



Seasonal School in Digital Transformation 2025

Artificial Intelligence & Machine Learning
for Public Administration

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Artificial Intelligence in the Public Sector. An opportunity or a threat?

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Universidad Politécnica de Madrid

Let's start with a couple of questions

- How many of you use AI systems, for your personal life, almost every day?
- And as part of your professional work?
- Are you aware of the many different types of AI that exist?
 - In other words, AI is not only ChatGPT/Copilot/Gemini/<<you name it>>





About me



Oscar Corcho

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@ocorcho

- Full professor at Universidad Politécnica de Madrid
 - Director: AI department at UPM
 - Co-director: Ontology Engineering Group
 - Academic co-director: European Master AI4Gov
- Co-founder: Localidata (open data) and library (GenAI)
- Top Spanish young researcher in Engineering: López de Peñalver award (2016), Real Academia de Ingeniería
- Interests
 - Data sharing (open government data, data spaces)
 - Semantic technologies
 - Open science



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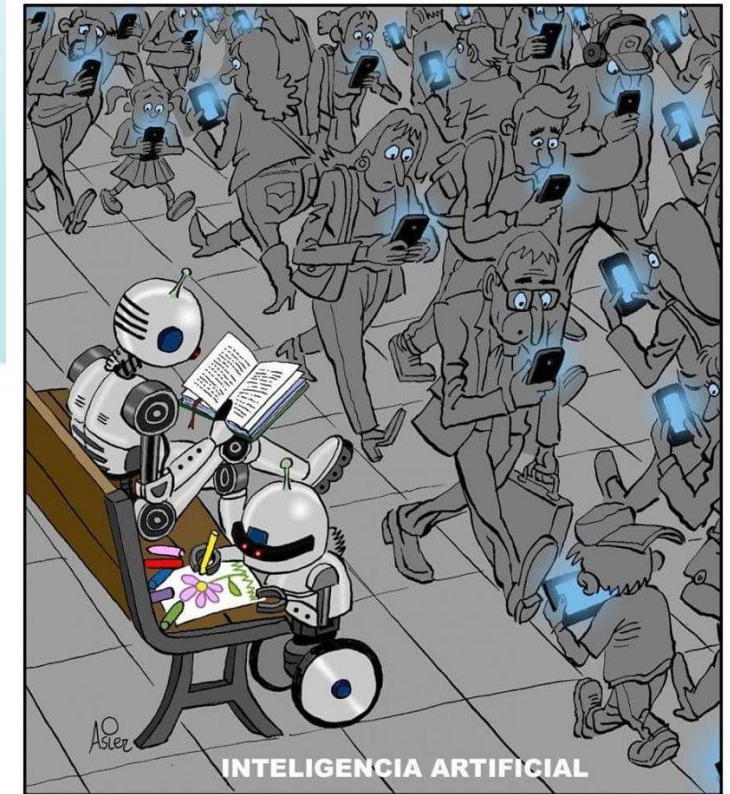


What is Artificial Intelligence?

And a bit of why AI now?

Dartmouth Conference (1956) – Clever machines

“The study is to proceed on the basis of the conjecture that **every aspect of learning** or any other **feature of intelligence** can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to **make machines use language**, form **abstractions** and concepts, **solve kinds of problems now reserved for humans**, and **improve themselves**”





AI Definition (by the European Commission) (2019)

“Artificial Intelligence (AI) systems are software (and possibly also hardware) systems **designed by humans** that, given a **complex goal**, act in the **physical or digital dimension** by **perceiving** their environment through **data acquisition**, **interpreting** the collected structured or unstructured data, **reasoning on the knowledge**, or processing the information, derived from this data and **deciding the best action(s)** to take to achieve the given goal. AI systems can either use **symbolic rules or learn a numeric model**, and they can also **adapt their behaviour** by analysing how the environment is affected by their previous actions.”

AI Definition (by the European Commission) (2024)

“AI system means a **machine-based system** that is designed by humans to operate with **varying levels of autonomy** and that **may exhibit adaptiveness** after deployment, and that, for **explicit or implicit objectives**, **infers**, from the **input** it receives, how to generate outputs such as **predictions, content, recommendations, or decisions** that can influence **physical or virtual environments**”

Main changes:

- No need to be designed by humans
- No reference to technologies/approaches

Types of AI

General AI (aka Strong AI)

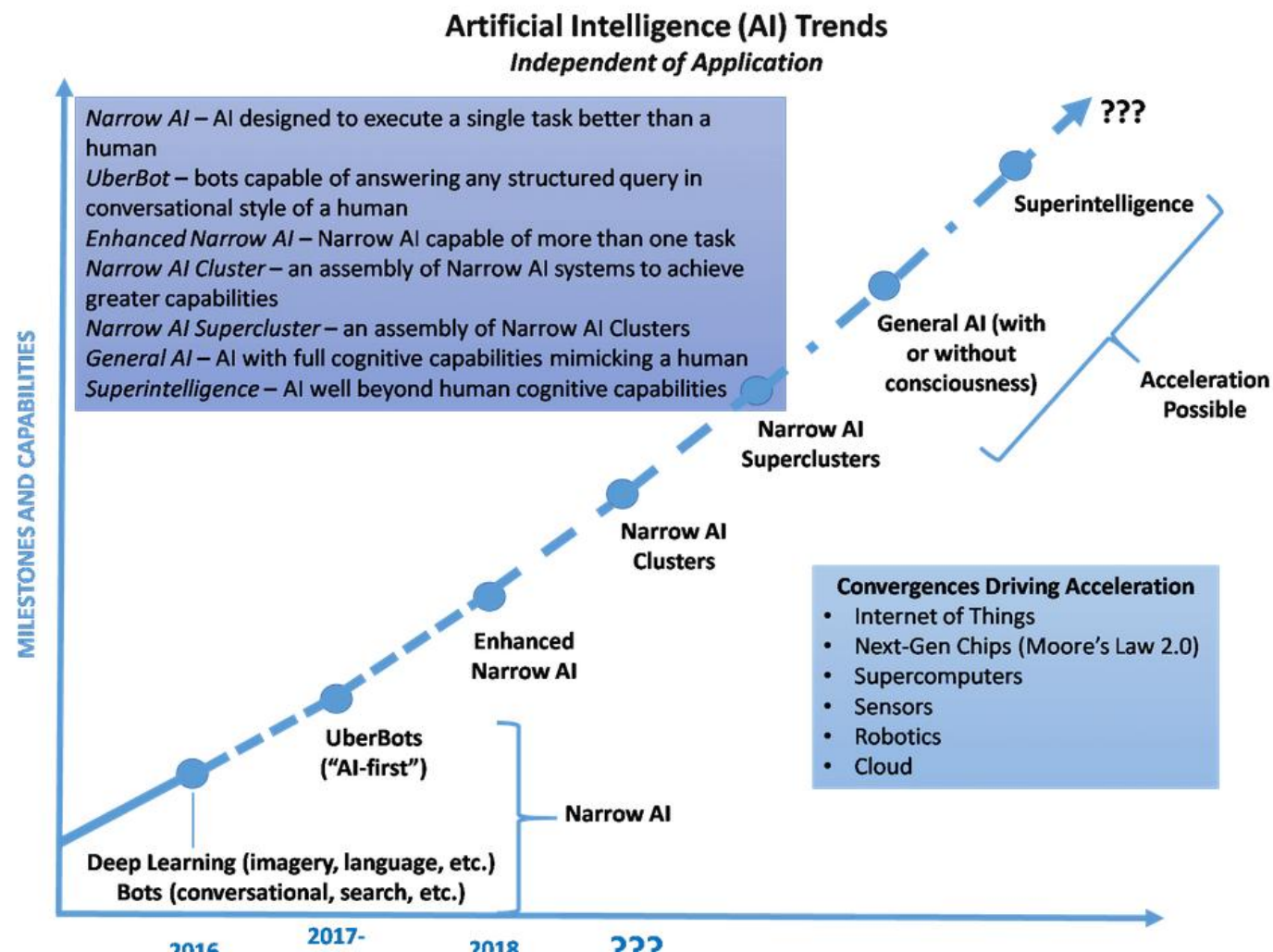
- Similar to the human intelligence
- Emulate heterogeneous processes
- Self-learning

Specific AI (aka Narrow AI)

- Solve specific problems/tasks

Which one is the one that we find nowadays?

By Tom Campbell • 05 Nov, 2017



A few examples of specific AI

Wide access and use of technologies by society and companies

- Speech Recognition
- Image Recognition
- Natural Language Processing
- Machine translation
- Games
- Predictions

....

Devices performing tasks previously performed by humans



Devices performing tasks that humans cannot perform

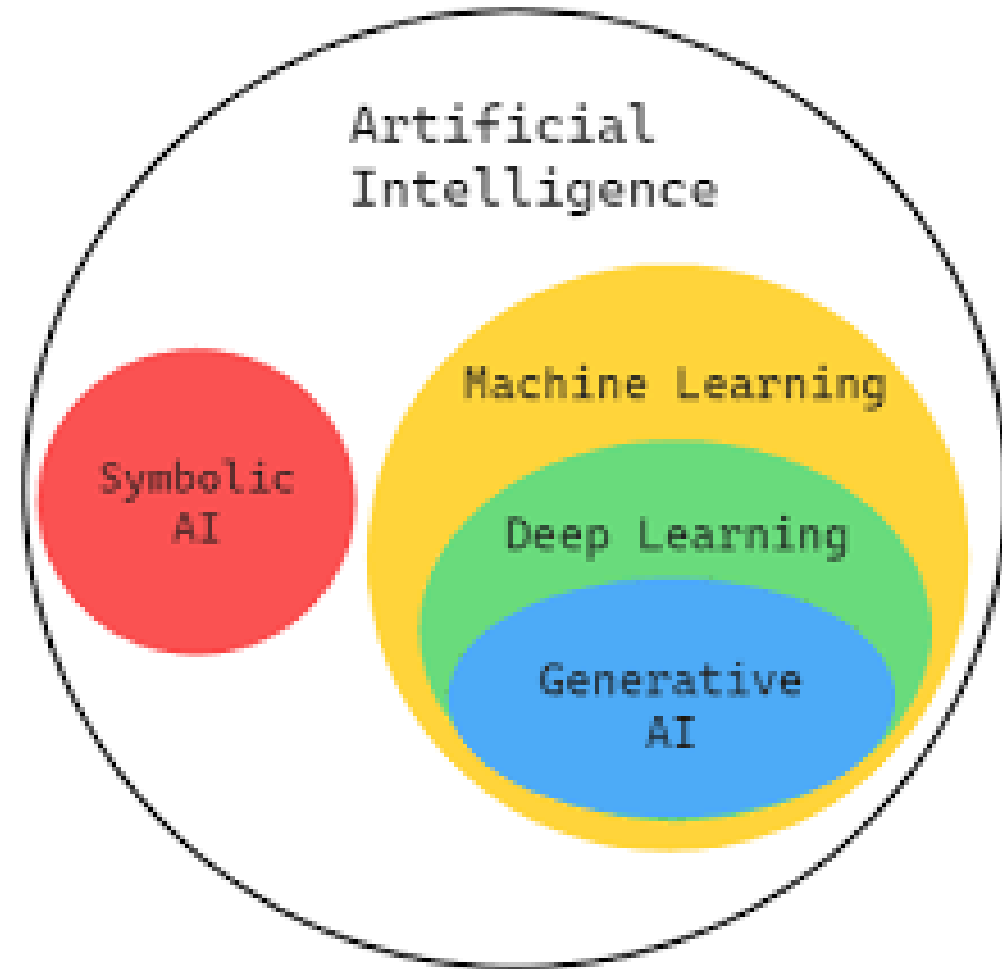


Devices for humans that increase their physical or cognitive abilities



Types of AI

- Based on the underlying technology/approach
- Examples
 - Symbolic AI
 - The knowledge graph of the European Agency for Railways
 - Machine learning
 - Public transport usage prediction in cities
 - Deep learning
 - Satellite image analysis for Urban Heat Islands detection
 - Generative AI
 - EU Agency for Asylum – MedCOI database and conversational agents



Source: <https://medium.com/@IbLahlou/overview-of-the-field-of-artificial-intelligence-9a59d694866b>

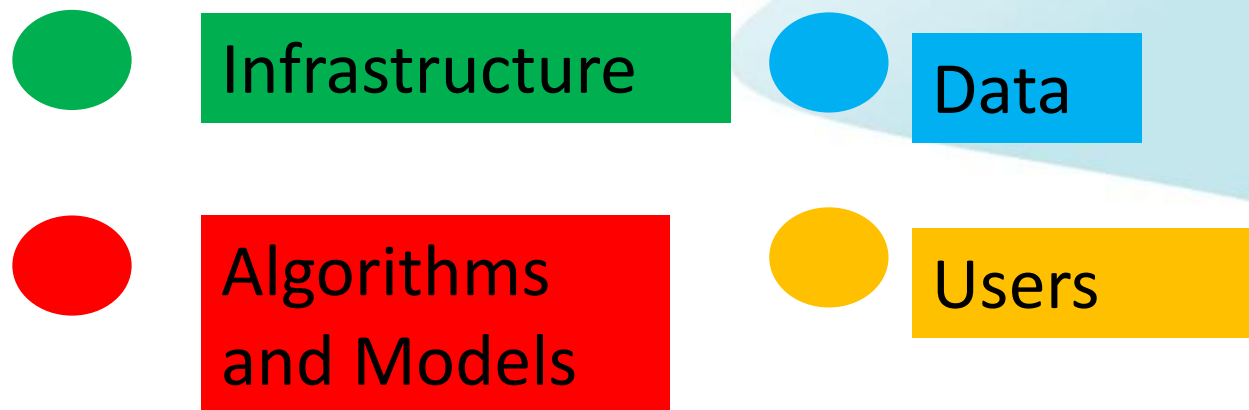


Ingredients for an AI system



Ingredients for an AI system

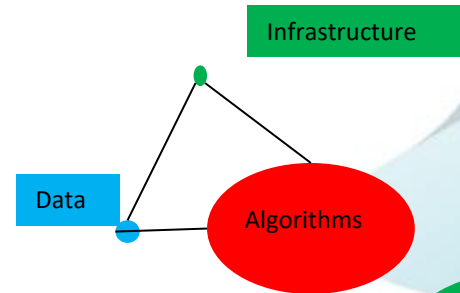
Any AI system requires:



Ingredients of AI in the AI evolution

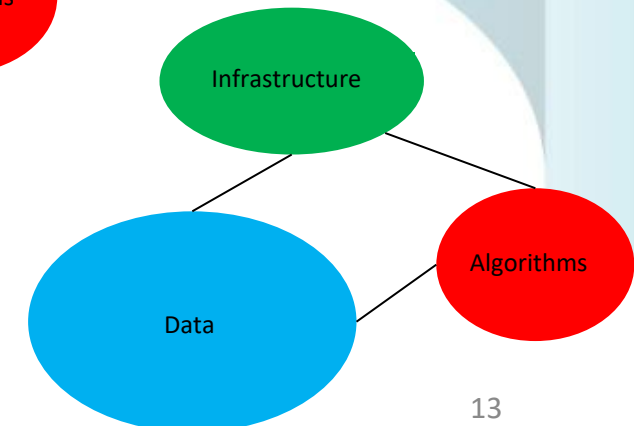
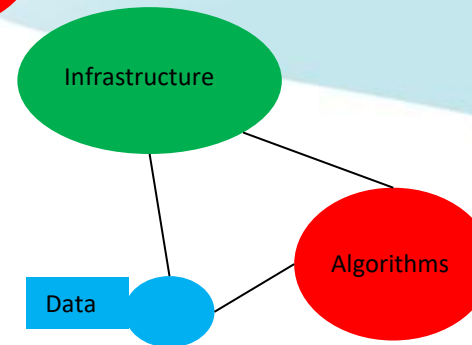
AI Winter

1. Toy problems
 - Limited amount of data
2. Limitations of Infrastructure
 - Processing power
 - Storage capacity
3. Emphasis in Algorithms

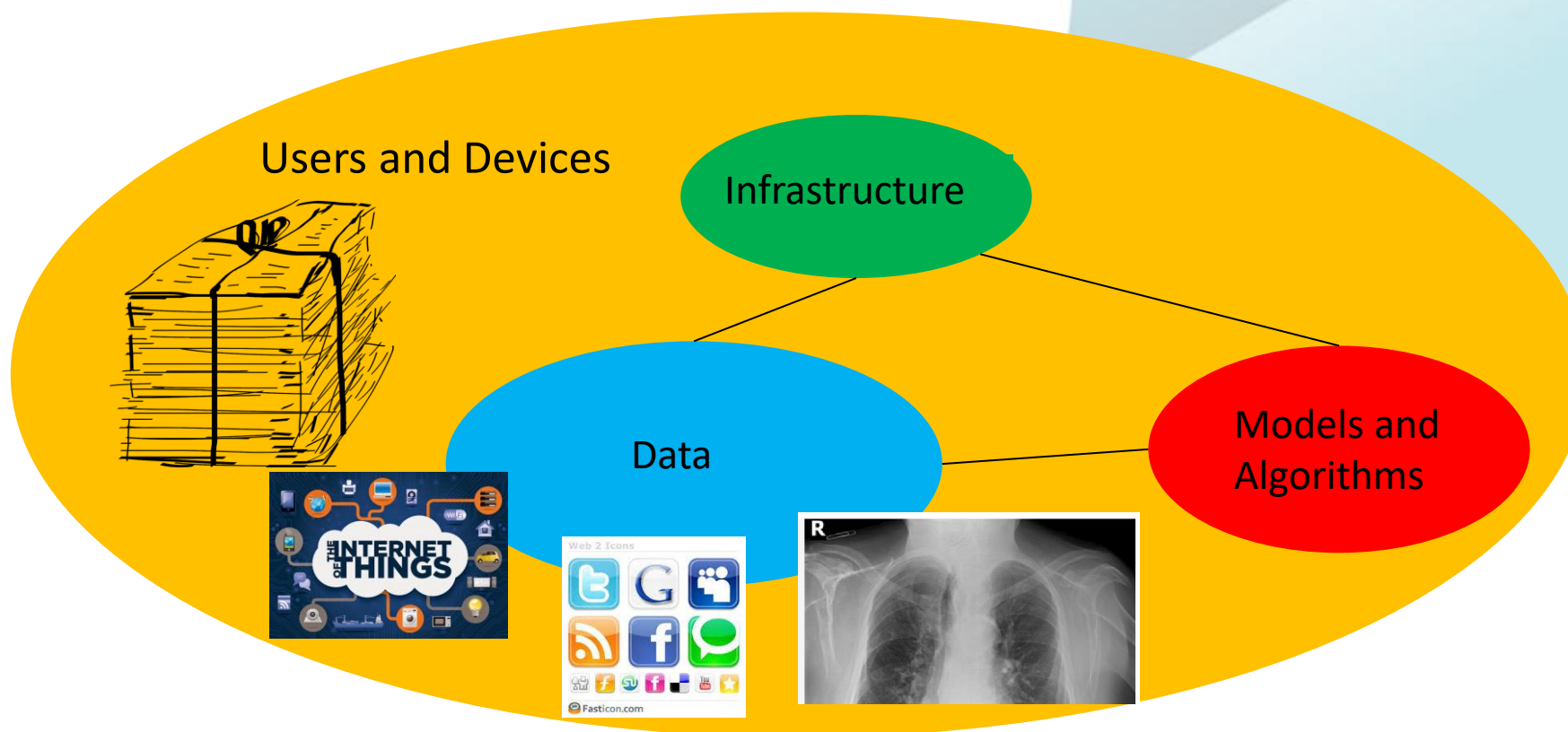


AI Spring

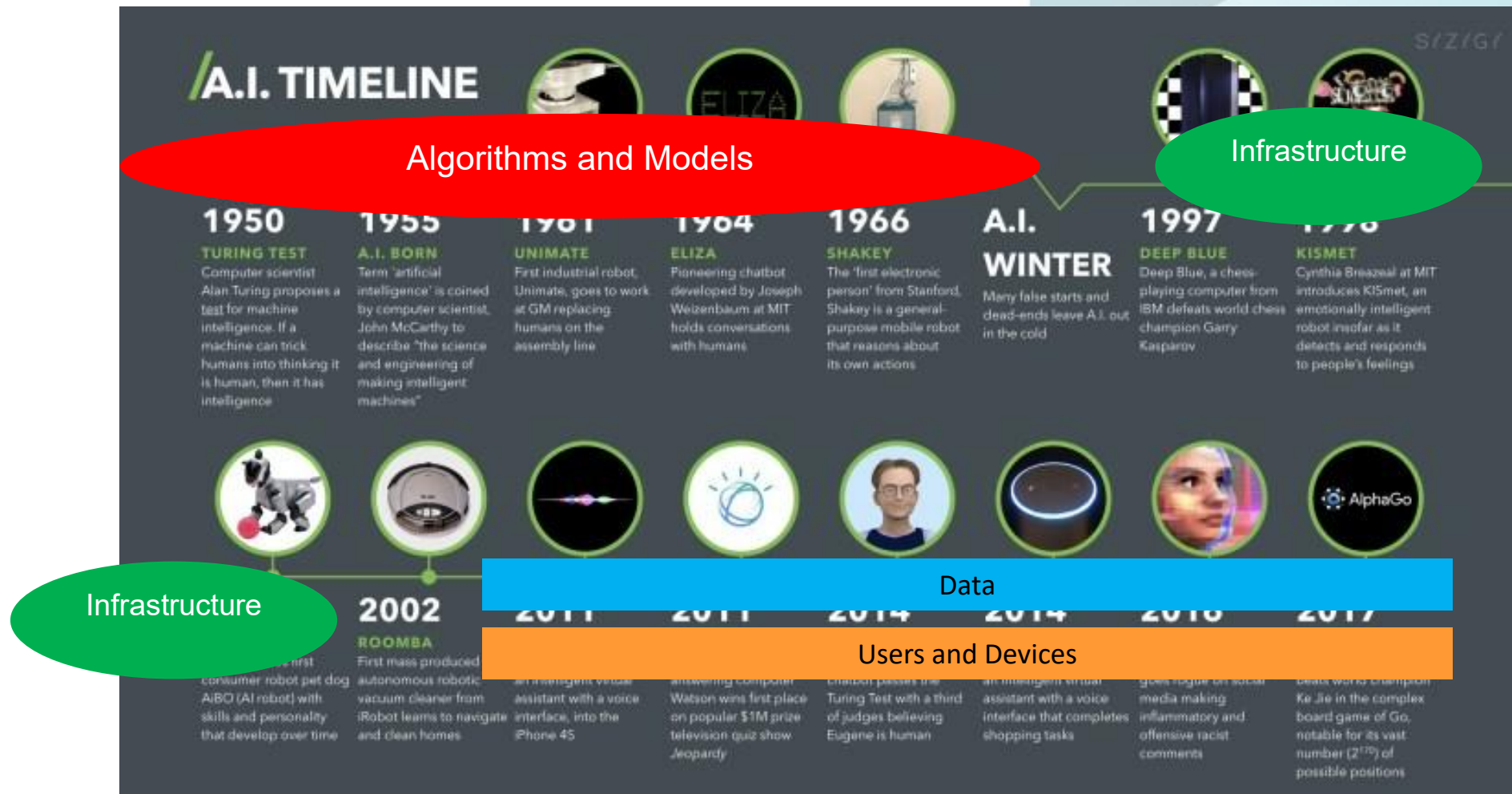
1. Real problems (Big Data)
 - Real time data processing
 - Data anytime, anywhere
2. Infrastructure and platforms
 - No limitations in storage and processing power
3. Less focus on AI algorithms



AI Evolution: ... + data, data and data



AI timeline





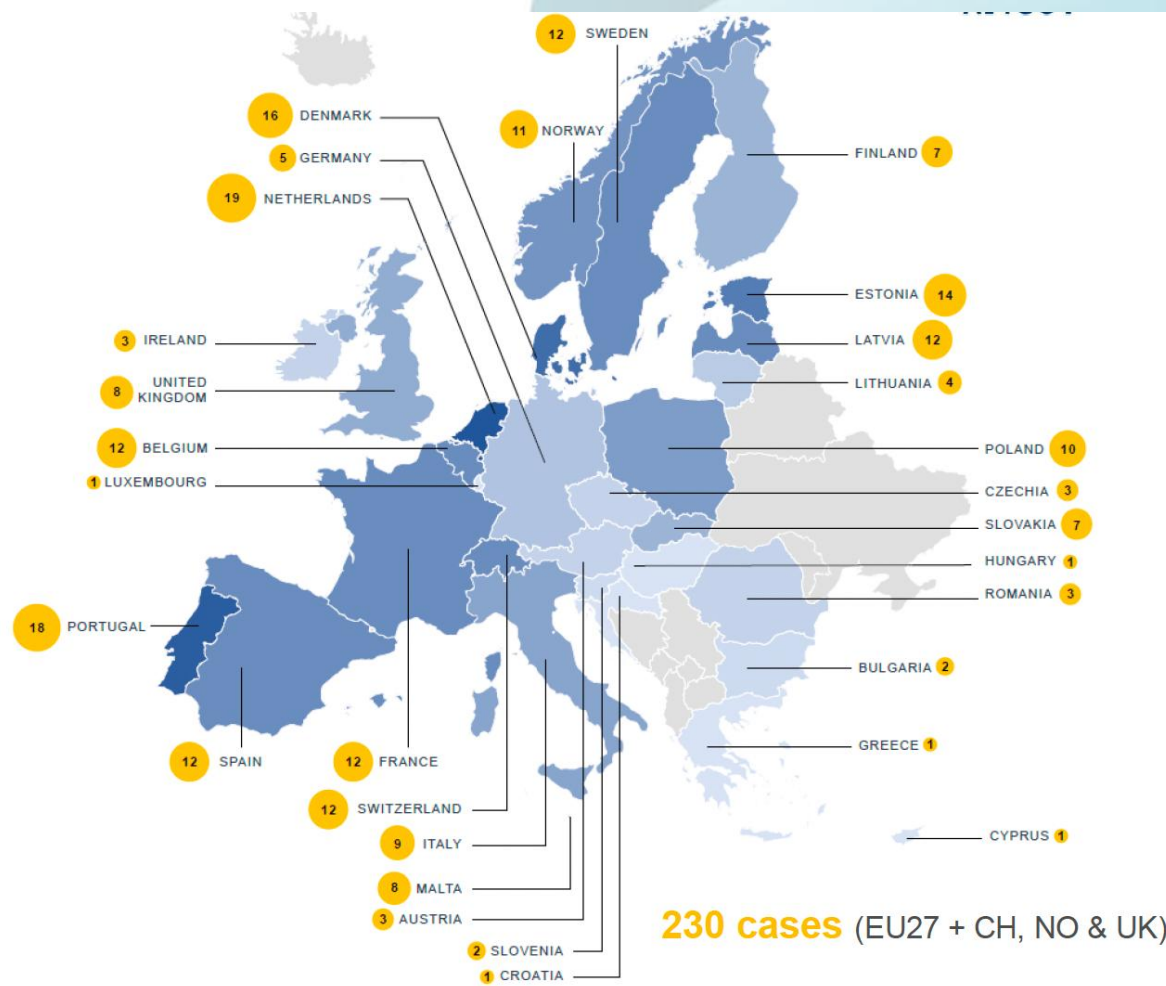
AI in the public sector

Where is it being used? Let's start with the analysis done by JRC in 2020

(source: most slides are taken from Gianluca Misuraca)

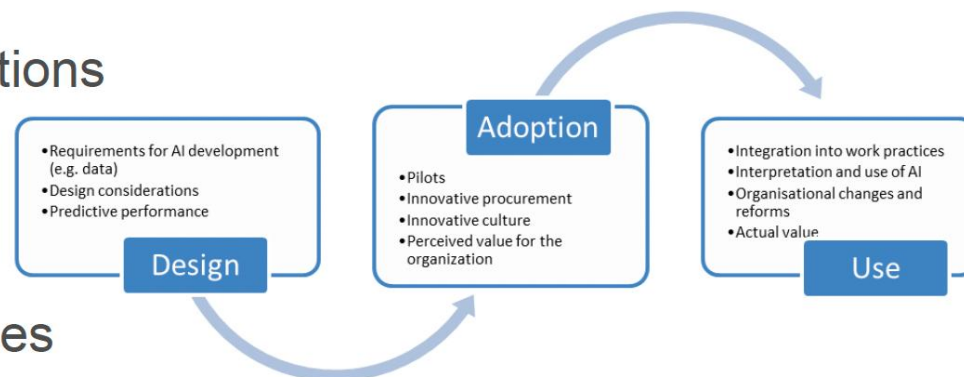
AI in the public sector: mapping AI use in public services in the EU

Source: Misuraca and van Noordt, 2020, JRC Science for Policy Report



Conceptualising AI-enabled innovation in the public sector

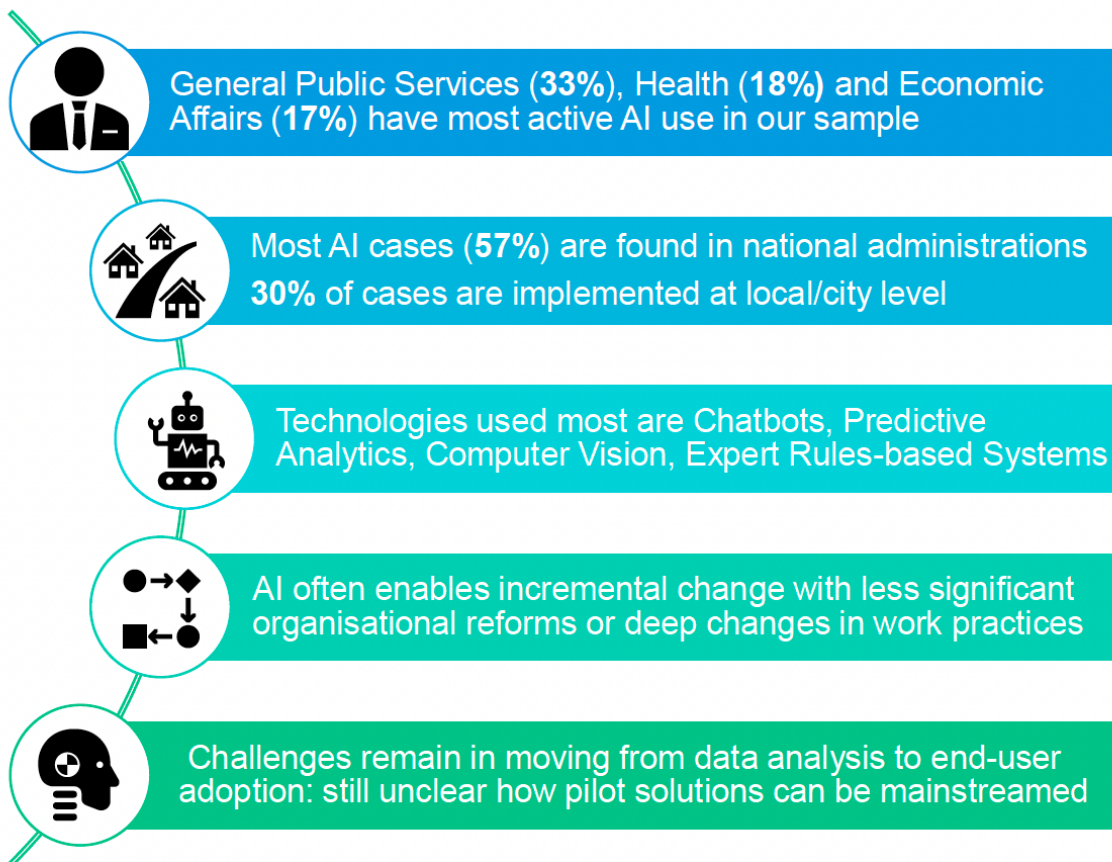
- Focus on adoption & use of AI applications
- Functional view of AI use:
 - Perception, Reasoning & Action
- AI typology derived from collected cases



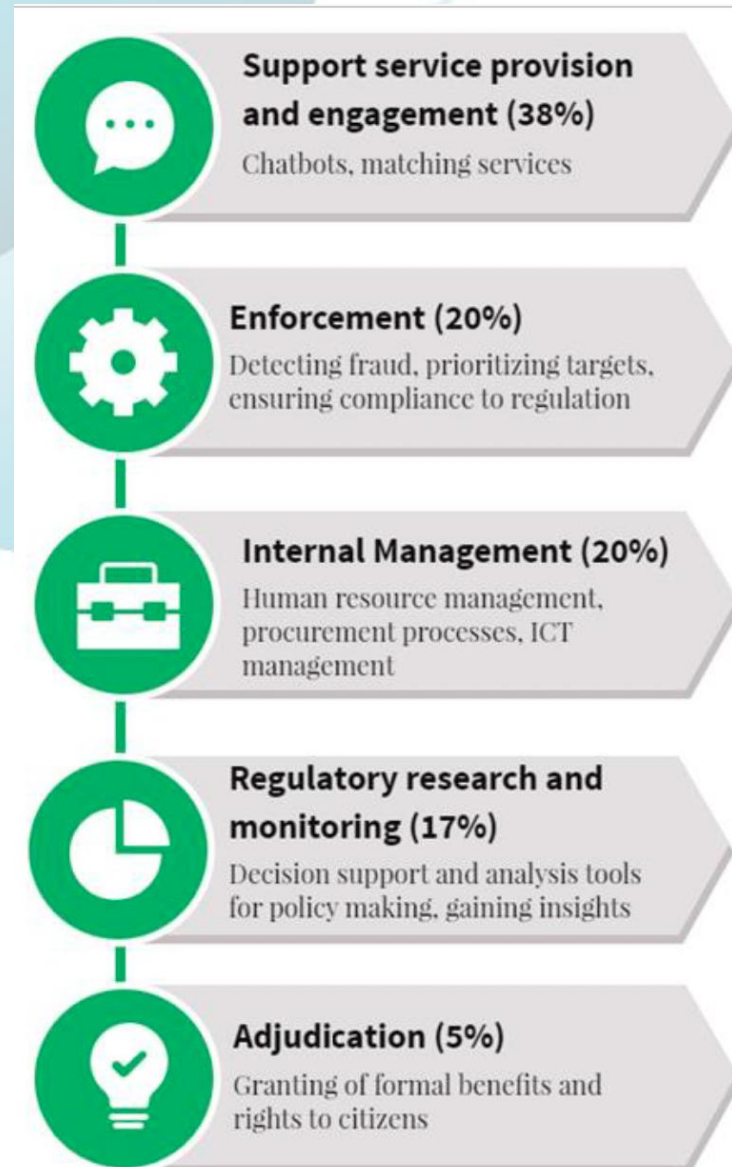
AI typology
Audio Processing
Chatbots, Intelligent Digital Assistants, Virtual Agents and Recommendation Systems
Cognitive Robotics, Process Automation and Connected and Automated Vehicles
Computer Vision and Identity Recognition
Expert and Rule-based Systems, Algorithmic Decision Making
AI-empowered Knowledge Management
Machine Learning, Deep Learning
Natural Language Processing, Text Mining and Speech Analytics
Predictive Analytics, Simulation and Data Visualisation
Security Analytics and Threat Intelligence



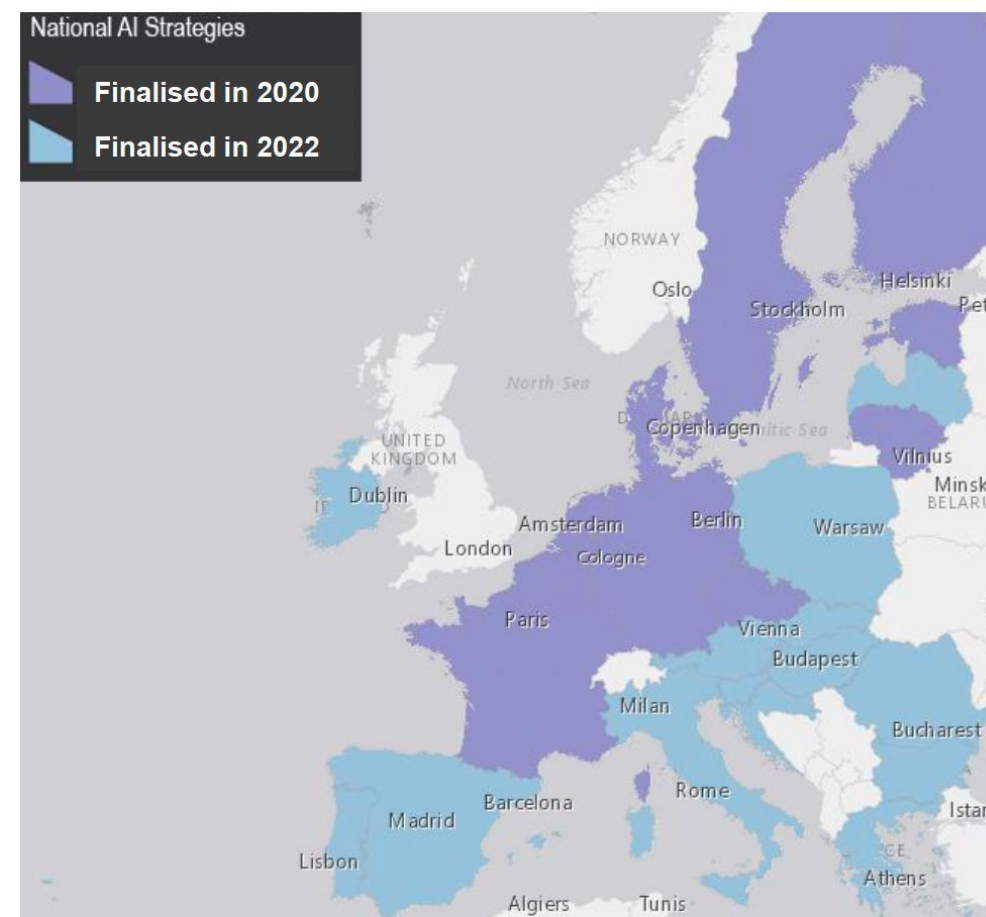
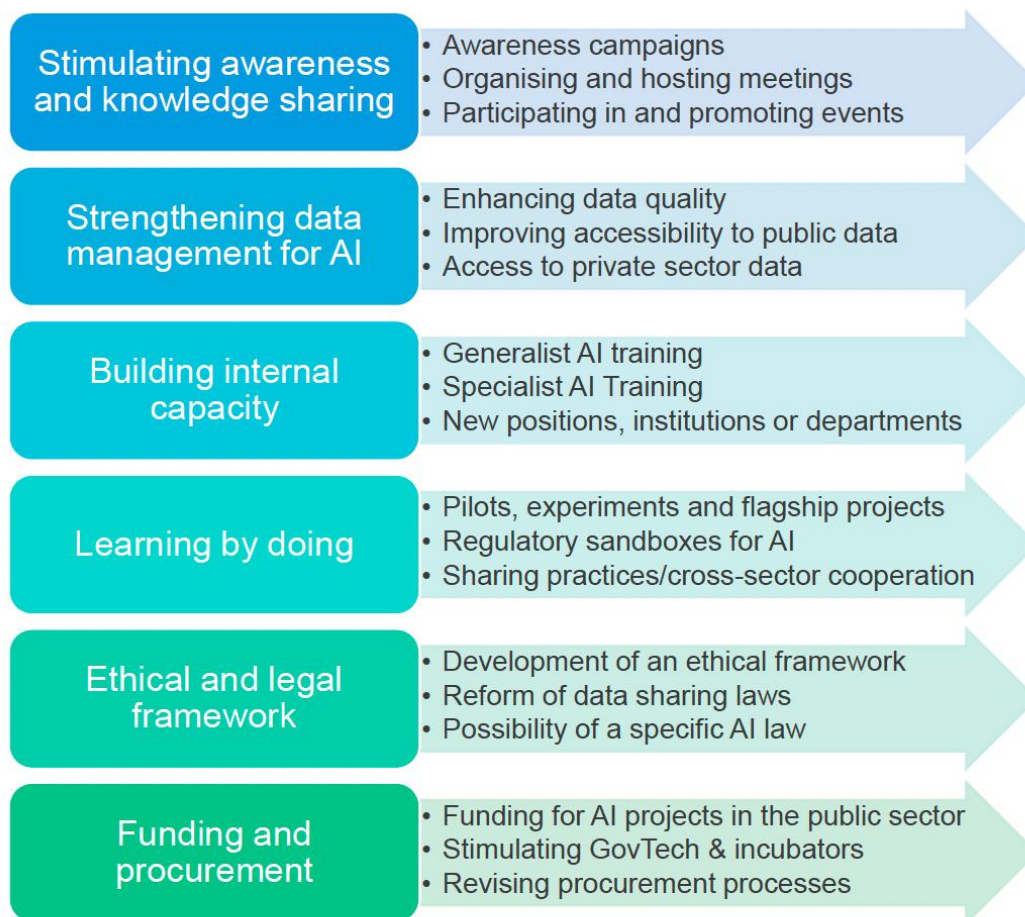
Key findings: AI use & purpose



Source: Misuraca and van Noordt, 2020, JRC Science for Policy Report



Policy actions on AI for the public sector. National strategies



Source: Misuraca and van Noordt, 2020, JRC Science for Policy Report

Some final highlights and conclusions from the AI Watch report

1. High level of heterogeneity of AI use across EU and unclear public value created
2. Search for “best practices”: learn from success stories and replicate / scale out
3. Beyond “ever piloting”: ensure the path to institutionalise AI into mainstream services
4. Little evidence of what works and what is actually threatening services quality
5. Varying scope and depth of strategies to develop and adopt AI
6. Innovative Public Procurement is crucial for adopting AI solutions
7. Sailing through new known unknowns and the multiple roles of government



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Since then, GenAI's irruption changes the landscape dramatically

New opportunities and challenges

JRC Public Sector Tech Watch

Public Sector Tech Watch Mapping Innovation in the EU Public Services

Bookmark

Like (3)

Translate

A collective effort in exploring the applications of Artificial Intelligence and Blockchain in the Public Sector



Khadidiatou Diaw

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Last update: 25/11/2024

Document



Year: 2024

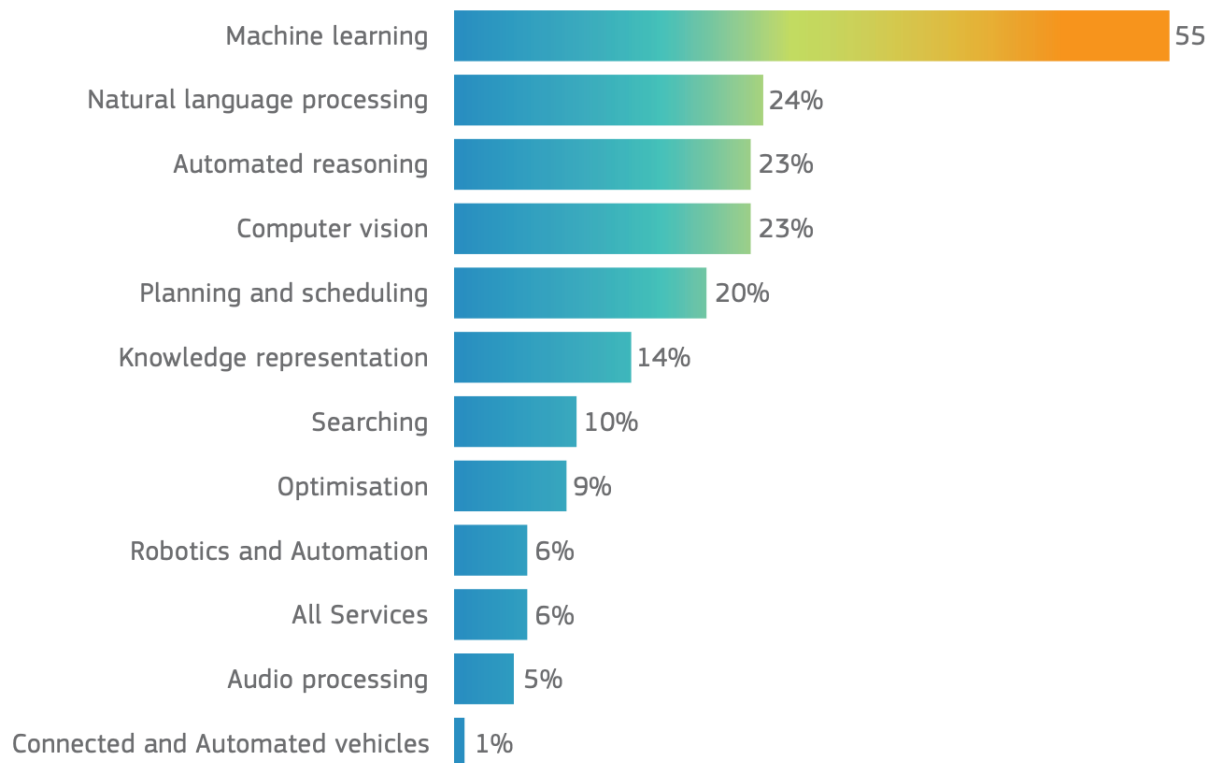
Corporate author(s): [Directorate-General for Digital Services](#) ([European Commission](#))

Personal author(s): [Agustina Brizuela](#) ; [Montino, Carlo](#) ; [Galasso, Giovanna](#) ; [Polli, Giovanni](#) ; [Martin Bosch, Jaume](#) ; [De Vizio, Leonardo](#) ; [Tangi, Luca](#) ; [Combetto, Marco](#) ; [Gori, Matteo](#)

This report presents the Public Sector Tech Watch (PSTW), the observatory launched by the European Commission's Directorate-General for Informatics (DG DIGIT) and the Joint Research Centre (JRC) to monitor and promote the use of emerging technologies like Artificial Intelligence (AI) and Blockchain in the public sector across Europe. PSTW serves as a knowledge hub and virtual space for stakeholders—including public administrations, the private sector, academia, and civil society—to access, share knowledge, and discuss the implementation of innovative public services. The observatory provides empirical evidence to better understand challenges and the effectiveness of these technologies in enhancing public administration functions. It also aims to foster a community for mutual learning and awareness at a European level. This report details the observatory's main features and summarizes data from over a thousand AI and Blockchain use cases in the public sector.

PSTW highlights

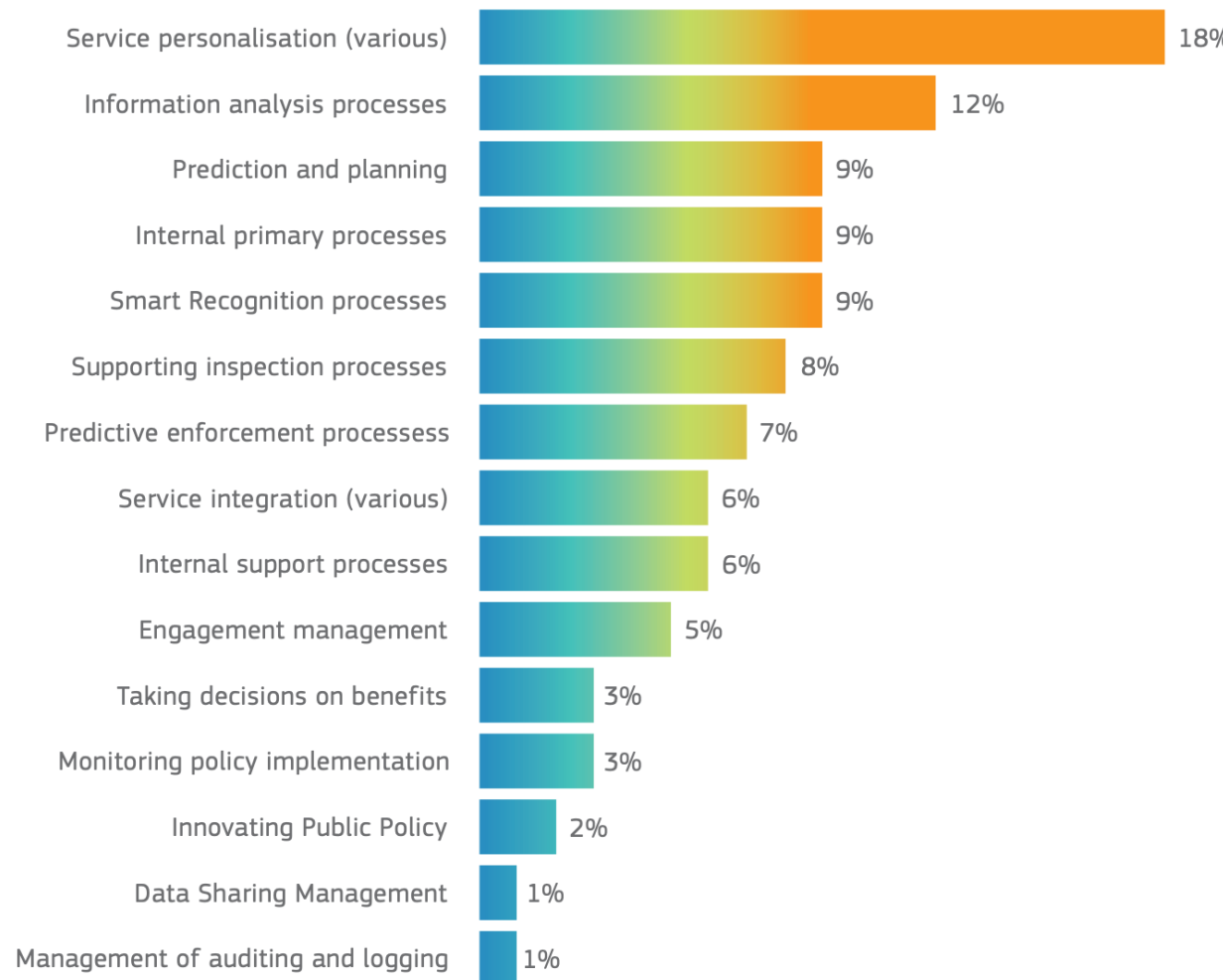
Figure 11. AI use cases distribution according to AI technology subdomains.



Source: PSTW Observatory

Note. Each case can be categorised with multiple AI subdomains; for this reason, the sum is above 100%.

Figure 12. AI use cases distribution according to Process and Application Type.



Source: PSTW Observatory



Opportunities for the public sector (with a few examples)

- Higher efficiency in processes
 - AI-assisted generation of public procurement documents (tender specification, administrative clauses, etc.)
- Opportunities for innovation
 - Identification of potential changes in land use and cadastral information based on the analysis of online sources (tenders, news, contracts, etc.)
- Improved service delivery
 - Automatic classification and delivery of citizen's claims and suggestions in a city
- Better decision-making for citizens, public administrations and businesses



Challenges for the public sector (with a few examples)

- Ethics and trustworthiness (see Prateek's presentation)
- Transparency and accountability
 - Why did you take this decision? How was the system trained?
- Data protection
 - How are the systems trained? Is it enough with the framework imposed by GDPR? What if some sensitive data is disclosed by an AI?
- Skills gap (a bit more now and also in Prateek's presentation tomorrow)
 - How do we commission AI-based services?
 - How do we know what is possible and what is not possible?
 - How do we evaluate the results before and after deployment?
 - How do we make sure that the services are sustainable (data, quality of decisions, etc.)



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Skills for public sector employees

It is not only about using AI. It is also about managing, regulating and governing AI-based systems

The AI4Gov journey



AI4Gov: Building the European ecosystem on AI for public services



1. Design, piloting and delivery of a world-class international master rooted in blended learning and project-based work
2. Develop an ecosystem on AI in public services across the EU
3. Establish an EU Centre of Excellence on AI for the public sector recognized worldwide



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DE MADRID



POLITECNICO
MILANO 1863
DIPARTIMENTO DI DESIGN



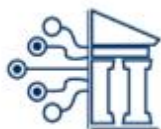
Friedrich-Alexander-Universität
Erlangen-Nürnberg



The AI4Gov Project is co-financed by the EU
CEF Telecom programme Action No 2020-EU-
IA-0064 under GA No
INEA/CEF/ICT/A2020/2265375



AI4Gov Master: training “functional specialists”



Master in
Artificial Intelligence for Public Services
AI4Gov



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DIPARTIMENTO DI DESIGN

- Integral curriculum teaching the technical, service design and policy aspects of applied Artificial Intelligence in the public sector

<https://www.ai4gov-master.eu/>



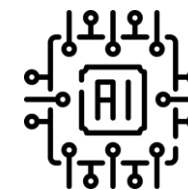
Governance and
policy aspects of
AI



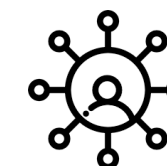
Human-centric
principles for AI systems
and service design



Focus on use
cases of AI in the
public sector



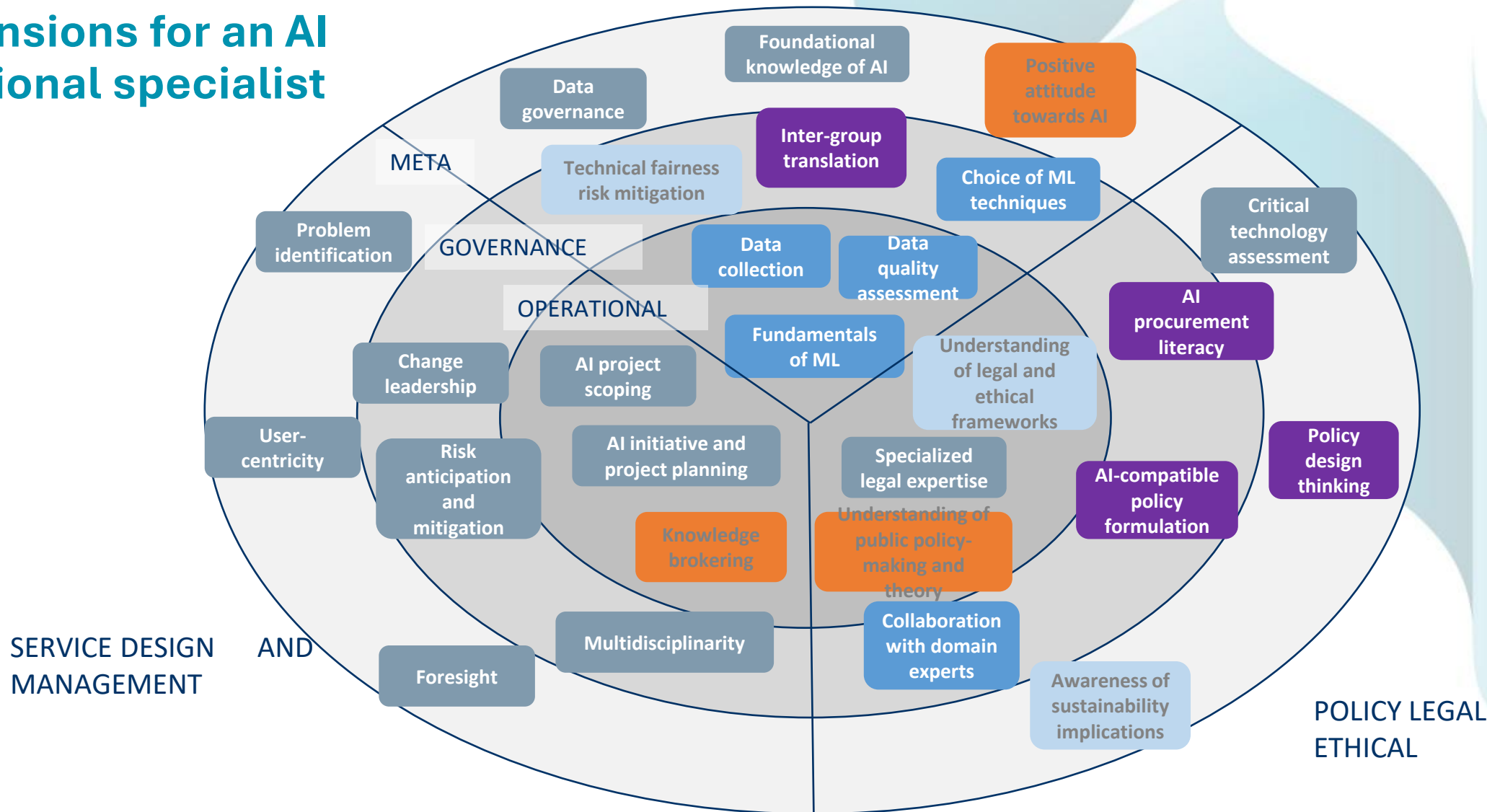
Technical knowledge
in on-demand AI
techniques



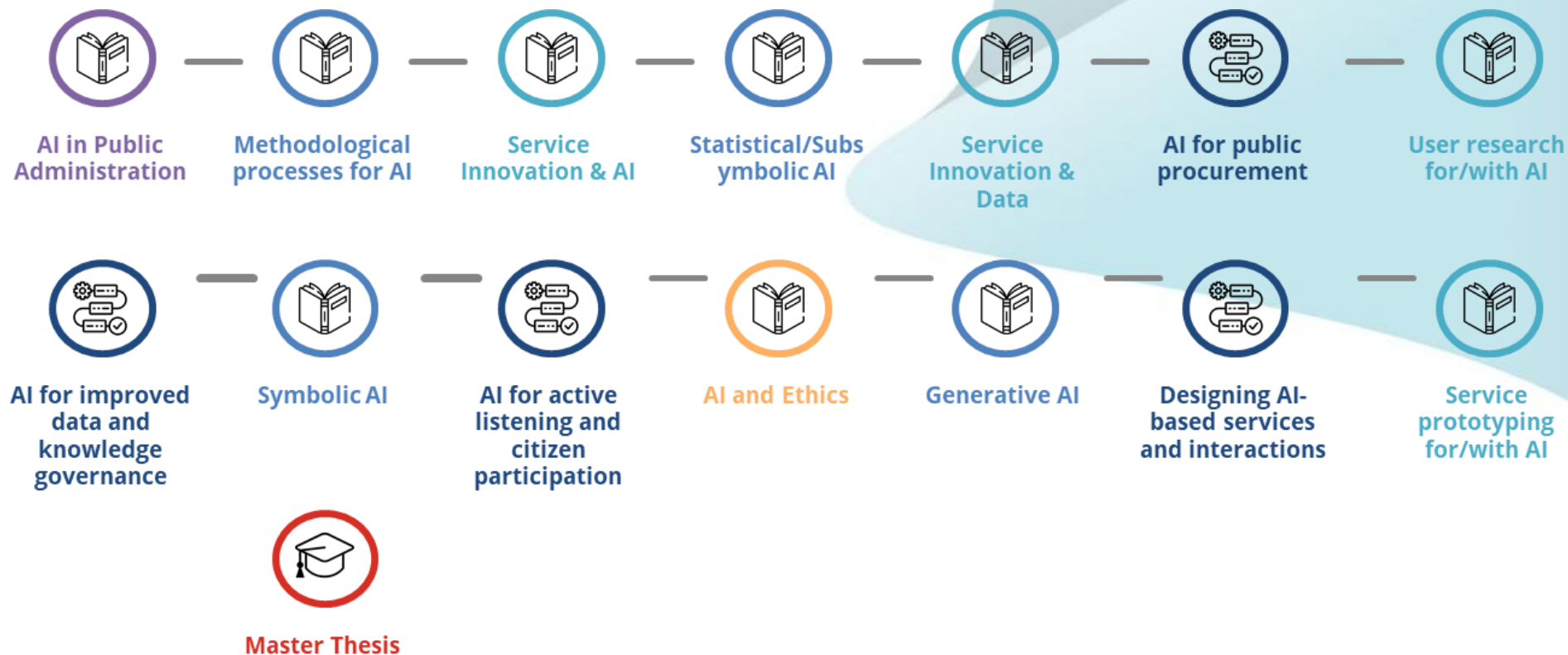
Networking with a
world-class
executive group



Dimensions for an AI functional specialist



The AI4Gov Master journey



The AI4Gov Toolkit – A practical framework for public sector innovation

- A visual and participatory framework to guide:
 - Understanding AI challenges in the public sector.
 - Mapping stakeholders and governance needs.
 - Designing responsible and human-centered AI solutions.
- Integrated into the master as a hands-on learning tool.





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Training AI functional specialists

Network of AI4Gov Alumni established

140

Students in four cohorts

21

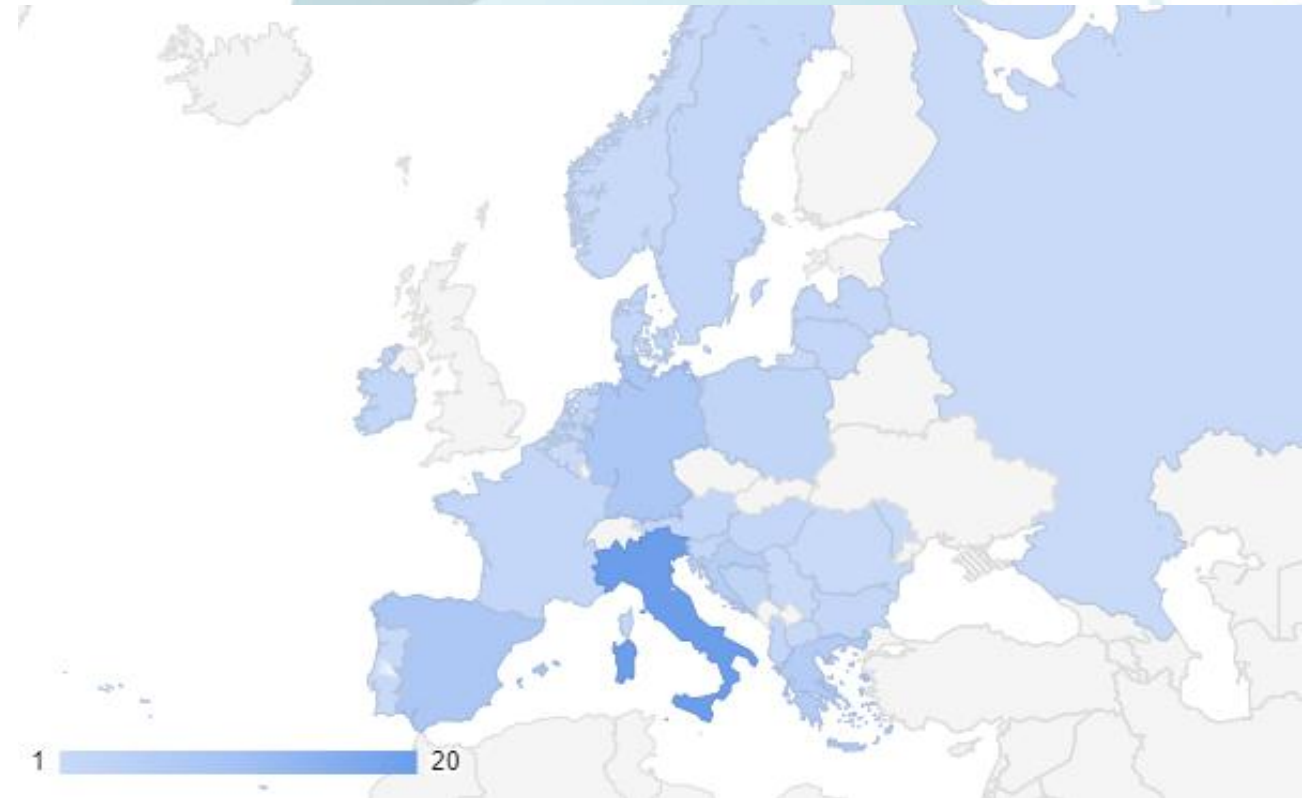
EU nationalities
represented / +50
nationalities

43%

Women

+90%

Students working
for/within the Public
Sector





Titles of (some) theses.

Case studies, reviews, landscape analysis

- Potential applications of AI to improve the enforcement in consumer protection and product safety/compliance.
- City traffic management: an AI-based approach
- Traffic enforcement for road safety using AI: from ideation to implementation.
- Radar interception and analysis (ELINT, Electronic INTElligence) using AI / ML
- Tender specification document for AI for tourism.
- Knowledge graphs used in the Italian context
- Comprehensive analysis of current situation and future implementation of AI solutions in Bosnia and Herzegovina - use case of public procurement.
- AI ethics from theory to action by focusing on case studies from the retail sector.
- eID based on face recognition: Case of Azerbaijan
- AI and service design for sustainability.
- Knowledge Graph of public procurement
- Portfolio approach to rethinking the mobility in the city of Skopje
- Small cities and AI - Challenges, potentials, inspiring use cases
- Emerging technology skills search among EU
- Essay on Ethics and AI
- AI Readiness
- Standardisation and AI
- Revolutionising Public Sector Experiences with AI and User-Centric Design
- AI in public administrations in Germany
- AI in public sector in cities in Croatia
- How can cross-sector cooperation increase the readiness for adopting of the AI systems and the implementation of AI systems in the Western Balkans public administration and at the global scale
- Digital Politics: How AI and Digital Platforms are Reshaping Political Campaigns
- Democracy-oriented indicators for AI National Strategies in EU MS from the retail sector.



Titles of (some) theses In-depth (research oriented) topics

- Privacy Preserving AI - Mitigating the Privacy Risks of AI Through Privacy Enhancing Techniques
- Landscape mapping of EU27 initiatives on ethics by design in AI
- Digitalization and AI in the academic landscape: German higher education institutions.
- Children's Position as a Stakeholder of AI
- Adapting Artificial Intelligence Model Cards for Public Services in Europe
- Application of AI techniques to policy-making
- AI4Inclusion
- Possible use cases of AI in the public sector (among EU Member States).
- Cross language information retrieval for public services
- Analysis of how AI has been procured from TED and other sources
- Artificial Intelligence to improve governance in the Public sector
- Civil Responsibility/Accountability in the use of AI. A new U.E regulatory roadmap?
- AI organizational readiness assessment for public institutions
- AI for the EU Funding & Tenders Opportunities Portal
- Functionalities that Generative AI can provide in education and healthcare
- Requirements and user stories on using AI for minutes of meeting.
- Design of a competence passport for health professionals
- Personalizing Public Services with AI. an analysis of the impact on inclusion, privacy and service delivery
- Development of semantic annotation tool for legal texts
- Predictive modelling for CRTM
- Data pipelines for annotation of scanned documents
- Designing a local-level data space platform as a strategic approach to reducing Human-Wildlife conflicts in rural Italy



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A joint initiative of the OECD and the EU,
principally financed by the EU



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Prerequisites for AI-enabled digital transformation

Ingredients for the application of AI in the public sector

A good data and knowledge governance model inside the organisation

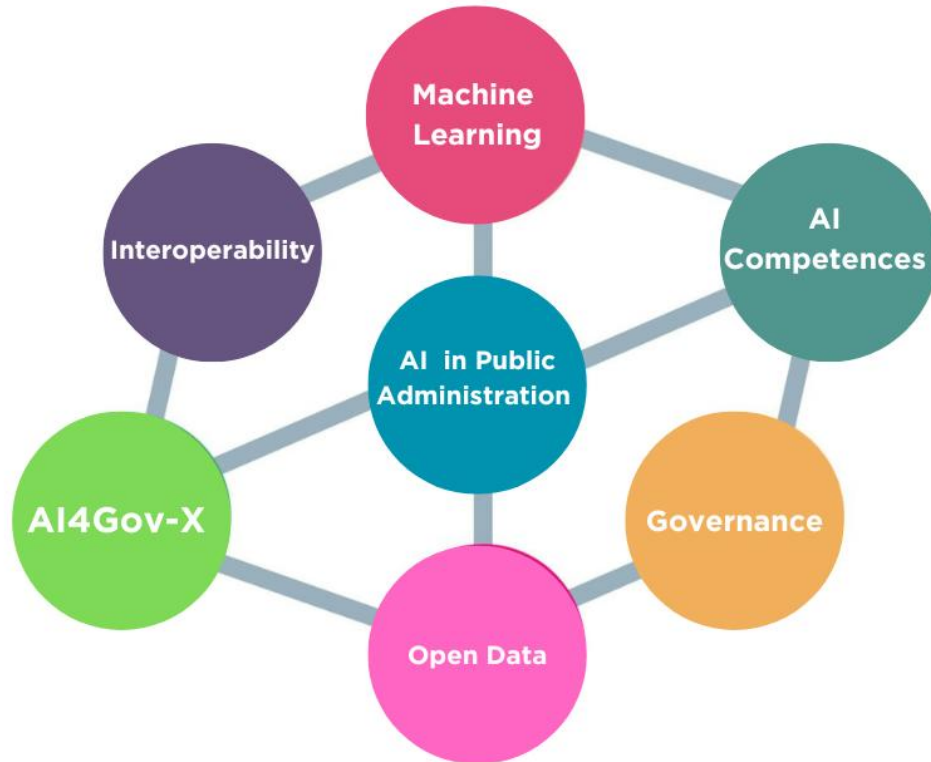
Clear rules for the procurement of AI-based services

Skills for public sector employees



In summary...

- Heterogeneous application of AI in the public sector
- AI systems are not only chatbots and LLM-powered conversational or information retrieval systems
 - Good old AI is also relevant, for many domains
- And most importantly.... It is not only about technology!!!
 - Importance of a good data governance in place in our public administrations
 - Reduce costs and errors due to low quality of data
 - Nurture skills across public service employees
 - Ensure trustworthiness



Thank you for your attention

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