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ARTIFICIAL INTELLIGENCE

at the service of citizens



AGID | The Agency for
Digital Italy

White Paper on Artificial Intelligence at the service of citizens

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By the Task Force on Artificial Intelligence of the Agency for Digital Italy
ai.italia.it

Coordination Board

Benedetta Arese Lucini, Giuseppe Attardi, Ernesto Belisario, Marco Bicocchi Pichi, Barbara Caputo, Antonella Cascitelli, Maria Chiara Carrozza, Lorenza Ciprandi, Juan Carlos De Martin, Fernanda Faini, Roberto Fini, Luigi Fiorentino, Emilia Garito, Fabio Gasparetti, Claudio Grego, Salvatore Iaconesi, Sandro Marco Incerti, Domenico Marino, Paolo Merialdo, Alessandro Micarelli, Alessandro Nasini, Manuela Pizzagalli, Eugenio Prosperetti, Stefano Quintarelli, Riccardo Torlone, Barbara Ubaldi, Giuseppe Vaciago, Enrico Verga, Guido Vetere, Alessandro Vitale

Agency for Digital Italy and Department for Public Administration

Antonio Samaritani, Marco Bani, Pia Marconi

Giuseppe Ariano, Claudio Biancalana, Michela Calanna, Patrizio Caligiuri, Alessandro Casacchia, Concettina Cassa, Manuel Ciocci, Francesca Cocomero, Angela Creta, Daniela De Blasis, Mauro Draoli, Marta Falzone, Valeria Favasuli, Sergio Gambacorta, Flavia Gamberale, Jacopo Gandin, Glenda Gentili, Francesca Grande, Elio Gullo, Enzo Maria Le Fevre, Giulio Lepri, Giuseppe Mancinelli, Elisa Petrucci, Davide Porrovecchio, Umberto Rosini, Luca Ruggeri, Erica Sirgiovanni, Matteo Trapani and Zanzabot

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Cover image: agsandrew/istockphoto



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Making the most of artificial intelligence in Italy and Europe

Artificial Intelligence, or AI, is one of the most promising technologies of our times - from saving lives to online shopping predictions and raising crop productivity.

That is not an exaggeration: AI can already help doctors to identify cancers and other diseases, thereby prolonging human life.

In the future, it could be used to predict and locate earthquakes. Italian startups already provide AI-based services, such as detecting transaction fraud.

AI stands to benefit society as a whole, across all sectors, for people going about their everyday lives as much as for business.

That also applies to government and public administrations: the focus of this White Paper published by the Agency for Digital Italy.

It identifies some main areas where AI can help – in health, education and judiciary systems; in public employment and security.

The Agency's paper takes a welcome look at how governments, public agencies and administrations can best use AI technologies to serve both people and business, to raise the efficiency of public services as well as user satisfaction.

Much of what AI can achieve in public administration chimes with the European Commission's promotion of e-government and digitised public services as part of building the Digital Single Market:

- saving time and public money, providing better public services.
- joining them up across borders, raising efficiency and improving transparency.
- bringing people closer to their governments; involving them more in decision-making.

Developing and promoting AI will be very much a European, not just a national project.

It is an opportunity that Europe, collectively, should not hesitate to grasp firmly.

To that end, we will need an open and inclusive debate that involves all our countries on how best to use these new technologies: how to respect fundamental rights such as privacy, liberty, security and non-discrimination.

This paper already shows how Italy's efforts in AI are a good example for other countries to emulate – and how they can help in Europe's broader reflections on the way ahead.



Andrus Ansip
Vice-President of the European Commission for
the Digital Single Market

A new common culture for the innovation of public services

Artificial Intelligence will redesign our lives. Our daily lives of human beings, citizens, workers, parents, and children are changing before everyone's eyes. Indeed, we can be sure that our customs will soon be reshaped consequently generating social changes that require an individual and collective reflection and in some cases, perhaps, even an upset reflection. Technology is neutral in itself but it is not so in its application and it is even less neutral for those who, working on the development of societies, often find themselves deciding what is right or wrong or, in a given context, what is the best good or the least harm. The spirit with which the Agency for Digital Italy has undertaken this commitment is summarized in these few lines.

The aim of the pages that will follow the preface of this White Paper is the study, analysis, and the understanding of the opportunities and risks generated by the dissemination of Artificial Intelligence technologies in the public sector: hence, the definition of a shared perimeter within which to face all the challenges that this brings.

This document marks the beginning of a journey that the Italian Public Administration has already started: in recent months, we have created a community with which we have worked to draw the working lines that could help us define the approach to Artificial Intelligence in Public Administration that we will undertake to transform into the operational steps as of today.

However, it is at the end of this first phase of study, analysis, and comparison that I am further confident that, never as in this case, a platform that connects the public administration to the markets was extremely needed to have a frame value. Having clear ideas on the model of technological development and with a vision capable of contrasting the apocalyptic, exclusionary and non-governed scenarios.

A reflection that, in addition to being the leitmotif of the White Paper, moves from the clear awareness that public administration needs - for the sake of its decisions - to be competitive on these issues, without hiding. Today, more than ever, those who understand and govern the phenomena that surround it continue in the path of innovation; those who are affected will lose ground.

This is why the work just begun becomes a prerequisite to face the use of frontier technologies that allow the administration to capitalize on the innovation introduced by the infrastructural projects already underway and, starting from them, allows organizing the model of development of its future projects.

The recommendations published in this document are aimed to become design criteria for new services and methodological assets to guide the creation and development of pilot projects. In addition, the recommendation will also serve for the innovative result of the technologies that will be implemented and for the common value approach. Only by following this path we will succeed in relating the benefits of Artificial Intelligence in the daily "practice" of citizens.



Antonio Samaritani
Director General of the Agency for Digital Italy

For those who do not have time: Summary of the White Paper

This White Paper aims at analysing the impact of Artificial Intelligence (AI) in our society and, more specifically, in the Public Administration, in order to promote digital transformation. It is the result of the work of the Agency for Digital Italy and with a task force of experts. The objective is to facilitate the adoption of these technologies in the Italian Public Administration, to improve services to citizens and businesses, thus giving a decisive impulse to innovation, the proper functioning of the economy and, more generally, to progress in daily life.

Today, Artificial Intelligence can drive vehicles, take care of elderly or sick people, perform dangerous or weary jobs and help make informed decisions based on the rational management of large amounts of data. Also, AI can enable us to communicate in languages we do not know, help us study and increase the cultural or entertainment experiences at our disposal. In the Public Administration, it can be used profitably in the healthcare, education and judiciary systems, public employment, security and, more broadly, in the management of relations with citizens, which can be simplified and at the same time be more effective, quick, and efficient.

As prerequisite to achieve these objectives is necessary to define “Artificial Intelligence”, from both a theoretical and a technical point of view. This serves to understand opportunities and limits of these technologies, as well identify their most effective areas of application. The White Paper focuses on tools that can have positive effects on the work of the Public Administration, such as the use of chatbots to answer citizens’ queries and cut through layers of bureaucracy, or the use of robots to take care of the sick, algorithms that can read results of medical exams and these that support the preparation of educational path of students in order to improve their performance. Particular emphasis is placed on the means for monitoring and managing careers, those for the surveillance of public places or for the recognition of network threats, as well on tools for the rational management of problems generated by natural disasters.

The successful implementation of these technologies in public services requires the public sector to evaluate the critical challenges that must be faced to integrate Artificial Intelligence in a profitable way.

The first challenge is the Ethical challenge, which remains central to any consideration in this field. There is a need to strongly affirm the anthropocentric principle stating that Artificial Intelligence is always at the service of the citizen and not vice versa.

Moreover, it is necessary to formulate general principles of equity with the aim of using these new technologies to address some universal needs such as to respect freedom, and to guarantee individual and collective rights. More specifically, in the field of ethics, the functioning of Artificial Intelligence raises some issues, i.e. those related to the quality and neutrality of data, the responsibility of those who use algorithms, transparency and accountability, as well as protection of privacy.

The aim is to demonstrate how the incorrect use of the technologies at our disposal can contribute to the development of a more unjust society that fuels inequalities, while awareness of the risks involved in relying on “smart” machines can help us minimize inequalities and plan a better world.

The second challenge that is addressed is the technological one: Artificial Intelligence is not yet able to reproduce the complex functioning of the human mind, but only some of its circumscribed capacities. Therefore, one of the goals is to make existing and future technologies more similar to our way of relating to the world.

In the short term, the priority is to work on personalization and adaptivity to ensure that data and algorithms at our disposal can be increasingly more effective in allowing us to operate individually in some specific areas of our daily life. For the purpose of this White Paper, the focus is on rendering more effective the work of the Public Administration (in addition to the sectors mentioned above: tax, mobility and transport).

The document then analyzes the **fundamental issue of skills that must be developed in the age of Artificial Intelligence**. The issue is addressed from both the citizens’ and the civil servants’ points of view. Citizens in general, and primarily those who would like to operate in the IT sector, need to understand how algorithms and databases that are used by the Public Administration, civil servants need to constantly ameliorate their skills.

However, even for those who want to engage in other sectors, it will be necessary to know how to act in contexts that will increasingly assign to machines tasks that were previously performed by people (typically, the simplest and most repetitive ones). This challenge underlines the importance of understanding how to relate with machines and coexist with them in a world that is always more populated by technology. The State bears the responsibility to respond to these needs by both shaping an education system able to keep up with these changes and encouraging lifelong learning.

However, in order to achieve these goals, civil servants and people employed in the public sector must be properly trained. They will face the need to understand what are the Artificial Intelligence tools they need to integrate into their work processes and which ones they can use with citizens. In this sense, a properly trained Public Administration can become a real propeller of innovation.

The fourth challenge is related to data which are the fuel of Artificial Intelligence.

First of all, these must be of good quality, exempt as much as possible from biases produced by humans. Biased data can easily influence algorithms. This is why it is critical to secure a right organizational methodology and create the best conditions in the contexts in which the data is produced. This is also true for data collected by IoT devices and sensors that are fragmented, heterogeneous and not highly interoperable, despite being connected to one another.

Furthermore, there is the so-called linked open data of public bodies, a real mine of information that would be very useful to generate applications of Artificial Intelligence at the service of the citizens. However, they must first be retrieved and filtered by means of semantic technologies and shared ontologies. Lastly, precisely for this kind of data, we highlight the need to ensure equal and non-discriminatory access to anyone wishing to use it.

The fifth challenge is the legal one. As always, when it comes to how to regulate the activity of the public administration, it is focused on the balance between the interests of the community and those of the individual. In the field of Artificial Intelligence it is necessary to reconcile the principle of transparency of administrative acts and procedures or the protection of personal data with the right to privacy. A second issue that the public sector has to face is the relationship between the necessity of guaranteeing transparency in the context of algorithmic decision making and protecting the copyright of the creators of the algorithms. Moreover, in the event that the public administration uses programs that help the decision-making process, or programs able to take autonomous decisions, it is necessary to face the issue of accountability.

The White Paper addresses all these issues and provides some technical solutions that are also included in the European Regulation on the protection of personal data (GDPR), which will become effective in all EU countries on May 25th 2018. In general, the principles to be followed are: the transparency of algorithms and related databases, the definition of the connected responsibilities of users and the need to prevent that the use of data in the Public Administration generates a pervasive social control, in contrast with the fundamental rights of the citizen.

The sixth challenge falls directly under the responsibility of the Public Administration as it is linked to the adoption of AI technology in the public sector, for instance to improve the relationship between the State, citizens and businesses. As anticipated in the third challenge, the White Paper underlines the importance of training public employees, particularly officials and managers, on the functioning, benefits, as well as ethical and technical implications on the use of AI technologies in the public sector.

The basic principle is that Artificial Intelligence should support people and help them carry out their activities, without replacing them.

This last point anticipates the theme of the **seventh challenge: preventing inequalities**. Indeed, Artificial Intelligence solutions must be accessible to everyone and it must be of simple and immediate use.

This kind of technology can reduce social inequalities in the field of education and training, health and disability, knowledge and human rights. However, Artificial Intelligence can also increase inequalities, if the data it feeds on or the algorithms that make it up are affected by discriminatory bias.

Therefore, the Public Administration must pay great attention to the development of inclusive, accessible, transparent, not discriminatory and free from bias solutions.

In order to verify the actual benefits deriving from the use of Artificial Intelligence in the Public Administration, **the eighth challenge is connected to the measurement of the impact** of AI technology. Once again, the challenge is presented from the point of view of both citizens and institutions. In the first case, the focus is on improving people's quality of life and customer satisfaction; in the second case, on rendering the organizational processes more efficient and effective.

In this section, emphasis is placed on the necessity to conduct both multidisciplinary quantitative and qualitative research. Indeed, the impact of technology on citizens and institutions has different facets, including economic, technical, social, cultural, psychological and anthropological factors. These variables are not always measured by the Public Administration, however, the introduction of Artificial intelligence in the public sector is such a sensitive issue that requires an attentive impact assessment.

The last challenge, the human being, is linked to the development of a discourse around Artificial Intelligence. Indeed, citizens and Institutions should be aware of the significant importance of these tools. To this end, experiments are proposed in the fields of design, arts, psychology, anthropology and sociology that can close the gap between research, industry, and society.

Artificial Intelligence represents simultaneously a technological and a social innovation that can radically transform our world.

Taking this into consideration, the White Paper includes a set of recommendations drafted by the Agency for Digital Italy, the Task Force and a community of more than 500 experts and citizens. The objective is to share the recommendations with the readers in order to raise a long lasting discussion that should accompany the processes of development, modernization and improvement of the State and our society.

Eudaimonia (gr. εὐδαιμονία, lett. "being in the company of a good demon"), as illustrated by Aristotle, defines human well-being as the highest virtue for a society. Eudaimonia can also mean "prosperity", as it denotes an overall condition of well-being in which human beings perceive their benefits starting from the conscious contemplation of ethical considerations that help us define how we wish to live.

Whether our ethical substratum is Western (Aristotelian, Kantian), Oriental (Shinto, Confucian), African (ubuntu) or attributable to any other tradition, creating autonomous and intelligent systems that explicitly respect the inalienable human rights and cultural values of users, it is possible to give priority to the improvement of human well-being as a parameter for progress in the "algorithmic age". Recognizing the potential of a holistic approach, prosperity should in this way become more important than the pursuit of one-dimensional objectives such as increased productivity or a country's GDP growth.

Source: The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems_, 2017, IEEE - Institute of Electrical and Electronics Engineers

Ref. (https://standards.ieee.org/develop/indconn/ec/ead_executive_summary_v2.pdf)

Italy and digital services

The measure of intelligence is the ability to change
Albert Einstein

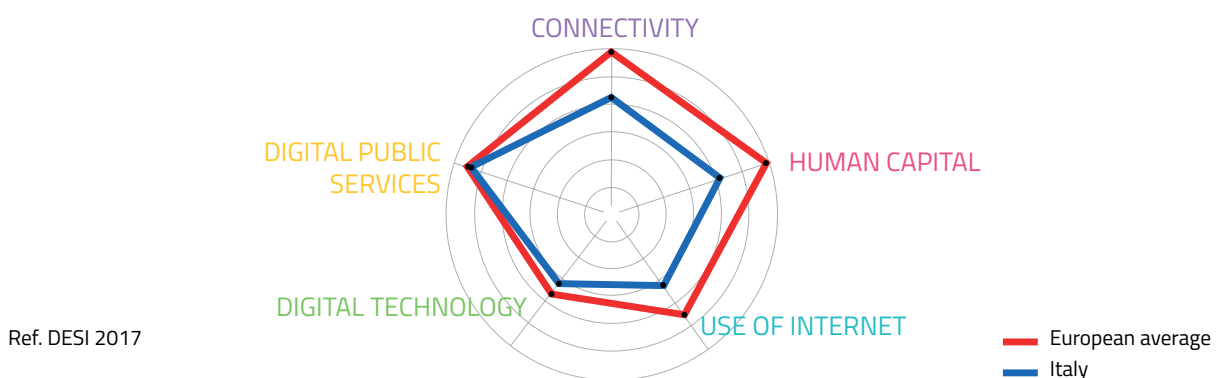
Introduction

“ It takes something more than intelligence to act intelligently.
(Fëdor Dostoevskij) ”

The aim of this White Paper is to analyse the impact of Artificial Intelligence (AI) on our society and, specifically, how these technologies can be used by Public Administration (PA) to improve services for citizens and businesses. All of this is part of a broader scenario of reflection on the policies to be implemented to facilitate the digital transformation, the engine of social, the economic and the cultural development.

To accelerate this transformation process, it is possible to draw inspiration from international experiences that have brought tangible results: Italy must excel in the search for innovative strategies, perhaps able to feed on the historical, cultural and social wealth of the country and the Mediterranean, and at the same time, succeed in seizing the best that has emerged from the strategies of those countries that were the first in making the evolution of public information technology the lever for transition to a new global structure of the economy and society.

THE KEY WORDS OF DIGITAL TRANSFORMATION



It is therefore necessary to support the country's innovation forces in order to obtain increasingly competitive models and to initiate a radical change in the relationship between citizens, administrations and the market. The ultimate goal of this process is the creation of modern, easy to use, accessible and high-quality public services therefore oriented, to the understanding of users' needs thus, allowing the level of citizen satisfaction and trust in the institutions to be increased.

The document intends to outline the development prospects of digital public services and the challenges that the country will have to face to implement and use the new technologies while respecting ethics and laws, putting the citizen at the centre of this evolutionary path.

An overview of digital government in Italy

Before describing the state of the art and the future prospects of Artificial Intelligence in our society and in Public Administration, it may be useful to analyse what is happening in the field of digital transformation in the public sector, in order to understand the current situation and imagine how AI can create synergies with the process of digitising the country.

According to data reported in the last Report of the Organization for Economic Cooperation and Development (OECD) on Digital Transformation¹, our country is in 5th place worldwide for the production of the most cited scientific documents on machine learning after the United States, China, India and Great Britain (science, innovation and digital revolution).

Also in the same Report (section on growth, work and digital transformation), 2015 data on the dissemination of industrial robots show that Italy is among the leading economies in Europe (behind Germany, Czech Republic, Slovak Republic and Slovenia) in terms of use of robots (ex. number of robots compared to the value added in manufacturing), while showing indices equal to 1/3 compared to those of the world leader (South Korea).

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As the Digital Economy and Society Index - DESI 2017², Italy is growing, but there is still a gap between the supply of digital services and their actual use. Our country has nevertheless made progress on connectivity, a basic condition to allow the development of a digital ecosystem, thanks also to the Ultra Broadband Plan³.

According to the data of the Annual Report of the Authority for Communications Guarantees (AGCOM), at present 90.7% of families with at least one minor have a fixed and mobile broadband connection, a figure that stops at 20.7% for families with members aged over 65. At the same time, 91.6% of households with at least one graduate member have a broadband connection, a figure that falls to 55.3% for families in which the highest education is junior high school.

90,7% 90.7% BROADBAND CONNECTION IN FAMILIES WITH AT LEAST ONE MINOR

91,6% BROADBAND CONNECTION IN FAMILIES WITH AT LEAST ONE GRADUATE

¹ OECD Science, Technology and Industry Scoreboard 2017, Ref. Highlights relativi alla Digital Transformation in Italia: <https://www.oecd.org/italy/sti-scoreboard-2017-italy.pdf>.

² Ref. <https://ec.europa.eu/digital-single-market/en/desi>.

³ Ref. bandaultralarga.italia.it.

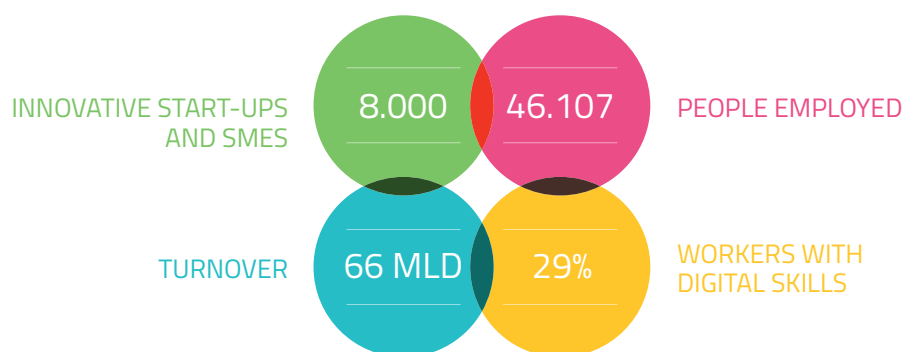
This, once again, highlights the centrality of demand, and not just supply, in stimulating the dissemination of internet-based technologies in Italy.

Confirming the importance of the “demand factor” are data on the Italian dynamism of start-ups and innovative small and medium-sized enterprises (SMEs). In our country, according to a census updated to 2017⁴, they are about 8,000, twice the number compared to 2015, employing 46,107 people, including shareholders and employees.

The digital market is growing and the ICT sector is undergoing a development phase thanks to the increase in investments: in 2016, it grew by 1.8% to reach Euro 66 billion in turnover⁵. As too is the demand for high-level digital skills, in a context in which only 29% of the workforce possesses them compared to the EU average of 37%⁶.

As for digital public services, as the DESI again confirms, Italy is positioned at the top of the ranking in terms of quantitative supply but has low percentages of use by the population.

THE DIGITAL MARKET IN ITALY



Source: “Annual Report to the Parliament Start-ups and innovative SMEs” Mise, 2017 and “Digital in Italy: markets, dynamics, policy 2017” Assinform, 2017

Also Eurostat partly confirms this fact: a more streamlined relationship with the Public Administration⁷, when this is made possible, the tools made available are used by only 13% of citizens compared to a European average of 30%⁸.

4 Ref. Annual Report to Parliament on the state of implementation and the impact of policies in support of Start-ups and Innovative SMEs”, Mise, 2017.

5 Ref. “Digital in Italy: markets, dynamics, policy 2017”, Assinform, 2017.

6 Ref. note 1.

7 Ref. “E-Government benchmark 2017”, European Commission, 2017.

8 Ref. <http://ec.europa.eu/eurostat/web/digital-economy-and-society/data/main-tables>.

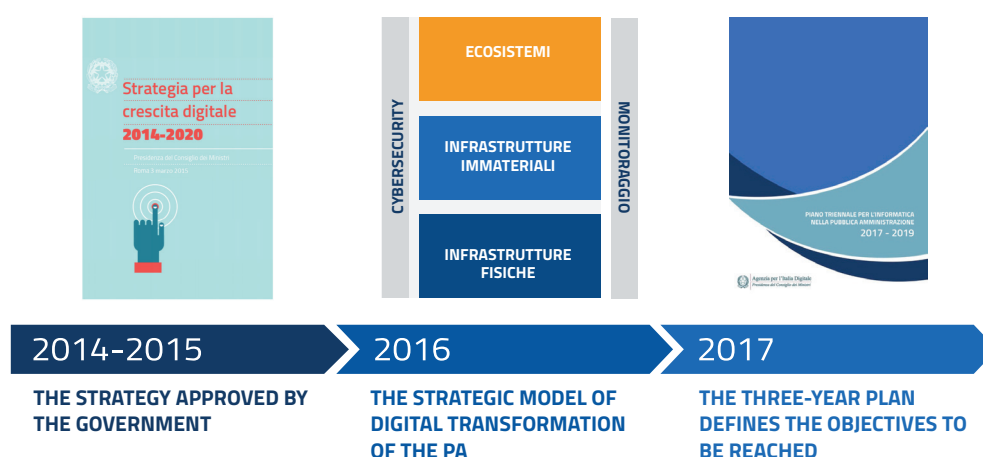
The Italian digital strategy

In the context of the European Digital Agenda⁹, Italy has developed its national strategy by converting the EU objectives into initiatives aimed at the digital transformation of public administration¹⁰. In so doing, the interventions in the public sector become the driving force for business development and the growth of citizens' skills. The 2014-2020 strategy of the Digital Agenda has therefore become a veritable tool to pursue the great objectives of growth, employment, quality of life and democratic participation.

But the challenges of digital transformation have changed quickly: Internet of Things (IoT), big data analytics, Artificial Intelligence and Blockchain are the vectors through which the new digital economy moves.

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FROM DIGITAL AGENDA TO THREE-YEAR PLAN



Also to address these issues, in 2017 the three-year plan for information technology in the Public Administration¹¹ was approved, which contains operational indications (actions, times and objectives) for the development of four pillars: digital ecosystems or policy areas (health, school, justice, etc.), immaterial infrastructures (that include enabling platforms and data of the PA), physical infrastructures and cybersecurity.

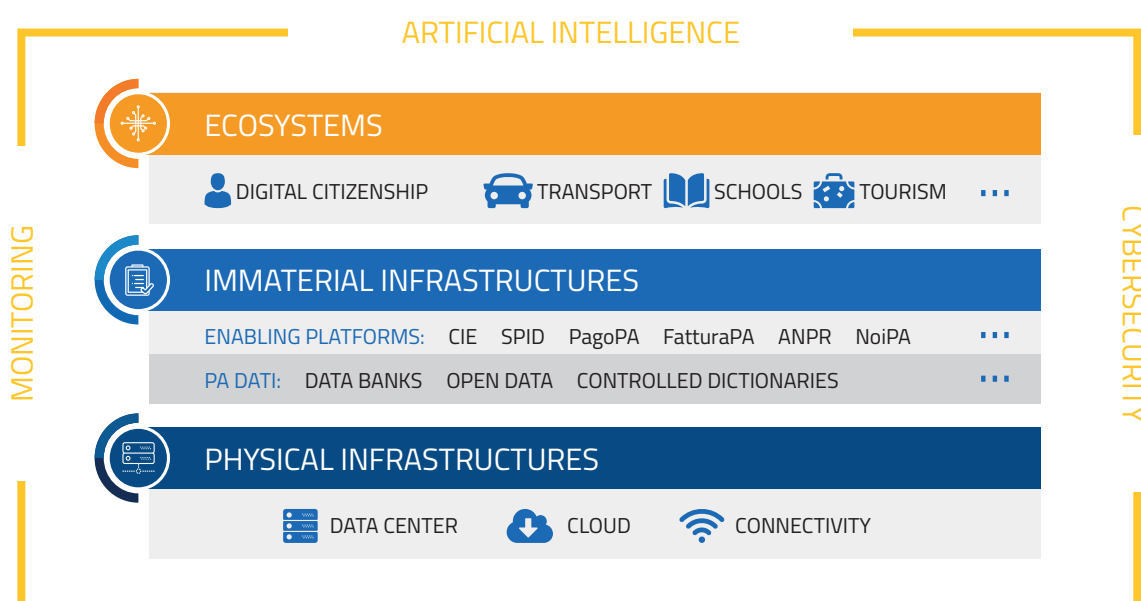
⁹ The European Digital Agenda, launched by the European Commission in May 2010, has precisely defined the objectives for developing digital economy and culture in Europe within the framework of the Europe 2020 strategy.

¹⁰ The main objectives are: centralizing planning and public spending in regard; aim at the centrality of user experience and needs; use an architectural approach based on open and standard logics; seek solutions to stimulate cost reduction and improve the quality of services.

¹¹ Ref. <https://pianotriennale-ict.italia.it/>.

The Plan was created to effectively guide the digital transformation of the country, becoming a reference for central and local administrations in the development of their information systems. It sets the fundamental architectural principles, the rules of usability and interoperability and rationalises ICT expenditure.

EVOLUTION OF THE STRATEGIC MODEL THANKS TO ARTIFICIAL INTELLIGENCE



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Tackling these challenges, which still appear “new”, imposes, however, the identification of a new technical, ethical and regulatory framework that enables the public sector to address and manage new scenarios, exploiting the projects of today and providing tools and skills for those of the future. At the same time, it is necessary to plan the ways to stimulate and accompany the cultural evolution of the country, involving the population, overcoming diversity, reticence and conflict, and identifying new perspectives.

The use of Artificial Intelligence tools applied to services, the central subject of this White Paper, is only one of the sectors in which Italy is trying to achieve the objectives of the Three-Year Plan for Information Technology in Public Administration. For this specific purpose, the “Artificial Intelligence Task Force at the service of citizens”¹² was set up to discuss the new possibilities offered by this type of technology, in general in our daily life and, more specifically, in the construction of a new relationship between State and citizens.

¹² Ref. <https://ai.italia.it>.

Project sheets of the three-year plan

SPID

The Digital Identity Public System is a service that allows citizens to access all the online services of the Public Administration with a single digital identity consisting of username and password. It can be used on a computer, tablet or smartphone. It is a secure authentication system that guarantees the protection of personal data that cannot be used or transferred to third parties without the user's permission. What can I do with SPID? For example, healthcare service bookings, school enrolments, access to the public Wi-Fi network, business practices with a single password.



SPID IDENTITY
PROVIDED



ACTIVE DIGITAL IDENTITY
MANAGERS



ACTIVE
ADMINISTRATIONS

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Electronic Health Record (EHR/FSE)

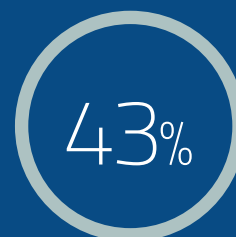
The EHR/FSE is the tool with which citizens can trace, consult and share their health history. The EHR/FSE manages all the health and social-health digital data and documents generated by the patient's present and past clinical events. It has a temporal horizon that covers the entire life of the patient and is constituted, subject to consent, by the Regions and Autonomous Provinces for the purposes of prevention, diagnosis, treatment and rehabilitation pursued by the National Health Service and the regional social and health services taking care of the patient.



OPERATING REGIONS



CITIZENS WHO
ACTIVATED FSE



REPORTS ISSUED BY
FSE

E-billing

E-billing is a document in digital format the authenticity and integrity of which are guaranteed by the presence of the electronic signature of the person issuing the invoice and sending it to a specific Interchange System (SDI).

Public Administrations are obliged to issue, transmit, manage, and store invoices exclusively in electronic format.



INVOICES MANAGED



E-BILLING OFFICES ON
INDICEPA



ADMINISTRATIONS
PRESENT ON INDICEPA

PagoPA

PagoPA is an initiative that allows citizens and businesses to pay the Public Administration electronically on the basis of rules, standards and instruments defined by AgID and accepted by the PA, Banks, Post Offices and other adhering payment institutions (Payment service providers - PSP).



PARTICIPATING PA



ACTIVE PA



TOTAL TRANSACTIONS

Digital security (CERT-PA)

The CERT-PA (Computer Emergency Response Team Public Administration) is a structure that operates within AgID and is responsible for the processing of IT security incidents of the domain constituted by public administrations.

The CERT-PA intervenes following reports from: public administrations of constituency, Italian IT security organizations; other Italian or international organizations (CERT network); monitoring and intelligence activities.



REPORTS RECEIVED
BY CERT PA



VE IMPORTED IN
INFOSEC



IOC PROCESSED BY
INFOSEC



MALWARE ANALYZED BY
INFOSEC

Open Data

Open data is public data that must be published in a way that is easy to reuse. To this end, key aspects are: licensing, standardization, quality, accessibility even through automated applications.

Each administration is required to issue open data to contribute to the enhancement of public information assets, in line with international and national open data policies.



DATASET



ADMINISTRATIONS

Artificial intelligence today

By far, the greatest danger of Artificial Intelligence is that people conclude too early that they understand it.

Eliezer Yudkowsky

“ The AI products that will be most popular in the next 20 years, those that we will all use, have not yet been invented. This means that we are not late. (Kevin Kelly) ”

What is Artificial Intelligence (AI)?

There are many definitions, among them, the one of the University of Stanford, which identifies it as “a science and a set of computational techniques that are inspired - albeit typically operating in a different way - by the way in which human beings use their nervous system and their body to feel, learn, reason and act” ¹³.

AI pervades our lives even if we are not aware.

AI technologies are emerging as a central force in society. The sector has gone from simply developing systems that are intelligent to developing intelligent systems that are reliable and knowledgeable.

Source: Artificial Intelligence and life in 2030, One hundred year study on Artificial Intelligence, Stanford University, 2016

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Novels and science fiction films exploit and give credit to fear of the unknown: Artificial Intelligence is often represented in a negative way, as a danger to humanity, potentially capable of taking over and dominating ¹⁴ us but in reality AI is already part of our daily life.

With the digital assistants of mobile phones, driver assistance systems, the chatbots ¹⁵ that respond when we call public or private entities, systems for machine translation of texts and speeches, robots in the factory, algorithms that recommend us products and services to our liking and those that assist us in learning, or increasingly realistic and engaging video games.

BY
2025
AI COULD

MOST LIKELY

Record a song that will be in the Billboard Top 100
Create a work of art valued at \$ 100,000
Write a successful TV series

NOT VERY LIKELY

Sign a best seller for the New York Times
Write an Oscar movie
Win the Pulitzer Prize for Journalism

Source: AI takes center stage, Bot.Me: A revolutionary partnership, Pwc 2017

¹³ Ref. “Artificial Intelligence and life in 2030, One hundred year study on Artificial Intelligence”, Stanford University, 2016, p. 5.

¹⁴ Think of the computer Hal9000 in 2001 Space Odyssey (Kubrick, 1968) or of the exterminator robot in Terminator (Cameron, 1985).

¹⁵ Ref. detailed box in “The main areas of application”.

Artificial Intelligence, for example, can improve our lives by driving in our place, taking care of elderly people in need of assistance, carrying out dangerous and arduous jobs, helping us make informed decisions, rationally managing large amounts of data that would otherwise be difficult to interpret, allowing us to communicate while not knowing the language of our interlocutors, following us in our studies or increasing cultural and entertainment experiences or speeding up bureaucratic procedures.

This is possible in certain specific application areas¹⁶ thanks to recent developments in AI techniques, essentially due to the wide availability of annotated data, to the improvement in learning techniques and to the availability of high computational capacity at increasingly accessible costs.

AI RESEARCH AREAS

Some of the areas currently of priority were not so in the past and it is likely that different areas will emerge in the future.

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LARGE-SCALE MACHINE LEARNING

Many basic problems in machine learning (such as supervised and non-supervised learning) are well known. A central focus in current studies concerns the chance of increasing the ability of algorithms to work on extremely large datasets.



DEEP LEARNING

For example, the ability to learn convolutional neural networks has brought many benefits to the computer vision sector, with applications such as object recognition, video labelling and other variants.



REINFORCEMENT LEARNING

While traditional machine learning has a clear focus on pattern mining (rule extraction), reinforcement learning has shifted focus on decision making and its motivational levers. This technology can help advance the ability of AI to learn and perform actions in the real world.



ROBOTICS

Robotic navigation in static environments is widely resolved. Current efforts are focused on providing robots with the ability to interact with the surrounding reality in a predictable way.

¹⁶ Ref. "Artificial Intelligence and life in 2030, One hundred year study on Artificial Intelligence", Stanford University, 2016, p. 9.



COMPUTER VISION

It is currently the most relevant form of machine perception. This is the AI sector on which the advent of deep learning has more impact.

Until a few years ago, support vector machines represented the most used method for visual classification activities. However, the evolution and low-cost availability of large-scale computing, the availability of large amounts of data and the fine-tuning of networks of neural network algorithms has allowed the AI to perform visual classification tasks better than human beings.



NATURAL LANGUAGE PROCESSING

Often associated with automatic speech recognition, it is a very dynamic sector in the area of machine perception. Research in this area is now focused on the ability to develop systems capable of interacting with people through dialogue and not with simple standard reactions.



COLLABORATIVE SYSTEMS

Research on collaborative systems investigates models and algorithms to support the development of autonomous systems that can collaborate with each other and with human beings.



CROWDSOURCING AND HUMAN COMPUTATION

Focused on the creation of innovative ways to exploit human intelligence.



INTERNET OF THINGS - IOT

Research focused on the idea that many devices can be connected and exchange information is becoming more and more substantial. In this area, AI can elaborate and process the huge amount of data resulting from these interactions.



NEUROMORPHIC COMPUTING

Traditional computers use von Neumann's architecture model (I/O, models, data and separate memory). With the success of the deep neural networks, alternative models are being developed, many of which are inspired by neural biological networks.

Source: AI takes center stage, Bot.Me: A revolutionary partnership, Pwc 2017

The main application areas

There are already examples of how PA can benefit from adopting AI solutions; among these we already see effects and applications in the health, education and judiciary system, in public employment, security and, in general, in the management of relationships with citizens.

In this latter field, Artificial Intelligence can be used to answer questions, to look for but also to process documents, fill in forms, to correctly route various types of requests or to perform translations¹⁷.

CHATBOT

For example, a chatbot equipped with AI can respond simultaneously to conversations that come at a given time, eliminating waiting times and, once having understood the needs of its interlocutor, can direct him to the right departments, help him find the documentation he needs, provide instructions to correctly submit his written requests, if necessary also speaking in a foreign language, or translating the bureaucratic terms that the user does not understand.

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In this way, public officials can be freed from the task of answering the simplest questions and tasks, which are often the most recurring, saving time to devote to other activities, to provide complex advice and better services.

Some of the functionalities described can also be used in healthcare, for example to manage examinations and tests more rapidly.

In this sector, research into robots that take care of patients is also very interesting, possibly memorising the medicines to be administered to them, the times and doses, or monitoring their state of health by means of biometric measurements to be transmitted to the doctor, even accompanied by a possible hypothesis.

Precisely this type of situation, which could lend itself to significant ethical and scientific controversies or to potential conflicts of interests between patients and doctors, highlights a focal point in which AI is excellently positioned, with its ability to create unprecedented interactions between administrative-technological systems and human beings.

¹⁷ Ref. Hila Mehr, "Artificial Intelligence for Citizen Services and Government", Harvard Ash Center for Democratic Governance and Innovation, 2017.

Moreover, it is already possible to imagine programming intelligent systems that read tests results and interpret them, based on the statistics conducted on large amounts of similar data and on their meaning¹⁸. There are even predictive tools to assess potential risks of evolution of individual diseases.

Precision medicine, research on personalized treatments, analysis on the possible effects of certain drugs on individual patients are all areas that promise great results, thanks to the ability of Artificial Intelligence to store and process a lot of information on patients; however, at the same time, they require careful monitoring by the medical community as well as strict observance of privacy and ethical and professional standards¹⁹.

USES OF ARTIFICIAL INTELLIGENCE

- | | |
|---|---------------------------------|
| ✓ STRENGTHEN IT SECURITY AND PRIVACY | ✓ IMPROVE HEALTH AND WELL-BEING |
| ✓ PREVENT TUMOURS AND DISEASES | ✓ INFLUENCE ECONOMIC GROWTH |
| ✓ MAKE MORE EFFICIENT USE OF CLEAN ENERGY | ✓ CONTRAST CLIMATE CHANGE |
| ✓ ENSURE GREATER FINANCIAL SECURITY | ✓ REDUCE INCOME DISPARITY |
| ✓ TRANSFORM GLOBAL EDUCATION | ✓ REDUCE GENDER DISPARITY |

Source: Artificial Intelligence and life in 2030, One hundred year study on Artificial Intelligence", Stanford University, 2016

Something very similar is happening in schools, where artificial teaching assistants are already available, able to follow students individually, suggesting content and concepts selected to help them develop their skills, deepen their knowledge, or bridge the gap with their fellow students²⁰.

These tools can be used by Public Administration for staff training, career management and internal organisation.

The security sector can also benefit from the development of Artificial Intelligence technologies. For example, in the surveillance field, with computer vision and natural language processing systems that can process large amounts of images, texts and speeches, to detect possible threats in real time.

18 Ref. IBM's "Watson for Oncology", imagined as a true oncologist's assistant in the fight against cancer.

19 For example, the paradox of automation: doctors could rely too much on the machine (that in psychological experience "never fails") and not take responsibility for a diagnosis different from that of the machine (that could be wrong, possibly because of a bug, a system error).

20 Ref. <http://www.lastampa.it/2017/06/15/multimedia/tecnologia/woogie-lassistente-robot-che-aiuta-i-bambini-a-studiare-e-non-solo-ZlrNV7rKtt3MqoKZ54U3uM/pagina.html>.

Or in the environmental disaster prevention field, where it is possible to perform simulations of the consequences of natural phenomena, both before and after they occur, as well as during their development, helping the authorities to decide how to intervene. Similar technologies can also be used by law enforcement agencies, to patrol cities, based on continuously updated data, linked to the crimes committed in the various areas and to other significant variables.

Finally, also public decision makers can use intelligent algorithms, capable of processing large amounts of data, for example on the resources available in disadvantaged areas, or on the progress of the various sectors - health, judicial, scholastic, agri-food, etc. - in order to obtain a clearer view of the choices they must or want to accomplish. It is possible, as they are experimenting in Japan²¹, that personnel in public offices respond in a personalised manner to all citizen requests, using adequately instructed Artificial Intelligence tools, which automatically produce the contents to be sent.

It will be up to the administrations to decide how to use the resources freed up by the introduction of these new technologies, in a range of options that include the qualitative improvement of services and the reduction of costs for their operation.

SECURITY

One of the main problems in all these areas is that of guaranteeing the security of the AI systems: entry of an attacker in systems that, for example, will be able to drive a bus, could jeopardize the lives of those on board, as too could tampering with the surveillance tools of a public place make it vulnerable to attacks, or knowledge, by a hacker, of the model used by the Artificial Intelligence for the management of sensitive data, could make such data insecure.

To effectively address these issues, it is necessary to put in place various solutions, some of a technical nature, others of a more general nature, raising awareness among citizens and administrations. From a technical point of view, it is important to work to ensure that, by law, certain standards are guaranteed, both for the security of the data used by the algorithms, as well as for the security of the algorithms themselves, imposing that, for their implementation, the security by design paradigm is always followed²².

²¹ Hila Mehr, Artificial Intelligence for Citizen Services and Government, Harvard Ash Center for Democratic Governance and Innovation, 2017, p. 8.
²² In essence, this paradigm requires that security be pursued already when designing databases and Artificial Intelligence algorithms.

The potential of AI in Public Administration

The potential of Artificial Intelligence for Public Administration is manifold. Nevertheless, the scientific community and public opinion highlight some critical issues that must be taken into account in order to prevent distorted effects in the application of these tools and technologies.

With reference to machine learning systems, it already happens today that both the data that an AI feeds on and the algorithms it consists of produce bias²³ - distorted interpretations of the information in its possession - affecting its "reasoning"²⁴ and leading it into error. Making predictions with inadequately designed tools can only lead to wrong and, in many cases, even ethically incorrect decisions²⁵.

Furthermore, it is worth pointing out that, currently, Artificial Intelligence is able to carry out, with a certain precision, a small number of cognitive activities²⁶ referring to specific sectorial domains, generally lacking background knowledge.

If correctly designed and implemented, AI technologies can in fact guarantee concrete prospects for improving the quality of life. In the relationship between citizens and public administration, they will be able to allow greater accessibility to public services, facilitating a substantial reduction in their costs, with benefits in terms of reduction of social spending, which can thus be reallocated. In perspective, it will be possible to enhance many procedures with adequate automation, offering citizens the opportunity to interact with the State in a more agile, effective and personalised way.

We will all benefit from this, including the elderly, the disabled and citizens belonging to the disadvantaged categories.

This will allow Public Administration to recover and strengthen the relationship of trust with the community. In order to encourage this recovery, introducing technologies such as AI in PA requires technical and administrative, but also systemic, narrative and aesthetic interventions, capable of generating meaning and involvement.

23 Ref. "Bias and inclusion", AI NOW 2017 Report, p. 14.

24 Ref. box di approfondimento in "Prevenire le disuguaglianze".

25 Ref. "Sfida Etica".

26 For further information <https://hbr.org/2016/11/what-artificial-intelligence-can-and-cant-do-right-now>.

PA may also use AI methodologies and technologies to support the rationalisation and integration of its databases, in a perspective of semantic interoperability that makes it easier to circulate information between administrations to the benefit of end users²⁷.

The enormous wealth of knowledge generated and collected over time in such databases is often “invisible”, because unstructured, dispersed in multiple archives and largely in the memory of people rather than of the organization. Making “invisible knowledge” visible is one of the potential and most promising areas of application of AI in the PA with solutions able to read and understand and classify the contents of documents and reports produced over decades to obtain the most relevant information.

AI will also affect the redefinition of the relationship between public and private with a view to greater transparency through the implementation of e-procurement practices. Among the areas that in the next decade will benefit from the AI revolution, in fact, will be precisely that of public procurement.

WHAT ARE THE POTENTIAL DAMAGES ASSOCIATED WITH IA SYSTEMS

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DIGITAL

- ✓ Automated phishing of fake emails, websites and links to steal information.
- ✓ Massive hacking, through the automated discovery of system vulnerabilities.
- ✓ Deceive AI systems by exploiting to own advantage the defects in the interpretation of reality by AI.

PHYSICAL

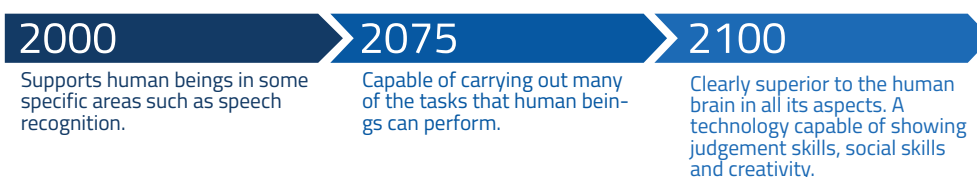
- ✓ Automated terrorism using drones or autonomous vehicles as weapons.
- ✓ Swarms of Robots trying to achieve the same goal.
- ✓ Remote attacks, made possible by the fact that autonomous robots can be controlled from any distance.

POLITICAL

- ✓ Propaganda, through images and fake videos that are easily generated.
- ✓ Automatic removal of dissent, thanks to the possibility to find, analyze and automatically remove texts and images.
- ✓ Personalized persuasion, with the use of public information to influence someone's opinion.

Source: AI experts list the real dangers of artificial intelligence, Dave Gershgorin Feb. 2018

FORESEEN DEVELOPMENTS OF IA

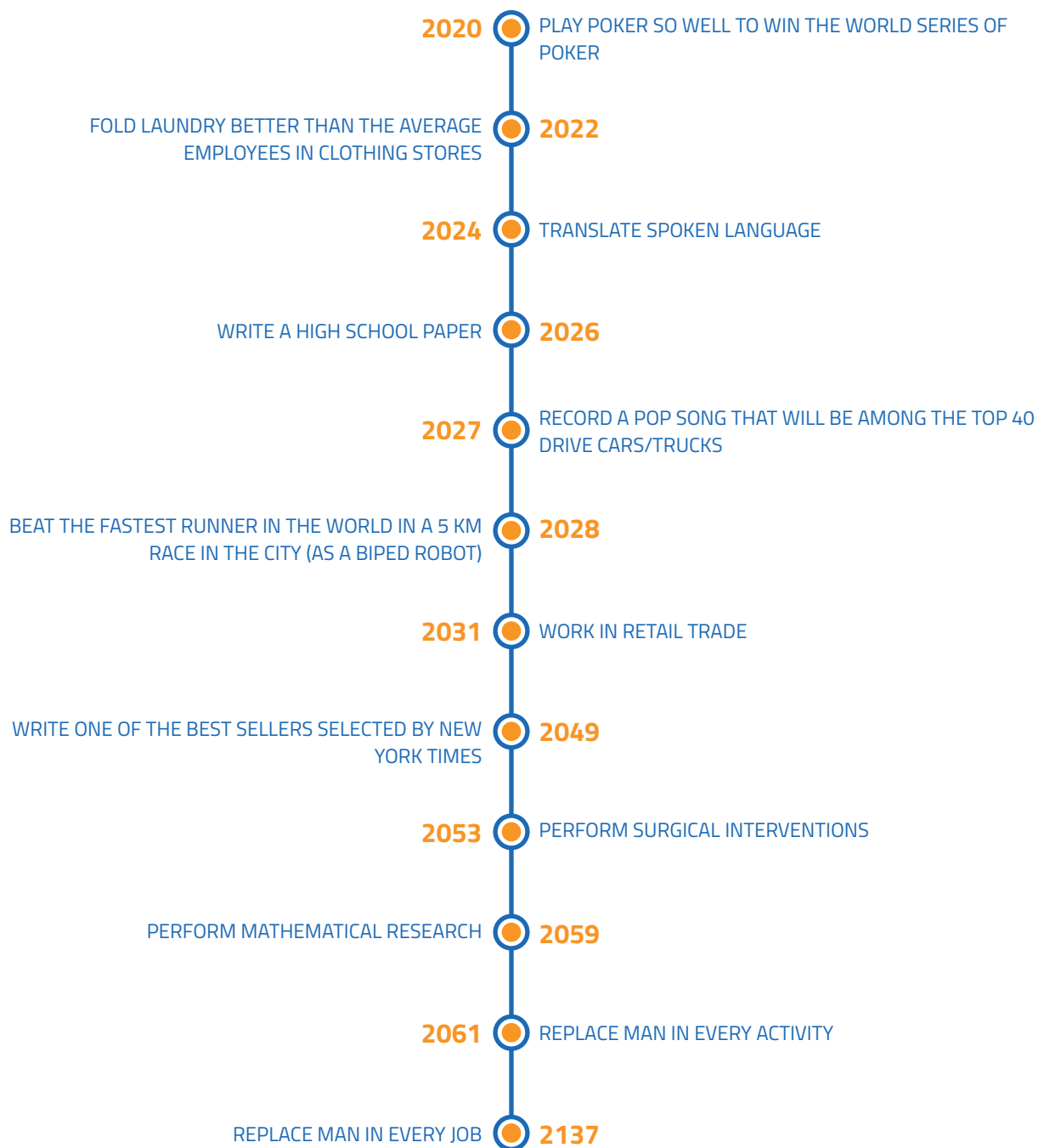


Source: Destination unknown: Exploring the impact of Artificial Intelligence on Government September 2017- Centre for public impact

²⁷ Ref. The interoperability model of the Three-Year Plan: <https://pianotriennale-ict.italia.it/interoperabilita>.

POSSIBLE PROGRESS OF ARTIFICIAL INTELLIGENCE

Progress in Artificial Intelligence could lead to the replacement of workers with more efficient robots in the future. We provide a time frame based on a survey conducted by a group of AI researchers with Katja Grace together with the Future of Humanity Institute at the University of Oxford. The survey identified the year in which AI-controlled technologies will be able to perform the following activities:



Source: When Will AI Exceed Human Performance? Evidence from AI Experts, May 2017, Katja Grace, John Salvatier, Allan Dafoe, Baobao Zhang, Owain Evans, Future of Humanity Institute, University of Oxford

Hypothetical scenario

Giulia, her father Tommaso and little Gaia are now fictional characters. We do not know yet if anyone will live their lives or some glimpses of them. What is certain is that Artificial Intelligence is changing our everyday life from all points of view.

How will our working days be in 5, 10 or 25 years?

What will our relationship be with the cities we live in with the consistent introduction of AI solutions?

Giulia has just turned off her computer. It is five o'clock in the afternoon and she has just gone through the exit turnstiles of the Ministry. It is Monday and she is running towards the bus stop. She cannot believe she is going home so early so that she can then go to that contemporary art exhibition that interests her so much. This is a very busy time for her both at work and at home. She has summarized thousands of questionnaires on behalf of the Ministry; the activity that once would have taken her entire afternoons over documents today has become a task that can be completed in a few days without too much effort.

Thanks to the online data processing platform to which she has access from her office, Giulia has managed to have an automatic summary of the documents on which she is working in less than a week. When she was hired about 15 years ago, a job like this would have taken twice as much, maybe three times as much for her and her colleagues.

Who would have thought that one day she, born in the age of analogical communication, and who has grown up with the Walkman and with books under her arm, could no longer do without algorithms?

Today, Giulia gets to the city avoiding traffic. Through an app installed on her mobile phone, the Municipality recommends what public transport to use to get home sooner and she can choose the least polluting solution. While she is sitting on the bus, Giulia is on the Facebook page of the Palazzo hosting the exhibition. She wants to know the exact opening time and if there is an area reserved for children at the venue.

She asks Marina, not a secretary but the museum chatbot that replies in real time from the display. "Science fiction" compared to when a few years ago, she had to go through many pages of Internet sites and telephone exchanges to obtain the simplest information.

Switchboards do not exist anymore.

Technology is an integral part of her life, it has simplified her work and brought the world closer. She knows very well that the algorithm universe needs to be ruled, since simplification and data usage have two different sides.

For the last weeks, they have been discussing at home and with the closest friends the situation of Giulia's father, Tommaso, who was diagnosed with cancer a few months ago.

A few hours after receiving the medical report, the hospital communicated the family that Tommaso would not be operated. Diagnostics has taken giant leaps, as well as study of genomes.

By querying data that was unknown to her family, doctors found out that Giulia's great-great grandfather and fourth grandfather had developed a similar disease due to a genetic disorder that is very hard to treat. "Even after surgical intervention, chances of recover are less than 30%" the computer sentenced.

The hospital will not embark on a path that algorithms define "too costly for the low probability of success".

Lights and shadows, but Giulia has almost arrived home. Her daughter Gaia and Stitch, a robot that has become her personal teacher and babysitter, are waiting for her. Stitch itself is a son of "Artificial Intelligence" and it deals with Gaia's education ever since she has joined the secondary school. It uses advanced learning techniques, which adapt themselves to Gaia's level, helping her reviewing the most difficult subjects and replacing Giulia during the after-school.

Giulia lives alone for most of the year and she has to combine her mother's role with her job, which is very demanding since she needed to specialise in tasks and duties that are different from those required for being recruited at the Ministry several years ago.

Giulia greets her daughter, she checks with Stich that the maths exercise is completed and that the homework has been done before she starts playing with Gaia.

Her smartphone rings, it notifies that she has to check questionnaires for her job.

It rings again, the exhibition is opening and the last bus to the kids' corner is arriving. AI has also changed her relationship with time and watches.

It rings again, this time it's a call, her mother. It is unexpected: in the algorithm time it is almost impossible to be late, but, you know, the mom is always the mom.

The challenges of AI at the service of the citizens

Artificial intelligence is the future, not only for Russia, but for all humankind. It comes with colossal opportunities, but also threats that are difficult to predict. Whoever becomes the leader in this sphere will become the ruler of the world.

Putin, in his official speech for the inauguration of the Russian school year in September 2017

China, Russia, soon all countries w strong computer science. Competition for AI superiority at national level most likely cause of the third World War.

Elon Musk, founder of SpaceX, co-founder and CEO of Tesla, responds on Twitter to Putin's message, September 2017



1 ETHICS

“ Ethics change with technology.
(Larry Niven) ”

The issue of Artificial Intelligence, as with the appearance and affirmation of every new technology, re-proposes the contrast between the “doom-mongers and enthusiasts”²⁸.

The **doom-mongers** fear that Artificial Intelligence will prevail over people, will decide for them, steal their jobs, discriminate against them, violate their privacy, and will secretly control them by conditioning their lives.

The **enthusiasts**, on the other hand, dream of a world where machines are capable of autonomously performing bureaucratic processes, of being used as powerful computational tools to process and interpret large amounts of data in the best way, replacing men in the most burdensome and repetitive tasks, and creating solutions able to diminish crime and eradicate diseases.

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DOOM-MONGERS

- AI will have the upper hand over people
- AI will decide for them
- AI will steal their work from them
- AI will discriminate against them
- AI will violate their privacy



ENTHUSIASTS

- AI independently conducts bureaucratic processes
- AI is a powerful calculation tool
- AI can replace men in the most demanding tasks
- AI can create solutions to reduce crimes
- AI can create solutions to eradicate diseases

Basically there are two perceptions of technology, of diametrically opposite sign.

That of the “**doom-mongers**”, negatively assesses the introduction of AI in Public Administration (PA), citing a series of critical issues that could have negative effects not only on the efficiency and effectiveness of the measures but also on citizens’ rights.

That of the “**enthusiasts**”, on the other hand, considers the use of AI to be extremely positive, believes that the implementation of these technologies can significantly improve not only the activity of the PA but also the quality of life of citizens and that a total and unconditional process of research and development is therefore necessary in this area²⁹.

²⁸ Ref. Umberto Eco, *Apocalittici e integrati*, Bompiani, 1964.

²⁹ The utopias of the “Californian ideology” (Richard Barbrook, *Imaginary Futures: From Thinking Machines to the Global Village*, 2007) are currently contrasted by the radical criticism of technological “solutionism” (Eugenij Morozov, *To Save Everything, Click Here. The Folly of Technological Solutionism*, 2013).

Two extreme points of view, each with different peculiarities, which must be critically analysed in order to resolve the weaknesses indicated by the “doom-mongers” and modulate the strengths sustained by the “enthusiasts”.

The examples mentioned above are not chosen by chance, but are the result of the debate that in recent years has been going on in the scientific community and in civil society regarding the impact of AI systems on our lives.

The ethical challenge of the introduction of Artificial Intelligence solutions is represented by the need to respond in a balanced manner to the polarisation of these two visions, integrating innovation and taking into account the effects that this has already had and will continue to have in the development of society, respecting and safeguarding the universally recognised core values.

The use of AI based on algorithms of data analysis in decision-making processes related to social, health and judicial issues (such as risk assessment) therefore requires a thorough reflection in terms of ethics and, more broadly, of governance.

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The algorithms for data analysis involve high costs that encompass the entire evolutionary cycle of their functioning: from implementation to evolutionary maintenance, to the verification of results and to the training of users who must use them responsibly. Speaking of greater efficiency or tax cuts thanks to the use of AI technologies in public services can be a misleading narrative register as a correct development of such tools implies high costs and great attention to the ethical aspects related to their use.

The focus on the functional development of this technology requires the economic and professional resources suitable for ethical development and above all in line with the data it processes and the decisions it guides. Otherwise, what will come out of the analysis will only help finance the private sector, with the illusion of helping people. Or, worse, to introducing a distortion or a flight of responsibility, from time to time referring the cause of decisional errors to the algorithms instead of the decision makers.

Capitalizing on the benefits of technology requires important investment on the part of the PA and a significant commitment to improve the quality and efficiency of services and to have systems that are secure and able to truly reduce inequalities.

Public Administration is therefore called upon to deal with numerous and complex ethical issues.

To understand its extent, it is possible to analyse those that represent the central elements in the public debate and in scientific analysis:

DATA QUALITY AND NEUTRALITY³⁰

Machine learning systems need data which is “annotated”³¹ by human beings (supervised learning) or at least selected and prepared (unsupervised learning).

This also includes errors or bias introduced, even inadvertently, by the designers, replicating them in all future applications. For example, datasets with bias they propagate the same evaluation errors in the meaning of an image or a concept, as happened, for example, with certain algorithms used to prevent crimes, in which the data was compromised by a historical series that emphasised ethnic differences³².

Or unbalanced datasets, that overestimate or underestimate the weight of certain variables in the reconstruction of the cause-effect relationship necessary to explain certain events and, above all, to predict them.

ACCOUNTABILITY E LIABILITY³³

The examples just mentioned highlight the strong impact that Artificial Intelligence has on the decision-making activity of public entities. Both when it acts as an assistant to human beings as well as an autonomous entity, AI generates effects on the lives of people in relation to which it is necessary to be able to establish legal liability.

Nevertheless, the ownership of the latter is not clearly identifiable, since it could be attributed to the producer³⁴ or to the owner³⁵ of the Artificial Intelligence, or even to its end user³⁶. Those who design AI systems can be responsible for design or implementation defects, but not for behaviour caused by inadequate instruction datasets.

Can a public decision-maker be considered politically responsible for the decisions made on the basis of algorithms that process data affected by the bias mentioned above? What type of responsibility can there be for Public Administration? If a robot hurts someone, who should be held responsible and who, if anyone, has the obligation to compensate the victim (and with which assets)? Can the public decision-maker transfer his political responsibility to an AI system that does not respond to a clear principle of representation? Is it ethically sustainable that, in order to improve the efficiency and effectiveness of measures, certain important choices can be made with the influence of an AI or even completely delegating them to the AI?

And in trusting an AI system, how can its consistency be controlled over time? These are just some of the issues that emerge in this area and highlight the need to establish some principles for the use of AI technologies in a public context.

30 Ref. “Data challenges”.

31 Data that is enriched with comments and metadata. For example, a caption can act as a description of an image.

32 Bruno Lepri, Nuria Oliver, Emmanuel Letouz, Alex Pentland, Patrick Vinck, “Fair, transparent and accountable algorithmic decisionmaking processes. The premise, the proposed solutions, and the open challenges”, Science business media, Springer, 2017.

33 Ref. “Legal challenge”.

34 There are neural networks whose calculation algorithms are not completely reconstructable, not even by their programmers, generating what is called the “black-box effect”.

35 What currently happens in the field of robotics.

36 With a parallel, we could cite the case of construction works. The builder bears full responsibility for the first years after the inauguration of the work, but then the responsibility passes to the person responsible for its maintenance.

TRANSPARENCY AND OPENNESS³⁷

The issue of the responsibility of public administration also has to do with the duties of the latter with respect to citizens, when it decides to provide them with services or to make decisions that concern them, using Artificial Intelligence solutions.

The functioning of the latter must meet criteria of transparency and openness.

Transparency becomes a fundamental prerequisite to avoid discrimination and solve the problem of information asymmetry, guaranteeing citizens the right to understand public decisions. It is also necessary to think about the policies chosen to determine the benchmarks (benchmark policy) to avoid effects of a larger scale: as an administrator can act in a non-transparent manner by pursuing not the common good but private interests, a non-transparent algorithm could realize the same offenses even more broadly, producing not only injustices but also social discrimination.

PROTECTION OF THE PRIVATE SPHERE³⁸

A further need, closely linked to the previous one, is to protect the data of individuals. PA must design services based on AI able to guarantee efficiency and prompt response, but also protection of citizens' sensitive data.

This requirement, strictly connected to the legal context, has some ethical peculiarities concerning the use that PA can make of the data that has come to its knowledge in contexts different from those in which it was collected.

Is it ethically sustainable that PA, through the use of data collected for other purposes, takes action based on the new derived information? Is it ethical to use this data to feed predictive systems?

To address these challenges, it may be helpful to follow some general principles.

Among these we can mention the need for an anthropocentric³⁹ approach, according to which Artificial Intelligence must always be put at the service of people and not vice versa⁴⁰.

Moreover, there are principles of procedural (non-arbitrary procedures), formal (equal treatment for equal individuals or groups) and substantial (effective removal of economic and social obstacles) equity, as well as the satisfaction of certain basic universal needs, including respect for the freedom and rights of individuals and the community⁴¹.

These and many other aspects related to the need to place AI at the service of people in every context are analysed in subsequent challenges.

37 Ref. "Legal challenge".

38 Ref. "Legal challenge".

39 Ref. http://www.g7italy.it/sites/default/files/documents/ANNEX2-Artificial_Intelligence_0.pdf.

40 Necessary, paraphrasing Kantian thought, that AI "treats man always as an end and never as one of the means", Immanuel Kant, *Fondazione della metafisica dei costumi*, 1785.

41 Ref. <https://medium.com/code-for-canada/responsible-ai-in-the-government-of-canada-a-sneak-peek-973727477bdf>.

2 TECHNOLOGY

“ If a typical person can do a mental task with less than one second of thought, we can probably automate it using AI either now or in the near future. ”
(Josh Lovejoy)

Although Artificial Intelligence (AI) is currently not able to reproduce the complex functioning of the human mind⁴², but only approximate some limited abilities⁴³, it is a discipline which, acquired over sixty years of scientific, methodological and technological research, has become pervasive in industry and society. Its models and methods can certainly be conveniently used as tools for the implementation of innovative solutions in complex socio-technical systems, such as that of public administrations, provided that, together with the opportunities, the limits of their scope of application are understood.

The new frontiers of particular interest for Public Administration are those related to studies and research on how AI systems are able to cooperate in the most effective way with human beings.

This approach exploits AI machine learning and adaptation capabilities to provide a human-machine interaction that best meets the needs of users, their interests and the real context in which they operate.

Therefore, it becomes important to conduct research consisting of methodological investigation, modelling, implementation and testing of Artificial Intelligence systems for various domains of interest to PA.

Linguistic technologies (Natural Language Processing - NLP) are certainly of great interest and are the basis of a large number of applications that fall within Artificial Intelligence. The deployment of these technologies, based today to a large extent on Open Source software, requires the availability of specific text datasets (ex. annotated corpora), lexicographical and semantic (ex. wordnet), as well as the dissemination of specialized skills necessary to manage training and adaptation processes to various areas of application (ex. health, justice, finance).

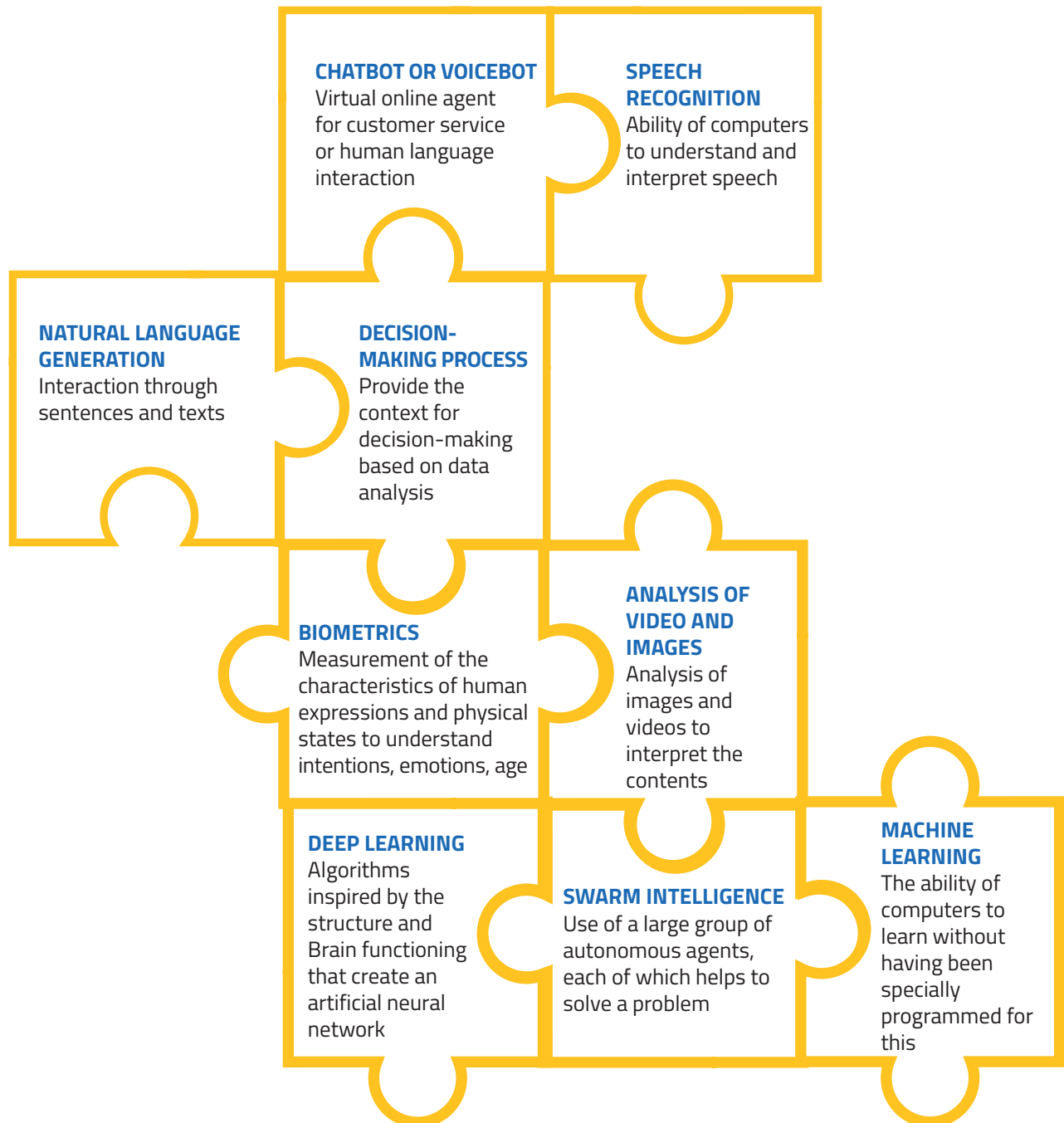
The lack or unavailability of adequate resources for the Italian language, together with a lack of skills in the use of NLP technologies, could cause both a loss of competitiveness compared to other nations, and a dependence on platforms and solutions provided by a restricted number of subjects operating under monopoly conditions.

The distinctive characteristics of the “technological challenge” can therefore be identified by two keywords: “personalisation” and “adaptability”.

⁴² Research on so-called Full Intelligence and Strong AI, in terms of both Neuro Evolution (NE) and Brain Intelligence (BI), is still in its infancy.

⁴³ Typically, those that do not require more than one second to provide a response to an external stimulus.

MAIN TECHNOLOGIES CLASSIFIED AS AI



In fact, the overcoming of this challenge means to be able to create PA systems and services modelled on the multiple needs of citizens, able to evolve with them, able to encourage personalised experiences.

This issue can be approached analytically by linking the most developed sectors and technologies in the field of Artificial Intelligence with the activities and tasks typical of Public Administration.

The areas of use of “intelligent” technologies⁴⁴ in Public Administration are innumerable, not only from a long-term perspective, but, in certain cases, even in the current situation.

For example⁴⁵ here we can mention:

HEALTHCARE SYSTEM

diagnostic tools able to assist in the analysis of reports; integration of different sources and data merging; epidemiological analysis to identify public health risks early; instant translation services to facilitate hospital and territorial medical visits to foreigners; predictive tools to evaluate potential risks of disease evolution or to evaluate the effectiveness of therapies; patient assistance tools, able to follow them during treatment; precision medicine, for the identification of personalised treatments; better logistics organisation of healthcare structure activities.

CITIZEN RELATIONS

in the simplification of procedures and in order to obtain a two-way communication between PA and citizens and a personalised interaction in which citizens have all the necessary support to satisfy their most varied needs.

JUDICIAL SYSTEM

simplification of legislation; fraud identification; fight against corruption and crime, especially organised crime; reduction of civil litigation through easier access to legislation and jurisprudence; digitisation of documents and understanding of the text and information present.

SCHOOL SYSTEM

automatic evaluation tools; personalisation of teaching material; automated tutoring, by means of recommendation tools to maintain attention; suggestions concerning personalised variations to be introduced in the school programme; extraction of predictive indicators for school drop-out risk.

⁴⁴ Ref. the technologies listed in chapter 2.

⁴⁵ Ref. “Challenge reduce inequalities”.

SECURITY

AI amplifies the integrated impact of publicly available structured and unstructured data, thanks to which it can support advanced forms of management and prevention in the policing field.

PUBLIC EMPLOYMENT AND PLACEMENT

organisation of employees and careers; career counselling and management of internal processes and documentation.

MOBILITY AND TRASPORT

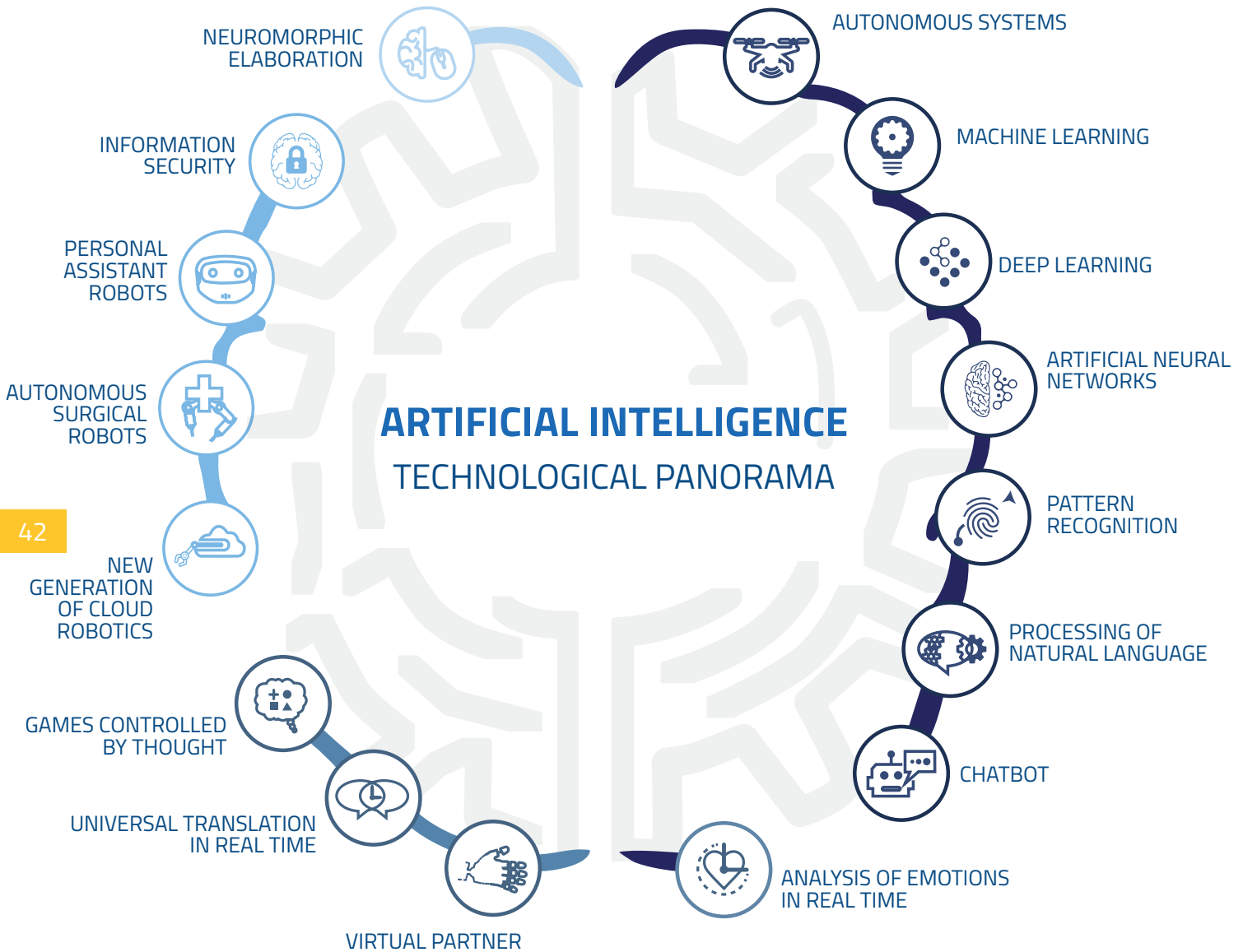
traffic management, traffic and pollution predictive models, management of public transport logistics, but also autonomous transport solutions; real-time monitoring of sensor data.

TAX SYSTEM

application of AI techniques to identify cases of potential tax avoidance and evasion through the analysis and crossover of data from different sectors of the state;

ENVIRONMENTAL MONITORING

the use of machine learning algorithms on 5G wireless sensor data (ex. video cameras, radioactivity detectors, chemicals, temperature, brightness, humidity, etc.) could allow monitoring and intercepting critical events in the territory (ex. automatic search of events on video surveillance data combined with chemical detection analysis to identify eco-crimes such as spills of harmful substances, similarly possible to define indicators for fires, floods, collapses, etc.).



AVAILABLE TECHNOLOGY

- Now
- 1-2 years
- 2-4 years
- > 4 years

Source: Callaghan Innovation 2017, Frost & Sullivan "Artificial Intelligence- R&D and Applications Road Map" (Dec 2016), Harvard Business Review- The competitive landscape for Machine Intelligence (Nov 2016), Shivon Zilis and James Chan "The State of Machine Intelligence, 2016" (2016), Stanford University, "Artificial Intelligence and Life in 2030" (2016)

BORBOT PROJECT

Project: virtual assistant to support customer service staff

AI technology used: question answering

Public entities involved: National Museum of the Royal Palace of Caserta

The Borbot project, which stands for Borboni and Robotics, was launched in 2017 by the National Museum of the Royal Palace of Caserta. It is a virtual assistant, present on the Museum's Facebook page, which through question answering is able to respond to users' questions, providing detailed tourist information and news on the monument.

In a month, the system was able to perform an average of 20 thousand interactions, supporting the Museum's front office service and allowing the customer service staff to focus on services with greater added value.

Website: <http://borbot.it/>

DECISION SUPPORT SYSTEM FOR CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Project: remote monitoring system for patients suffering from COPD

AI technology used: machine learning

Public entities involved: Unit of Processing Systems and Bio-IT of the Bio-Medico Campus of Rome, Polyclinic University Bio-Medico Campus of Rome

The Polyclinic University Bio-Medico Campus of Rome has experimented on a group of 22 patients with COPD the use of a home remote monitoring system capable of detecting potentially dangerous events for patients.

Developed by the Unit of Processing Systems and Bio-IT of the Bio-Medico Campus of Rome, it works through AI techniques of machine learning and acquires three times a day heart rate data and haemoglobin saturation through a pulse oximeter connected to an app specifically designed for smartphones. This way, the system evaluates any dangerous situations for the patient and signals them to the healthcare unit.

The experiments on the data collected show that the recognition performance of potentially dangerous events of the system are better than those obtained by medical experts. Furthermore, the support offered by the system in the decision-making process allows increasing agreement among specialists.

Website: www.unicampus.it/ricerca/unita-di-ricerca/sistemi-di-elaborazione-e-bioinformatica



SKILLS

“ We cannot teach our kids to compete with machines. Machines are faster, do not get tired, do not become angry. We have to teach our kids something unique. In this way, in thirty years' time, they will have a chance.
(Jack Ma) ”

While all of us in everyday life are beginning to come across Artificial Intelligence tools (e.g. chatbots, virtual assistants and automated traffic calculation and management systems), there is a different familiarity in its use in professional contexts or in Public Administration⁴⁶.

The world of work is impacted by a profound transformation and in we will soon see an evolution of professions: there will be new ones, while the existing ones will be extensively modified with the introduction of new processes and methodologies⁴⁷.

It will be necessary to ensure that people are able to design and develop AI systems and applications, also in direct and deep collaboration with research and major technology operators.

In the same way, it will be of fundamental importance to cultivate and develop the skills necessary for the interaction between human beings and AI, which will become increasingly complex by virtue of the possibility of touching the language, gestures, body, emotions and many other expressive dimensions of mankind⁴⁸.

The consolidation of skills is therefore crucial to be aligned with the great technological and socio-economic changes that the world is about to face, in order to be able to prepare young generations, but also adults, to seize future challenges.

How are these skills enabled? There are several areas to act on: that, more specifically, of training public and private workers, on both the demand as well as the supply side, the more general, but not less important, aspect of the literacy of everyone in order to fully exploit digital services, and the most advanced aspect of specialized and trans-disciplinary training.

⁴⁶ Hila Mehr, "Artificial Intelligence for Citizen Services and Government", HARVARD Kennedy School ASH Center for Democratic Governance and Innovation, 2017.

⁴⁷ Carl Benedikt Frey, Michael Osborne, "The Future of Employment: how susceptible are jobs to computerisation?", The Oxford Martin Programme on Technology and Employment, 2013.

⁴⁸ Ref. Challenge 9 "The human being".

In the second area, that of literacy, it is important to help people understand what Artificial Intelligence is and what benefits it can actually make and what risks it entails, in order to enable them to make the best use of the services offered, inculcating a positive and optimistic approach in the collective imagination avoiding the rejection of the unknown⁴⁹.

Furthermore, since the relationship with AI largely takes place through natural interfaces - such as speech, written text and gestures - it is necessary to "educate" citizens with the aim of reducing the access gap to such technologies.

This latter point, of course, primarily involves the school system, which must take into account the changes described in order to make the training of citizens and workers of the future effective.

Currently, and probably still for many years, Artificial Intelligence will be able to perform rather simple tasks.

Already today, however, it is important that the school system and the university system enable students for the future in which they will live as adults, therefore developing problem solving and information analysis and synthesis skills, as well as those of formulation of independent opinions, creativity, empathic interaction and refined use of one's sensory and psychomotor capacities, areas in which it will be difficult for machines to compete with human beings.

It clearly emerges that knowledge models based mainly on the memorisation of notions and information that have not been analysed or briefly elaborated and organised, and teaching methods that prioritise the quantity of knowledge acquired rather than the critical education of the student, are destined to progressively lose importance.

Regarding the third area, that of specialist and trans-disciplinary training for public and private professionals who intend to work in the AI sector, it is important to prioritise training in multidisciplinary contexts, providing them with the skills that are fundamental to fully understand the meaning of the solutions that will be developed from time to time and which will be destined to have an impact on people's lives.

⁴⁹ Ref. Challenge 9 "The human being".

At the moment, in addition to technical experts in specific disciplines such as machine learning and data science, of fundamental importance will be transversal figures such as psychologists, anthropologists, sociologists and humanists in general, able to improve the interaction between AI and its users, fully understand how the latter can be inserted in the various contexts of everyday life, improving its conditions, and establish meaningful interconnections between disciplines, so as to be able to create new generations of designers who are able to create systems of technological excellence that are also able to generate meaning and a tangible increase in economic, cultural, social and psychological well-being.

There is currently a disproportion between the demand for specialist figures in the fields of advanced technologies and the availability of adequate skills therefore, the private sector is willing to pay very high salaries in order to compete in the innovation market with the contribution of the best talent.

PROFESSIONS THAT DID NOT EXIST 10 YEARS AGO

- | | |
|---------------------------------|-----------------------------------|
| ✓ DEVELOPER OF APP | ✓ CLOUD COMPUTING SERVICES EXPERT |
| ✓ ADMISSIONS CONSULTANT | ✓ SOCIAL MEDIA MANAGER |
| ✓ MILLENNIALS GENERATION EXPERT | ✓ MARKET RESEARCH DATA MINER |
| ✓ USER EXPERIENCE DESIGNER | ✓ DATA SCIENTIST |
| ✓ CHIEF LISTENING OFFICER | ✓ DATA ARCHITECT |
| ✓ SUSTAINABILITY EXPERT | ✓ DATA VISUALIZER |
| ✓ ELDERLY ASSISTANCE EXPERT | ✓ DATA ENGINEER/OPERATOR |

Source: Forbes, Megan Casserly 2012

A challenge of PA will be to be able to retain researchers and professionals, albeit not being able to compete with the salary levels offered by the private sector⁵⁰.

The skills in administrations are in fact a determining factor for the balanced introduction of new technologies, for which it is important that the administrations are not dependent on suppliers.

Therefore, with a view to developing skills, permanent and specialist training mechanisms will be required at all levels. It is necessary to integrate the debate on the replacement of the workforce with an analysis of the new market needs and how the improvement of the skills of workers adequately trained on issues of AI can impact the quality of services and solutions offered by the market and the Public Administration.

From a training point of view, regardless of the educational or professional level, the integration of AI in learning programmes can contribute to increasing human abilities, supporting decision making and facilitating the possibility of engaging in more specialised or more creative activities.

One of the objectives of Artificial Intelligence applied to cognitive systems is precisely that of increasing human abilities. Therefore, It is necessary to develop a profound awareness of the implications of the inevitable programming and calibration errors of such systems, that in exalting some aspects of the information available could inadvertently deform the importance or meaning.

From this point of view, Public Administration must become an “innovation gym”: just as, thanks to the Industry Plan 4.0⁵¹, companies know they have to implement resources and skills to keep up with the market, also PA, if it does not want to lose in capability, competitiveness and attractiveness, will have to envisage a plan to expand the skills of public employees and innovate digital services⁵².

50 Cade Metz, “Tech Giants are paying huge salaries for scarce AI talent”, The New York Times, 22 10 2017.

51 Ref. <http://www.sviluppoeconomico.gov.it/index.php/it/industria40>.

52 With this in mind, it will be essential to focus not only on training/updating of personnel but also on the ability to attract and retain resources with skills that can support the adoption of AI solutions in the public sector.

4 ROLE OF DATA

“Artificial Intelligence will be greater than electricity and fire.”
(Sundar Pichai - CEO Google)

Artificial Intelligence (AI) techniques and tools are benefiting today from the enormous amount of personal and environmental data that is registered daily by IT systems. The quality and interoperability of this data are a determining factor for the possibility of applying new technologies.

Among the main AI techniques that can be used to process such data, for example, is that of so-called supervised learning. In this case, the data must be “annotated” by humans who teach the machines how to interpret it. This operation is very onerous since it requires a conspicuous and complex amount of human work. In addition to the long time necessary to perform this annotation work, the discretion of the annotators could generate uneven datasets (i.e.: similar data annotated in a different way), weakening the operation of machines and propagating errors and biases⁵³.

The challenge associated with the role of data is therefore the creation of conditions, including organisational conditions, which allow Artificial Intelligence to use correctly created databases, where consistency, quality and intelligibility are guaranteed.

In the Internet of Things field, one of the main challenges to be addressed is that the data collected by interconnected devices and sensors is different from that with which the scientific community of data-scientists has had to deal with in the past. In fact, the greatest successes that have been achieved in the AI field regard applications such as image processing, autonomous driving and web search that have been made possible thanks to the availability of large and relatively structured datasets, able to be used therefore in training machine learning algorithms.

On the contrary, data coming from a multitude of connected devices can be fragmented, heterogeneous and distributed irregularly in space and time: a challenge of rare complexity for anyone who wants to analyse data in a structured manner.

A second area of discussion is the management and research of data published on the web in the form of linked open data⁵⁴. This data, which may regard both the institutional task of a public body (e.g. land registry or administrative data) as well as its operation (e.g. internal data) is made accessible and usable through open formats. While representing a mine of information, the data needs adequate tools to be exploited to its full potential. In particular, information retrieval⁵⁵ and filtering models and methods are needed based on semantic technologies and shared ontologies.

⁵³ Ref. the “Ethical Challenge”.

⁵⁴ Ref. https://www.w3.org/egov/wiki/Linked_Open_Data.

⁵⁵ Information Retrieval: the set of techniques used for the targeted recovery of information in electronic format.

This work, already envisaged by the the Digital Administration Code (DAC) and launched within the scope of the activities of the Digital Team, will be part of the broader perspective of conceptual governance of public information assets.

Regarding the huge data assets of the Public Administration, the challenge that AI technologies allow to face is that of transforming such data into widespread and shared knowledge, such as to make the Public Administration transparent to citizens and above all to itself, guaranteeing to citizens and administrators not only semantic access to information and interoperability of processes, but a better understanding of the relationship between state and citizen.

Once the conditions for the proper functioning of the Artificial Intelligence methodologies have been created, one of the tasks of Public Administration will be to aggregate the data necessary to support process improvement. This could be achieved through the creation of an open platform for the collection, generation and management of certain types of data, directly related to Public Administration⁵⁶. The decentralised use of public datasets, essential for the development of active participation practices (civic activism), in turn requires specific capabilities of governance of the socio-technical system of Public Administration. It is in fact essential that data quality is ensured at source, through the generalised adoption of guidelines and appropriate content standards.

To achieve these ambitious objectives, there are many issues to be addressed, including some that have been appearing in the e-government plans of developed countries for many years.

ISSUES TO BE FACED

- ✓ truthfulness and completeness of data
- ✓ data distribution and access methods
- ✓ design and definition of shared ontologies
- ✓ supervision of public dataset quality
- ✓ estimate of the economic value attributable to the data
- ✓ tools that allow citizens to monitor data production
- ✓ management and promotion of data access⁵⁶
- ✓ regulation of data usage⁵⁷.

The last three items of the list just presented introduce a further issue for PA: making sure that anyone who wants to develop Artificial Intelligence solutions useful for citizens can have equal and non-discriminatory access to the necessary data.

⁵⁶ Ref. https://pianotriennale-ict.readthedocs.io/it/latest/doc/09_data-analytics-framework.html.

⁵⁷ For example, "grand challenges" can be called. Those organised by NIST on Speech Recognition and Machine Translation, by DARPA on Autonomous Vehicles, or by ImageNet on Vision are famous.

⁵⁸ Ref. <http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32016R0679>.

SMART PLANNER SYSTEM

Project: Support for sustainable mobility policies

AI Technology used: Automatic planning through algorithms

Public entities involved: Bruno Kessler Foundation, Municipality of Trento, Municipality of Rovereto, Municipality of Bologna.

The Smart Planner system was realized by the Bruno Kessler Foundation.

It currently has about 15 thousand users and is used by the Province of Trento, the Municipality of Rovereto and is being tested in the Municipality of Bologna to support sustainable mobility policies. The system, released under an open source license, is based on automatic planning AI techniques and is able to suggest to users that connect through an app from their smartphone the quickest and most ecological solutions to get to a certain destination of the city. Through the analysis of data intercepted by multiple sources, the app provides personalized indications on which public, private or shared means of transport should be used to reduce polluting emissions and travel times. In 2016, 30% of those who used the app got to the city with means of transport that they had never used before.

Website: www.smartcommunitylab.it/

DANTE H2020 PROJECT - Challenge 4

Project: automatic data mining and analysis solutions to understand how terrorist networks work

AI technology used: web mining

Public entities involved: Ministry of Defence - General Command Arma dei Carabinieri

The Dante - DETecting and ABalysing TErrorist project related to online contents and financial activities - is funded by the European Commission under the European H2020 Program, Challenge of Secure Societies and involves 18 European countries, including Italy that participates with the Ministry of Defense and with the General Command of the Carabinieri. Through the project, an automated system of extrapolation of data from unstructured sources has been implemented, which works through AI methods and techniques applied to web mining, able to identify, retrieve, collect and analyse large quantities of heterogeneous content and in more languages both on the plain web and on the dark and deep web to trace the operations of the terrorist networks, in particular financing, training and propaganda activities. This system allows to greatly improve and make more accurate the investigation techniques of law enforcement on terrorism and to trace information even on channels that are traditionally more difficult to investigate, such as the dark web.

Website: www.h2020-dante.eu/



LEGAL CONTEXT

“ Whether our ethical substratum is Western (Aristotelian, Kantian), Oriental (Shinto, Confucian), African (ubuntu) or attributable to any other tradition, creating autonomous and intelligent systems that explicitly respect the inalienable human rights and cultural values of users, it is possible to give priority to the improvement of human well-being as a parameter for progress in the “algorithmic age”. *(Fabiola Giannotti)* ”

When it comes to regulating the activity of Public Administration, one of the fundamental problems is the balance between the interests of the community and those of the individual. In the field of Artificial Intelligence (AI), ensuring this balance is particularly complex. The most advanced AI techniques require huge amounts of data to be effective. There is therefore considerable economic interest in collecting sensitive data and it is necessary to analyse some of the main legal issues that may concern AI. Among these: the principle of transparency of administrative acts, legal liability, privacy, information security and intellectual property⁵⁹.

Within the scope of Public Administration activities, the principle of transparency is cardinal and therefore must also inspire the design of new public services based on AI solutions. For this purpose, the criteria to be used undoubtedly include transparency of the algorithms, the construction logic of the databases on which they operate and defining the related responsibilities⁶⁰.

today, AI algorithms can directly influence public assessments and decisions Already, as well as the administrative procedures themselves. This poses a problem of accountability, i.e. verifying the actual legal liability upstream of certain decisions or results, posing a series of challenges for Public Administration:

- ✓ find methods that are uniform and compatible with the current system so that the administration can justify its actions, also in the part processed by AI systems.
- ✓ indicate the data sources that feed AI and through which it has made its assessments, and make the managers of administrative procedures aware of the processing methods used by AI systems.

To ensure utmost transparency, citizens must be enabled to understand through which path the AI system has reached a certain result⁶¹, in a sufficiently clear way to possibly recognize a calculation error and to intervene to correct it.

⁵⁹ Ref. the “Ethical Challenge”.

⁶⁰ For this purpose, the Digital Administration Code (DAC) has established the figure of the digital ombudsman, to whom citizens can send reports and complaints in case of non-compliance or violations related to the use of digital systems by public administration.

⁶¹ Jurisprudence has already established that - in the case in which algorithms are used for administrative activities - the right of access to the algorithm must always be guaranteed (Ref. sentence TAR Regional Administrative Court Lazio-Roma, Sect. III-bis, no. 3769/2017).

The use of sensitive data by Public Administration AI systems can compromise citizens' right to privacy, as well as certain fundamental rights of the individual, in the event that the data collected is used to forecast events of social interest, from traffic management to crime prevention. One of the challenges is to avoid that the use of data by PA generates pervasive social control in contrast with fundamental citizens' rights⁶².

As for the possible "threat" of the right to privacy, it may be necessary to implement certain principles and tools present in the European General Data Protection Regulation (GDPR), such as the Data Protection Impact Assessment and Privacy by Design. The former requires those who use IT tools that may violate the right to privacy to make a prior assessment of the impact of these technologies on the protection of personal data. The latter is based on the idea that the rules on the protection of personal data must be already incorporated in the software design phase, ensuring that the identification data of citizens is anonymous or covered by pseudonym, reduced to the minimum necessary and that its use is limited to specific purposes.

The challenge is clearly to find a balance between the effective use of Artificial Intelligence at the service of citizens and respect for their right to privacy, giving them the opportunity to express their informed consent to the processing of data by intelligent systems.

To ensure that the AI solutions acquired (or developed) by the Public Administration comply with the provisions of the current regulations, it is necessary to carefully monitor the procurement procedures for goods and services. In particular, it is appropriate that - before the decision to contract - the administration proceeds to the comparative verification of the solutions available on the market, possibly proceeding to appropriate consultations. Furthermore, it is recommended that - in the event of a tender - the requirements and characteristics of AI solutions are precisely defined, with particular reference to compliance with applicable laws, so as to always guarantee the legitimacy of the administration's activities.

GDPR

The provisions of the GDPR regulate both the responsibilities of the controller and the rights of the party subject to personal data processing. Regarding AI, the GDPR applies when technological systems are developed using personal data, and if exploited to make decisions that concern people.

Article 5 of the GDPR summarizes these principles and states that data must be:

- processed in a lawful, transparent and fair manner (principle of legality, fairness and transparency);
- collected and used for a specific and explicitly stated reason (principle of purpose limitation);
- adequate and limited to the purposes for which it is processed (principle of data minimization);
- correct and updated (principle of accuracy);
- not archived identifiably for longer than necessary (principle related to the data retention period);
- processed in such a way as to guarantee adequate protection of personal data (principle of integrity and confidentiality)

⁶² Ref. the "Data role challenge".



ACCOMPANYING THE TRASFORMATION

“ If a typical person can do a mental task with less than one second of thought, we can probably automate it using AI either now or in the near future.
(Andrew Ng) ”

Artificial Intelligence (AI) is both a technological and social innovation, since it brings with it all the benefits and complexities that can radically transform society, including the public sector. An innovation, therefore, that can contribute to improving the quality of the services offered and to reinforcing the relationship of trust between administration and citizen.

The opportunities offered by the AI concern both the increase in efficiency of administration operations and user satisfaction. To exploit them to the fullest and to ensure that citizens fully understand their advantages and potential, it is also necessary to deal with issues concerning governance, the use of new technologies and the ability to manage data.

An aspect not to be underestimated in our country is related to the existence of a full-bodied role of “intermediaries” in the relationship between citizens/businesses and the Public Administration, combined with a culture of “delegation” that often introduces a real barrier in the relationship between users and institutions.

In this sense, it will be desirable to invest heavily in the cultural change necessary to create a substrate on which to reposition, in the key of simplification and use of digital, the new relationship between citizens/businesses and the Public Administration.

Furthermore, the transformation process we are witnessing involves the creation of a culture within Public Administration that includes capacity building activities, both with respect to the presence of a leadership that promotes the use of artificial intelligence, as well as the capacity of public officials to implement them.

Within the scope of public services, AI can be used to optimise the internal resources of PA to increase the use of online services, supporting, for example, a series of activities such as:

- completing complex tasks;
- dispatching citizens' requests and answering their questions;
- effectively managing large amounts of data;
- combining information from different datasets;
- providing faster answers based on predictive scenarios;
- automating repetitive processes;
- analysing data that includes text/audio and video information⁶³.

⁶³ Hila Mehr, “Artificial Intelligence for Citizen Services and Government”, HARVARD Kennedy School ASH Center for Democratic Governance and Innovation, 2017.

TYPES OF PROBLEMS OF THE PA THAT CAN BE SOLVED BY AI APPLICATIONS

DISTRIBUTION OF RESOURCES

- Executions of activities are slowed down without the necessary administrative support.

LARGE DATASET

- Datasets are too large for employees to work efficiently.
- Results and knowledge could improve by combining internal and external datasets.

LACK OF EXPERTS

- Answering even the simplest questions, takes the time of experts.

PREDICTING SCENARIOS

- The prediction of possible scenarios requires long work on historical data.
- The inability to predict increases the response time for the most urgent questions.

PROCEDURES

- Tasks are repetitive by nature.

DISSIMILAR DATA

- Data includes various information: visual/spatial and auditory/linguistic.
- Qualitative and quantitative data must be summarized on a regular basis

Source: Artificial Intelligence and life in 2030, One hundred year study on Artificial Intelligence", Stanford University, 2016

Finally, the integration of AI can contribute to increasing the capacity of public employees, as a tool to support decision-making and without ever replacing human judgment. The immediately perceptible benefit, together with the possibility of having systems that learn to accompany decisions in an accurate and personalised way, is the possibility of saving time for employees who can dedicate themselves to more specialised activities or that require greater creativity and empathy. In this way, services become more efficient, relations with citizens are improved and the level of trust in institutions is increased.

The introduction of AI in people's lives requires the design of processes that facilitate the understanding and acceptance of technologies by the user, not only through the use of experimentation but also through collaboration mechanisms that allow citizens to participate in the design of AI platforms.

Thanks to the co-creation approach, as happens in design thinking, users perceive technology as their own and show a greater propensity to use it. Moreover, where issues or problems in its use are found, citizens show a greater propensity to actively participate in their solution⁶⁴.

In facilitating the vicinity and engagement of citizens towards new AI-based public services, design itself plays a key role. In fact, it represents the meeting point between technology and people.

Designers will have to design interfaces that do not just mimic human actions, since this mechanism can generate alienation, but that are able to establish a relationship of trust with citizens, using a language that is understandable and that puts them at ease⁶⁵.

The challenge will be to build flexible systems able to provide answers that adapt to the user's contingent needs, thus ensuring better and more efficient services. A peculiar characteristic of AI is indeed that of correlating continuously evolving data coming from multiple sources and extracting dynamic response models from it.

Another area on which the designers will have to focus will be the design of AI systems able to anticipate the needs of citizens without having an invasive approach that could compromise the user experience.

Another crucial element for introducing AI in a structured manner in the administration concerns the ability to manage data and to exploit the great wealth of information that PA possesses, facilitating not only interoperability, but also transparency and reliability.

In light of this, it is desirable that the application of AI technologies to public administration aims at adopting shared ontologies in line with the internal organisation of PA and with the types of services to be provided, developing controlled vocabularies able to interpret and interoperate the databases of national interest to the fullest⁶⁶.

In this regard, knowledge, representation, and self-learning systems can be a valuable aid in increasing the accountability of the models. The adoption of collaborative methods can further ensure that the models adopted are compatible with PA and remain consistent with the regulatory framework.

64 Medium, "The role of design in collaborative AI", 4-11-2017.

65 Medium, "Human Design for Artificial Intelligence and Agents", 19-10-2017.

66 Ref. http://pianotriennale-ict.readthedocs.io/it/latest/doc/04_infrastrutture-immateriali.html.

In addition to the potential described above, some criticalities in the adoption of AI in the public sector can be identified: in general, AI systems can be implemented successfully only if high data quality is guaranteed.

In terms of governance, the transformation process we are witnessing also involves the evolution of relations between public and private players.

Benefiting from AI in public services does not necessarily mean developing new solutions from scratch. On the contrary, it is possible to look at what has already been adopted by other governments, or draw on technologies already established on the market.

Area of collaboration between the public and private sectors is that of procurement. In this sense, AgID, for example, has recently started initiated comparison and experimentation of new scenarios for the dissemination of PCP (pre commercial procurement).

PCP

Pre Commercial Procurement (PCP) is an innovative purchasing formula on Research and Development issues, which enables procurement for new methods of relationship and discussion with the market, in line with the great challenges posed by a modern Public Administration⁶⁷.

The program deals with issues of significant social impact and public innovation: from autism to protection from environmental risks, to food safety and quality, as well as innovative technological solutions applied to healthcare and e-government. Not only large companies but also start-ups, small businesses and venture capitalists have the opportunity to present innovative ideas and proposals.

The PCP is therefore a fertile ground for experimentation and research aimed at meeting social needs even with innovative tools related to AI. An example in this sense is the “Technologies for Autism” contract aimed at identifying Virtual Reality and Augmented Reality technologies typified for people with an autism spectrum condition (ASC).

⁶⁷ Italy is first in the ranking of EU countries for capacity to implement pre-commercial procurement.

PROGETTO PIERINO

Project: extraction and retrieval of online information

AI technology used: semantic analysis, information extraction

Public entities involved: Digital Humanities Research Group of the Bruno Kessler Foundation, Ministry of Public Education

The Pierino project (Piattaforma for the Extraction and Recovery of INformation Online) was created by the Digital Humanities research group of the Bruno Kessler Foundation and Tommaso Caselli of Vrije Universiteit Amsterdam and led to the creation of a platform for the automatic analysis of linguistic data, which works through AI techniques of semantic analysis and modules for the automatic processing of natural language. The platform was used for the first time by the Ministry of Education to analyse the data of public consultation "The good school" and allowed elaborating and summarizing 270 thousand comments in less than a week, allowing a significant reduction in analysis time of questionnaires. The platform has been designed in such a way as to be as flexible as possible to quickly process data from future consultations.

Website: <https://dh.fbk.eu/news/collaboration-miur>



PREVENTING INEQUALITIES

“ Technology is neither good nor bad; nor is it neutral.
(First law of Kranzberg) ”

The objective of this challenge is to pay further attention on the ways in which Artificial Intelligence (AI) technologies can trigger positive effects in terms of reducing the existing socio/economic/cultural differences.

There are several areas in which the integration of AI solutions would reduce social inequalities⁶⁸.

These include:

- education and training;
- knowledge and guarantee of individual rights;
- health and disability, intended as support for situations of hardship.

A significant intervention of intelligent learning support systems is conceivable in the school sector. There is a long tradition of using the computer for these purposes: from Computer Assisted Instruction (CAI) systems to Intelligent Tutoring Systems (ITS).

In ITS there is always a student model, understood as a knowledge base in which the student's characteristics and knowledge are explicitly represented. This solution plays a supporting role as it provides integration to traditional teaching systems, helping to fill learning gaps of students with cognitive problems.

Another point of intervention in the school sector is the reduction of the linguistic gap. The offer of adequately modelled simultaneous translation services could help to close the gap generated by new waves of migration, thus offering valuable assistance to study⁶⁹. Artificial Intelligence technologies could also play a decisive role in the battle against functional illiteracy⁷⁰.

Furthermore, the AI could be applied to overcome the limits imposed by the need to have specialist knowledge to carry out certain activities. AI systems could spread access to information, knowledge of rights and could facilitate the methods for exercising them by those who are in difficult living conditions and that do not have certain knowledge, thus contributing to reducing discrimination.

This represents a very important area of work that requires appropriate awareness raising and cultural promotion.

⁶⁸ Ref. the "Technology Challenge".

⁶⁹ The use of artificial intelligence at the service of machine translations is now widespread (for example the cases of Google, DeepL).

⁷⁰ Ref. <https://www.compareyourcountry.org/pisa/country/ITA?lg=en>.

As for the disability sector, some interesting solutions are pointed out as they can guarantee easier, and more usable, access to services thus, improving the quality of life of individuals.

For example this is the case of integrated speech synthesizers for visually impaired persons, which could be implemented with automatic editing programs that can remember previous communications and provide drafts of text, or some experiments involving people suffering from degenerative diseases, like ALS, which provide communication systems which can complete and facilitate the communication process.

Considering types of AI solutions already known, the use of digital assistants could fill the gaps in various categories transversally: for example, thanks to AI problems such as dyslexia could be monitored and corrected through the use of digital assistants that can perform the function of the speech therapist or psychologist.

The challenge of inequalities should also be tackled from the perspective of the need to prevent increasing existing inequalities.

There are two levels of potential discrimination, one involving access to and use of AI technologies and one induced by the same AI systems, based on race, gender and other social factors.

It is necessary to operate in order to ensure access to AI tools and solutions as well as to ensure awareness of their use, in order to avoid that only certain categories can benefit from these technologies. In this case, we must avoid thinking that the AI is in itself a value, especially if its use is not accompanied by appropriate interventions aimed at reducing the possibility of creating further gaps. It should also be avoided that the AI technologies themselves lead to inequalities.

A PA linked to the paradigm of social responsibility should not create situations in which the most advanced contact methods, which are also the simplest and which guarantee greater accessibility of services, are the exclusive preserve of those who, by culture, propensity, social extraction or technological endowment are more predisposed to such uses⁷¹.

It is necessary that the Public Administration carefully manages the development of AI solutions on order to guarantee that:

- ✓ they are inclusive, accessible, transparent and comply with legal requirements;
- ✓ they do not have discriminatory profiles;
- ✓ are free from bias.

⁷¹ Ref. Art. 8 of the Digital Administration Code (Legislative Decree no. 82/20015).

In recent times, one of the most active research areas in the field of AI has been the study of bias⁷² both from a more formal statistical point of view and from a broader legal and regulatory profile.

In a positive scenario, AI systems can be used to “increase”, improve human judgement and reduce our conscious or unconscious biases. However, data, algorithms and other design choices that can influence AI systems, can reflect and amplify the cultural assumptions existing at a given historical moment and, consequently, inequalities.

Consequently biases become the basis for making decisions, favouring some scenarios instead of others, creating disparities and non-homogeneous distribution of opportunities⁷³.

To do this, it is necessary to expand the bias search and mitigation strategies, not limiting them to a strictly technical approach. Biases, by their nature, constitute structural and long-term distortions that require a deep interdisciplinary research in order to be faced.

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Addressing and solving critical issues linked to bias therefore necessarily requires an interdisciplinary collaboration and transversal listening methods to different disciplines⁷⁴.

This is where the most important game for the prevention of inequalities is played. This is the context in which the Public Administration has the task of intervening, addressing the development of AI solutions, aware of the enormous potential that these have in the promotion of a more widespread equity and in reducing the gaps existing in our community.

CASES OF BIAS

Some cases of bias that recently have figured prominently:

A case of unconscious bias/discrimination is, for example, the percentage of male personnel who develop AI services compared to the female percentage (Ref. Global Gender Gap Report 2017 https://assets.weforum.org/editor/AYpJgsnL2_I9pUhBQ7HII-erCJSEZ9dsC4eVn5Ydfck.png, WEF).

Another case, within the United States courts <https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing> (Software used in the United States with the aim of predicting which individuals more than others are likely to be “future criminals” - has highlighted bias/prejudice against people of colour.

Lastly, the extensive use of NLP techniques is rapidly showing how much the vocabularies of the most spoken languages <https://www.technologyreview.com/s/602025/how-vector-space-mathematics-reveals-the-hidden-sexism-in-language/>, are strongly affected by gender bias.

72 Ref. “Ethical Challenge”.

73 Episodes of this kind have occurred in many cases: in rating algorithms, in the assignment of gig economy jobs and, in general, in algorithmically mediated work.

74 Ref. Ainow, “Expand AI bias research and mitigation strategies beyond a narrowly technical approach”, 2017, p. 2

MATHISIS H2020 PROJECT

Project: teaching support for children with DSA, ADHD, autism spectrum and multiple disability

AI Technology used: Affective Computing

Public players involved: first and second grade Italian public schools

Mathisis - Managing Affective learning through intelligent atoms and smart interaction - is a project funded by the European Commission under the 2015 Horizon2020 ICT program and involves 18 European countries, including Italy.

Through the project, a teaching support platform was created for children with DSA, ADHD, autism spectrum and multiple disabilities. The platform, connected to a webcam, a tool for the recognition of movement and a gyroscope, through AI techniques of affective computing recognizes the moods and levels of attention of students and, based on these, increases or decreases the degree of difficulty of the didactic exercises.

The project was tested on a sample of first and second grade Italian public schools, involving just fewer than one hundred students.

According to the first results of the experimentation, the use of this platform has improved the learning path of the students, increasing their concentration and attention levels.

Website: <http://mathisis-project.eu/>



MEASURING THE IMPACT

“ The pace of change has never been this fast, yet it will never be this slow again.
(Justin Trudeau) ”

“Change has never happened this fast before, and it will never be this slow again”⁷⁵. The introduction of new Artificial Intelligence (AI) technologies in the society and, in particular, in the Public Administration, brings with it the natural desire to measure and understand its social impacts, risks and opportunities.

It is now essential to measure the impact of public policies, both in terms of the user, i.e. the citizen, and the PA. Regarding the first point, it is necessary to think in terms of improving the quality of life of people, but also the conditions of use of what is offered to them.

The measurement of the impact in using Artificial Intelligence solutions in the PA contemplates the use of qualitative and quantitative indicators. For example, the methods for measuring customer satisfaction (e.g. social impact, well-being of citizens, accessibility and usability of the tools) or related to the optimization of organizational processes in terms of efficiency and effectiveness.

Many quantitative models subdivide workers by their employment and try to hypothesize which professions will be replaced by technologies, in other words these models base their operation by considering jobs and employment as a unit of analysis⁷⁶. However, technology often does not completely replace a professional figure but replaces only some specific activities. Workers who previously held a particular task are therefore addressed and reassigned to complementary activities that use the new technologies. Over time, technology leads to a complete rethinking of organizational processes and objectives.

Given the complexity of the phenomenon to be analysed, the impact must be measured necessarily taking into account a multidisciplinary approach, which allows defining the impact also from an anthropological, psychological and sociological point of view, as well as from a technological and econometric point of view.

For this reason it is necessary to identify new sets of indicators that can better adopt this multidisciplinary, in synergy with the indicators existing today.

In any case, it is necessary to keep in mind that the methods adopted to measure the impact can promote a better understanding of the services by the users and encourage the transition to new governance models⁷⁷.

⁷⁵ Justin Trudeau, Canadian premier, in his speech at the World Economic Forum Annual Meeting 2018 Ref. <https://www.weforum.org/agenda/2018/01/pm-keynote-remarks-for-world-economic-forum-2018>.

⁷⁶ Ref. Challenge “Skills” and Challenge “Reducing inequalities”.

⁷⁷ Ref. Challenge “Accompanying transformation”.

Mapping the needs and defining the impact objectives with all the actors involved, collecting real-time information on how all the nodes of a network interact, are the first essential steps in understanding and defining correct policy assessments.

Unfortunately, these assessments are not updated so frequently as they should, due to financial limitations or unavailability of competent assessors. As policy assessment is commonly based on data, AI could enable a faster and more accurate analysis.

A greater balance in the analysis of opportunities and risks could be an important factor to increase awareness of the real impact⁷⁸ that AI can have in our daily lives.

Finally, measuring the impact of these technologies is useful in terms of designing and developing AI, in order to guarantee reliability and transparency as well as to reduce the risk of errors, also as regards the Public Administration⁷⁹.

Analysing its operation allows us to determine valid models for an ethical and responsible use of AI.

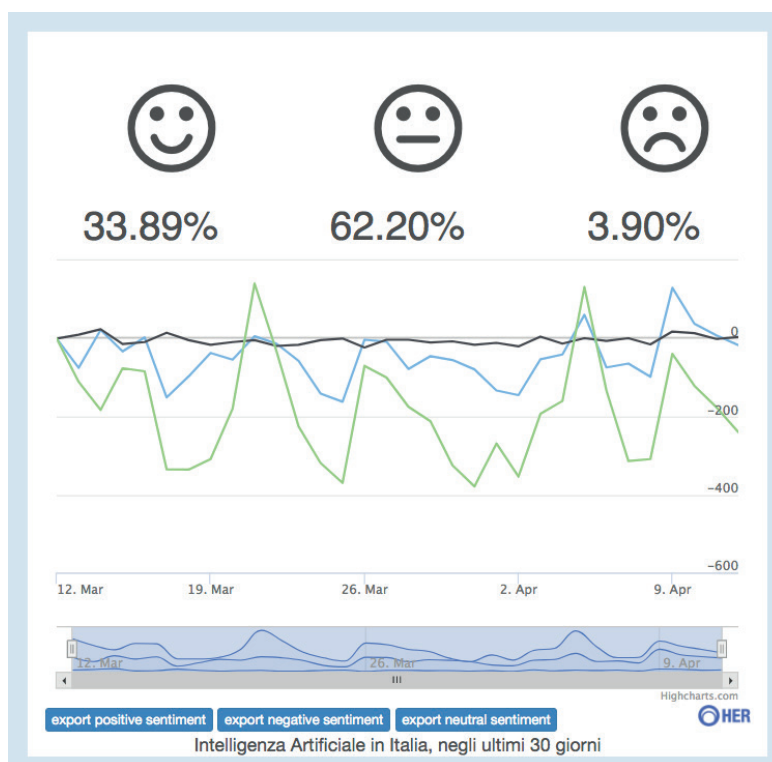
Measurement tools must be strict to determine the effective social impacts of AI and to define how these technologies can actually influence our lives.

ITALIAN OBSERVATORY ON ARTIFICIAL INTELLIGENCE

The Italian Observatory on Artificial Intelligence is promoted by the Task Force on Artificial Intelligence in collaboration with the HER - Human research institute Ecosystems Relations and aims to analyse with various techniques - including Sentiment Analysis - conversations about AI in the main social networks.

⁷⁸ European Commission - DG for Research and Innovation, Directorate A -Policy Development and Coordination, Unit A.6 - Open Data, Policy and Science Cloud; "Vision and Trends of Social Innovation for Europe", 2017.

⁷⁹ Ref. https://www.researchgate.net/publication/23542471_Spatial_diversity_in_local_government_revenue_effort_under_decentralization_A_neural_network_approach.



SIMPATICO H2020

Description: Simplification of the interaction between citizens and public administration

AI Technology used: Automatic language processing

Public entities involved: Bruno Kessler Foundation, Municipality of Trento

The "Simpatico-SIMplifying the interaction with Public Administration" project was coordinated by the Bruno Kessler Foundation as part of the European Horizon 2020 program and consists in the application of AI solutions in the online offices of the municipal administrations. In 2016, the Municipality of Trento started the project experimentation phase, together with the city of Sheffield (UK) and the region of Galicia (Spain) integrating advanced automatic language processing technologies, in particular AI techniques for automatic text content simplification, in some municipal services accessible through the Electronic Help Desk for citizens of the Municipality website.

From an initial evaluation, it emerged that this integration led to:

- a reduction in the time taken to accept electronic requests of 40%
- a reduction in requests for additional information of 50%
- a reduction in the total time required to complete an online claim of 50%.

Website: www.simpatico-project.eu/



THE HUMAN BEING

“

Think of birds, then think of airplanes. Both fly, but they have nothing in common but a single fundamental characteristic: the fact that they both respect the principles of aerodynamics. This is the best way to compare human intelligence to artificial intelligence.

(Yoshua Bengio)

”

The introduction of Artificial Intelligence in the world involves existential and psychological issues that need to be addressed as they affect the possibility of perceiving, understanding and acting on the world, and how human beings are individually positioned in relation to the society and the environment, with substantial impacts on rights, freedom and opportunities for personal and professional fulfilment.

AI is already present in many spheres, services and processes of our everyday life: the technologies we use to mediate relationships with other human beings, the objects and places in which we live, influence behaviour, methods of working, learning, communicating, and having fun. All of us have, more or less consciously, faced this reality, even if on AI there are still perplexities due to the lack of understanding of the technology itself and of its real effects in the society.

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In this lack of knowledge, which is present at all levels of society and education, it is easy that a narration made of distorted news or influenced by despotic fiction is inserted. This risks to negatively affect the collective imagination, degenerating into distortions of reality typical of the self-fulfilling prophecy theory⁸⁰.

Several empirical and sociological studies, and social psychology experiments⁸¹, have repeatedly shown how radical these capabilities of intervention can be on imagination.

Therefore, these are actions that have an impact on the psychological, social and existential spheres. To accompany citizens, laws, regulations and good technical and technological practices are not enough (though necessary): we need a narrative and an imaginary built by society in an inclusive way outlining the meanings of AI and the roles we want to assign to it.

Contemporary society, characterized by strong digitalisation, has the task of creating the prerequisites for which people can develop, together and responsibly, a vision of the world that is coherent with the innovations that these technologies bring with them. In this sense, the value of social sciences and of public communication is enhanced even more compared to the construction of a predominantly strategic narration⁸². If the future is the consequence of the choices made in the present we cannot raise the issue, leaving unattended the interpretation of technological development and of its social consequences.

There are several approaches that, in a transdisciplinary way, contribute to the construction of a scenario that facilitates the understanding and involvement of the human being in the introduction of AI solutions.

⁸⁰ Ref. Robert Merton, R.K., "La profezia che si autoavvera", in Teoria e Struttura Sociale, vol. II. Il Mulino, 1971.

⁸¹ Ref. <https://www.forbes.com/sites/kashmirhill/2014/07/10/facebook-experiments-on-users/#386e02291c3d>.

⁸² Ref. Challenge "Accompanying transformation".

Design, arts, psychology, anthropology, sociology and other humanistic disciplines can and must create links between research, industry and society, to support pedagogical initiatives capable of helping different communities to understand the boundaries and implications of these technologies.

On the one hand, art and design have always played a crucial role in involving people in a common narrative. On the other hand, they allowed the great processes of innovation suggested by not focusing on needs, but on aspirations⁸³, desire and imagination. Historically, Art has helped to draw new imaginations and open new opportunities, raising the level of criticism and causing the participation and involvement of people, crossing cultures, social classes, professions, and skills.

This task⁸⁴ is finally recognized also at European level, thanks to programs that use the arts to bring innovations into the common imagination, contributing to build a positive social meaning, which is shared and above all aware of the advantages and uses of innovations. The non-secondary effect of this approach is, in economic terms, the creation of new markets; in social terms, instead, it generates greater participation, solidarity, a sense of belonging to a cosmopolitan world.

Offering its citizens the opportunity to socially build a shared imagination of the role of technologies such as AI, is of fundamental importance not only in terms of social inclusion but above all as a citizenship investment.

A conscious citizen, who understands and feels understood, is a citizen whose sense of belonging generates greater trust in institutions. The citizen participating in public action and to the proposed solutions, inclined to support and constructive criticism of the government activities, is able - with different levels of involvement - to support the design of always better systems and solutions, in an context increasingly free from digital and cultural divides.

Historically, Italy has played an exemplary role in innovating through beauty, aesthetics and well being and in stimulating leading cultural and social processes.

Innovative by tradition, as a Nation we must not give up on bringing the characteristic features of Italian style (design, creativity, aesthetics) within this narration of the system, still to be built but focused on the well being of people.

A vision that constitutes for our Nation an international competitive advantage, built on the ability to "imagine the world". For this reason, it is necessary to create and support initiatives in which artists and designers work side by side with AI researchers, humanists, engineers and managers.

⁸³ Ref. <https://publications.europa.eu/en/publication-detail/-/publication/a97a2fbd-b7da-11e7-837e-01aa75ed71a1>.

⁸⁴ For example, the STARTS program of the European Commission and the "Arts program" at CERN.

ITALIAN OBSERVATORY ON ARTIFICIAL INTELLIGENCE

Help a community grow: public consultation for the drafting of the AI White Paper

The AI White Paper promoted by the AI Task Force was opened to public consultation from 13 February to 12 March 2018 in a special section of the site <https://ai.italia.it/>.

Experts, researchers, entrepreneurs, public officials, university professors and citizens have contributed with suggestions, comments, and recommendations sharing experiences, articles and documents in different ways:

- through the appropriate section present on the sides of each paragraph of the White Paper on the Readthedocs platform;
- directly within the open threads for the purpose of the AI Task Force Community;
- via email intelligenza-artificiale@agid.gov.it;
- through the appropriate form prepared for reporting recommendations .

In total, the Task Force received more than 100 comments, contributions and recommendations, many of which were incorporated into the current version of the AI White Paper.

Recommendations

If I should make only one recommendation, I would say that machines will never have common sense. Understood as something that makes me immediately realise that the thing just appeared in the middle of the road is not a boulder jumped out from nowhere but a plastic bag; knowing that “it is better not to talk about this with my friend today”; imagining that a pin can be nailed on a wall I can also use the back of a book. Or again: I’m losing a chess match (or Go, or scopone scientifico...) against the computer, but I do not care because the fire alarm started and we all are running towards the exit while the computer is still calculating its next move, chained to its fate.

Luciano Floridi

Here is a list of recommendations, drawn up taking into account the 9 challenges presented in this document and the suggestions received through the public consultation.

These recommendations are not to be considered definitive or immutable, but they evolve with the continuous public debate on Artificial Intelligence.

- 1 Promote a national platform dedicated to the development of AI solutions in order to:
 - promote the collection of annotated data, codes and learning models;
 - organize and convey tests openly before the release of AI systems used in the PA in order to evaluate their behaviour and limit the anomalies and the amplification of the bias;
 - offer adequate computing resources to experiment with techniques and solutions;
- 2 Disclose to the public the intermediate results of the elaboration of AI algorithms (ex. parameters of neural networks) operated on data from public administrations, subject to conditions that may harm the privacy and security of citizens. These results must allow the reproducibility of the processes, their evaluation and verifiability.
- 3 Enable with new resources the computational linguistic systems for the Italian language (such as digitized lexicons or annotated corpora) to be distributed with open licenses, in order to favour the development of services based on the treatment of natural language;
- 4 Develop adaptive customization and recommendation systems that facilitate interaction with the services offered by public administrations based on the specific requirements, needs and characteristics of citizens. These systems can also be used to identify critical issues that hinder the improvement of public services;
- 5 Promote the creation of a National Competence Centre that is a point of reference for the implementation of AI in the PA and that can provide predictions of impact and measurement of the social and economic effects of AI systems, in order to enhance the positive effects and reduce risks. The centre of competence must also propose a Manifesto with the cardinal principles of the implementation of AI in the PA;

- 6 Facilitate the dissemination of skills through the promotion of certification of professionals working in the area of AI (through the creation and adoption of a shared framework) and provide for the establishment of training paths for the inclusion of workers with ability to understand and implement AI solutions in the public administration (for example through specific courses at the National School of Administration). The numerous professional skills lacking are an opportunity to think about training courses focus on lasting and sustainable gender equality, both from a numerical point of view (ex. STEM graduates) and from a financial point of view (ex. remuneration equality);
- 7 Provide a PA 4.0 plan to encourage PA investments in AI solutions starting from a call for challenges through open innovation tools and procurement for innovation;
- 8 Support the collaboration between research, business accelerators and innovation hubs, both public and private, also at European level, to promote the adoption of AI solutions in the public sector;
- 9 Establish a Trans-disciplinary Centre on AI, in synergy with the Skills Centre, which will have the following tasks:
 - promote and disclose the debate on the evolution of ethics;
 - support critical reflection on emerging ethical issues;
 - improve the conditions for involving experts and citizens to transform technical and social considerations into regulations, standards and technical solutions.
- 10 Define guidelines and processes based on the principle of security-by-design in the use of AI, increasing the levels of control and facilitating the sharing of data on cyber attacks to and from AI by all European countries.

And now? The first steps for an AI-ready PA

“ All life is about problem solving.
(Karl Popper) ”

This section represents a list of suggestions that is definitely not exhaustive on what could be the first steps that the Public Administrations, also through the support of AgID, can follow to start implementing AI or to fully exploit its potential, without incurring the risks raised in the challenges of this White Paper.

Some tools are already used by the administrations that feed them in daily life to increase the efficiency and effectiveness of services; in other cases, it is necessary to think of new ones, precisely to cope with the lack of adequate solutions of Artificial Intelligence that support the administration in the administrative activity and in the management of services. In this paragraph, we aim to indicate a small “toolbox”, a starting point pending more operational steps and paths that can give a more solid and clear context to new technological solutions, sustainable implementation of Artificial Intelligence really at the service of citizens.

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AREA OF APPLICATION OF AI SOLUTIONS

Public administrations and dedicated project teams faced with the issue of the role that AI can play in the management of their activities must move from a starting point: AI is not always a panacea and is not suitable for any type of challenge.

Therefore, it is necessary to analyse in advance which internal processes or services to citizens can be facilitated by the use of technologies based on AI and, at that point, develop the expectations and impact in relation to the support that can derive in terms of efficiency and/or fairness.



WELL-PLANNED INITIAL INVESTMENTS

Once the Public Administrations have identified the areas in which AI can really help, it is necessary to reflect on the resources they need, starting with the budget necessary to implement the new technologies, followed by the involvement of experts (external or even internal if appropriately formed) that know the most suitable AI technology for the need expressed. Furthermore, the Administrations cannot take into account the time necessary for the internal structure to implement the AI solutions identified, especially when large quantities of data and information must be uploaded to develop them.

The Task Force of the Italian Digital Agency remains available to explore forms of co-financing and identification of the needs of the Administration through the email intelligenza-artificiale@agid.gov.it.



LET'S NOT FORGET THE THREE-YEAR PLAN

AI requires accelerating the path of digital transformation. The Three-Year Plan provides all the indications to build the foundations on which it will be possible to implement AI solutions. There are already many tools useful for the implementation of the Three-Year Plan, such as the minimum measures for ICT security to public administrations, which must be adopted to counter the most common and frequent threats to which their information systems are subject. Or the many procurement channels that can be activated, depending on the financial perimeter and the diversified technical needs: from the more classic appeal to the Electronic Market for Public Administration (MEPA) and to the Public Connection System (SPC), in particular, lot 3 on Interoperability for data and application cooperation and lot 4 on the creation and management of portals, APP, websites and web applications), up to the procurement tools for innovation.

In particular, on this last front, the references are those of pre-commercial procurement (PCP, both on a national scale also in the context of regional planning through European funds) and finally to the public procurement of services and innovative products (PPI).



START "SMALL"

As with many other technologies, it is advisable to test the AI on a small scale before applying it at full capacity in its activities.

Developing a pilot program allows those who decide to implement AI solutions to become familiar with the technology and to correct any errors during development thus allowing the service itself to improve.

There are several models that can be used to set up projects in an agile manner: the site designers.italia.it provides a tailor-made kit for the PA for the development and design of projects.

In addition, AI involves a series of risks, well highlighted in the various challenges of the White Paper, related to data protection and privacy, ethical dilemmas, the risk of bias deviations. In order to limit current and future problems as much as possible, it is a good practice to involve the entities involved in AI-based services from the pilot project, exposing data and algorithms in a transparent and replicable manner.



WORK ON DATA

It is useful to start from the need of AI to feed on data, at the base of every application of these technologies. For this reason, a typical challenge faced by those who use AI is the access, availability and quality of data.

The higher the quality of the data, the better the accuracy and performance of the AI system will be. However, public data is often collected by different administrations and, in many cases, it is fragmented, limited and not easily accessible.

Thus, all administrations must ensure the quality and usability of the data they provide, so as to be easily employed to test, use and refine AI systems.

Useful tools, modelled on the needs of the PA for the use of data, their interpretation and procedures for release, are the site dati.gov.it and the National Guidelines for the Valorisation of Public Information Assets.



DEVELOPMENT OF PROFESSIONALISM AND SKILLS

Universities have great expertise in the AI sector, with dedicated R&D projects and programs, in addition to the new training and teaching offer of courses and the establishment of ad hoc departments.

At the same time, administrations need substantial investment in human capital to manage the growth and potential of new technological systems.

Universities and the public sector in general should face the possible lack of AI-related skills with synergy and identify new models for working with AI experts from the private sector and academic world.

On the ai.italia.it portal, a mapping of AI-related courses in Italy will soon be available.

In the meantime, the evolution of the Italian ecosystem can be observed (<https://ia.italia.it/en/ai-in-italy/>) related to start-ups, research centers and other realities that deal with the production or use of AI solutions.



STAY UPDATED

The reference portal of the Artificial Intelligence Task Force, ai.italia.it will remain active and updated with the initiatives that will be deployed in the coming months. It is advisable to consult it frequently and to subscribe to the newsletter to stay updated on developments and news.

The community will also remain active, where it is possible to participate in open (or start new) discussions on issues related to the Task Force activity and to AI in general.

For any information or any collaboration, there is always the email intelligenzaartificiale@agid.gov.it

Appendix

Summary of technical terms*

NEURAL NETWORKS

Special learning machines that act through functions corresponding to ensembles of linear operators (neurons or perceptrons). They are usually organized in layers, activated according to a rigid order (feedforward inference), a non-linear activation function and can be trained through adaptation algorithms.

They produce a backward reinforcement (or a penalty in the case of errors) backwards (back propagation), from the results of the classification (ex. potential errors) to the adjustment of the backward operators, in the reverse order to that of the decision taken. These networks have been given the name of multilayer networks (back propagation multilayer perceptrons) and constitute the basic algorithmic paradigm for so-called deep learning methods.

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DEEP LEARNING

Deep networks (deep neural networks) are characterized by a large number of layers. They exploit enormous sets of examples for the development of the operator system connected to the various layers and thus proceed to the induction of optimal non-linear decision functions in the space of decision functions.

The recent successes of these paradigms in complex games, in artificial vision or in the treatment of semantic phenomena in texts, constitute one of the highest results of AI.

They are of great importance because they show the practical utility in the combination of complex representations of the problem, a recursive algorithm useful in training and the results of the theory of functional optimization, while offering enormous research prospects at the same time.

NATURAL LANGUAGE PROCESSING

AI research sector typically dominated by a cascade of complex processes, where the concatenation of grammatical and finally semantic morphological evidences regarding a text provide (often incrementally) the necessary evidence for the interpretation of a document or a network of texts.

* elaboration by the IA Task Force

MACHINE LEARNING

Automatic Learning (or Machine Learning, ML), the ability to exploit data and previous experiences in the performance of a task for the optimization of the operating process itself. In automatic learning, the system uses data to acquire new knowledge, new rules and new decision criteria that establish new optimal behavioural models with respect to certain criteria: for example, more accurate decisions (for example, in cases where the system is able to decide correctly in a larger number of future cases) or more cost-effective decisions (for example in cases where the same decisions can be made through the use of fewer resources, such as for example with less CPU operations or exploiting less memory).

In Automatic Learning, the data related to a problem (task) are annotated by experts and operators and used through the application of induction algorithms in order to generate more efficient explanatory and implementation models for this task. Therefore, ML is often used to generate significant components of a knowledge base and inference rules for problems that have a large number of examples.

KNOWLEDGE DISCOVERY

According to the Unsupervised Machine Learning algorithms, it is possible to determine regularity and correlations between input data by applying quantitative methods (clustering or probabilistic analysis) on sets or data flows expressed by complex representation (sequences, trees, graphs). The result is the induction of explanatory models of data (categories of grouping of input data or rules of association between properties and classes of individuals) that are sources of new knowledge emerging from data flows and may suggest phenomena to be interpreted by experts (thus maintaining a perspective strongly focused on the expert, human in the loop).

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