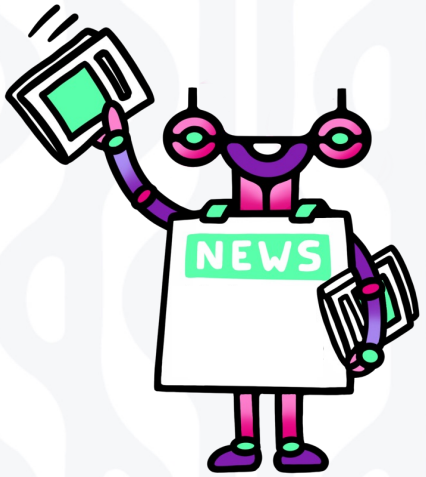
Technologies that will change our lives

Daphni perspective, summer 2023

Foreword



Deep-tech outlook: shovel and pickaxe of our technology for good strategy.

We all know that we have no choice but to build a sustainable future. This includes not only environmental sustainability, which is needed to address climate change, but also social sustainability. Both dimensions require responsible use of resources and forward-looking solutions.

This is where deep-tech (i.e., advanced technologies that offer a step-change advantage over existing solutions through technological breakthroughs) comes in. Deep tech stretches our limited resources, enables the creation of new models of use, and can directly solve fundamental problems. Yes, we believe that technology can save the world. It may not be THE answer, but it is certainly one of the answers.

As VCs, it is critical that we identify and invest in innovations that address significant challenges and shape the future, our future. This requires us to understand the evolving technology landscape, to anticipate shifts in both technology and consumer behavior, so that we can make informed decisions about promising ventures to the best of our ability.

This report is an overview of 17 technologies that we believe are important to watch. It's not just for investors, but for anyone interested in the future of technology. We haven't gone into the investment specifics of each technology but rather tried to give a clear and broad understanding of what they are and their limitless possibilities.

Since its inception in 2016, DAPHNI has been investing in sustainable models and deep tech. Portfolio companies such as Back Market and Hubcycle are accelerating the adoption of circular economy models, while Pasqal and AnotherBrain are pushing the boundaries of their respective fields (quantum computing and bio-inspired AI).

17 topics covered, with unequal awareness from the general public

	Made the headlines	Some awareness	Still under the radar
 **Energy**	Green hydrogen	Nuclear fusion Battery lifecycle management	Nuclear micro-reactors Energy harvesting
 **Bioscience & nature**	Gene-editing	DNA sequencing Regenerative agriculture	Bio-printing Data & AI for biodiversity
 **Computing**	Large language models	Quantum computing	Computer chips innovations
 **Space**	Space infrastructures		Space sustainability
 **Consumer**		Contour crafting	Digital twinning

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Nuclear fusion: unlimited clean energy might be less than a decade away

What it is and why it can change the world

Nuclear fusion is the process of combining light atomic nuclei, typically hydrogen isotopes, to form heavier elements, primarily helium. This **process releases a tremendous amount of energy** due to the conversion of a small amount of mass into energy. Fusion is the same **process that powers the sun** and other stars, and if harnessed on Earth, it has the potential to provide a **nearly limitless, clean, and safe energy source**.

Tech and scientific fields involved

- Plasma physics
- Materials science
- Superconducting magnets
- Vacuum technology
- Electronics
- …

Challenges being solved

- **Achieving and maintaining the extreme conditions** required for sustained fusion reactions
- Developing **materials that can withstand the harsh environment inside a fusion reactor** (notably heat, neutron radiation, and erosion)
- **Scaling up experimental reactor designs** to a practical, cost-effective, and commercially viable size

Recent news & selected key projects

Microsoft
HELION

Partnership to start using electricity from nuclear fusion as soon as 2028. Helion must demonstrate its ability to produce energy by the end of 2024.

NIF

National Ignition Facility announced that for the first time, its plasma produced more energy than it absorbed.

CFS

In March 2023, Commonwealth Fusion Systems obtained the components and authorizations to build the first SPARC experimental plant.

iter

Largest project worldwide, associating 35 countries. Unlocked $6.8Bn additional fundings in 2021. First plasma planned for 2025.

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Micro-reactors: Making nuclear rhyme with modular

What it is and why it can change the world

Micro nuclear reactors are **compact, modular nuclear fission power plants**, built to produce electricity and heat in the spectrum of 1 to 20 MWe. They represent a shift away from the standard of large, centralized nuclear plants, advocating for a **marriage of nuclear power with modularity and adaptability**. Their applications range from off-grid power supply for remote locations, lunar power, to the generation of energy on a building-by-building basis in urban landscapes. While it's **unclear whether this innovation will ever garner broad public acceptance** it undeniably stands as one of the boldest attempts to deliver **substantial amounts of low-carbon energy**

Tech and scientific fields involved

- Material science
- Reactor design
- Manufacturing techniques
- Remote control systems

Challenges being solved

- **Gaining public acceptance** and addressing concerns related to safety, waste disposal, and proliferation risks
- **Navigating complex regulatory and licensing processes**, which can be time-consuming and resource-intensive
- **Achieving economies of scale in manufacturing**, as well as demonstrating the commercial viability and competitiveness of micro reactors compared to alternative energy sources

Recent news & selected key projects

Canadian Nuclear Laboratories

CNL is building a micro-modular reactor that could provide for 5k people during 20 years while generating 1 m^3 of radioactive waste. Reactor is shipped in 90 pieces for modular assembly.

UK SPACE AGENCY

Plans to have a lunar micro-nuclear reactor ready to send by 2029. Power on the moon that does not depend on location and sunlight, could unlock space, defense and commercial use cases.

RADIANT

US startup trying to replace diesel generators with air-cooled nuclear microreactors, notably in remote villages and to provide resilient backup power for hospitals, datacenters and military.

Westinghouse

Developing eVinci mobile micro-reactors that need refueling every 3 years. Can be dismantled on-site ecologically. Mostly thought for military uses, to provide power in remote areas.

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Battery Lifecycle Management (LMC): A technical and logistical imperative

What it is and why it can change the world

As batteries will become increasingly important, so will the **optimization of their LCM**. It encompasses an array of technologies for:
(1) **Optimal use**, notably through software and data intelligence extend usage and lifespan; (2) **Reuse** i.e. giving a 2nd life to batteries, potentially with some transformations like connecting several packs to create storage units;
(3) **Recycling** to retrieve critical components required for new batteries; and
(4) **Safe disposal**, raising the question of the **initial design of batteries.**
All these levers are required for **battery-powered goods to have satisfactory carbon footprints**

Tech and scientific fields involved

- Cleaner next-gen battery recycling technologies
- Sourcing of materials
- 2nd life energy storage
- Introducing new technologies like solid state batteries to the LCM

Challenges being solved

- **Alignment between private and public sectors** is paramount so means and efforts are put in the right place
- **Cleaner and efficient versions of battery recycling** methods like pyrometallurgy, hydrometallurgy, biometallurgy, direct recycling, mechanical treatment and water leaching
- Continuous development of LCM technologies as **new battery technology types** get introduced in the supply chain

Recent news & selected key projects

Voltfang

Based in Aachen, Voltfang is the leading German player of 2nd life EV battery Smart energy storage systems. With clients like Aldi and McDonalds, they focus on Commercial and Industrial clients.

Li-Cycle

Li-Cycle is the industry leader in closed loop resource recovery technology for battery recycling. They recover up to 95% of materials in all types of lithium-ion batteries.

REDWOOD MATERIALS

US-based firm, RM has received $2.8B+ in funding. They create a closed-loop, domestic supply chain by recycling and refining lithium-ion batteries while remanufacturing anode and cathode components.

KULR

Kurl Technologies Group is offering a one-stop-shop approach for batteries. They offer services and technology for design, assessing, testing, transporting, and disposing battery packs.

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Energy harvesting: Small omnipresent renewable energy, under the radar

What it is and why it can change the world

Instead of relying on large natural energy sources like the sun, wind, and rivers, energy harvesting utilizes an **array of technologies to capture minor amounts of energy from unconventional sources**. These include light, heat, vibrations, radio waves, physical movement, or even miniaturized traditional renewables like micro wind-turbines.
At the intersection of **low-carbon energy and quality of life enhancements**, these technologies will allow the sustainable scalability of multiplication of the micro-electronics devices, by rendering **power cords, battery changes, recharging, and refueling redundant**

Tech and scientific fields involved

- Nanotechnology
- Energy conversion materials
- Miniaturized energy storage
- Low-power electronics

Challenges being solved

- Provide **sufficient and consistent power output** for various applications, particularly in environments with **fluctuating or intermittent energy sources**
- Ensuring the **reliability, durability, and efficiency of energy harvesting** materials and components, as they need to operate effectively in a wide range of conditions and environments

Recent news & selected key projects

University of Massachusetts Amherst

Researchers could harvest continuous electricity from air humidity using any material with nanopores using the "generic Air-gen effect." This technique, scalable and interruption-free, is promising.

Gwangju Institute of Science and Technology

GIST researchers reported on a novel thermoelectric generator design that is inspired by the skin of a zebra, and can convert temperature gradients to electricity, using light and biodegradable materials.

ENERBEE

Grenoble-based startup making "IoT w/o batteries" happen, through autonomous sensors. Currently applications include HVAC systems, industry 4.0, mobility and smart cities.

everactive

Has developed energy harvesting systems fully integrated on-chip, allowing batteryless IoT operation from multiple low-energy sources (indoor solar, vibrations, thermal gradients,…)

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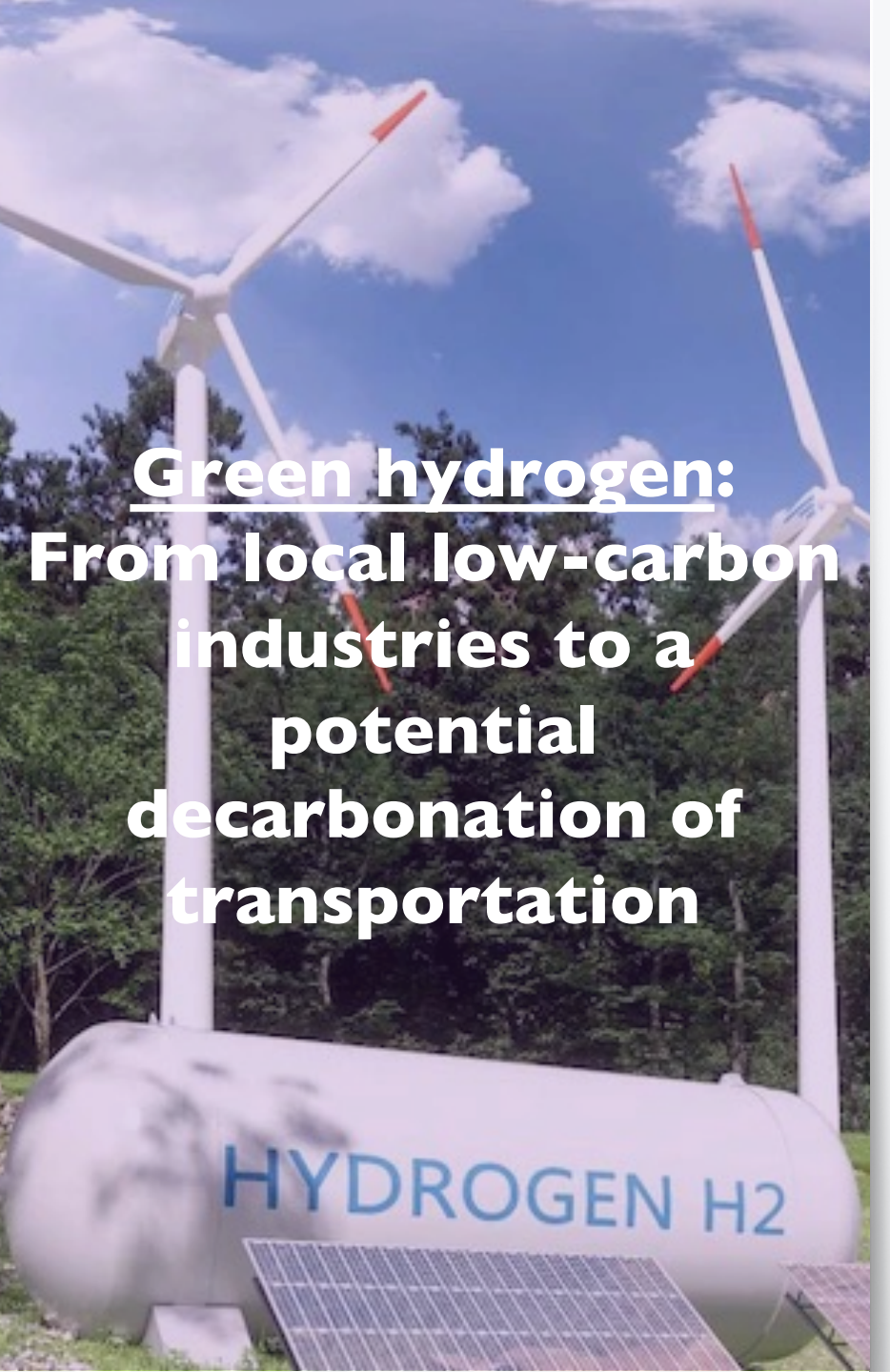

Green hydrogen: From local low-carbon industries to a potential decarbonation of transportation

What it is and why it can change the world

Green hydrogen, derived from low-carbon or renewable electricity, offers an **efficient energy storage medium** due to its abundance, cleanliness, and high density. Despite relying on mature technologies like electrolysis, the hydrogen **industry is still emerging, with Europe keen on retaining its lead**. The immediate focus is on **expanding local use in industrial sites and ports**, offering cost-effective hydrogen and manageable capex. Ultimately, hydrogen aims to significantly contribute to transportation decarbonization, where the **potential for CO2 footprint reduction is vast but demands infrastructure** for regional, national, and cross-border networks.

Tech and scientific fields involved

- Electrochemistry
- Materials science
- Mechanical engineering
- Chemical engineering
- Renewable energy
- Environmental science

Challenges being solved

- **Efficiency**: green hydrogen has a round-trip efficiency of 20-50%, which is low. It calls for significant increase of low-carbon electricity production capacity, and/or limit the use cases where hydrogen is competitive
- **Storage & transportation**: as hydrogen is a very small molecule, it can escape from many kinds of containers and embrittle some metals
- **Infrastructure**: outside of local industrial applications, hydrogen is a capex-intensive solution

Recent news & selected key projects

H2 green steel

Swedish startup created in 2020 which has raised close to $400m to develop low-carbon steel production, using green hydrogen instead of coal and state-of-the-art production processes.

EODev

Develops and sells stand alone hydrogen-powered generator. Made the headlines in 2021 for powering the Eiffel Tower lights with hydrogen. Actively works with the Île-de-France region.

HYVIA / Renault

Renault Group and HYVIA presented the Renault Master Van H2-Tech to the World Hydrogen Summit 2023 in Rotterdam, which need a 5min recharge for 400km of autonomy.

Amelia / Universal Hydrogen

Plans to start operating 3 hydrogen-fueled planes in 2026, for regional flights. Universal Hydrogen is focused on making kits to convert planes to hydrogen and will deliver the 3 converted planes.

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Bioscience & Nature

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DNA sequencing: we are finally close to map human genomes at scale

What it is and why it can change the world

Thanks to advancements in NGS, the **cost of sequencing a human genome dropped from $100M in the 2000s to $1000 today**. However, it remains challenging as a genome has 3.05B DNA pairs, needing c.30 sequencing iterations for accuracy.

Improved accessibility to sequencing enables **breakthroughs in gene editing**, enhances our **understanding of biology and diseases**, and expands **personalized medicine**. Progress is ongoing, as only 30M people participated in sequencing, with **few hundred thousand genomes fully sequenced**.

Tech and scientific fields involved

- Genomics
- Genetics
- Bioinformatics
- Molecular biology
- Biotechnology

Challenges being solved

- **Data privacy and ethics**: misuse could lead to discrimination in healthcare, employment, or insurance, hence a need for robust guidelines
- **Data volumes & computational challenges**: given the size of human genomes, their storage and analyze are "big data" issues
- **Standardization and Interoperability**: the variety of sequencing platforms and analysis methods calls for standardization

Recent news & selected key projects

Oxford NANOPORE Technologies

DNA sequencing hardware specialist, having recently released MinION, a portable device to sequence DNA in real-time, while supporting long reads, based on nanopore technologies.

PacBio

Gas developed Single Molecule, Real-Time (SMRT) sequencing technology. It is unique in that it monitors the incorporation of nucleotides into a growing DNA strand in real time.

Genomics England

The UK is set to begin sequencing the genomes of 100k newborn babies, i.e. 1/12th of newborn babies over two years, on a voluntary basis. The program will screen for around 200 rare diseases.

unesco

Has launched programs on environmental DNA, which means analyzing DNA strands in air or water to get information on animal populations, and their resilience to climate change.

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Gene-editing: Harnessing DNA for healthcare and beyond

What it is and why it can change the world

Precision gene editing employs advanced techniques to **alter an organism's DNA with remarkable accuracy and efficiency**. The most celebrated tool in this regard is **CRISPR-Cas9**, a revolutionary device functioning like molecular scissors. As a fresh technology, we're merely at the threshold of understanding its vast potential. It holds substantial promise in **combating formidable diseases** such as cancer, blood disorders, and AIDS, alongside genetic disorders. Excitingly, it could also play a significant role in crafting **microorganisms**, establishing disease-resistant crops, and even **encoding our "cold" data into DNA** for nearly eternal and energy-free storage.

Tech and scientific fields involved

- Genetics
- DNA sequencing
- Molecular biology
- Bioinformatics
- Synthetic biology

Challenges being solved

- **Reducing off-target effects** and ensuring the safety and specificity of gene-editing tools
- Developing **efficient and reliable delivery systems** for gene-editing components to reach target cells and tissues.
- Addressing **ethical, legal, and social concerns** related to the use of gene editing, particularly in human germline editing, which can have heritable effects and impact future generations.

Recent news & selected key projects

TUNE THERAPEUTICS

Has successfully lowered the cholesterol levels of monkeys using a version of CRISPR that doesn't permanently alter DNA — suggesting a safer way to use the technology. Tune has raised $40M.

Massachusetts Institute of Technology

MIT scientists found a method to engineer specific cancer-related mutations. It speeds-up considerably traditional approaches, needing months to produce / analyze one mutation.

Intellia THERAPEUTICS

Leading company in CRISPR-based genom editing technologies, with $1Bn+ funds raised. One of co-founders received the chemistry Nobel Prize in 2020. Over 13 lines in the pipeline as of 2023.

SNIPRBIOME A CRISPR COMPANY

Thanks to the largest series A in Scandinavia, SniprBiome is developing a novel approach to medicine by target killing unwanted bacteria directly in microbiome, and is the 1st to file IP on the matter.

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Bio printing: Will we print the new organs we need anytime soon?

What it is and why it can change the world

Bioprinting, a form of additive manufacturing, crafts **3D biological structures from bio-inks** composed of living cells and biomaterials. It utilizes techniques like inkjet, extrusion, or laser-assisted printing to build intricate, precise structures layer by layer. Its principal applications lie in **tissue engineering, drug development, and regenerative medicine**. With the potential to revolutionize healthcare, pharmaceuticals, and cosmetics, bioprinting enables the **creation of bespoke tissues, tailored drug therapies, and sophisticated in vitro models** for drug testing and disease research. Still, consensus is that 3D printed organs are still a lifetime away.

Tech and scientific fields involved

- Additive manufacturing
- Cell biology
- Bio-inks
- Biocompatible materials

Challenges being solved

- Improving the **resolution, speed, and scalability** of bioprinting techniques to create larger and more complex structures
- Developing **bio-inks that can mimic the properties of native tissues**, support cell viability, and promote tissue maturation
- Addressing **ethical, regulatory, and safety concerns** related to the use of bioprinted tissues and organs in clinical settings

Recent news & selected key projects

CELLINK

Develops some of the best 3D bioprinters and inks on the market, that are instrumental to discoveries in 3D cell culturing, and drug development. It released the first universal bioink back in 2016.

ARRAYJET

CRO locating in the UK, uses non-contact inkjet printing technology to provide innovative solutions to pharma, life science and diagnostic industries.

BRINTER®

Located in Finland, it prints tissue models layer-by-layer. It also develops personalized oncology medicine by 3D printing patient-specific tumors and then testing potential drugs on them.

CollPlant **stratasys**

Announced an agreement to collaborate on 3D printed breast implants. Bioprinted tissues will act as a scaffold structure, within which living cells can proliferate to then degrade into the body.

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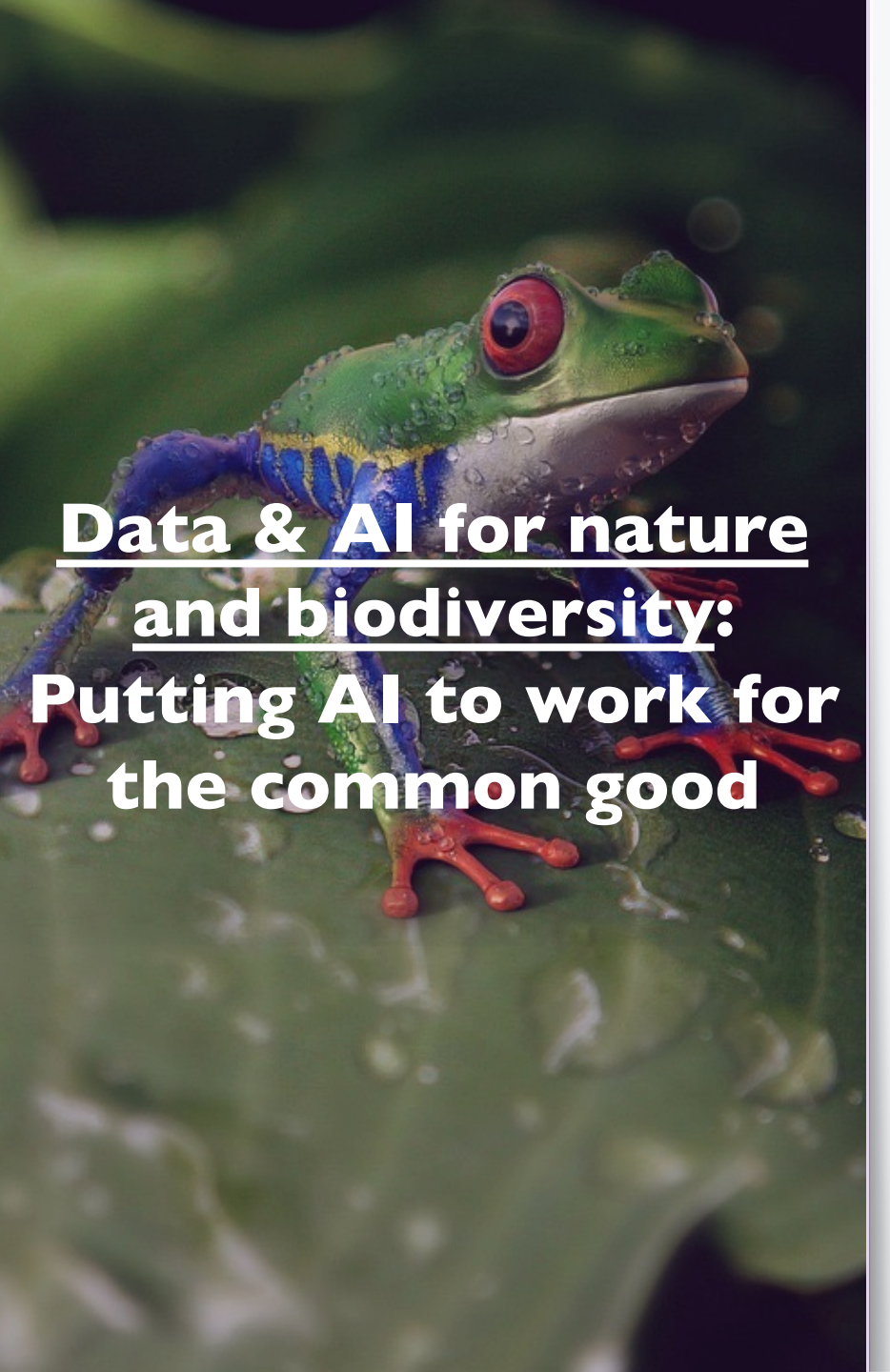

Data & AI for nature and biodiversity: Putting AI to work for the common good

What it is and why it can change the world

While it may not spring to mind instantly, the intersection of AI and nature conservation is rich with untapped potential. Unveiling an underestimated realm where tech meets ecology, here are eight compelling use cases:

1) Specifies identification & tracking
2) Habitat monitoring & analysis
3) Poaching prevention
4) Climate change analysis
5) Restoration efforts
6) Wildlife surveillance
7) DNA for species identification
8) DNA for species revival based

Recent news & selected key projects

1) eBird iNaturalist

Rare species are difficult to detect. As data is missing, data crowdsourcing initiatives such as eBird and INaturalist play an important role to support researchers.

2) Conservation Metrics

Uses machine learning to analyze aerial drone as well as camera traps and acoustic sensors footages and monitor wildlife habitats. Have covered 200+ monitoring.

3) PAWS Air Shepherd

Nonprofits and researchers collaborate to prevent poaching. PAWS uses game theory to plan prevent crimes, while Air Shepherd also analyzes air drones in real time.

4) Climate Change AI

Nonprofit from 2019 dedicating to catalyze work on how AI and ML in particular can help understand, predict, fight and adapt to climate change.

5) dendra SYSTEMS

Digital platform to scale ecosystem restoration, through ecosystem insights based on satellite and drone imagery, management of targeted initiatives and aerial seeding through drones.

6) WILDME

Open software platform that leverages state-of-the art machine learning to monitor species, with the ability to develop specie-specific models. Currently covers 50+ species and led to 70+ publications.

7) International BARCODE OF LIFE

Leverages DNA barcoding of species as well as environmental DNA to discover species, understand how they interact with ecosystems, and their dynamics. Works for several governments.

8) revive & restore

Uses genomic technologies to complement and augment conservation practices. First applications revolve around biobanking tools, the goal is to create a Genetic Rescue Toolkit enabling to revive species.

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Regenerative agriculture: A necessary shift in how we grow food

What it is and why it can change the world

Regenerative agriculture is a **transformative shift** that unites **reverence for nature with sustainable food growth**. It's about **healing ecosystems as we cultivate**, shunning harmful pesticides, nurturing biodiversity, optimizing water cycles, and actively sequestering carbon. This vision harmonizes **time-honored practices with modern innovations**. Core methods include cover crops, mindful crop rotation, managed grazing, no-till farming, and agroforestry, enhanced by cutting-edge tools. Drones, satellite imagery, GPS-guided machinery, smart irrigation, advanced soil health testing, and digital farm management software all play their part.

Tech and scientific fields involved

- Agronomy
- Ecology
- Hydrology
- Microbiology
- Agroforestry

Challenges being solved

- **Economic constraints**: transitioning can require costs and temporarily reduced yields, which calls for financial support / new models
- **Education and training**: many farmers are not familiar with regenerative farming practices and how to implement them effectively, hence a knowledge gap to be addressed
- **Measurement and verification**: measuring the benefits of regenerative farming is both complex and difficult to standardize

Recent news & selected key projects

As agriculture represent c.70% of the scope 3 emissions of large F&B brands, they launched significant programs in favor of regenerative agriculture over the past few months.

Nonprofit organization uniting the full value chain of agriculture to harmonize best practices of regenerative farming (standards, audit procedures, education, training, reporting,…).

One the world's most funded Agritech startup with of $900M raised, focused on developing microbial and digital technologies to improve agriculture sustainability and efficiency.

Digital platform and IoT sensor provider to help farmers leverage data to make informed decisions and adopt precision farming. Also offers training on agriculture 4.0 and corresponding techs.

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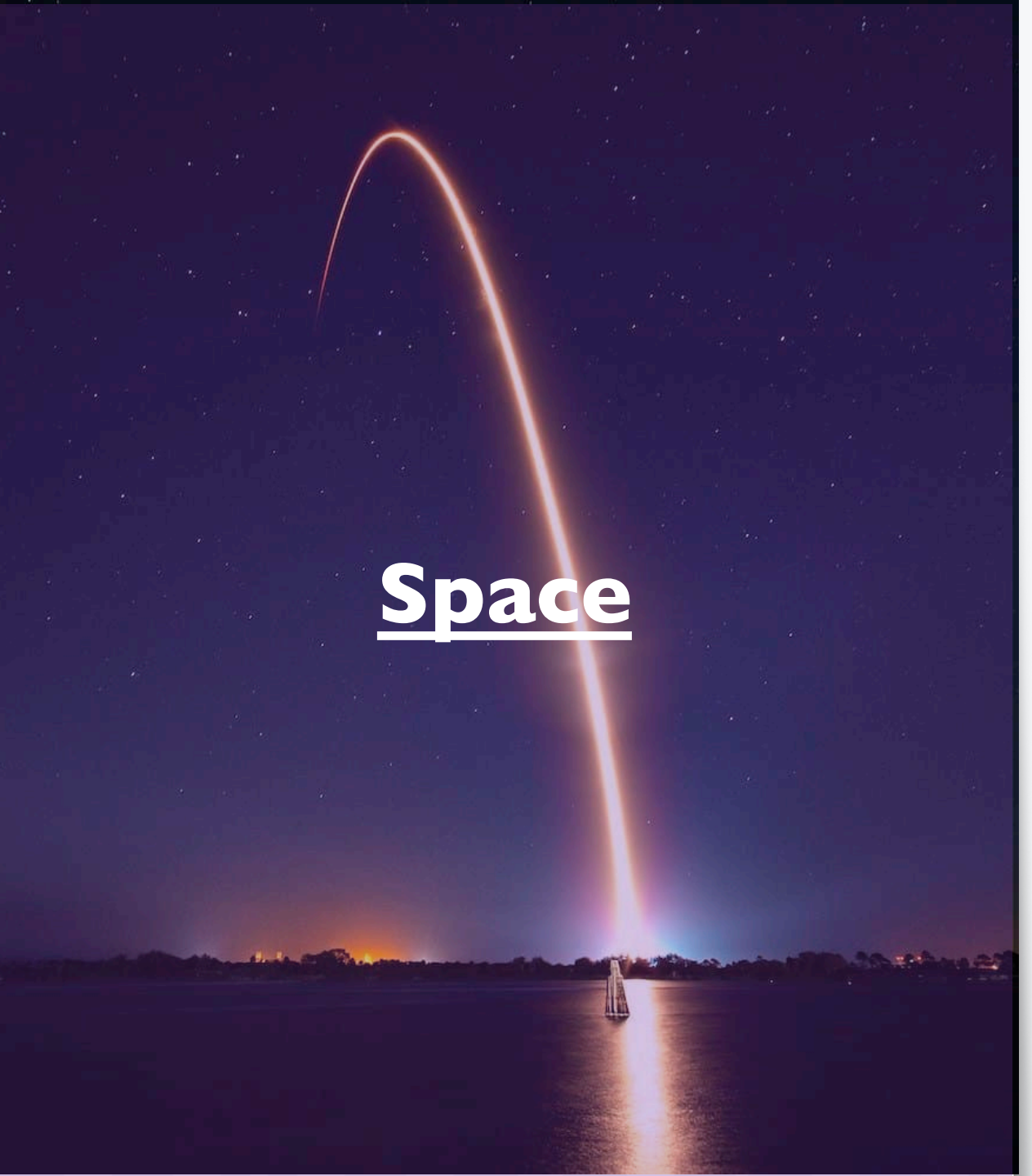

Space

11. Space infrastructures: an exponential acceleration
12. Space sustainability: sky has a limit

Space infrastructures: An exponential acceleration

What it is and why it can change the world

The **number of active satellites in space has skyrocketed**, tripling from 2000 to 2019, and remarkably, tripling again by 2022. This growth is fueled by the upsurge of **compact, low-orbit satellites**, as well as progresses in rocket launch and reuse technologies. While still nascent, some practical applications are surfacing, including **satellite-based internet** and next-gen **satellite imagery**. Gazing into the future, once-far-flung ideas like **space tourism and habitats** on the moon or Mars appear closer than ever. Even more ambitious visions, like **asteroid mining, in-space manufacturing, and space-based power generation** are no longer (completely) sci-fi.

Tech and scientific fields involved

- Aerospace engineering
- Astrophysics
- Computer science
- Advanced materials

Challenges being solved

- **Cost & ROI**: most space use cases still require lots of R&D and operational investments, leading long and uncertain payback periods
- **Policy & regulation**: space activities are governed by international treaties, and increased spatial activities will call for more comprehensive internationally agreed regulation
- **Tech development**: multiple technical breakthrough are still required before the most advanced use cases can come to life

Recent news & selected key projects

STARLINK OneWeb ASTRANIS

Multiple large and well-funded projects are creating constellations of satellite to provide worldwide internet connectivity, without the need for infrastructures on Earth.

isar aerospace

Builds rockets through automated production. It offers launch services dedicated to deploying and resupplying satellite constellations and ensuring low-cost space access for small satellites.

AXIOM SPACE

Building the first commercial space station, in collaboration with NASA. Launch of the first section of the platform that will operate in low-Earth orbit is expected in 2025.

pixxel

Develops a constellation of hyperspectral earth imaging satellites.
The constellation is designed to provide global coverage every 24h, aiming to detect, monitor, and predict global phenomena.

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Space sustainability: Sky has a limit

What it is and why it can change the world

With **teeming spatial objects orbiting earth comes great data challenges**: managing traffic, avoiding collisions, managing debris, speeding up earth-space data transfer and enable satellite-to-satellite communication.
While those topics sound simple, the **size of space**, the **speed of orbital objects**, the **limited bandwidth** of satellites and the **lags in earth/space communications** create real challenges.
Efforts in these fields are **critical for the viability of large-scale spatial projects**. In 1978, Donald J. Kessler warned about the point where space debris would start destroying functioning objects and block space exploration.

Tech and scientific fields involved

- Aerospace engineering
- Spatial telecommunication
- Astrophysics
- IA and predictive analytics

Challenges being solved

- **Policy & regulation**: space activities are governed by international treaties, and increased spatial activities will call for more comprehensive internationally agreed regulation
- **Accurate tracking and predictive analytics**: as the # of objects grows, so does the need of accuracy and sophistication in predictions
- **Removal technologies**: as there are currently few proven tech to remove or deorbit space debris

Recent news & selected key projects

LEO LABS

On a mission to make space fleet management safe. Has created a global radar network for tracking objects and debris in low Earth orbit. Offers include collision avoidance support for satellite operators.

Astroscale

Aiming to create space sustainability. Their ELSA-d mission, launched in 2021, is demonstrating technology to capture and deorbit defunct satellites. Also develops in-orbit life extension services.

clearspace today

Europe project spun-off from the EPFL Space Center in 2018 to develop in-orbit servicing and space debris removal technologies. Recently opened a US subsidiary.

HEDRON

Building a network of data relays (small satellites with optical inter-satellite links) to connect space to Earth in real-time.
NASA is similarly investing in optical communication to speed-up data transfers.

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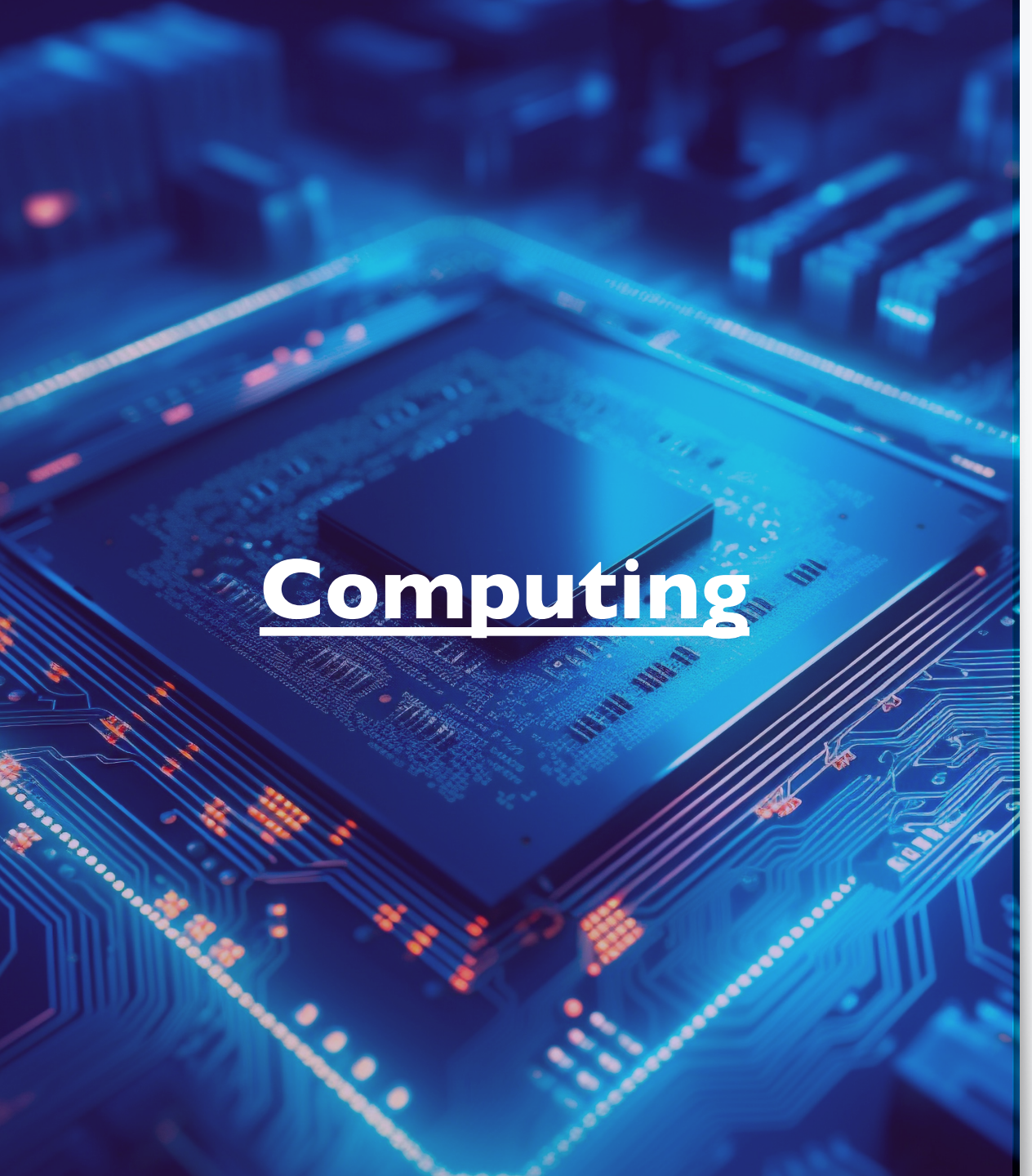

Computing

13. Quantum computing: revolutionary specialized computing for advanced scientific and technical fields

14. From neuromorphic to atomic scale chips: The new generation of computing hardware is on its way

15. Large Language Models: the latest and most promising child of AI

Quantum computing: revolutionary specialized computing for advanced scientific and technical fields

What it is and why it can change the world

Quantum computers represent a significant shift in computing. Instead of using the simple binary of 0s or 1s, **they exploit quantum bits** that can exist in both states at once. It gives them a **unique ability to process a vast array of possibilities**, which has applications in numerous **highly-specialized scientific fields**. Also, do not think about them as stellar-fast general-purpose machines that you might one day have at home.
Their impact will be remarkable in areas like **cryptography, cybersecurity, materials science, drug discovery, climate modeling, nuclear fusion, battery modelling** more.

Tech and scientific fields involved

- Quantum physics
- Materials science
- Computer engineering
- …

Challenges being solved

- **Maintaining qubit coherence** and reducing errors in quantum operations, known as "quantum noise"
- Developing **efficient error-correction algorithms** to improve computational accuracy
- **Scaling up the number of qubits** while maintaining their performance, as well as miniaturizing the systems to **make them more practical for widespread adoption**

Recent news & selected key projects

PASQAL

French leader with real commercial applications in multiple fields (energy, mobility, healthcare, finance,…) through 100-300 qubits computers. 1k+ qubits machines in R&D, has raised €140M+.

IBM

Has released a 433 qubit processor (Osprey), and modular systems to combine processors and reach 4k+ qubits machines by 2025. Committed $100M to build a quantum centric supercomputer.

Sony Innovation Fund / QUANTUM MOTION

Sony participated in the £42M fundraising of Quantum Motion, as well as Bosch and Porsche. It focuses on building silicon-based qubits, to unlock scalable and cost-effective quantum-computing.

IQM

European leader and IBM's competitor in superconducting quantum computers. Has raised over $250M. Sells both full-fledge quantic computers and quantic accelerators/

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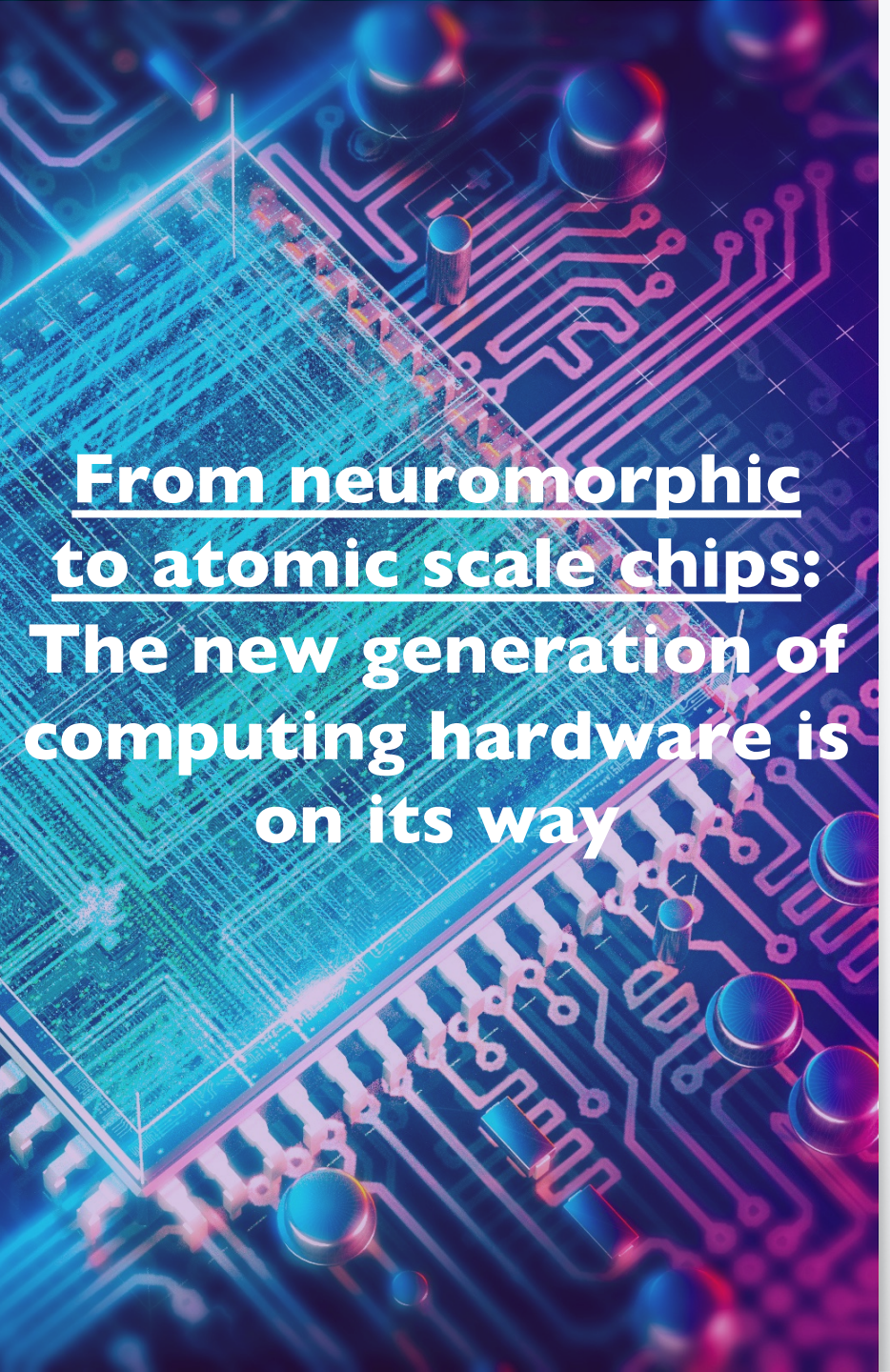

From neuromorphic to atomic scale chips: The new generation of computing hardware is on its way

What it is and why it can change the world

While chips densities are no longer doubling every two years, **Moore's law is far from being obsolete** as computing technologies are still delivering exponential improvements. Following techs hold big promises in that respect:

1) **Photonic chips**, relying on light vs. electricity to transmit information
2) **Spintronics**, leveraging the spin of electrons to transmit information
3) **Atomic scale chips**, using individual atoms to transmit information
4) **Neuromorphic chips**, inspired by the structure of the humain brain
5) **Carbon nanotube transistors**, to go beyond the limitations of silicon
6) **3D chips**, trying to overcome the limitations of 2D miniaturization

Tech and scientific fields involved

- Optics
- Nanotechnology
- Computer science
- Material science
- Electrical engineering

Challenges being solved

- **Atomic scale chips and spintronics** are overall still in early development phase, waiting for a breakthrough
- Carbon nanotube tech is mature enough to have generated **interest in the wire and cable space for niche applications**, yet is still far from being able to replace silicon
- **Neuromorphic, photonic and 3D chips already exist technically**, with first production lines ramping-up

Recent news & selected key projects

tsmc

World's first dedicated semiconductor foundry, from Taïwan, leading the industry in terms of nano-scale chips. Current roadmap goes as far as 2026, with the production of 3nm process tech.

ASML

Dutch company, leading builder of advanced machines for making nanoscale chips. Provides hardware, software and services to chip makers.

nimble AI

EU-funded initiative, built upon a consortium of advisors covering the full value chain to develop neuromorphic sensing & processing 3D integrated chips, for computer vision application.

LIGHTMATTER

US project having raised $250M to use light-based technology to meet computational needs of AIs efficiently and reduce power consumption of data centers.

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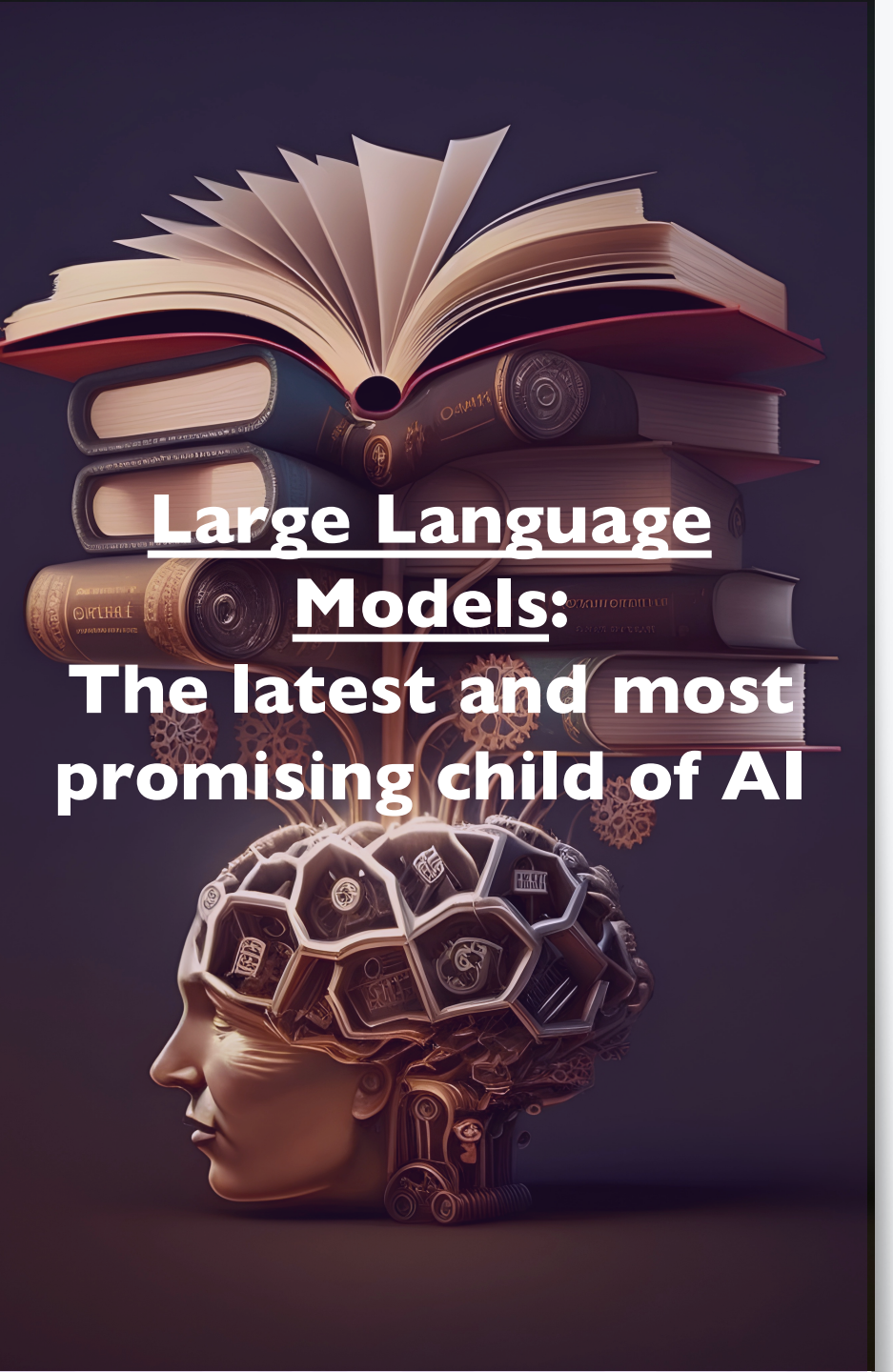

Large Language Models: The latest and most promising child of AI

What it is and why it can change the world

Large Language Models (LLMs) are **AI systems, trained on extensive text data** to recognize human language patterns and **produce human-like text**. These models often convey not only a grasp of language syntax and semantics, but also the **capability to generate insightful, innovative, and occasionally intricate responses**.
As we delve into the potential of these models, we **begin to see their immense promise**, both to the general public and organizations: ushering in a new era of personalized, scalable support, automating routine intellectual tasks, and **enhancing daily activities**.

Tech and scientific fields involved

- Generative AI
- Deep learning
- High-performance computing
- Software engineering
- ...

Challenges being solved

- **Long-term memory and deeper user context comprehension** is a shared future goal between generalist and task-specific models
- **Strengthening data privacy and security** to increase institutional trust.
- **Mitigating biases and hallucinations.** Given the lack of perfect data sets, monitoring and correcting model biases is paramount

Recent news & selected key projects

OpenAI | Microsoft

Leading organization at the forefront of developing large language models with ChatGPT, its most notable product released in 2022.
Microsoft has invested +$10Bn in OpenAI in 2023.

MISTRAL AI

Building the French ChatGPT: Finetuning LLMs for business needs.
Created in 2023 by LLMs experts of DeepMind and Meta, has raised +$100M.

ANTHROP\C

AI-driven research company that focuses on increasing the safety of large-scale AI systems.
Co-founded by OpenAI veterans, created in 2021, has raised $1.5Bn.

ADEPT

Adept's ACT-1 displays as an overlay window on top of existing software like Google Chrome or Salesforce.
Created in 2022 and has raised $415M.

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Digital twins: A new era of simulation, prediction and planning

What it is and why it can change the world

Digital twins, software replicas of real-world entities, **concretize the promises of IoT and multidimensional data use**, by simulating scenarios, predicting future events, and assessing risks. When data is both rich and well-organized, these twins enable experimentation with people, places, and systems. **Early adopters include supply chain & industrial people**, while urban planning and healthcare have recently begun adopting the tech, as both are sectors where poor decisions could lead to irreversible consequences. Going forward, the **emergence of Digital Twins of Customers** (DToC) is set to revolutionize innovation and personalization at an unprecedented scale.

Tech and scientific fields involved

- Computer science
- Data science
- Internet of Things
- Cybersecurity

+ domain specific sciences, depending on what digital twins represent

Challenges being solved

- **Data volume and integration**: digital twins require integration of vast and diverse data sources, implying high maintenance and costs
- **Model complexity**: as real-world is complex, models require frequent control and update to be accurate
- **Data privacy and security**: important in urban planning and healthcare application, will become crucial in DToC use cases
- **Real-time capability**: required in some use cases, adds to the difficulties mentioned above

Recent news & selected key projects

SG SPACE

Virtual Singapore is a 3D digital replica of Singapore built on topographical as well as real-time, dynamic data. Serves as a single source of truth for simulations of solutions to urban planning issues.

midas

Meaningful Integration of Data Analytics and Services is a EU-funded initiative to create a healthcare data platform for public bodies across Europe to simulate their envisioned policies.

SenSat Digitising the world

UK startup building digital simulations of the real world to solve complex problems. Companies operating in physical domains are enabled to visually interact with and understand their data.

TWAICE

German startup using digital twins of lithium-ion batteries to offer predictive analytics and then improving their lifecycle, EV fleet management, energy storage,…

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Contour crafting: your next house might be printed in 24 hours

What it is and why it can change the world

Contour Crafting, an advanced form of additive manufacturing tailored for construction, has recently seen breakthroughs that enable the use of **large-scale 3D printers to construct full structures layer by layer** from a programmed blueprint. Leveraging a movable gantry or robotic arm, this process not only shapes walls with quick-drying concrete but can **also integrate intricate components** like conduits for electrical and plumbing systems. Anticipated **benefits are striking**, including **speedy construction** that can be measured in mere days or even hours, significant **reduction in hazards and waste**, and the **feasibility of complex architectural designs.**

Tech and scientific fields involved

- Mechanical engineering
- Materials science
- Robotics
- Computer science
- Civil engineering

Challenges being solved

- **Quality control and regulation**: ensuring the buildings created meet quality requirements and local regulatory standards
- **Materials**: fast-drying concrete has limitations in terms of strength, durability and environmental impact, hence the need for new materials
- **Capex:** large scale 3D-printers expensive pieces of machinery
- **Workforce** : need to upskill workforce, and potential negative impact on employment is contour crafting becomes mainstream

Recent news & selected key projects

Nantes Université / Nantes Métropole Habitat

Back in 2017, Nantes pioneered the contour crafting space by printing YHNOVA, a social lodging of c.100m^2 with an innovative design, in only a few days

COBOD

Worldwide leader of on-site 3D-printing, having developed BOD2, the most used 3D printer, as well as mini batch plant to produce concrete pon-site. Works for homes and other infrastructures.

Mighty Buildings

Eco-friendly contour crafting with off-site printing of panels, using proprietary light stone materials instead of concrete. Automates 80% of construction and removes 99% of waste.

Diamond Age

On-site robotics-as-a-Service approach focused on the housing market: uses large-scale robotic structures to speed-up construction process and build up to 250 houses per year per development area

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Nanotech & molecular machine
Haptic clothing
Ambient intelligence
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Smart dust
Li-Fi
Zero knowledge proof
Emotion AI
Swarm robotics
Volumetric displays
Solid-state batteries
Meat alternatives
AR/VR
Virtual world(s)
Edge computing
Next generation of biometric identification
Advanced industrial robotics
Commoditized rockets
Web 3 for the masses
Traceability
And many more for another time

MARC SIMONCINI

PIERRE-ERIC LEIBOVICI

PIERRE-YVES MEERSCHMAN

CHARLES-HENRY TRANIÉ

OLIVIA MARK

ROXANNE CROSSLEY

PAUL BAZIN

MARIE FERRI

STANISLAS LOT

ALEXANDRA DUBAR

SHABIR VASRAM

Our invest team is waiting to meet you

JONAS SIMONIN

CHRISTIAN PINTO

PAUL LLAGONNE

ALEXANDRE GAUMONT

daphni

Certified B Corporation

This company meets the highest standards of social and environmental impact

Website

Portfolio & track-record

Application form