Romania in the era of Artificial Intelligence

A strategy for the development and adoption of AI technology at a country level

Preamble

Artificial Intelligence (AI) deals broadly with designing intelligent computer systems, i.e. systems able to perform complex tasks that normally require human intelligence. The rapid development of the field in the last decade and its impact indicate its strong potential to generate a technological revolution in the near future, with implications in every sector of activity: healthcare, education, mobility, public administration, social services, workplace organisation, business administration, social interactions, entertainment and more.

Although the benefits of using AI technologies to enhance people's lives and gain economic growth are significant, they can also cause major disruptions, such as increased economic divide between countries or between social strata, restructuring of the job market due to automation, violation of (data) privacy because of intrusive technologies, and others.

In order to maximise the benefits while mitigating the associated risks, it is paramount that the development and adoption of AI is strategized at a country level, such that all the stakeholders are correctly identified and their efforts are coordinated in a way that guarantees that the wellbeing of all citizens is prioritised.

This document identifies the stakeholders relevant for Romania and presents a recommended roadmap that they should follow to develop and adopt AI technologies at a country level and in agreement with the directives of the European Union regarding ethics of AI adoption.

Stakeholders

General category	Representatives	Role		
		Provider	Beneficiary	Regulator
Public institutions	Local administration		☐	
	Government		☐	☐
	Presidency			☐
Education entities	Universities with AI programs	☐	☐	
	Universities without AI programs	☐		
	High Schools	☐	☐	
Research entities	Public institutes	☐		
	Private institutes / NGOs	☐		
Private sector	IT companies	☐	☐	
	Non-IT companies		☐	
Civil society	NGOs		☐	

Our vision:

Grow responsibly through knowledge

Romania to **enhance Romanian people's lives** through AI technology, while becoming an **active major contributor to the European and global AI ecosystem**.

growth

knowledge

responsibility

community

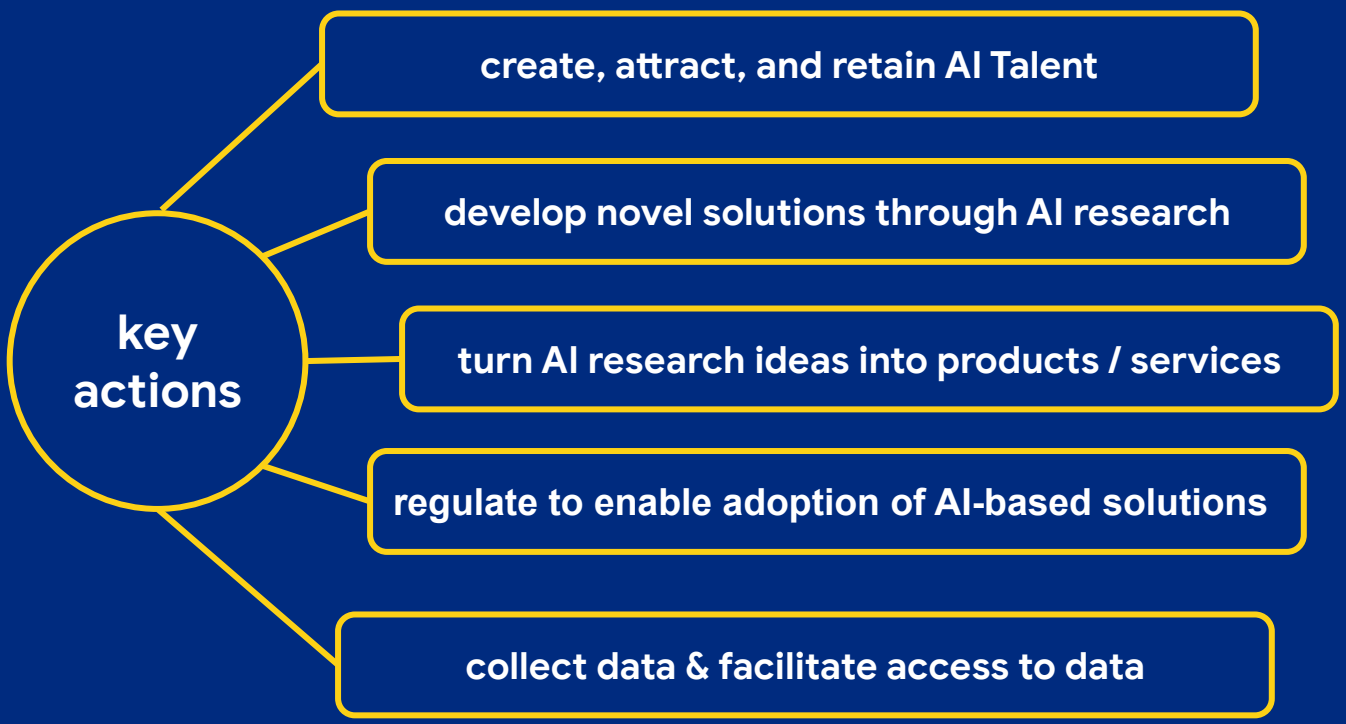
Mission

Increase the quality of people's lives and obtain significant economic boost through the development and adoption of AI technologies at a country level, while respecting and reflecting human ethical values, as emphasised in the EU guidelines for AI adoption. At the same time, make Romania an active partner and contributor at the European and global level, by developing original projects to benefit the local region, Europe and the entire world.

To achieve the objectives set above, all the relevant sectors in Romania - private, public and academic - must join efforts and create an optimal framework that ensures:

- the creation, attraction, and retention of AI talent in Romania;
- the development of innovative concepts, methods, and solutions through AI research;
- the industrialization of AI research ideas;
- the proactive and effective adoption of AI solutions to generate growth and meet people's needs;
- the efficient collection of data enabling the development of AI solutions.

All these objectives must be followed through a human-centric approach to guarantee that the development and adoption of AI has maximal positive impact on the future of work and wellbeing of the Romanian people and that it will reflect human ethical values in line with the international community.



Strategic directions

1. *AI Talent:* develop educational programs on AI to create talent; prioritise funding for AI projects (fundamental research, start-ups) that would attract and retain people with AI skills; support events and initiatives that strengthen and connect the local AI communities.
2. *AI Research & Development:* create frameworks to facilitate collaboration between academia and industry on AI research projects; joint private and public funding for research in AI; align the local research community to the international standards.
3. *Industrialization:* create incubators / start-up / digital sandbox / accelerators to support fast transition from research ideas to products
4. *Education in STEM and Future of work:* conduct impact studies on the changes brought by AI development and adoption on the job market. Adapt the education system and put a focus on STEM disciplines to prepare the next generations for these potential changes. Inform and educate the population about the potential of AI.
5. *Data*: legal framework for data collection and sharing; facilitate the development of infrastructure for data collection and sharing; ensure privacy, security of private information and protection against data misuse.
6. *European and international cooperation*: promotion and sync of Romanian interests with EU priorities and global challenges. Collaboration with CLAIRE and ELLIS organizations.
7. *Regulation*: develop proper regulation that facilitates AI adoption at national level, with a focus on boosting public procurement and public-private-academic partnerships, as well as on ensuring customer protection and cyber security; democratization of access to AI development and deployment capabilities/ resources/ services.
8. *Ethics:* ensure ethical, security, and safety considerations are taken into account in the development and adoption of the AI technology.

Impacted domains

1. Agriculture & Environment

Agriculture is one of Romania's main sectors of activity, with an agricultural capacity of 14.7 million hectares, and contributing about 6% of GDP. Approximately 3 million people (almost 30% of Romania's workforce) are employed in agriculture.

However, the agricultural capacity is heavily underexploited (about 6.8 million hectares are not used), due to obsolete technology, fragmentation and erosion of soil, desertification, and difficulty in accessing funds.

Using AI-based systems within a properly regulated framework has a significant potential for agriculture, to counteract the aforementioned issues. Examples of promising projects:

- Weather forecasts
- Autonomous machines (tractors, agribots, drones)
- Enhanced analytics on collected data (soil sensors, connected livestock)
- Precision agriculture
- Wildlife and forest monitoring (including illegal activities)
- Prediction and/or rapid response in case of events of environmental impact
- Waste management monitoring
- Smart automatic control of irrigation systems

Impacted domains

2. Healthcare

Health is the main factor influencing the wellbeing of the people, hence it represents a central priority for this strategy. The increase in the percentage of aging population and the decrease in density of medical doctors per capita, put healthcare at the top of priorities for Romania.

AI technologies have a tremendous potential to improve access to healthcare services and the services themselves, through projects such as:

- Enhance effectiveness of prevention programmes
- Education and training of healthcare professionals
- Support doctors in diagnosis and treatment
- Monitoring of chronic diseases
- Research
- Facilitate access to diagnosis and treatment for rare diseases
- Improve management of public healthcare system
- Intelligent bots to assist medical personnel and patients for timely access to information

Impacted domains

3. Education

Romania's future depends on the education system available to young generations. The obsolete methods used in teaching combined with the poor training of teachers lead to concerning percentages of functional analphabetism in Romania, especially in rural areas. AI technologies have the potential to revolutionise the education system through projects such as:

- Personalised content presentation, evaluation and feedback
- Classes augmented with AR & VR technologies
- Recommendations for further studying and curation of content
- Enhanced blended learning through AI
- Gamification concepts implemented through AI technology

Impacted domains

4. Infrastructure and Smart City

Romania's infrastructure has been slowly improving but is far behind other European countries. Utilizing the existing infrastructure optimally while at the same time accelerating the process of improving the existing infrastructure is key for Romania to be able to enhance its production and improve people's wellbeing. There is a huge potential to employ AI technology for:

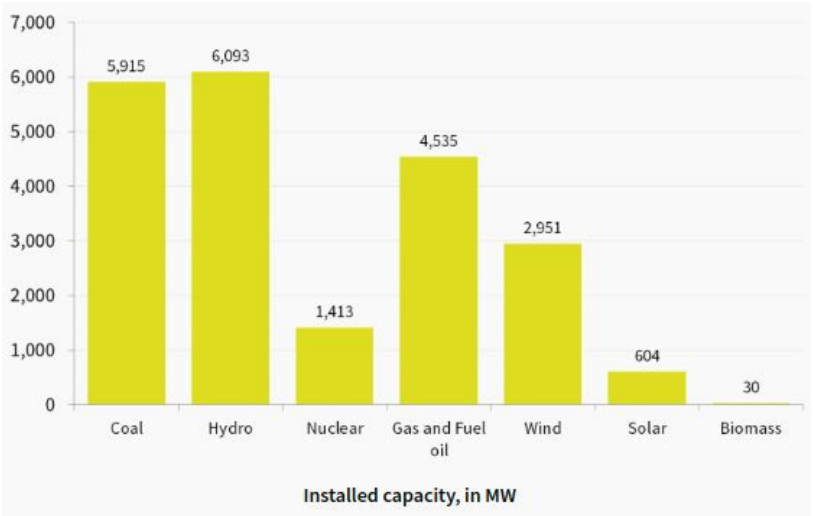
- Autonomous driving for personal cars
- Autonomous driving for transportation of goods
- Scheduling and tracking of goods
- Smart traffic lights
- Timetable prediction for public transportation
- Scheduling and automation of public transport
- Smart sensors for irrigation in urban areas

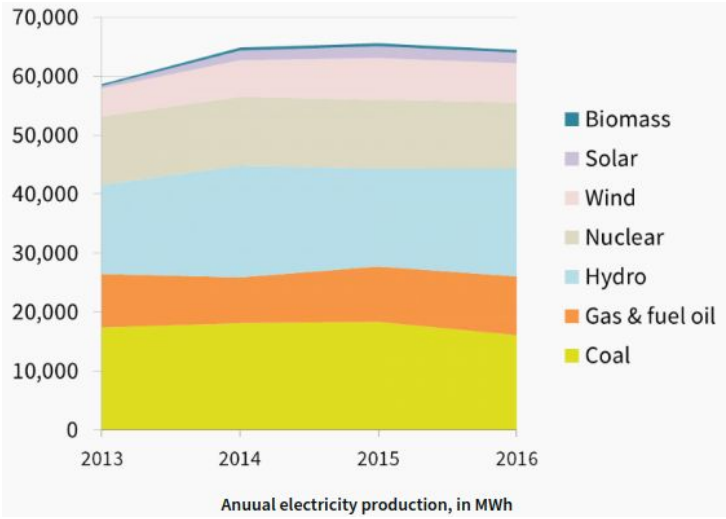
Impacted domains

5. *Energy production and distribution*

Romania has a balanced electricity mix, with coal, hydropower, natural gas, nuclear energy, and wind power having comparable shares of capacity and power generation. However, almost all units are fairly old. Improving maintenance of existing infrastructure is crucial. AI could have a positive impact in the sector through projects such as:

- Better estimates of available resources of petrol and gas to inform exploitation and storage decisions;
- Predict machines and equipment load using smart sensors for better maintenance.





Impacted domains

6. *Manufacturing*

AI has the potential to increase automation and improve productivity in manufacturing by exploring the following directions:

- Improve digitization of manufacturing (e.g. image processing for transitioning old model formats to new digital support).
- Defect & fault detection via image processing.
- Production demand forecasting for reduced production waste.
- Improved product development using data science for obtaining insights from usage data.

Impacted domains

7. *IT services, Business administration, Banking, Insurance, Financial Services, and Cybersecurity*

Romania, similar to other Eastern European countries, has a large IT and customer services sector, oriented mostly to the outsourcing market, rather than productization. AI technology can improve the efficiency and quality of these services. These could include:

- NLP tools to improve quality and efficiency of communication in written form (e.g. access to information, smart autocomplete, or automated information retrieval, automated categorization, etc.);
- Speech recognition and speech-to-text to transcribe audio to text, categorize or prioritize;
- Automation of tasks using smart chatbots.

8. *E-government and public administration*

- Improve customer interactions e.g. via relying on modern NLP tools
- Chatbots

9. *Tourism, travel, and entertainment*

- Recommender systems
- Smart customer support
- Information retrieval

10. *National security and defense, cybersecurity*

Existing projects related to AI

Education and research dissemination

EEML summer school and workshops

- Started in 2018
- Organised by Romanian researchers from abroad and Romania
- Targeting Eastern European countries

SSIMA Medical summer school

- Started in 2015
- Organised by UPB and international researchers

Recent Advances in AI conference

- Started in 2017;
- Organiser: University of Bucharest
- https://conferences.unibuc.ro/raai2019/

Master and doctoral programs in AI

- **UB, UPB, UPT** (coming soon)**, Iași** (coming soon)

Research & Development

- **Academia (Institutes of the Romanian Academy: RACAI, IMAR)**
- **Private sector (companies, RIST)**

Proposed projects related to AI

Education

Project title	**Teach the teachers**
Motivation	Several countries and education institutions have stressed the need for AI education (Basics of Machine Learning and Robotics) to start early on in the education programs, i.e. before university.
Description	Create a training program in Romania for high-school teachers from all over Europe to provide them with the basic knowledge and skills of AI, with the goal of enabling AI education before university.
Requirements	Location equipped with modern lecture rooms and laboratories Cloud compute resources Team of international experts delivering the lectures and practical sessions
Why in Romania	Cost effective due to lower cost of living in Romania Modern buildings available in universities Bucharest airport is well connected Contribute to develop the EE region
Stakeholders	Education institutions (high-schools)
Funding	European, private

Proposed projects related to AI

Education

Project title	**International Master's program**
Motivation	Democratization of education in AI is becoming a priority within the AI research community. Moreover, many Romanian experts from abroad are keen to support the local education system. A 1.5 years Master's program can have a significant impact, in a limited amount of time.
Description	Create a Master's program in a Romanian university with lectures given by international and local experts. Ensure high standards that will create and attract AI talent.
Requirements	Location equipped with modern lecture rooms and laboratories Cloud compute resources Framework for setting up such a program Team of international experts delivering the lectures and practical sessions
Why in Romania	Cost effective due to lower cost of living in Romania Modern buildings available in universities Bucharest airport is well connected Develop the EE community
Stakeholders	Romanian Universities
Funding	Mainly private

Proposed projects related to AI

Education

Project title	**Industry-funded chairs in ML for Romanian Universities**
Motivation	AI-skilled experts are highly valued in the job market and it is becoming increasingly difficult for universities to compete with giant companies in hiring experts, due to limited resources. However, even one expert per university, growing a team of researchers and PhD students around him/her, can have a significant impact and boost the Romanian research in AI.
Description	Create a framework for companies to fund positions in universities for AI experts to teach and lead research groups. Aligned metrics with international standards including focus on research.
Requirements	Competitive funding Cloud compute resources Regulation for such a framework
Why in Romania	Romania has great potential in STEM disciplines, but currently it lacks experts to mentor and lead research teams
Stakeholders	Romanian Universities
Funding	Mainly private

Proposed projects related to AI

Research & Development

Project title	**ML-ELI Machine Learning for High Power Lasers**
Motivation	Magurele Laser is the highest power laser in the world, and has a great potential to enable high impact biomedical technologies. Creating a European team of machine learning researchers at Magurele around the experts in the field could accelerate progress significantly in the area of high power physics.
Description	Create a European Machine Learning Research team around the Magurele Laser
Requirements	Location equipped with modern infrastructure Cloud compute resources Team of international ML experts with interest in high-power physics
Why in Romania	Efficient combination of domain knowledge and ML expertise Modern facilities available due to European funding Contribute to develop the EE region
Stakeholders	Romanian Research Institutions
Funding	European

Proposed projects related to AI

Research & Development

Project title	**ML for Agriculture**
Motivation	Agriculture is a vital sector for Romania. However its resources are not utilized in an efficient and sustainable manner. The project focuses on bringing AI technology to improve monitoring of these resources and hence lead to better informed decision.
Description	Create a network of sensors to collect data monitoring natural resources such as wildlife, fish, forests, as well as status of crops around the country. Provide a framework for utilizing the data to build systems able to predict events of interest from the data. Use change detection for tracking illegal activities related to deforestation.
Requirements	Location equipped with modern infrastructure Cloud compute and cloud storage Deployment of sensors in order to collect data Regulation regarding data collection and access Team of experts to provide tools to process the data
Why in Romania	Important problem for Romania's economy and workforce Romania is heavily under-utilizing its capacity in this domain
Stakeholders	Romanian agriculture sector
Funding	Private, Public, European

Proposed projects related to AI

Research & Development

Project title	**A (AI) doctor for every village**
Motivation	Romania has a very low density of medical personal per capita. This is particularly true in the rural areas. This project could be relevant for other European countries dealing with isolated rural areas and aging population.
Description	AI-based system that helps to triaje and automate simple medical diagnosis that can be provided in any village. The system can include speech synthesis and rely on audio input. The system should integrate information in a centralized manner, allowing supervision by qualified personnel which can intervene or recommend the patient to be seen by a doctor.
Requirements	Team of medical experts and ML experts to set up the system Secure and trustworthy cloud compute and cloud storage Domain experts that can intervene if necessary Regulation regarding processing and storage of sensitive data
Why in Romania	Lack of medical personnel
Stakeholders	Civil society
Funding	Public, Private, European

Proposed projects related to AI

Research & Development

Project title	**Romanian corpus of text and speech**
Motivation	A large number of services could be improved in Romania using intelligent chatbots operating in writing or spoken language. To produce maximal impact, these should be trained on a large Romanian corpus.
Description	Collect and gather Romanian text and spoken language from various sources (customer service support conversations, books, wikipedia Romanian version etc.)
Requirements	Regulation regarding processing and storage of potentially sensitive data (e.g. medical)
Why in Romania	Most of the existing corpora for NLP are in English, so most of the AI-based tools are sub-optimal when applied for Romanian.
Stakeholders	Research institutions
Funding	Public, Private, European