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# Digital Technologies Case Studies:

AI

# Why focus on emerging technologies?



- **Artificial Intelligence (AI)** involves software algorithms attempting to replicate tasks that traditionally required human intelligence. **AI applications are pervasive in economic, social, and personal spheres, from financial management to romantic partner matching.**

# AI in a nutshell



- Software algorithms that make an effort to mimic actions that traditionally require human intelligence are referred to as artificial intelligence, or AI.
- Early attempts at artificial intelligence (AI) development mostly center on giving computers highly regimented knowledge and then trying to have them resemble human decision-making.

# Diagnosing lung cancer (Google)



- Challenges persist, such as radiologists' errors and skill disparities. **Northwestern University and Google** collaborated on an AI system detailed in "**Nature Medicine**," surpassing expert radiologists.
- The **AI**, with **4D vision** and **deep learning**, excelled due to its 3D analysis, granularity, and novel signal discovery. This AI can aid radiologists, especially in regions lacking experts, bridging the healthcare gap.


# Crunching emerging market knowledge for investors (Arkera)

- Traditional methods, like reading online newspapers, provide limited insights.
- Smart investors turn to AI, like **Arkera** and **Sigmoid**, which synthesize vast data points from sources like social media in various languages.
- These AI systems analyze information, predicting events accurately.
- AI's strength lies in **processing massive data sets** and understanding content, from movie scripts to CEOs' earnings calls.

# How AI is transforming agriculture



- AI is ushering in **Agriculture 4.0**, *the age of precision agriculture*.
- Precision agriculture uses AI to sense and respond to micro conditions on a farm, down to the level of a tiny area or a single plant.
- AI technologies such as **computer vision, IoT devices, & robotics** are being used to develop smart tractors, harvesters, and drones for precision agriculture.

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- **Smart tractors** use **cameras & AI** to distinguish between crops & weeds, and then apply herbicide only on the weeds.
  - **Smart harvesters** use **AI** to analyze images of grain and adjust the machine settings in real time to avoid damaging the grain.
  - Farmers are embedding **IoT sensors** into the soil to collect *data on moisture, nitrogen, phosphorous, and potassium*, which can be used to control irrigation and fertilizer application more precisely.
  - **Agricultural drones** are being used to map & survey crops, and to apply fertilizers and pesticides in a targeted manner.
  - **AI-based predictive analytics** can help farmers make better forecasts about future demand, price fluctuations, and crop yield, which can help them optimize their planning.
  - **Deploying AI technologies for more sustainable and productive farming can increase global food production and protect our scarce resources.**

# Aquabyte: Applying machine learning to aquaculture



- **Aquabyte** is a Silicon Valley company that **applies machine learning & computer vision** to the **aquaculture** industry.
- The AI relies on **computer vision & edge computing** to **analyze images of fish in pens**.
- Models generate several types of crucial information, *including fish biomass, sea lice counts, and pellet detection*.
- This technology helps farmers make better decisions about when to harvest fish, project revenues, and reduce feed waste.



## Contactless Shopping - How AiFi is pioneering autonomous retail shopping



### Benefits for retailers:

- Being able to open more stores, including nano stores in food deserts.
- Keeping stores open 24/7
- Generating more traffic
- Real-time visibility into the inventory in each store
- Vast amounts of data on shoppers' behavior to optimize the store layout and the mix of products and brands

### Benefits for shoppers:

- Convenience and efficiency
- Nano stores can be opened almost anywhere
- Easy access, contactless shopping, and not having to wait in a queue

## AiFi's technology:

- Relies on ceiling cameras to track shoppers and what they put in their carts
- Computer vision systems analyze this data to keep a running tally
- Synthetic data obtained from simulations is used to train the AI models
- The AiFi solution is modular, making it agnostic to countries or regions and scalable to larger-sized stores

## Overall goal:

To bring autonomy to physical retail and transform it completely

# How Pinterest uses machine learning



- It uses AI to **personalize** the user experience, **understand the semantics of images**, and **integrate AI with augmented reality**.

## Two important AI models used by Pinterest:

- **Computer vision model:** This model interprets each image and understands its semantics, such as whether the image is a cookie, a shirt, or a floor, and its style, such as vintage or modern.
- **Recommendation system:** This model predicts the hundred pins out of 250 billion that are most likely to be of interest to each user, and displays these pins on the user's home screen.

### How Pinterest uses AI to understand the semantics of images:

- Pinterest uses data from how people assemble pins on their virtual boards to learn the multiple meanings of each image.
- For example, if some users organize an image under "tiles", others under "kitchen renovation", and yet others under "vintage floors", Pinterest can conclude that this particular image has multiple meanings.

### How Pinterest uses AI to integrate AI with augmented reality:

- Pinterest users can now snap a photo of their living room and see how different types of furniture would look in their own home.
- This is done by using AI to understand the 3D structure of the room and the dimensions of the furniture.

### Conclusion:

Pinterest is constantly pushing the deployment of AI to the next level to improve the user experience and make it easier for users to find the content they are looking for.

# How Stanford researchers developed a self-navigating cane



Stanford researchers have developed a **prototype augmented cane** that uses AI to help the visually impaired walk faster, more confidently, and more safely.

- The augmented cane is made from off-the-shelf parts and costs \$400.
- The cane has a **LIDAR sensor, 3D sensors, a digital camera, an inertial measurement unit, and a microcontroller.**
- The AI in the cane converts sensor data into **three-dimensional images, decodes images, & monitors the user's position, speed, and direction.**
- The cane can provide **audio feedback** to the user about *obstacles, key objects, and navigation directions.*

# How Moderna deployed AI to speed up vaccine development

- **Moderna** is a digital biotech company that is platform first, digital first, and AI first.
- The company uses **synthetic mRNA**(has the potential to completely transform pharma, vaccines, and drugs) molecules to instruct ribosomes to produce specific proteins.
- **Moderna's drug design studio** uses AI to simulate millions of possible nucleotide sequences to create the desired protein.
- AI can produce 1,000 mRNA molecules per month, compared to 30 molecules using manual processes.
- The best way to deploy AI is to develop **narrowly trained models to achieve very specific goals.**
- Moderna's example shows that becoming an AI company requires walking the talk in everything we do.

## Additional Important information:

- Moderna was able to develop its mRNA vaccine in 44 days, compared to the typical decade-long development time for vaccines.
- Moderna's use of AI massively accelerated the development of its mRNA vaccine.
- AI models are used for a variety of tasks, including **developing the optimal plan for clinical trials, managing robots in the factory, doing quality control, and forecasting the need for call center resources.**

# How Lemonade uses AI to reinvent insurance



- **Lemonade** is a digital insurance company that relies on AI for everything, from assessing risks to underwriting policies to handling claims.
- Customers interact with Lemonade through two AI bots, Maya and Jim.
- Maya helps customers buy policies or make changes to them, while Jim focuses on claims handling.
- Lemonade believes that heavy reliance on digitization and AI yields many benefits, **including faster speed, lower cost, less hassle, and higher customer satisfaction.**



## Here are some additional important details:

- Lemonade targets Millennials, especially those below 35, who tend to be digital natives with relatively simple insurance needs.
- Lemonade's central strategy is to target **first-time buyers of insurance**.
- A third of Lemonade's claims are settled instantly by AI.
- A majority of Lemonade's claims are settled within a day and paid instantly.

# How AI is transforming banking



## Macro level

- AI enables the **utilization** of much **more comprehensive data** on *each customer and the ecosystem surrounding that customer*.
- Enables the application of much smarter analytics to this data. And it enables the complete transformation of customer engagement.

## Examples of AI in banking

- **Business customers:** AI can be used to better assess Jim Foundry's borrowing needs and the best risk-adjusted rate for loans, as well as to predict customer demand and possible supply disruptions.
- **Fraud detection:** AI algorithms can do a far better job at detecting and preventing fraud than earlier approaches.
- **Customer engagement:** AI is enabling innovations such as facial recognition to access bank accounts and voice commands to do banking on mobile apps.

## **Economic impact of AI in banking**

- McKinsey estimates that on a global basis, use of AI more comprehensively could unlock as much as \$1 trillion annually in economic value for the banking sector.
- Large chunks of this opportunity lie in better marketing and sales, as well as better risk management.
- Significant opportunities also lie in more optimal management of the bank's staff as well as deployment of capital.

# How AI is advancing the power sector



- AI is being used to predict *the output of renewable energy sources, such as solar and wind, several hours in advance.*
- Used to optimize **power generation** in seemingly stable contexts. Ex: Norway's hydro energy sector.
- AI is being used to predict **equipment failures in advance** and to avoid turbine shutdowns.
- **Drones** equipped with **high-resolution cameras** are being **used to monitor electricity transmission systems** and to **predict the need for preventive maintenance.**
- **AI algorithms** are being used to optimize the routing of electricity from *varying supply sources to varying customer demand.*
- AI is being used to help distribution grids analyze the mass of data from rooftop solar panels, electric cars, and other new sources of energy and demand, and to ensure that the network continues to match supply and demand in an optimal manner.

# How Google uses AI to improve data center cooling systems

- **Machine learning** can help *reduce energy consumption* beyond traditional best practices by learning from actual performance and automatically generating a best-fit model.
- Google pioneered the use of machine learning to **optimize data center cooling systems**, and its **neural network model** has been shown to achieve a **40% reduction** in energy used for cooling.
- Google's AI-powered cooling system now runs entirely on its own, with only minor oversight by engineers.
- The use of AI to optimize data center cooling systems is rapidly becoming standard practice at data centers worldwide.

### Some other important points:

- The sheer number of possible equipment combinations and their set point values make it difficult for humans to determine where the optimal efficiencies lie.
- Machine learning is ideal for solving this type of problem because it can learn from actual performance without being explicitly programmed.
- Google's neural network model was trained on historical data from multiple facilities, and it was able to figure out various tweaks that could boost power usage efficiency in previously unknowable ways.
- The AI-powered cooling system is able to make needed adjustments with far greater speed than human engineers.

Data centers currently account for over 1% of global energy usage, and the industry's goal is to keep this percentage constant even as the volume of data processed by data centers grows exponentially.



## **Some additional Links:**

[12 most popular AI use cases in the enterprise today](#)

[The 19 Best AI Use Cases in 2023](#)

[Top 10 Use Cases Of AI and Machine Learning](#)

[10 Amazing Cases Of Using AI in Business](#)