the future<sup>40</sup>.

Generative AI represents, to date, a new frontier in medicine, potentially capable of changing our conception of healthcare in the future<sup>41</sup>.

There are several successful examples of this technology in the medical field and, among others, we mention *AlphaFold*, thanks to which the phenomenon of protein folding, which has, for a long time, hindered progress in medicine and biology, has finally been deciphered<sup>42</sup>.

Microsoft has announced the design of a new clinical documentation tool (based on GPT-4), called “Dragon Ambient eXperience” (DAX), which will automate clinical documentation by listening to conversations between patients and medical staff, thus creating

<sup>39</sup> In these terms, C. NASI, *Generative ai: il futuro della medicina tra opportunità e sfide per i diritti fondamentali*, in *Rivista Italiana di Medicina Legale (e del Diritto in campo sanitario)*, fasc. 2/2023, p. 327.

<sup>40</sup> See. E. DI IORI, *Caterina, Rita, Nicole: come cambia il rapporto tra Pubblica Amministrazione e cittadino nell'epoca di Alexa e Google Home*, in A. F. URICCHIO - G. RICCIO - U. RUFFOLO (curated by), *Intelligenza Artificiale tra etica e diritti. Prime riflessioni a seguito del libro bianco dell'Unione europea*, Cacucci Editore, Bari, 2020, pp. 631-664. The A. states that “i risultati ottenuti dall'interazione tra cittadino e assistenti virtuali hanno comunque dimostrato una prima apertura verso queste nuove tecnologie, entrate ormai nell'uso comune e quotidiano, che determinano oggi un cambio di marcia in ogni ambito, dal lavoro alla vita privata”.

<sup>41</sup> On AI as the future of medicine, see M. R. KING, *The Future of AI in Medicine: A Perspective from a Chatbot*. Available on: [https://link.springer.com/article/10.1007/s10439-022-03121-w?utm\\_source=getftr&utm\\_medium=getftr&utm\\_campaign=getftr\\_pilot](https://link.springer.com/article/10.1007/s10439-022-03121-w?utm_source=getftr&utm_medium=getftr&utm_campaign=getftr_pilot).

<sup>42</sup> J. JUMPER - R. EVANS - A. PRITZEL - T. GREEN - M. FIGURNOV - O. RONNEBERGER - K. TUNYASUVUNAKOOL - R. BATES - A. ŽÍDEK - A. POTAPENKO et al. (2021). *Highly accurate protein structure prediction with AlphaFold*. Disponibile su: <https://www.nature.com/articles/s41586-021-03819-2>; See. anche F. REN - X. DING - M. KORZINKIN - X. CAI et al. (2023). *AlphaFold accelerates artificial intelligence powered drug discovery: efficient discovery of a novel CDK20 small molecular inhibitor*. Available on: <https://pubs.rsc.org/en/content/articlelanding/2023/SC/D2SC05709C>.

a summary of information to be included within the electronic medical record<sup>43</sup>. It can be applied to optimize a personalized care pathway for the patient through patient monitoring

remotely, through, for example, the detection of health parameters with the use of smartwatches and wearable devices. An example of this is *Zepp Aura*, a new *software* developed by the company *Zepp Health*<sup>44</sup>, which promises to improve the quality of users' sleep by listening to sounds specially selected by generative AI. With a view to contributing to the innovative improvement of healthcare organization and management models, it was also used during the COVID-19 pandemic, during which chatbots were designed and used in hospitals for contactless screening of infected patients, useful for both users and healthcare facilities<sup>45</sup>. On this occasion, *generative AI* represented a formidable ally both in the diagnosis and management phase of the full-blown disease or, again, in the prediction of epidemiological trends<sup>46</sup>.

One of the fields of medicine most affected by generative AI is confirmed to be pharmaceuticals<sup>47</sup>, ope la stessa, with the discovery of a cure drug for Ebola<sup>48</sup>. It has shown that it can accelerate the discovery and development of new drugs, thanks to the possibility of pre-testing their efficacy through computer simulations, rather than testing them in the first instance on animals and humans.

Finally, moving on to the scientific research side, it is undeniable that ChatGPT-4<sup>49</sup> It is a useful support to the work of researchers also in the drafting of scientific publications,

<sup>43</sup> N. GILLILAND (2023), *Healthcare and generative AI: What are the emerging use cases?*. Available on: <https://econsultancy.com/healthcare-generative-ai-examples/>.

<sup>44</sup> For an accurate explanation of the devices designed and manufactured by Zepp Health (including *Zepp Aura*), please refer to the official website: <https://www.zepp.com/>.

<sup>45</sup> On the role of *generative AI* in the fight against COVID-19, see A. TRIPATHI - P. KAUR P - S. SURESH (2021), *AI in Fighting Covid-19: Pandemic Management*. Disponibile su: <https://www.sciencedirect.com/science/article/pii/S1877050921011248>; K. SHAMMAN - A.A. HADI - A.R. RAMUL- M.M.A. ZAHRA - H.M. GHENI (2023), *The artificial intelligence (AI) role for tackling against COVID-19 pandemic*. Available on: <https://www.sciencedirect.com/science/article/pii/S2214785321052160>; K.H. ALMOTAIRI - A.M. HUSSEIN - L. ABUALIGAH - S.K.M. ABUJAYYAB, et al. (2023), *Impact of Artificial Intelligence on Covid-19 Pandemic: A Survey of Image Processing, Tracking of Disease, Prediction of Outcomes, and Computational Medicine* <https://www.mdpi.com/2504-2289/7/1/11>; M. MAZZANTI - A. SALVI - A. SALVI - S. GIACOMINI - E. PERAZZINI et al. (2022), *Artificial Intelligence tools for effective monitoring of population at distance during Covid-19 pandemic. Results from an Italian pilot feasibility study (recovai-19 study)*. Disponibile su: <https://www.medrxiv.org/content/10.1101/2022.02.04.22270087v1>; F. CEREÀ, *Intelligenza artificiale a servizio dei pazienti per il contrasto a CoViD-19*, in *Nuova giur. civ. comm.*, n. 3-2020, pp. 45 ss.

<sup>46</sup> G. JAIN, et al., *A deep learning approach to detect Covid-19 coronavirus with X-Ray images*, in *Biocybernetics and Biomedical Engineering*, 4, 2020, pp. 1391-1405.

<sup>47</sup> See. A. BLANCO-GONZÁLEZ - A. CABEZÓN - A. SECO-GONZÁLEZ - D. CONDE-TORRES et al. (2023), *The Role of AI in Drug Discovery: Challenges, Opportunities, and Strategies*. Disponibile su: <https://arxiv.org/ftp/arxiv/papers/2212/2212.08104.pdf>; G. SHARMA - A. THAKUR (2023), *ChatGPT in Drug Discovery*. Disponibile su: <https://chemrxiv.org/engage/chemrxiv/article-details/63d56c13ae221ab9b240932f>.

<sup>48</sup> J. STEPHENSON (2021), *WHO Offers Guidance on Use Artificial Intelligence in Medicine*. Disponibile su: <https://jamanetwork.com/journals/jama-health-forum/fullarticle/2782125>.

<sup>49</sup> Regarding the health profile intercepted by the *generative AI* si rimanda al contributo di D. AMRAM, *Governo dei dati, "Open AI" e salute: profili introduttivi*, in *Rivista italiana di medicina legale e del diritto in campo sanitario*, 2/2023, pp.

although, in a critical sense on this point, it has been pointed out that such a use could generate «un'infodemia guidata dall'intelligenza artificiale»<sup>50</sup> and, therefore, a danger to the protection of collective health.

### 3. The paradigmatic case of Ginger.io

The danger of discrimination and algorithmic distortions is one of the greatest stimuli for taking care of the profile of the ethical construction of the algorithm, a need that is even more marked within the “administrative relationship” citizen-public administration as well as in the particular and of our interest health administration-patient.

To this end, it is of significant importance to set evaluation criteria for the adoption of artificial intelligence software, which have been well detailed by the AI4People group<sup>51</sup>, established on the initiative of the European Union. It outlined a picture of the opportunities and risks related to the development of AI, indicating the objectives to be pursued: i) to enable human self-realisation, without devaluing individual capacities; ii) to improve human action, without removing personal responsibility; iii) to cultivate social cohesion, without eroding human self-determination.

For an AI system to be built<sup>52</sup> In order to meet these principles, AI4People indicates seven requirements: a) human initiative and control; b) technical robustness and safety, including resistance to attack, an overall safety plan, accuracy and reliability, and reproducibility; c) data *privacy* and *governance*, including respect for the confidentiality, quality and integ-

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293-298.

<sup>50</sup> L. DE ANGELIS - F. BAGLIVO - G. ARZILLI - G.P. PRIVITERA et al. (2023), *ChatGPT and the rise of large language models: the new AI-driven infodemic threat of health*. Disponibile su: <https://www.frontiersin.org/articles/10.3389/fpubh.2023.1166120/full#h8>.

<sup>51</sup> L. FLORIDI - J. COWLS - M. BELTRAMETTI - R. CHATILA - P. CHAZERAND - V. DIGNUM - C. LUETGE - R. MADELINE - U. PAGALLO - F. ROSSI - B. SHAFER - P. VALCKE - E. VAYENA, *AI4People-An Ethical Framework for a Good AI Society: Opportunities, Risks, Principles, and Recommendations*, in *Minds and Machines*, 28, 2018, 690. The AI4People group has also outlined the characteristics of an ethically appreciable Artificial Intelligence, respectful of fundamental rights and obsequious to the following four ethical principles, which can be summarized in compliance with the parameters listed below: i) respect for human autonomy: human beings who interact with AI must be able to maintain their capacity for self-determination in a full and effective way (for this reason, AI should not subordinate, unjustifiably coerce, deceive, manipulate, condition human beings, but rather be designed to augment, integrate and enhance the cognitive, social and cultural capacities of human beings); ii) Harm prevention: entails the protection of human dignity and mental and physical integrity (according to this principle, AI systems and the environments in which they operate must be safe and secure, and should not cause or exacerbate harm or adversely affect human beings); iii) fairness: understood in its substantive and procedural dimensions The substantive dimension implies a commitment to ensure a fair and equitable distribution of costs and benefits and that individuals, as well as groups of individuals, are free from bias, discrimination and unjust stigmatisation (the procedural dimension implies the possibility and ability to challenge and obtain compensation against decisions unfair and unjust assumptions assumed by artificial intelligence systems and the humans who use them); iv) explainability: algorithmic processes must be transparent, the capabilities and purposes of AI systems must be openly communicated, and algorithmic decisions must be explainable to the individuals concerned both directly and indirectly.

<sup>52</sup> For an examination of the fundamentals of robotics and A.I. law, see U. RUFFOLO, *Intelligenza artificiale e responsabilità*, Milano, 2017.

rity of data and access to data; d) transparency, including traceability, explainability and communication; e) diversity, non-discrimination and fairness, including the prevention of bias<sup>53</sup>, accessibility, a universal *design* model and the participation of all stakeholders; f) social and environmental well-being, including sustainability and respect for the environment, social impact, society and democracy; g) liability, including verifiability, minimisation and disclosure of adverse impacts, impairments and remedies<sup>54</sup>.

A medically relevant example of the question of axiological architecture above can give an idea of the delicacy of intelligent machine construction in harmony with the credentials listed above.

An application has been created in the United States of America called Ginger.io<sup>55</sup>, which has the function of assisting and supporting hospital facilities; This application, the installation of which is authorized by the hospital that intends to adopt it, automatically and invisibly records the data, habits and movements of patients. Data *mining* work has shown that changes in people's habits and movements can explain a cold, a seasonal illness, anxiety or stress.

The Ginger.io application does not diagnose patients directly, but merely reports a change that in the medical lexicon is called “non-compliant” with a certain drug or a certain type of treatment.

The positive effect deriving from the use of this application, also in terms of reducing healthcare spending, is a decrease in hospital admissions; On the other hand, such an artificial intelligence system could arrogate to itself the responsibility of deciding who will be given attention by a doctor and who will not, “in altri termini, può arrivare a selezionare chi può avere possibilità di ricevere cure e chi invece ne verrà escluso”<sup>56</sup>.

In order to achieve the ethical-moral principles and objectives outlined here, aimed at limiting and amending the critical application of AI, the construction of *software* through a public-private comparison, thanks to a governance approach, could prove to be of indefectible importance legislation that takes into account the indefectible negotiation of the regulatory power of the public authority with private initiatives<sup>57</sup>.

<sup>53</sup> See. G. GIORGINI PIGNATELLO, *Il contrasto alle discriminazioni algoritmiche: dall'anarchia giuridica alle “Digital Authorities”?*, in *federalismi.it*, 2021, 16, pp. 114- 135.

<sup>54</sup> On this subject, see G. COMANDÈ, *Intelligenza artificiale e responsabilità tra “liability” e “accountability”*. *Il carattere trasformativo dell'IA e il problema della responsabilità*, in *Analisi Giuridica dell'Economia*, 2019, 1, pp. 169-188.

<sup>55</sup> It is a start-up born in the MIT Media Lab in 2011 by a group that studies ways to apply computer algorithms to mobile phone data in order to know the level of health of individuals and entire populations (!Big Data from Cheap Phones”).

<sup>56</sup> P. BENANTI, *Le macchine sapienti*, Bologna, 2018, p. 22.

<sup>57</sup> See F. FAINI, *La “governance” dell'intelligenza artificiale tra etica e diritto*, in *Notizie di Politeia*, 2020, 137, pp. 59-82.

To this end, the public decision-maker should commit himself to the construction of free and ethically valuable software or outsource proprietary *software*<sup>58</sup> able to respond to these ethical and regulatory petitions in a satisfactory manner<sup>59</sup>.

The path traced for the construction of an intelligent machine that respects and adheres to an axiology of anthropocentric matrix is a resolution of political orientation, overflowing national borders, as indeed all the problems arising from the process of globalization and technological development: on this point, we turn our gaze towards the aspiration to an “ethically sustainable” algorithm.

The drive towards the achievement of an “ethically sustainable” algorithm that is intended to be accepted in public action rests on the ambition that it will be able to compose the antinomy between dehumanized technological development and the demands of human dignity.

The archetypal example of the application Ginger.io makes the tact of how delicate the issue of the use of AI is, first of all downstream, which, without any doubt, brings advantages in terms of efficiency and cost-effectiveness of the health organization, on the other hand, as emerged, can be the cause of dehumanization and surrogacy of the human factor. The question of the typology and ethical inference referred to by the chosen algorithmic tool is a fundamental transition to trace the perimeter and connotations of the *species* of human/machine synopsis<sup>60</sup> that is intended to be implemented, in which an out-out is consumed between the values (and disvalues) to be pursued<sup>61</sup>.

<sup>58</sup> On the legal nature of *software* as a legal issue, see R. BORRUSO - S. RUSSO - C. TIBERI, *L'informatica per il giurista*, Milano, 2009, p. 229 ss.

<sup>59</sup> As well pointed out by D. MARONGIU, *Mutamenti dell'amministrazione digitale*, in D. MARONGIU - I.M. DELGADO (curated by), *Diritto amministrativo e innovazione, Scritti in onore di Luis Ortega, Diritto e processo amministrativo, Quaderni*, 23, Napoli, 2016, pp. 42-43, about the preference expressed in legislation towards free software, “ciò significa che non si è trattato, per il legislatore, di sposare la logica dell'open source sul piano strettamente etico o, almeno, questo non è stato l'elemento fondante della *ratio legis*; viceversa appare prevalente l'aspetto, molto più pragmatico, legato al carattere di gratuità del software open source, e pertanto al fatto che la sua acquisizione risponde a politiche di spending review”.

<sup>60</sup> See V. MOLASCHI, *Algoritmi e nuove schiavitù*, in *federalismi.it*, 2021, 18, pp. 205-234

<sup>61</sup> The awareness of this proposed need for a synthesis of opposing needs and impulses is entirely ascribed to human understanding: the solution of this axiological problem is a choice left to man, since “possiamo porre la conservazione alla distruzione, possiamo decidere che le macchine debbano completare gli umani e non sostituirli... possiamo fare in modo che il mondo sia governato dalle persone e non dalle macchine... il futuro della robotica può essere inclusivo e democratico, e riflettere l'impegno e le speranze di tutti i cittadini... e le nuove leggi della robotica possono guidarci in questo lungo viaggio”. In these terms, F. PASQUALE, *Le nuove leggi della robotica. Difendere la competenza umana nell'era dell'intelligenza artificiale*, Roma, 2021, p. 50. Frank Pasquale's new laws of robotics take on the guise of a 'compass rose' capable of guiding the choice about the form of AI: only in this way will a healthy relationship between public power and citizens be preserved and, at the same time, an attempt will also be made to govern the anarchic, destructive and discriminatory tendency of algorithms. In particular, this new core of 'key principles' of robotics is composed of the following precepts: 1. Robotic systems and AI must be complementary to professionals and not replace them; 2. Robotic systems and AIs must not counterfeit humanity; 3. Robotic systems and AI must not escalate a zero-sum arms race; 4. Robotic systems and AIs don't always have to indicate the identity of their creators, controllers, and owners. Frank Pasquale has the merit of grasping the need to update the paradigms of robotics, so that they can guide the coexistence between man and machine, inspired by the ethical principles developed in international conventions, through an international governance that makes the ethical-moral objectives of soft law acts current and concrete.

## 4. Medical research in the “land of algorithms”

The awareness of this proposed need for a synthesis of opposing needs and impulses is entirely ascribed to human understanding: the solution of this axiological problem is a choice left to man, since “Nel paese degli algoritmi”<sup>62</sup>, An essay describing the merits and concerns related to the development of computation in the most disparate fields.

In the work just mentioned, as far as we are concerned, we give credit to the encounter between various disciplines and, in particular, to the intersection between mathematical models and medicine, especially in the field of research in which laboratory simulations, through the algorithmic medium, allow the achievement of exciting results - even in a prospective key.

Such as, for example, the research in Penn State’s Regenerative Medicine Laboratory conducted by Jean with a group of scholars in 2009, aimed at intertwining the medical and engineering perspectives in order to develop techniques to create tissues in the laboratory with which to replace damaged tissues. This project has deepened research into the repair of myocardial tissue after a heart attack, or for the development of techniques aimed at eliminating the phenomenon of rejection through the creation of tissues directly from the patient’s own stem cells.

Jean is fully aware of the risk of *bias*, whether implicit or explicit, capable of contaminating the goodness of the algorithmic result: in the field of medical research, this uncertainty takes on a dimension of high sensitivity, given the possible repercussions on the protection of public health.

Jean focuses on the responsibility of managing computational output, as she knows the danger of algorithmic bias<sup>63</sup>.

The circumstance in question concerns research carried out in the aftermath of the terrorist attack in Boston, which took place on April 15, 2013 in the Back Bay neighborhood, marked by the explosion of two bombs during the city marathon. The research group of which Jean is a part, through the study of the geography of the neighborhoods affected by the explosion, aims to build an algorithmic model – imbued by definition with its basic abstractness and a consubstantial approximation – capable of calculating the effects of the bombs on the citizens involved in proximity to the terrorist event, potentially victims

<sup>62</sup> A. JEAN, *Nel paese degli algoritmi*, Neri Pozza Editore, Vicenza, 2021.

<sup>63</sup> In his essay “Algoritmi al potere”, Bruno Romano, Focusing on the relationship between the principle of equality and the elitist power of algorithms, he emblematically represents the delicacy of this economic and social imbalance: “i problemi sociali delle relazioni umane, comprensivi anche dei conflitti giuridici, ricevono dall’algoritmo un risultato, che, in modo ambiguo, si può nominare come soluzione conforme alla giustizia ed alla legalità, perché deriva da quell’impostazione dell’algoritmo che appartiene ai signori, ai padroni, capaci dell’acquisizione e del trattamento dei dati, e che, in quanto ristretta cerchia sociale, si impone al resto dell’umanità, ai servi”, thus l’A. in B. ROMANO, *Algoritmi al potere, Calcolo Giudizio Pensiero*, Torino, 2018, pp. 26-27. See also R. BODEI, *Dominio e sottomissione- Schiavi, animali, macchine, Intelligenza artificiale*, Bologna, 2019.

of head trauma. Since head trauma is a difficult pathology to diagnose, easily confused with mere psychological trauma, the research group decided not to publish the results of the work, due to the plausible instrumentalization that insurance companies could have made of it with respect to the damages already previously paid to patients. As Jean eloquently explains, “non solo sarebbe difficile spiegare i complessi algoritmi sviluppati per le simulazioni, ma ancor più arduo sarebbe sensibilizzare le persone sul senso critico con maneggiare quel genere di risultati”<sup>64</sup>.

The research group was convinced to omit the publication of the study because it was aware of the intrinsic difficulty of explainability – *rectius* clarity – of the computational syllogism and the abstract logic to which the algorithmic models used refer, which is why the researchers preferred to forget the results reached by the study project.

This anecdote gives an idea of the multitude of ethical-moral aspects that can be conveyed in the encounter and use of the unprecedented possibilities born from the country of algorithms.

In this regard, it is necessary to grasp the ontology of the *scientia superveniens* of *machine learning* that voraciously propagates in every cavity of human action.

The history of the algorithm goes back a long way, but its rise is inextricably linked to the construction of a society based, mathematically and culturally, on the efficiency of the method, to the detriment of the accuracy of the result, accepting a certain margin of error as the only plausible option for solving classes of complex problems<sup>65</sup>.

Machine learning *systems*, which are based on a learning mechanism, maximize – also qualitatively – their ability to abstract and adhere to the optimal solution, through ‘training’ on a data set, whose breadth and completeness also determine the success of the robotic *output* with respect to the reality to which it refers<sup>66</sup>.

On this point, Paolo Zellini offers a clear reconstruction of the Copernican commutation that took place in the hard sciences sector, in which the prism of *exactitude* has abdicated in favor of the dogma of *efficiency*<sup>67</sup>.

<sup>64</sup> A. JEAN, *Nel paese degli algoritmi*, cit., pp. 88-89.

<sup>65</sup> L. PREVITI, *La decisione amministrativa robotica*, Editoriale Scientifica, Napoli, 2022. In relation to the issue of automated procedures, in whole or in part, using machine learning systems, he noted that “il recente ingresso, a partire dal settore privato, di algoritmi di apprendimento automatico (machine learning) ha condotto ad un ripensamento delle tradizionali modalità di svolgimento di attività, materiali o intellettuali, che erano in precedenza esclusivo appannaggio dell’operatore umano”. L’utilizzo di sistemi di I.A. che si fondano sulle predette formule ha reso oggi possibile ... Adottare decisioni sulla base di accurate analisi statistiche e di complessi calcoli probabilistici, nonché fondate sulla previa individuazione di inediti schemi e modelli contenuti nei dati, che la mente umana non saprebbe cogliere da sola o con facilità” (p. 47).

<sup>66</sup> See the operational logic implemented by the Prometea software, which is elaborated on by J.G. CORVALÁN, *Inteligencia artificial: retos, desafíos y oportunidades - Prometea: la primera inteligencia artificial de Latinoamérica al servicio de la Justicia*, in *Rev. Investig. Const.*, 1, 2018.

<sup>67</sup> Since “data la difficoltà di risolvere con algoritmi veloci intere classi di problemi di dimensione elevata collegata fra loro per via della riducibilità, si usa l’espedito di indebolire la richiesta di esattezza, e si riguadagna in efficienza ricorrendo ad algoritmi approssimati o a procedure il cui risultato coincide con la soluzione cercata con una probabilità sufficientemente alta. Tutto è calcolato, allora, con un margine di errore. L’incertezza e l’approssimazione sono la norma,



Starting from these punctuations, our discourse cannot obliterate the risk of *bias* to which computational syllogisms are subjected, based on efficiency rather than on the exactness of the result.

A very delicate aspect concerns the quality of the data available to the machine learning algorithm: the *databases*, *indexers*, and *crawlers* that contain or collect the data are like herbivorous animals grazing in the meadows of information<sup>68</sup>.

Even an infinitesimal contamination of data can be the result of pathologies of the *output*, obtained from the work of the machine learning machine, flawed in the results, pardon the pun, from the vice of data quality.

The real possibility that the data entered into the machine contains *bias*<sup>69</sup> or are a source of discrimination for certain social categories is an aspect to be taken into due consideration, to the extent that such distortions can occur even in the absence of “maliciousness” on the part of those who instruct the machine<sup>70</sup>: Such hidden discriminations are included in the data<sup>71</sup>, only apparently free of errors, the existence of which can in fact be detected, sometimes, only through a complex reading capable of discovering the hidden prejudices<sup>72</sup>.

Emblematic, in this sense, is the phenomenon of “*uncertainty bias*”, a distortion of the classifications made by decision-making systems due to a double dysfunction: 1) a group is underrepresented in the sample, causing greater uncertainty in the forecasts related to it; 2) the algorithm is risk-averse, therefore, all things being equal, it will opt for choices that grant greater confidence. This paradigm favors the groups that are best represented

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e coesistono curiosamente con il carattere categorico dei processi di calcolo”, P. ZELLINI, *La dittatura del calcolo*, cit., p. 136. Regarding the paradigm of efficiency, in another contribution, Zellini pointed out that “nel calcolo numerico su grande scala, l’effettività teorica degli algoritmi vuole diventare efficienza computazionale. E oggi sembra chiaro che per essere reali, gli stessi enti matematici costruiti con un processo di calcolo devono potersi pensare alla stregua di algoritmi efficienti. Ora l’efficienza dipende soprattutto dal modo in cui crescono la complessità computazionale e l’errore nei calcoli. In special modo l’errore dipende da quanto velocemente crescono i numeri nel corso del calcolo”, in these terms P. ZELLINI, *La matematica degli dèi e gli algoritmi degli uomini*, Milano, 2016, pp. 13-14.

<sup>68</sup> Expression taken from P. DOMINGOS, *L’Algoritmo Definitivo, La macchina che impara da sola e il futuro del nostro mondo*, Torino, 2016. The A. stresses the absolute centrality of computational logic, noting that “Viviamo nell’era degli algoritmi. Solo una o due generazioni fa, erano pochissimi a sapere cosa si intendesse per algoritmo. Oggi con la loro onnipresenza nella vita quotidiana, gli algoritmi sono un ingrediente fondamentale della civiltà moderna” (p. 23).

<sup>69</sup> On this subject, see the contribution of A. GATTI, *L’algoritmo tra volontà e rappresentazione*, in *DPCE online*, 2020, 3, pp. 3457-3461.

<sup>70</sup> On the involuntary nature of errors in data, it is necessary to refer to the general problem of preferring unsupervised algorithms, opting for raw data rather than explicit theoretical models. On this point, see, C. ANDERSON, *The end of theory: The data deluge makes the scientific method obsolete*, in *Wired magazine*, 2008.

<sup>71</sup> D.M. TARAMUNDI, *Le sfide della discriminazione algoritmica*, in *Genius*, 24 ottobre 2022, explains that *correlation* biases (*proxies*) are caused by the “correlazione di diversi insiemi di dati da parte di un algoritmo può portare a pratiche discriminatorie (ad esempio, associare il genere a una minore produttività sul lavoro, non a causa di una relazione causale, ma perché storicamente le donne sono state valutate più negativamente degli uomini a parità di prestazioni lavorative”.

<sup>72</sup> See, N. LETTIERI, *La discriminazione nell’era delle macchine intelligenti. Modelli possibili di analisi, critica e tutela*, in *Genius*, 24 ottobre 2022. The author, dealing in depth with the issue of *bias*, exposes his conviction about the possibility of mitigating the risk of algorithmic discrimination (also a definition with polysemic nuances) through the method of the so-called *Critical data and algorithm studies* combined with the computational science approach.

in the *dataset* from which the algorithm is based, since the latter will find greater certainty in predictions<sup>73</sup>.

Excessively relying on certain computational decision-making aids - and trustingly anchoring them even when they are in error - can damage our decision-making capacity, particularly with respect to the most complex cases, i.e. in cases where the machine does not grasp all the relevant aspects or in the case where the relevant “data” cannot be made available to it<sup>74</sup>.

In the medical field, it is necessary to understand how the relationship between efficiency and explainability is explained, given that it takes on specific connotations in this contingency.

If it is true, as it is true, that the danger of *bias* is far from remote and of undeniable significance, there is discussion about the use of generative AI in medicine with the aim of greater accuracy, which corresponds to a proportional increase in the inexplicability of the *output*<sup>75</sup>.

The phenomenon of the black box is exacerbated when the intention is to insist massively on the accuracy of the results, an approach that increases the indices of inexplicability of the result.

Post hoc *explanation methods* can improve the interpretability of medical AI systems without compromising their accuracy: the problem of model explanation, or “*global problem*”, consists in providing a global explanation of the black box through an interpretable model. Conversely, the problem of explaining the outcome, or “*local problem*”, given a black box and a certain instance of *input*, lies in providing an explanation of the outcome of the same on that instance<sup>76</sup>.

Despite the attempt to synthesize accuracy and explainability, *post hoc* methods also suffer from non-negligible criticalities<sup>77</sup>: the addition of *post hoc* methods of explanation offer

<sup>73</sup> See B. GOODMAN - S. FLAXMAN, *European Union regulations on algorithmic decision-making and a “right to explanation”*, in *AI magazine*, 38, 3, 2017, as well as, the objectivity of the data, L. GITELMAN, “*Raw Data*” *Is an Oxymoron*, Cambridge, 2013.

<sup>74</sup> On the concept of *automation bias*, see K. GODDARD - A. ROUDSARI - J. C. WYATT, *Automation Bias. A Systematic Review of Frequency, Effect Mediators, and Mitigators*, in *Journal of the American Medical Informatics Association*, 19, 1, pp. 121-127. On the incompleteness of the data taken by the software as a basis for the decision, please refer to S. DIANA, *Noi siamo incalcolabili. La matematica e l'ultimo illusionismo del Potere*, Viterbo, Stampa alternativa, 2016.

<sup>75</sup> In the medical field, however, there are currently already applications characterized by computational inscrutability, such as electroconvulsive therapy, which is very effective for severe depression, has not yet been explained with regard to its mechanisms of action; On this subject, see the study by A. ESTEVA - B. KUPREL - R.A. NOVOA et al., *Dermatologist-level classification of skin cancer with deep neural networks*, in *Nature*, 2017-542, pp. 115 ss. Equally, it is known that the functioning of many drugs that seem to work is unknown; On this point See. E.J. TOPOL, *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again*, New York, Basic Books, 2019.

<sup>76</sup> So, «it is not necessary to explain the whole logic underlying the black box but only the reason for the prediction on a specific input instance», so R. GUIDOTTI - F. GIANNOTTI - D. PEDRESCHI, *Explainability*, in G. COMANDÉ (curated by), *Law and data Science*, Edward Elgar Publishing, 2022, p. 166.

<sup>77</sup> The opacity of the algorithmic black box runs the risk – albeit partial – of overlapping with the opacity of other human minds and, in some respects, even of one’s own mind as “human agents are [...] frequently mistaken about their real

only an approximation of the computations of a “black box” model, which is difficult to interpret by humans, leaving a significant amount of exegetical uncertainty; moreover, they are structurally incomplete<sup>78</sup>; still “gli obiettivi dei metodi di spiegazione *post hoc* sono spesso poco specificati, soprattutto se si considera il problema della relatività degli agenti nelle spiegazioni”<sup>79</sup>.

Structural opacity marks *machine learning* and *deep learning systems*<sup>80</sup> whose operation remains obscure and impenetrable even for the programmers themselves<sup>81</sup>, so as to assign to these algorithms the nomenclature of *black box*.

On the other hand, it is important to argue about the preferability of a system aimed at explainability rather than accuracy<sup>82</sup>, postulating that an increase in diagnostic accuracy cannot causally infer an improvement in patient outcome<sup>83</sup>: in other words, “esiste un di-

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(internal) motivations and their processing logic, a fact that is often obscured by the ability of human decision-makers to invent post-hoc rationalizations”, so J. ZERILLI et al, *Transparency in algorithmic and human decision making: Is there a double standard?*, in *Philosophy and Technology*, 2019; 32(4), p. 666.

<sup>78</sup> See. C. RUDIN, *Stop explaining black box machine learning models for high stakes decisions and use interpretable models instead*, in *Nature Machine Intelligence*, 2019;1(5), pp. 206-215. Nel contributo di J. HATHERLEY - R. SPARROW - M. HOWAR, *The Virtues of Interpretable Medical AI*, cit., p. 3, The incompleteness of the post-hoc method is effectively clarified. On this point, giving a practical example of this criticality, the use of an explainer that highlights the characteristics of a computed breast tomography that have been most influential in classifying the patient as high risk is envisaged. Even if the highlighted features were intuitively relevant, according to the authors, such an “explanation” gives the physician little reason to accept the model’s findings, especially if the physician disagrees.

<sup>79</sup> C. D’ELIA, *Gli strumenti di intelligenza artificiale generativa nel contesto sanitario: problemi di ottimizzazione delle risorse e questioni di spiegabilità*, cit., p. 348. According to the A., “una spiegazione che presuppone un background in informatica, per esempio, può essere utile per i produttori dei sistemi di AI medica, ma è probabile che non fornisca alcuna comprensione a un professionista medico che non ha tali competenze tecniche. Di conseguenza, nonostante le grandi speranze che la spiegabilità possa superare le sfide dell’opacità e del trade-off accuratezza-interpretabilità nell’AI medica, i metodi di spiegazione post hoc non sono attualmente in grado di affrontare questa sfida”.

<sup>80</sup> In *deep learning*, in particular, it is not possible to verify its mechanisms from the outside. In these systems, the model consists in the use of “artificial neural networks” which, in imitation of human neural networks, are multilayered, in the sense that the *output*, generated, on the basis of an *input*, at one level, is incorporated and used as input in the next layer; and since each layer contains thousands of units, the data being processed are continuously processed in their interaction, with an increasing complexity that is not manageable by human intelligence: in essence, the algorithm is in fact capable of generating other algorithms. For a better understanding of the subject even for laymen, please refer to the contribution of A. LONGO - G. SCORZA, *Intelligenza artificiale. L’impatto sulle nostre vite, diritti e libertà*, Mondatori Università, Milano, 2020, pp. 43-45.

<sup>81</sup> In the case of machine learning and deep learning algorithms, the algorithm’s internal decision-making logic is dynamically modeled by the available training data. The result is that the algorithm is constantly changing its internal structure, making it difficult – if not impossible – to understand the internal logic. As explained by J. TANZ, *Soon We Won’t Program Computers. We’ll Train Them Like Dogs*, in *www.wired.com*, 2016, When engineers peer into a neural network, what they see is an “ocean of math,” a massive, multi-layered set of computational problems that — constantly deriving relationships between billions of data points — generates hypotheses about the world.

<sup>82</sup> While diagnostic and predictive accuracy is certainly important for improving patient health outcomes, it is by no means sufficient. Medical AI systems must be understood «as intervening in care contexts that consist of an existing network of sociotechnical relations, rather than as mere technical “additions” to existing clinical decision making procedures», thus M. Berg, *Patient care information systems and health care work: A sociotechnical approach*, in *International Journal of Medical Informatics*, 1999; 55(2), pp. 87-101.

<sup>83</sup> See T. GROTE, *Randomised controlled trials in medical AI: Ethical considerations*, in *Journal of Medical Ethics*, 2022; 48, pp. 899-906.

vario tra l'accuratezza dei sistemi di AI medica e la loro efficacia nella pratica, nella misura in cui i miglioramenti dell'accuratezza di un sistema tecnico non si traducono automaticamente in miglioramenti dei risultati sanitari a valle<sup>84</sup>.

This notation rests on the decisive fact that there is no perfect equation between the response of human users to the results of algorithmic systems and the human reaction to our own judgments and intuitions, or even to the recommendations of other human beings. In fact “l’incapacità di combinare efficacemente il processo decisionale umano e non umano (cioè, algoritmico, statistico e automatico, ecc.) rimane uno degli ostacoli più evidenti e più perplessi per la comunità del processo decisionale comportamentale”<sup>85</sup>. Prevailing human biases influence the interpretation of algorithmic recommendations, classifications, and predictions. “Il giudizio umano [...] introduce pregiudizi ben noti in un ambiente di IA, tra cui, ad esempio, l’incapacità di ragionare con le probabilità fornite dai sistemi di IA, l’extrapolazione eccessiva da piccoli campioni, l’identificazione di falsi modelli e l’indebita avversione al rischio”<sup>86</sup>. In safety-critical settings and high-risk decision-making settings, such as medicine, this type of bias could pose significant risks to the health and well-being of patients.

Higher accuracy, therefore, is not enough to promote the use of “*black box*” *medical AI systems* compared to less accurate but more interpretable systems in clinical medicine.

Following this *common thread*, the success of AI in the medical field rests on the explainability of the results<sup>87</sup>, on the basis of the all-human propensity to engulf and elaborate what is understood: it is on the level of human behavioral analysis that it is necessary to focus, focusing on the attitude/tendency of human agents to use tools capable of being understood in high-risk procedures such as medical ones<sup>88</sup>.

Pulling the strings of the discourse, in the land of algorithms, the specialty of health administration is confirmed, in which the relationship with efficiency and the axiom of trans-

<sup>84</sup> C. D'ELIA, *Gli strumenti di intelligenza artificiale generativa nel contesto sanitario: problemi di ottimizzazione delle risorse e questioni di spiegabilità*, cit., p. 349.

<sup>85</sup> So J.W. BURTON - M.K. STEIN - T.B. JENSEN, *A systematic review of algorithm aversion in augmented decision making*, in *Journal of Behavioral Decision Making*, 2020; 33(2), p. 220.

<sup>86</sup> In these terms, S. Gerke et al., *The need for a system view to regulate artificial intelligence/ machine learning-based software as medical device*, in *Digital Medicine*, 2020; 3(1), p. 53.

<sup>87</sup> As pointed out by A. SIMONCINI - S. SUWEIS, *Il cambio di paradigma nell'intelligenza artificiale e il suo impatto sul diritto costituzionale*, in *Rivista di filosofia del diritto*, 2019, n. 1, p. 98, the right to receive information on the logic of operation of the algorithm that allows us to understand how it works “si basa sul presupposto che gli algoritmi – soprattutto quelli predittivi – abbiano una logica, nel senso deterministico-matematico che normalmente utilizziamo. Ovvero che vi sia una connessione ripercorribile e verificabile di induzioni correttamente svolte tra principi generali ed applicazioni, normalmente basate sul principio di causalità. Il punto è che [...] la gran parte degli algoritmi di nuova generazione si basa su relazioni statistiche e non causali, e quindi i criteri di inferenza non sono facilmente riproducibili e soprattutto comprensibili. Questo è particolarmente vero per le reti neurali, che basano le loro predizioni su pattern nascosti all'occhio del programmatore inferiti direttamente dai dati, ragione per cui non sappiamo di fatto quali correlazioni stiano sfruttando per costruire l'output fornito”.

<sup>88</sup> On this subject, please refer to the contribution of J. HATHERLEY - R. SPARROW - M. HOWAR, *The Virtues of Interpretable Medical AI*, cit., pp. 1-10.

parency itself take on its own specificities and declinations: the accuracy of the result gives way to the alternative of the *explainable* output<sup>89</sup>, opposing the phenomenology of the *black box* for different aspects than what happens in the citizen-institution relationship<sup>90</sup>, since the physiological and instinctive willingness to accept what is explainable and to shun opacity imposes, or at least suggests, a developmental direction to AI in medicine tending to pay abundant attention to the development of explainable outputs<sup>91</sup>, compatible with human ontology.

It is the hard sciences that require an effort to switch the black box paradigm so that the need for transparency can be matched with the implementation of A.I. systems.<sup>92</sup>, conceived, modelled and built in an anthropocentric projection.

In the land of algorithms, rather than radicalizing attention on the structure of the artificial agent, there is a strong need to discover the ways in which human action is interconnected in its most intimate and instinctual guise and the contribution of the machine.

Consequently, the ethical and moral aspect plays a fundamental role in guiding the phenomenon of identification with the techno-human condition, marked by a high degree of responsibility for the management of data and results, in which it is necessary to become fully aware of the danger of *bias*: the Gordian knot about the commendable and effective-

<sup>89</sup> A yearning pursued by *Explainable A.I.* (XAI). The achievement of explainability standards for A.I. systems is an ambition, from a technical point of view, which presupposes an enormous technical effort, to which the studies on *explainable AI are dedicated*. On this subject, compare the contributions of S. WACHTER - B. MITTELSTADT - C. RUSSEL, *Counterfactual Explanations Without Opening the Black Box: Automated Decisions and the GDPR*, in 31 *Harvard J. L. & Tech.*, 841 (2018); W. SAMEK - T. WIEGAND - K.R. MÜLLER, *Explainable Artificial Intelligence: Understanding, Visualizing, and Interpreting Deep Learning Models*, in *ITU Journal: ICT Discoveries*, 2017, 1, 1.

<sup>90</sup> Given that opacity is a distinctive trait, with different emphases, of all algorithmic models, even conditional (non-A.I.) ones, it emerges "per tutti la questione della compatibilità del sistema con la doverosa trasparenza dell'azione amministrativa e con la esplicabilità delle determinazioni finali, specie se adottate nell'esercizio di poteri autoritativi", In these terms, G. LO SAPIO, *La black box: l'esplicabilità delle scelte algoritmiche quale garanzia di buona amministrazione*, in *Federalismi.it*, n. 16/21, p. 121. A. explains that there are several factors that make algorithmic models obscure: a) firstly, they are the prerogative of engineering, computer science and logical-mathematical sciences and are transcribed, in order to be operational and processed by a machine, into "source codes" using, not the natural language with which legal rules and argumentation are expressed, but in one of the 2,500 computer languages available; b) the most technologically performing algorithms are also commercial entities, subject to industrial laws and intellectual property, protected by the manufacturing companies both in the eyes of competitors and from any malicious people aimed at "sabotaging" them; c) in any case, a software, even more so the technologically advanced ones of A.I., is always in continuous evolution, it is by definition "unstable", subject to continuous updates, versions, integrations, under penalty of malfunction or total non-functioning.

<sup>91</sup> One of the ongoing projects, launched by the National Laboratory of *Artificial Intelligence and Intelligent Systems* of CINI (National Interuniversity Consortium for Informatics), is "*HumanE AI Net*", funded by the European Union: through the collaboration of the best European research centers, universities and industrial centers of excellence in the field of A.I., and the sharing of a series of different skills (cognitive sciences, social sciences and the science of complexity) which follows the inclusive model already experimented even at the dawn of artificial intelligence, aims to make AI "comprehensible to humans", working on human-machine interaction. From a design point of view, the idea is to insert a series of checkpoints throughout the processing process, segment the operations into "modules" at the end of which the result is verifiable, and where it is the machine itself, which has been taught natural language, that explains why it has come to certain conclusions.

<sup>92</sup> See. M.W. MONTEROSSO, *Algorithmic Decisions and Transparency: Designing Remedies in View of the Principle of Accountability*, in *The Italian Law Journal*, 2019, 2, pp. 711-730.

ly integrated development of AI to human action in medicine stands out on the examination of the man-machine relationship.

In this sense, keeping the warning concerning the ontological difference between the artificial agent and the human understanding is the prerequisite of any discourse, not only in the medical field, that intends to fully address this relationship of identification between the parties<sup>93</sup>.

## 5. The Reserve of Humanity as a Guiding Principle of Technological Evolution in the Medical Field

The above considerations examined specific profiles of the polysemic computational transformation of the medical sector.

The survey focused on the synoptic and exemplary analysis of the entry of AI into the practice of personal care, through a transversal reasoning on the human-machine relationship. Further, a focus was placed on the participation of the ethical-moral profile with respect to the envisaged use of technology in research and in the medical field, which cannot be said to be neutral<sup>94</sup> but which implies consequences of reorganization of the health service.

The phenomenon of *the algorithmization* of health care is expressed in a different way compared to the equally relevant digitalization of the health organization.

The latter requires an infrastructural modernization of the P.A. in order to guarantee and make virtuous the digital mechanism that allows the implementation of telemedicine or the electronic health record, focusing its urgencies on the interoperability of systems, on the propensity for a state-centric vision of the health organization<sup>95</sup>, the greater benefit that can be derived from the accumulation of *healthcare Big Data* in a single collection

<sup>93</sup> After all, never forget that “tutto ciò che fa l'algoritmo lascia fuori di sé una domanda sulla natura più intima dell'uomo e sullo stesso algoritmo... ci sarà sempre una domanda inevasa sul carattere precipuo della nostra identità e del nostro discernimento... Anche in presenza dei più perfezionati algoritmi si è obbligati a rimandare a qualcosa di esterno al loro meccanismo, a una responsabilità e a una libertà radicale che forse non esiste neppure, e che coincide infine con quella essenziale incompletezza che la tradizione filosofica e sapienziale, come pure le ricerche sulla natura della coscienza, hanno ontologicamente identificato con l'essenza stessa dell'uomo”. So, P. ZELLINI, *La dittatura del calcolo*, cit., pp. 19-20.

<sup>94</sup> On the lack of neutrality of the algorithms, see U. KOHL, *Google: the rise and rise of online intermediaries in the governance of the Internet and beyond (Part 2)*, in *International Journal of Law and Information Technology*, 21/2, 2013, p. 187 ss.; M. VEALE - I. BRASS, *Administration by Algorithm?*, K. YEUNG - M. LODGE (ed.), *Algorithmic Regulation*, Oxford, 2019, p. 121 ss.

<sup>95</sup> On this subject, the notations of E. CATELANI, *La digitalizzazione dei dati sanitari: un percorso ad ostacoli*, in *Corti supreme e salute*, 2023, 2, p. 432. According to the A., “se è essenziale che i dati sanitari siano in rete, contemporaneamente si pongono poi una serie di problemi sulla gestione della sicurezza dei dati sulle modalità per far conoscere ed acquisire le relative informazioni anche fuori dallo stretto circolo paziente/medico curante. E proprio la funzione di omogeneizzazione nella raccolta e nella gestione dei dati sanitari non può non essere riconosciuta se non allo Stato”.

base<sup>96</sup>, as well as on digital education to be imparted to operators and citizen-patients for a profitable use of digital health services.

In order to be able to speak of algorithmic administration, the P.A. must have previously completed the prodromal step of digitization of its organization<sup>97</sup>, preliminary phase of the transition to the computer-official<sup>98</sup>.

On the basis of the diversity of the two phenomena, the exploratory notes about the reverberations of this *artificially intelligent* revolution and the suggested approach regarding the introduction of AI in health administration must be appropriately guided according to the parameter of the “precauzione costituzionale” since “la condizione di incertezza a riguardo dei possibili effetti negativi dell’impiego di una tecnologia (inclusa l’intelligenza artificiale) non può essere utilizzata come una ragione legittima per non regolare e limitare tale sviluppo”<sup>99</sup>.

If, therefore, on the one hand, full anchorage is placed in the “precauzione costituzionale”<sup>100</sup>, On the other hand, this paradigm must be confronted and interacted with the

<sup>96</sup> On the problems of protecting confidentiality in so-called data-intensive contexts, please refer to U. PAGALLO - M. DURANTE - S. MONTELEONE, *What Is New with Internet of Things in Privacy and Data Protection? Four Legal Challenges on Sharing and Control in IoT*, in R. LEENES - R. VAN BRAKEL - S. GUTWIRTH - P. DEHERT (curated by), *Data Protection and Privacy: (In) visibilities and Infrastructures*, Dordrecht, 2017, p. 59 e ss.

<sup>97</sup> R. CAVALLO PERIN, *Ragionando come se la digitalizzazione fosse data*, in *Diritto amministrativo*, 2020, 2, pp. 305-328, argues that taking the digitization process as complete is an approach that allows us to look at technological innovation, grasping the reciprocal complementary relationship between law and science. In particular, A. affirms that the algorithmic administrative act is a point of view of this complementarity, which obliges theorists to revisit the traditional legal categories and to a “technologically oriented” reading of the existing legislation, without denying that an administrative culture proves to be essential in defining the limits of validity that the algorithm must respect in the elaboration of the decision. The basic thesis is that a joint reading of the Italian legislation on administrative procedure and the European one on data processing requires that, if even a single data subject requests it, the outcome of the algorithm’s decision must be revisited in an adversarial manner between all the participants in the procedure, confirming the automatic decision, or deciding differently but at the same time ordering the correction of the algorithm: modifying the case histories or the weights assigned to them. This makes it possible to overcome criticism of the opacity and lack of reasoning of algorithms, enhancing the participation of interested parties in the administrative procedure. The valuable contribution, whose results and the argumentative framework underlying it are shared, concludes by emphasizing that the increased predictability of decisions and the easy identification of “serious and manifest injustices” of such a systemic way of administering, would guarantee a positive effect both in terms of increased administrative capacity and greater ability to evaluate the legitimacy of administrative action.

<sup>98</sup> The computer-officer expression, the next step of the computer-archive, è di J. FRAYSSINET, *La bureaucratie: l’administration française face à l’informatique*, Paris, 1981, p. 15, che discorre di “l’ordinateurfonctionnaire”. Come eloquentemente evidenziato da A. MASUCCI, *L’innovazione dell’azione amministrativa: dall’automatizzazione alla digitalizzazione del procedimento amministrativo*, in (curated by) D. MARONGIU - I.M. DELGADO, *Diritto amministrativo e innovazione, Scritti in onore di Luis Ortega*, in *Diritto e processo amministrativo*, Quaderni, 23, Napoli, 2016, p. 23 “i francesi con la loro attitudine al linguaggio colsero questa trasformazione e parlarono di “computer-*fonctionnaire*”, “computer-funzionario”. Questa formula voleva dire che il computer poteva realizzare anche delle attività amministrative ovvero non era solo supporto del funzionario, ma diventava esso stesso ‘funzionario’”.

<sup>99</sup> A. SIMONCINI, *L’algoritmo incostituzionale: intelligenza artificiale e il futuro delle libertà*, cit., p. 86. A. He speaks of ‘constitutional precaution’ in the face of growing cognitive uncertainty related to the exponential development of technology.

<sup>100</sup> Of great interest on the relationship between constitutionalism and Artificial Intelligence – also because of the possibility of comparison with the Spanish legal system – is the reading of the essay by F. BALAGUER CALLEJON, *La costituzione dell’algoritmo*, Mondadori, Milano, 2023.

principle of proportionality. Proportionality assessments are always included in the precautionary judgment<sup>101</sup>.

The adoption of AI tools must be subjected to a proportionality test in combination with the precautionary principle (and preventive protection), so as to seek a sort of “compromise” to be achieved by balancing the perception of the degree of seriousness of the technological risk<sup>102</sup> and the benefits of automation, in terms of efficiency and cost-effectiveness, of the P.a.’s actions.

Therefore, the precautionary principle is followed in the medical field<sup>103</sup> and, as noted in the paper, human mediation<sup>104</sup> in high-risk contexts, it is necessary to dissect *the* interactional dynamic between the human agent and the *software*.

Research and development in the hard sciences is increasingly directed towards the machine learning model, a circumstance from which it can be deduced that technological evolution has undergone a real switching<sup>105</sup>.

<sup>101</sup>Since “il rapporto tra i due principi è indubbiamente assai profondo dato che le misure fondate sulla precauzione devono essere anche non sproporzionate o comunque necessarie”, In these terms, F. DE LEONARDI, *Il principio di precauzione nell’amministrazione di rischio*, Milano, 2005, p. 103 (nota 158). discusses “filiation” between proportionality and precaution. After all, “il rapporto tra i due principi è indubbiamente assai profondo dato che le misure fondate sulla precauzione devono essere anche non sproporzionate o comunque necessarie”, so S. Villamena, *Contributo in tema di proporzionalità amministrativa. Ordinamento comunitario, italiano e inglese*, Milano, 2008, p. 73.

<sup>102</sup>In the analysis of the phenomenon of risk and uncertainty, A. FIORITTO, *L’amministrazione dell’emergenza tra autorità e garanzie*, Bologna, 2008, p. 22, points out that “con la crescita dei pericoli del processo di modernizzazione cresce la minaccia a quei valori percepiti come essenziali dalla collettività e viene modificato il consueto assetto dei poteri e di responsabilità nel rapporto tra economia, politica e opinione pubblica, con la possibile conseguenza di centralizzare competenze decisionali e di ridurre, anche se solo temporaneamente, i diritti e le libertà politiche e sociali”.

<sup>103</sup>L’approccio precauzionale non equivale a negare l’utilità dell’IA nell’ambito dell’agire pubblico, because “essere scettici riguardo ad una tecnologia non significa respingerla o rifiutarla”, but to be urged to “impegnarsi in un dialogo critico e riflessivo su come e perché queste cose son costruite”, See. P.S. BAUMER ERIC - M. SIX SILBERMAN, *When the Implication Is Not to Design (Technology)*, proceedings of the SIGCHI conference on human factors in computing systems (Vancouver, BC, Canada, May 7th- 12 th 2011), New York, NY ACM, pp. 2271-2274.

<sup>104</sup>See D.U. GALETTA, “Human-stupidity-in-the-loop”? *Riflessioni (di un giurista) sulle potenzialità e i rischi dell’Intelligenza Artificiale*, in *federalismi.it* 5/2023, pp. 4-13, considers the preservation of the human role to be a fundamental transition in order to avoid the opaque empire of algorithmic logic. On this point, A. He stated that “l’utilizzo dello “Human in-the-loop”, oltre ad essere inevitabile sul piano giuridico quando si tratta di attività della Pubblica Amministrazione, consente anche di sfruttare capacità uniche dell’uomo, come la sua capacità di comprendere il contesto e di operare scelte eticamente orientate”, per poi criticamente concludere che “non solo l’essere umano funzionario farà ovviamente molta fatica a discostarsi dalle risultanze dell’algoritmo; e, quindi, la decisione, pur formalmente adottata dal funzionario, sarà in realtà quella suggerita dal sistema di IA di supporto. Ma in più, in base a tutti questi meccanismi (dati errati o con bias, incapacità di discostarsi dal risultato suggerito dalla “macchina” etc.) si rischia che l’Intelligenza Artificiale, invece di potenziare l’intelligenza umana, funga da effetto moltiplicatore delle imperfezioni della stessa, creando così uno scenario che definirei -ironicamente, ma non senza una seria preoccupazione di fondo - come di “Human-stupidity-in-the-loop”.

<sup>105</sup>Since “la vecchia IA era per lo più simbolica e poteva essere interpretata come una branca della logica matematica, ma la nuova IA è principalmente connessionista e potrebbe essere interpretata come una branca della statistica... il principale cavallo di battaglia dell’IA non è più la deduzione logica ma l’inferenza e la correlazione statistica”. In these terms, L. FLORIDI, *Etica dell’intelligenza artificiale. Sviluppi, opportunità e sfide*, Raffaello Cortina Editore, Milano, 2022, p. 22.



In the medical field, exponential adaptivity is required of the human agent<sup>106</sup> to the clinical contingencies to be faced, or with respect to the wise management of data, both in terms of protection of confidentiality and with respect to the scrutiny of study results based on mathematical models: this punctuation is preparatory to arguing in favor of the irreplaceability of human mediation.

Regarding the adaptivity required of the human agent in the context in which he operates<sup>107</sup>, The algorithmic dimension will not be able to aspire to be fully satisfactory and guarantee, since “il decisore algoritmico è per sua stessa natura insensibile ad adeguare la soluzione alla imprevedibilità del caso concreto e, soprattutto, senza stimoli eterodeterminati, non può certamente offrire l’evoluzione dei ragionamenti e delle interpretazioni, che si traducono nell’assunzione di soluzioni innovative e inattese, essenza stessa del progetto giuridico”<sup>108</sup>.

For this reason, the optimal solution of the balance between technological innovation and personal care rests on the assumption of the principle of reserve of humanity<sup>109</sup> which *medium*<sup>110</sup> indefectible for having a balance between the algorithmic thrust of generative AI and the protection of health, sometimes put at risk by the abstraction of which the computational syllogism consists by definition.

This principle is both a parameter and a guide for the transition to algorithmic administration, given that “la riserva di umanità, oltre che presidio per una intelligenza artificiale al servizio dell’amministrazione più giusta, efficace ed equa, è, quindi, in questo senso, anzitutto, un fondamentale fattore di legittimazione sociale dell’automazione avanzata a

<sup>106</sup>On the subject of the specificity of the human agent to interpret the specificity of the concrete case, see P. MORO, *Algoritmi e pensiero giuridico. Antinomie e interazioni*, in *MediaLaus – Rivista di diritto dei media*, 3, 2019, 11 ss. On the adaptive capacity of the Public Administration, please refer to B. L. BOSCHETTI, *La de-strutturazione del procedimento amministrativo. Nuove forme tra settori e sistemi*, Pisa, 2018, p. 227, which, waiting for the ability to read and use data assets could benefit regulatory optimality and increase collective well-being, insists that “nuove tecnologie vengono in rilievo non tanto, e solo, come oggetto della regolazione, ma come struttura di ottimalità regolatoria, capace di potenziare le capacità del sistema e, al tempo stesso, consentire una nuova flessibilità regolatoria”.

<sup>107</sup>The attribute of adaptivity is certainly typical of the conditional decisions of the Public Administration, as evidenced by E. FREDIANI, *Decisione condizionata e tutela integrata di interessi sensibili*, in *Diritto Amministrativo*, fasc. 3, 2017, p. 447. In this regard, the A., recalling the thought of A.O. HIRSCHMANN, *I conflitti come pilastri della società democratica ad economia di mercato*, in *Stato e mercato*, 1994, 133 ss., where the significance of the conflict is qualified in relation to its nature as a factor of development and growth to be assessed also at the cultural level, stresses that “La stessa clausola condizionale [...] appare divenire l’espressione di uno strumento di tipo *adattivo* e dinamico che consente di realizzare un equilibrio sistemico destinato a non rescindere autoritativamente il conflitto, ma a predisporre rispetto ad esso quello che Albert Hirschmann ha definito una forma di arrangiamento temporaneo (*muddling through*) nell’aprirsi e richiudersi continuo del conflitto medesimo”.

<sup>108</sup>F. FRACCHIA - M. OCCHIENA, *Le norme interne: potere, organizzazione e ordinamenti. Spunti per definire un modello teorico-concettuale generale applicabile anche alle reti, ai social e all’intelligenza artificiale*, Editoriale Scientifica, Napoli, 2020, p. 138.

<sup>109</sup>The discussion in doctrine about the reservation of humanity in algorithmic administration has been inaugurated in Spain and in particular by J. PONCE SOLÈ, *Inteligencia artificial, Derecho administrativo y reserva de humanidad*, in *Revista General de Derecho Administrativo*, 2019, p. 50.

<sup>110</sup>See. I.P. DI CIOMMO, *La prospettiva del controllo nell’era dell’Intelligenza Artificiale: alcune osservazioni sul modello “Human In The Loop”*, in *federalismi.it*, 9/2023, pp. 68-90.

mezzo di intelligenza artificiale”<sup>111</sup>. In order to prevent transhumanism from becoming a concrete reality from a utopian vision, the defense of decision-making and monitoring spaces that are the exclusive prerogative of humans is the crossroads to save “l’obiettivo di dare corpo, anche nel campo dei pubblici poteri, ad una umanità avanzata che non ceda definitivamente il passo alla tecnologia ma che ne sfrutti le potenzialità per esaltare i suoi tratti e capacità”<sup>112</sup>.

In other words, the role of robotics will not be able to replace the *human* intelligentsia<sup>113</sup>, for artificially intelligent agents express themselves on the plane of action and not of thought<sup>114</sup>.

The machinic switching of the organization of personal care has, even from this perspective point of view, confirmed the specialty of health administration: the reference is to the aversion to the *black box*<sup>115</sup> and the different and decisive argument aimed at the explainability of AI systems to be introduced in the medical field.

Given that this punctuation is not to be considered absolute, since the use of medical support mechanisms whose functioning mechanism is not known or knowable is already allowed, the request for transparency in the health sector is not based, as in the general dissertation on the features characterizing the 4.0 administration, on the limits imposed by the legal and dogmatic option of a “glass house” P.A. pursued by the legal system. If so, it

<sup>111</sup>SO, G. GALLONE, *Riserva di umanità e funzioni amministrative. Indagine sui limiti dell’automazione decisionale tra procedimento e processo*, Milano, 2023, p. 32.

<sup>112</sup>In these terms, M. O’CONNELL, *To Be a Machine: Adventures Among Cyborgs, Utopians, Hackers, and the Futurists Solving the Modest Problem of Death*, cit.

<sup>113</sup>The issue of the man-machine relationship is central to the issue of digital sustainability, which supports the centrality of man over the machinist. As noted by P. BENANTI - S. MAFFETTONE, *Decisioni politiche e sostenibilità digitale*, in (curated by) P. SEVERINO, *Intelligenza artificiale. Politica, economia, diritto, tecnologia*, Roma, 2022, p. 29, “abbiamo bisogno di un fondamento algoritmico della democrazia digitale” and, in that sense, “utilizzare eticamente la tecnologia digitale oggi, rispettando l’ecologia umana, significa cercare di trasformare l’innovazione in un mondo *digitale sostenibile*...significa indirizzare la tecnologia verso e per lo sviluppo umano, e non semplicemente cercare un progresso fine a sé stesso”.

<sup>114</sup>In this sense, the notations of R. CAVALLO PERIN, *Ragionando come se la digitalizzazione fosse data*, cit., p. 320, according to which “l’algoritmo si caratterizza per un atteggiamento di conservazione, o al più di razionalizzazione, delle pregresse scelte d’amministrazione, poiché è logica essenzialmente tratta dalle stesse, che lascia l’innovazione all’intervento umano, alla sua capacità di *intelligere*, cambiando anche radicalmente le scelte preesistenti, con quella prudenza e al tempo stesso creatività che non è sostituibile dall’intelligenza artificiale, poiché quest’ultima dell’intelligenza umana è pur sempre un derivato e mai un originale. Poiché è predittivo, l’algoritmo è capace anche di scelte discrezionali in continuità logica con le pregresse scelte umane, ma al tempo stesso l’algoritmo non è capace d’interpretazione innovativa, essendo la discontinuità – discrezionale o d’interpretazione – una caratteristica propria dell’*intelligere umano*”.

<sup>115</sup>On the subject of algorithmic opacity, it is worth noting the reflection of F. FAINI, *Intelligenza artificiale e regolazione giuridica: il ruolo del diritto nel rapporto tra uomo e macchina*, in *Federalismi.it*, 2/2023, pp. 1-29. According to the author, the statistical and probabilistic approach on which AI is based is characterized by “una sorta di congenita opacità che caratterizza gli algoritmi, che si declina in un’opacità strutturale, derivante dal funzionamento degli stessi e dal fatto che resta non comprensibile persino ai programmatori l’iter logico seguito dalla macchina per giungere al risultato partendo dai dati a disposizione, cui si sommano un’opacità linguistica, dal momento che il linguaggio è informatico e non è quello naturale delle norme giuridiche, e una possibile opacità giuridica, nel caso in cui gli algoritmi e le soluzioni di intelligenza artificiale siano oggetto di diritti di proprietà intellettuale o industriale riconosciuti agli ideatori”.

is the success of the *open government model*<sup>116</sup> to the detriment of the culture of secrecy, the result of a choice based on the different and more evolved interpretation of the administrative report.

Rather than in the paradigm of transparency<sup>117</sup>, to be updated with respect to the availability of digital and algorithmic means that can be used by the administration that determine new models of knowledge and data processing in the hands of the Public Administration<sup>118</sup>. In the medical field, the demand for explainability of the *output* is related to the peculiarity of clinical risk management and the relative propensity of the human agent to anchor to the comprehensible, eschewing the supine acceptance of the algorithmic response.

The Anatomy of the Techno-Human Condition<sup>119</sup> It is the crossroads to reasonably combine the exercise of the medical function and the use of new technological tools. This assumption requires a heuristic and epistemological reinterpretation aimed at interdisciplinarity that is opposed to a reprehensible and limited fragmentation *ratione materiae*<sup>120</sup>. If, on the one hand, the opportunities offered by AI in the medical field are essential for improving and making the protection of the person more efficient, it is equally essential to impose an anthropocentric vision on the development of technology. The reserve of humanity, thus speaking, plays the pivotal role of mediation between technique and the exercise of the medical function, in order to amend possible algorithmic deviations, ensur-

<sup>116</sup>The issue of administrative transparency is boundless and lavishly dealt with by the doctrine. Without claiming to be exhaustive, please refer to A. SIMONATI, *La ricerca in materia di trasparenza amministrativa: stato dell'arte e prospettive future*, in *Dir. amm.*, 2018, p. 311; M. C. CAVALLARO, *Garanzie della trasparenza amministrativa e tutela dei privati*, in *Dir. amm.*, 2015, pp. 121 ss.; A. NATALINI - G. VESPERINI (curated by), *Il big bang della trasparenza*, Napoli, 2015; P. CANAPARO, *I contenuti inderogabili e discrezionali della trasparenza amministrativa e le misure di garanzia*, in *Il nuovo diritto amministrativo*, 2014, n. 5, pp. 25 ss.; M.A. SANDULLI, *Accesso alle notizie e ai documenti amministrativi*, in *Enciclopedia del diritto*, agg. IV, Milano, 2000, p. 2. On this subject and further, as a bibliographic reference of absolute value, see G. ARENA - G. CORSO - G. GARDINI - C. MARZUOLI - F. MERLONI (curated by), *Trasparenza Amministrativa*, Milano, 2008; as well as among recent contributions, D. MASTRANGELO (curated by), *La trasparenza amministrativa. Aspetti e problemi*, Aracne, 2019; A. CORRADO, *Conoscere per partecipare: la strada tracciata dalla trasparenza amministrativa*, Napoli, 2018; D. ALFONSO, *Trasparenza amministrativa. Un diritto in via di informazione*, Napoli, 2018.

<sup>117</sup>See E. CARLONI, *Le intelligenze artificiali nella pubblica amministrazione*, in A. LALLI (curated by), *L'amministrazione pubblica nell'era digitale*, Torino, 2022, p. 52 who, speaking about the algorithmic switching of administration, pointed out that "è proprio di fronte all'opacità tecnologica, la trasparenza mostra la sua importanza per la capacità che ha di modularsi per rispondere a nuovi problemi e alle nuove sfide".

<sup>118</sup>On this subject, see the monographic work of M. FALCONE, *Ripensare il potere conoscitivo pubblico tra algoritmi e Big Data*, Editoriale Scientifica, Napoli, 2023.

<sup>119</sup>La prospettiva nella quale collocare l'interazione tra uomo e sistema informatico è quella della simbiosi uomo-macchina, già concepita all'inizio degli anni '60 da J.C.R. Licklider ... che implica uno stretto accoppiamento tra le componenti umane e quelle elettroniche dell'associazione ... Nell'associazione simbiotica prevista, gli uomini indicheranno gli scopi, formuleranno le ipotesi, determineranno i criteri ed effettueranno le valutazioni. Le macchine calcolatrici faranno il lavoro di routine che deve essere compiuto per preparare la strada per nuove idee e decisioni nel pensiero tecnico e scientifico", in these terms G. SARTOR, *L'informatica giuridica e le tecnologie dell'informazione*, Torino, II ed. 2012., p. 300, which mentions J.C.R. LICKLIDER, *Man-Computer Symbiosis*, in *Ire Transactions on Human Factors in Electronics Hfe-1*. March (1960), 4-11.

<sup>120</sup>"Siamo evidentemente al cospetto di problemi multidisciplinari che concerno la geopolitica, la politica, il diritto, le scienze, la tecnologia", so P. BENANTI, *Postumano, troppo postumano*, Roma, 2017, p. 41.

ing greater efficiency and compatibility in the relationship-identification between human and artificial intelligence.

In already difficult times for the Constitution<sup>121</sup>, the advent of technology, which also intersects with the fundamental right to health, is further stress for the protection of our legal system<sup>122</sup> as constitutionally ordained<sup>123</sup>.

Starting from the intimate connection between the reserve of humanity and the techno-human condition, the *invenio*<sup>124</sup> which can be seen from the reflections prepared concerns the fundamental role of the human sciences responsible for the evaluation of technological opportunities and able to “cogliere e analizzare i sogni, le aspirazioni, i miti e i desideri insiti in ogni opera dell’uomo”<sup>125</sup>, including Artificial Intelligence, which remains, apart from the nomenclature, a human construct.

<sup>121</sup>The phrase takes up the title of the essay by G. ZAGREBELSKY, *Tempi difficili per la Costituzione. Gli smarrimenti dei costituzionalisti*, Roma-Bari, 2023.

<sup>122</sup>In relation to AI-driven changes, F. PIZZETTI, *Con AI Verso la Società digitale*, in *federalismi.it*, n. 23/2023, p. IX, emphasizes how much of a sunny clarity it is that “nella società digitale molte cose dovranno essere ripensate, a partire dall’amministrazione, dal rapporto tra amministrazione e ruolo degli amministrati, per arrivare fino al nodo centrale dei sistemi costituzionali e ai diritti fondamentali che li caratterizzano, destinati anch’essi a dover fare i conti con una trasformazione di questa portata”.

<sup>123</sup>On the relationship between AI and the Constitution, see the interesting contribution by D. MARTIRE, *Intelligenza artificiale e Stato costituzione*, in *Diritto pubblico*, fascicolo 2, 2022, p. 444. The author, recalling the words of P. Calamandrei, *Discorso ai giovani*, 1955, fears a future in chiaroscuro for the constitutional order overwhelmed by the technological revolution, envisaging that “forse un giorno non troppo lontano anche le Costituzioni (se ce ne sarà ancora bisogno) verranno scritte da una intelligenza artificiale. Non avranno più senso a quel punto le parole di Calamandrei per cui «la Costituzione non è una macchina che una volta messa in moto va avanti da sé. La Costituzione è un pezzo di carta: la lascio cadere e non si muove. Perché si muova bisogna ogni giorno rimetterci il combustibile; bisogna metterci dentro l’impegno, lo spirito, la volontà di mantenere queste promesse, la propria responsabilità». Un giorno in cui non si avrà più fiducia negli uomini. Un giorno sbagliato”.

<sup>124</sup>The concept of *invention* is to be understood in the sense represented by Paolo Grossi in various works, in which A. argues that law is not “created” by an act of constituted power, it is not “a command falling from above on society called solely to obedience”: it must be “invented” (in the sense of “discovered”, from the Latin *invenio*) in the social and economic factuality of individuals in relation to each other. On this subject, see P. GROSSI, *L’invenzione del diritto*, Bari, 2017. See. P. GROSSI, *Della interpretazione come “invenzione” (la riscoperta moderna del ruolo “inventivo” della interpretazione)*, in *Quaderni fiorentini per la storia del pensiero giuridico moderno*, 2018, 47, pp. 9-19; ID., *La “invenzione” del diritto: a proposito della funzione dei giudici*, in *Rivista trimestrale di diritto e procedura civile*, 2017, 3, pp. 831-846; ID., *L’“invenzione” dell’ordine costituzionale: a proposito del ruolo della Corte*, in *Giustizia civile*, 2016, 2, pp. 237-240; ID., *L’“invenzione” della Costituzione: l’esperienza italiana*, in *Diritto pubblico*, 2016, 3, pp. 811-820.

<sup>125</sup>Thus, P. Benanti, *Postumano, troppo postumano*, cit., p. 41.