# Machine Learning Applications

Learn how machine learning can help your business and give you a competitive edge with 20+ examples across 4 industries.

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# Introduction

For decades, machine learning (ML) remained more in the sphere of research than active implementation. Recent years, however, have seen a significant uptick in its adoption rate.

Often described as part art and part science, the technology offers an abundance of applications for virtually every industry. From online shopping to epidemic prevention, there are hardly any areas of modern life that cannot be optimized with a judicious use of algorithms.

While still in its early days, the technology is already delivering real benefits to those who embrace it. A recent report by PwC concluded that, over the next few decades, AI will be the biggest commercial opportunity for businesses and nations.

A global online survey by McKinsey in 2018 found that 78% of respondents reported receiving significant or moderate value from implementing ML solutions in their operations, while only 1% claimed they saw none or negative value.

The unprecedented rise of AI and its transformative value for business and the society as a whole has led some researchers to believe that it's bound to become a "general-purpose technology," on par with other game-changing inventions, such as steam engines and the internet.

**However, the key to maximizing the returns lies in forging a comprehensive ML strategy based on solid technical capabilities in AI and a deep understanding of the potential use cases in your industry.**

We hope that the guide we've compiled will help you map where ML opportunities lie for your business and inspire you to incorporate some of the technology's transformative solutions to maintain a competitive edge.

# Machine Learning In Ecommerce

**The rise of online shopping is undeniable, and so is the competition between internet retailers.** To get ahead of the curve, ecommerce businesses are increasingly turning to artificial intelligence to better understand their shoppers' needs, create a more personalized customer experience, and boost sales revenue as a result.

The sector has for long been leading the way for the adoption of artificial intelligence. By making extensive use of the latest machine learning solutions, from recommender systems to augmented reality, online retailers are completely transforming how we shop online.

It's estimated that AI investments in the sector will continue to grow, totaling to a compound annual growth rate of 42.8% from 2019–2025.

## Recommender systems

Recommender systems are why Netflix always seems to have something that suits your tastes to watch, and Spotify keeps finding music you might like. They have been a key factor in the commercial success of giants with a large number of users, but they can be implemented with success on ecommerce platforms of any size.

The AI-powered systems analyze consumers' activity and browsing data, and create product recommendations tailored to their individual needs and preferences. To widen the range of products and services presented to the user, they also take into account the behavior of consumers who display a similar taste.

On the one hand, recommender systems are a great way for marketers to increase their sales volumes. On the other, they're helping consumers broaden their preferences and make more relevant choices in a world of product overload.

# Content personalization

Businesses that want to thrive in the highly competitive online retail sector need to go beyond generic offers or even basic personalization, such as page layouts. Thanks to machine learning, they can offer their customers exactly what they want and then some.

According to a report by McKinsey, personalization can deliver five to eight times the ROI on marketing spend and increase sales by 10% or more.

Accenture's Personalization Pulse Check report found that businesses' number one challenge in meeting consumer needs is "learning how to uniquely serve everyone without overwhelming anyone."

The paper also said that nearly half of the surveyed consumers left an online shopping website and went on to make a purchase on another site simply because it was poorly curated. The vast majority (91%) were also more likely to shop with brands who provide them with personalized offers and recommendations.

One of the ways businesses can inject some AI into their one-to-one marketing is by providing individualized incentives, such as birthday discounts.

For instance, to reduce the cart abandonment rate, which varies between 60% and 80%, online retailers can use artificial intelligence to analyze customers' digital body language while they're still on the site, and then provide them with the right messages to encourage a purchase.

Open Time Content is another AI-powered technology that helps marketers contextualize engagement. It populates emails with content at the time they're opened for the ultimate real-time retail experience.

To make the offer as appealing to the consumers as possible, it combines their previous shopping history with retailer's latest offers, and updates each time the email is accessed.

## Chatbots

Long gone are the days when talking to a machine was frustrating and weirdly amusing at the same time.

Thanks to natural language processing algorithms—which analyze and draw insights from chatbot conversations to keep improving their performance—the quality of exchange is often on par with that of human-to-human interactions.

For businesses, using chatbots means huge savings when customers require quick, simple answers. And since these are the most common inquiries, chatbots can do the job just fine.

In case the users need information the chatbot can't provide, it can instantly put them in touch with one of the customer service operatives, making sure that no inquiry goes unanswered.

## Dynamic pricing

You've certainly noticed how the price of your Uber ride home keeps fluctuating depending on the time of day, weather conditions, and availability of drivers. Although the carrier's dynamic pricing is legendary (after all, the company has over 100 experts working on them), the technique can benefit any business willing to invest in it.

[According to McKinsey](), companies that implement dynamic pricing report 2–5% sales growth and 5–10% increase in margins as well as higher levels of customer satisfaction.

The idea behind the practice is that customers get a personalized price, dependent on a specific set of circumstances. It can include pricing data from different online sources, including a company's competitors, as well as customers' individual shopping habits.

Machine learning is an essential element in this process: it makes it possible to identify shoppers' data patterns and to predict how responsive they might be to new prices.

## AI-powered A/B tests

A/B or split testing is a common practice in marketing and ecommerce. It consists of showing a group of users different versions of, for example, a website or an article headline. Then, you analyze which version drew more clicks and encouraged more interaction, and why. This version is the winner of the A/B test.

Manual implementation of the tests is often very time-consuming, and it takes a while to produce results. By injecting artificial intelligence into the technique you can make your product self-optimize in real time and deliver the best and most effective variation to your users, without the need to manually set up and fine-tune the A/B test.

The AI component allows you to test a potentially infinite number of variables at any given time. Notably, it can also take into account users' preferences and previous browsing history to determine the most suitable combinations.

## Shoppable augmented reality—AR/VR

Even though online shopping has been rapidly gaining ground, many consumers, in particular while shopping for clothes or beauty products, still stick to brick-and-mortar shops. The reason is simple: trying on an item before you purchase it not only saves you time and money, but it also makes the shopping experience fun.

However, thanks to artificial intelligence, consumers no longer need to leave their homes to discover new styles and curate their wardrobes.

Augmented reality (AR), often used together with AI and dubbed the [future of retail](), allows shoppers to virtually try on products such as clothing, eyewear, or makeup—in real time.

For instance, Pinterest recently partnered with cosmetic giants such as Estée Lauder, YSL Beauté, and Lancôme to launch a shoppable AR feature that allows users to "try on" different lipstick colors using the app's built-in camera. The platform will also display similar lip shades on skin tones that match the user's and let them explore related looks.
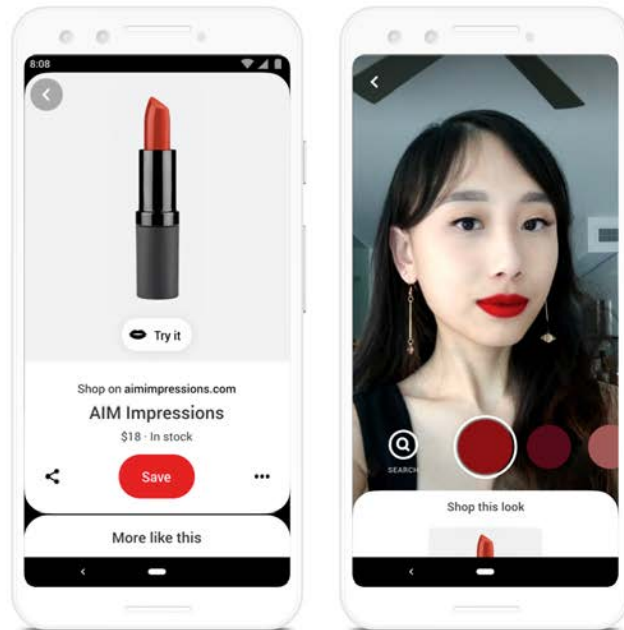


*Source: Pinterest*

The UK fashion retailer River Island has used AR to enable its customers to visualize what their homeware products could look like in their own home using their smartphones.

The effect lets users view selected products in 3D and place them anywhere within their home. Shoppers were also given the option to take a screenshot and upload it to social media for a chance to win the products.

Although the use of AR in online retail is not common yet, the spread of 5G is likely to accelerate its growth.

# Machine Learning In Health Care

The potential for application of artificial intelligence in health care and medical research is endless. The sector is well-suited for automation, not least because health services worldwide produce staggering amounts of data every single day.

Integrating artificial intelligence into the medical field can offer plenty of clinical benefits.

It can improve research, discover new drugs, and help diagnose diseases more accurately. The technology also has a lot of non-clinical uses, such as automation of administrative tasks and patient management systems.

Although the sector has seen plenty of innovation, there are still innumerable opportunities for companies willing to get involved and offer AI solutions. In the UK, for instance, the head of the National Health Service (NHS) has called on tech firms to come forward with proposals to help the service become a world leader in the use of artificial intelligence.

The goal is for the NHS to be the first national health service to use video and online consultations to digitize outpatient systems and involve AI in the process of interpreting scans, among some of the uses of the technology.

According to the chief executive of UK Research and Innovation, "You could look at almost any area of healthcare and see that advanced data science – if I could put it that way – has an enormous amount to offer. This technology has huge potential right across the world of healthcare."

Given how wide the range of potential AI uses is, narrowing it down to just a few cases is a tall order. Therefore, the examples we compiled below are just a taste rather than a definitive list of the ways machine learning can be used in health care.

## Detection and diagnosis

A recent study found that artificial intelligence has become more accurate at diagnosing diseases from medical imaging than trained clinicians. For instance, in research conducted last year, AI detected 95% of malignant melanomas from dermoscopic images, while doctors were able to diagnose an average of 86.6%.

Little wonder that health care providers around the world have scrambled to take advantage of deep learning to improve their diagnosis success rates. However, AI solutions are often poorly integrated with clinical workflows and EHR systems. This is currently the biggest blocker for implementing AI at scale, and addressing this weakness has become a priority for healthcare companies.

## Treatment recommendation

The effectiveness of a treatment plan depends on a wide range of factors, from previous medical history to personal lifestyle. Artificial intelligence has been used to combine and analyze patient data from various sources to determine the best course of treatment.

The ability of AI to process such huge databases and make tailored recommendations is revolutionizing personalized medicine. The machine learning component increases accuracy, improves clinical outcomes, and makes medical treatments more affordable.

## Discovery of new drugs

Developing new drugs is no small feat: it can take years of rigorous trials and cost billions of dollars.

Not surprisingly, the pharmaceutical sector has scrambled to come up with ways to speed up the process and make it more effective. Of all the solutions currently available, the benefits of applying artificial intelligence seem most promising.

There are plenty of startups working in the sector, with some of them, such as Cloud Pharmaceuticals, entering into collaboration with pharma giants.

Notably, as the number of novel first-in-class drugs coming to the market declines and the need to modernize the drug discovery process becomes evident, the investment in AI solutions in drug discovery continues to rise.

In a breakthrough development, the first drug molecule designed entirely by AI was set to enter human trials in January 2020. The compound, created to treat patients with OCD,

was developed by the Oxford-based startup Exscientia in collaboration with the Japanese pharmaceutical company Sumitomo Dainippon Pharma. It took just a year to develop and marked a critical milestone for the increasing role of AI in drug discovery.

## Epidemic prevention

The recent outbreaks of communicable diseases, such as the coronavirus, Ebola, and Zika, have shown that epidemics spread rapidly and place a huge burden on public health infrastructure. Even though the world is now more interconnected than ever, we're still not adequately prepared to detect and counter epidemics.

Artificial intelligence can be used to forecast the spread of infectious diseases and stop them from turning into epidemics. By collating and analyzing huge and disparate databases—such as weather, wind speed, flight data, or previous outbreaks—it can identify outbreak-prone areas, optimize the allocation of resources, and support disease prevention policies.

For instance, AIME created a tool capable of predicting disease outbreaks 30 days before they occur with at least 80% accuracy. It's used by health professionals around the world to tackle multiple mosquito-borne diseases such as dengue and Chikungunya.

## Streamlining of admin tasks

The application of AI in the health care sector is by no means limited to clinical care.

Given that 30% of all health care costs are associated with admin tasks, the technology can provide significant savings by automating some of them. And since health services globally are chronically underfunded, a demand for these non-clinical yet essential solutions is bound to remain high.

Artificial intelligence can be applied with success in administrative processes such as maintaining medical records, transcribing notes, issuing repeat prescriptions, and making appointments. By providing tools that automate mundane, labor-intensive tasks that have more to do with the red tape than providing medical treatment, the technology allows health care staff to focus on the more urgent job of meeting patient needs.

For instance, the Johns Hopkins Hospital in Baltimore has been able to speed up the process of assigning hospital beds to patients by 30% since it introduced an AI-powered allocation system. The solution, which combines bed availability and patient clinical data,

helps the hospital foresee demand for beds to avoid bottlenecks. As a result, patient waiting times have decreased while safety levels and revenue increased.

## Patient risk identification

AI can help clinicians identify at-risk patients in real time and prevent avoidable diseases by analyzing large amounts of historic medical data.

Smart wearables, such as the Apple Watch, can monitor wearers' heart rates and alert them if they detect any irregularities. The gadget, which works in a way similar to the ECG machine and is precise enough to spot early signs of a heart attack or a stroke, has been [credited](#) with saving countless lives.

Artificial intelligence can also be used in a non-clinical way to reduce patient risk. For instance, a [leading London hospital](#) developed a system that predicts which patients are most likely to miss appointments based on their previous record. The algorithm not only helps clinicians provide better care but also saves valuable resources and cuts waiting times.

# Machine Learning In Finance

Although the naturally conservative financial sector has not led the way for adoption of artificial intelligence, it is gradually opening up to the technology.

Their vast potential in data analysis, optimization, and pattern detection mean that ML-enabled solutions are rapidly replacing outdated, manual, and time-consuming practices that until recently were industry standards.

Financial institutions have applied artificial intelligence not only to protect their data from (increasingly AI-powered) attacks, but also to provide better customer service and streamline their processes.

As fintech warms up to the technology, it is estimated that the AI market in the sector will grow, from USD 7.27 billion in 2019, to reach over 35.4 billion by 2025.

## Fraud detection

Although fraud is relatively rare, it often means massive losses for organizations that don't have adequate safeguards in place. According to experts, online credit card fraud will amount to $32 billion in 2020.

As fraudsters, including state-sponsored attackers, increasingly turn to machine learning and other automation techniques, legacy approaches based on rules and predictive models no longer offer adequate protection from the emerging threats. To keep up with the escalating sophistication of attacks, defence systems used by financial institutions have to include artificial intelligence in their arsenal.

ML-based solutions can be applied to combat all types of fraud, including unauthorized card transactions, insurance claims, and loan applications. The ML-powered methods

analyze clients' behavior and shopping habits to create a mechanism that triggers an alert when it detects an unusual transaction.

They enable institutions to rapidly and accurately detect and move to neutralize complex threats that would have passed unnoticed through conventional systems.

## Credit scoring

The use of AI-based tools to assess credit worthiness is one of the most common applications of the technology in the fintech sector. Traditional rule-based methods can often work to the detriment of both clients and lenders as they focus predominantly on the potential borrowers' previous spending history.

Artificial intelligence can make the credit scoring process quicker and more accurate by taking into account alternative data (such as online behavioral patterns or smartphone habits) and relationships between variables that are often invisible to conventional methods.

For financial institutions, the use of AI can mean lower evaluation costs, more comprehensive reviews, and fewer risks of default. For clients, in particular those with weak or non-existent formal credit history, the tools can offer an opportunity to access credit.

In late 2019, Fujitsu tapped into an opportunity opened up by a shortage of credit analysis specialists in Japan by developing a cloud-based AI tool to screen potential borrowers. The platform leverages machine learning to generate credit scores based on bank and business transactions. Although it still requires some human intervention, it automates many of the repetitive and labor-intensive elements of the credit-scoring process.

## Insurance underwriting

In comparison to some other areas of fintech—for instance, fraud detection—the application of machine learning in insurance underwriting is not yet commonplace. However, as decision-makers are increasingly warming up to the idea of introducing more automation to save costs, it's likely to be used more widely.

A study by Accenture found in 2018 that 75% of surveyed insurers were planning to use AI to automate tasks to a large or a very large extent in the following three years. According to the research, 63% of executives believed that the industry would be completely transformed by intelligence technologies.

For instance, Lemonade, an Israeli fintech, has taken the global insurance market by storm thanks to its use of machine learning. The whole process of both requesting coverage and making a claim is done through an ML chatbot and takes minutes to complete.

However, machine learning has the potential not only to lead to more efficiencies, but also to enable insurers to innovate more and grow new lines of business.

**Applying the technology in insurance underwriting means more powerful and accurate prediction models that can analyze just about any type of risk.** By being able to rapidly collect and assemble vast amounts of data, AI models can explore a virtually unlimited number of factors that would normally be invisible to a human broker.

## Money laundering prevention

In the last decade, 90% of European banks have been fined for offences related to money laundering. Recent scandals involving ING or Deutsche Bank show that, no matter how large, no financial institution is immune from the risk.

Even though money laundering is estimated to account for as much as 2–5% of the global GDP, the efforts to combat the practice have been staggeringly low. There is a real opportunity for AI to help financial institutions replace inefficient and outdated practices, contain compliance costs, and respond to the increasing complexity of threats.

For instance, natural language processing can enhance customer due diligence checks. Unsupervised learning can aid humans in distinguishing between usual banking transactions and suspicious activity.

Thanks to its ability to consolidate vast amounts of data, AI can also identify fraud patterns, reduce the number of false positives, and therefore drive efficiency savings.

## Portfolio management

The rise of big data means that fund managers have access to more information than ever before when making decisions about their clients' wealth. Applying ML models to analyze the data opens up plenty of previously inaccessible opportunities and, as a result, enhances the investment process.

One of the biggest advantages of applying AI in portfolio management is the ability to conduct detailed market simulations. By analyzing swathes of data, algorithms can exploit

hundreds of different inefficiencies at once, predict investor behavior, and help provide more targeted results for the client.

Although AI has been slowly making inroads into the field, its spread has been held back by an overcautious approach towards the technology by asset managers.

In 2017, Japan's Government Pension Investment Fund (GPIF), the world's largest pension fund, contracted Sony to research how it can apply artificial intelligence to improve its asset manager portfolio monitoring.

The fund's CIO noted that the decision to venture into AI was borne out of frustration with the slow adoption of the technology by the financial sector despite the many benefits it can offer. He noted that the fund "wanted to show the industry that people like GPIF, such a boring institution, can benefit from AI. We are basically sending a message to the rest of the industry that they could be doing the same."

## Algorithmic trading

Algorithmic trading, also called automated trading, refers to the use of AI algorithms to place trades.

The algorithms consist of a set of instructions, such as timing, price, or quantity, which help it identify a relevant trading opportunity. Once such an opportunity is found, the software places an order instantly and at the best possible price.

Algorithmic trading removes the need for humans to monitor price changes and put in the orders manually. As a result, it minimizes the possibility of mistakes based on human error or bad judgment. It also carries out simultaneous checks on multiple market conditions and identifies patterns to help forecast future performance.

Although currently neural networks are the most popular machine learning model used in algorithmic trading, natural language processing and predictive analytics are gradually becoming more and more commonplace.

Natural language processing is being used to make sense of the latest developments and gauge the sentiment of the market by analyzing, for example, social media, RSS feeds, press releases, and newspaper articles. It helps traders keep up with all these sources, extract valuable information, and make correct trading decisions in real time.

# Machine Learning In Cybersecurity

In cybersecurity, artificial intelligence is somewhat of a double-edged sword.

Its fundamental ability to synthesize data, learn, and adapt can be weaponized to exploit vulnerabilities and mount highly sophisticated attacks. It can be used to compromise systems much faster than humans and cause more damage, yet make the attacks virtually imperceptible.

However, as the technology gradually becomes part of cyberattackers' toolkits, the very same capabilities that wreak havoc on organizations' systems can be harnessed by them to provide a defensive response. In fact, the only way to combat the menace of adversarial AI is with even more and even smarter AI.

## Password protection and authentication

While several years ago strong passwords were a good guarantee of a safe account, this is no longer the case. Although biometric authentication has been touted as a more secure alternative to textual passwords, it's not very convenient and can be easily compromised, too. For instance, researchers were able to get around it using AI-generated synthetic fingerprints.

Since ML-based algorithms can now be used to compromise and wreak havoc on password-protected security systems on a scale not seen before, the only way to combat them is with even superior AI solutions. And although there is no need to panic just yet, as the threats are only beginning to emerge, companies that want to be ahead of the curve will need to adapt to the changing security landscape.

Artificial intelligence can protect you from password-guessing attacks by checking passwords for complexity and suggesting alternatives when necessary. It can also enhance

biometrics in a number of ways, including by providing facial and voice recognition with more precise authentication models.

By tracking information on how users type, AI can build individual keystroke dynamics profiles to be used as part of multi-factor authentication.

## Cyber threat detection

An important factor in thwarting a cyberattack is the ability to detect it early. As the malicious activity spreads, it causes progressively more damage. It's not just security systems that get compromised as a result: a business's brand image can suffer immensely, too, in particular if the attack involved customers' data.

And yet, according to IBM's 2019 Cost of a Data Breach Report, it takes businesses an average of 279 days to identify and contain a breach.

The slow response rate is partly due to the overwhelming amount of malware being produced on a daily basis. Additionally, its increasingly complex nature makes threat detection by conventional systems a Herculean task.

To counter the massive growth of threats and nip any malicious activity in the bud, AI can spot anomalies by analyzing data with much more accuracy than existing IT solutions. The core of this capability consists of the application of user behavior models. They pick up on even the subtlest changes in how individual users interact with the IT systems and identify any red flags early on.

## Phishing detection and prevention control

According to a study by Verizon, phishing is the most prevalent cybersecurity threat. Just like other threats, phishing tactics are increasingly involving sophisticated AI, which dramatically decreases the ability to detect and neutralize them using conventional methods.

While measures such as increased user education and the use of password managers and multi-factor authentication play an important role, the only viable solution to combat the attacks calls for machine learning. Artificial intelligence can offer a platform-wide analysis of communication patterns, and detect any anomalous activity that often characterizes the first stages of an attack.

For instance, Phishing AI is an online tool that uses ML methods, such as computer vision, to detect precursors of phishing sites before they are used in an attack. It has the ability to

track over 10,000 phishing sites daily, protect end users from visiting them, and alert the targeted organizations about the planned attacks.

## Vulnerability management

According to one report, it takes organizations an average of 38 days to patch up a vulnerability. Yet, many of them still rely on traditional vulnerability assessments to identify any areas prone to exploitation, such as outdated software. The assessments often fail to take into account newer assets, for instance mobile or IoT devices. Typically, they also lack the capabilities to prioritize risks, leading to an inadequate response.

Given how time-intensive and prone to failure the process is, vulnerability detection and management stands to benefit enormously from the introduction of AI-powered solutions. In fact, since this task can require meticulous and tedious sifting through code line by line, it seems particularly well-suited for automation.

ML can be used, one the one hand, to proactively examine the systems down to a level unattainable to humans and provide a predictive risk analysis of a large number of attack vectors.

On the other hand, the technology can, for instance, track hackers' chat rooms on the dark web and analyze attack patterns help organizations prepare to repel them. Importantly, it can also prioritize the threats, helping businesses reduce operational costs.

For instance, a UK company Darktrace has developed a tool called Enterprise Immune System, which applies AI in a way that emulates how a human body defends itself against infections.

Unlike traditional methods that come with pre-defined threats, the innovative tool uses unsupervised machine learning to learn the "patterns of life" of the organization's each and every unit, then spot any early signs of deviations that would otherwise go unnoticed.

# Final Thoughts

From personalized film recommendations on Netflix through email phishing protection to smart watches monitoring the wearer's heart rate, AI-powered solutions touch almost every aspect of our lives.

The innovative services created with machine learning are already disrupting the markets. Businesses that want to remain relevant in the fast-changing digital landscape simply cannot afford to overlook these opportunities.

However, applying the technology is never a matter of just picking an algorithm or copying solutions used by other companies operating in your industry. To identify the best possible strategy, it's crucial to take a holistic approach that takes into account your overall business objectives and technical capabilities.

We've been helping businesses like yours build tailor-made ML solutions to meet their unique requirements and get a competitive edge.

We don't stop at creating the perfect AI model for our customers, though. Our services also come with end-to-end product design and software development.

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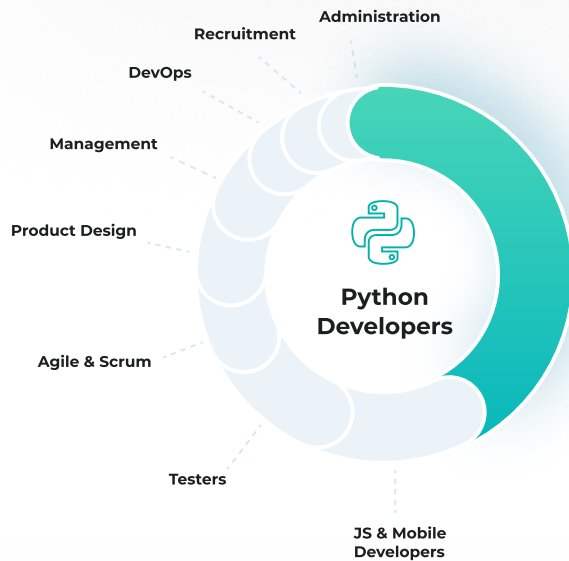Additional developers or experts supporting your development efforts within 14 days

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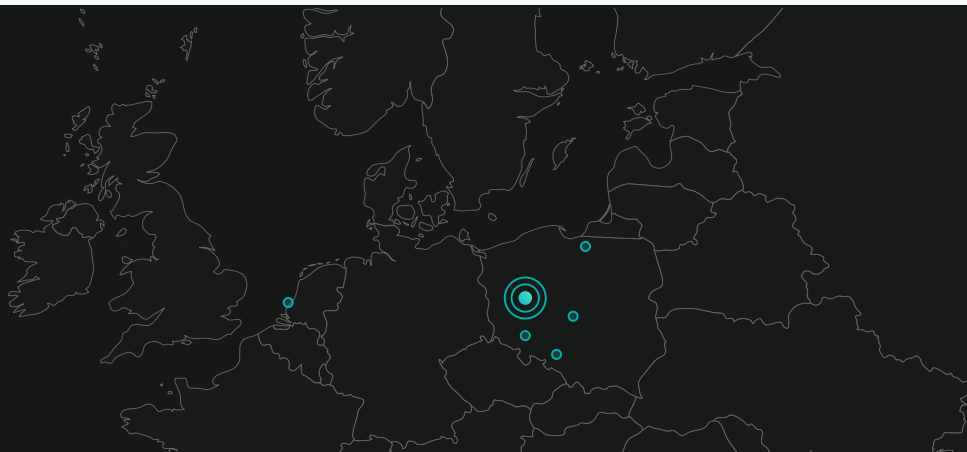professionals on board

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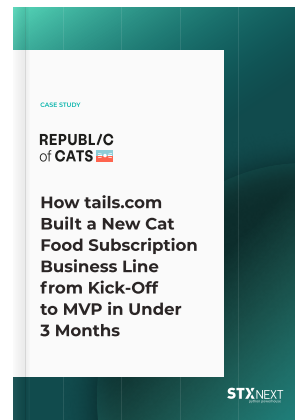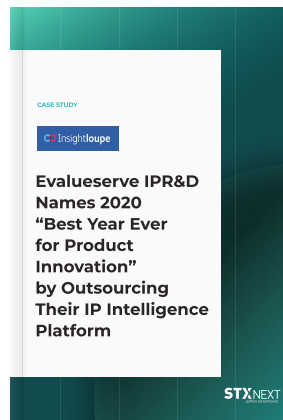# Locations

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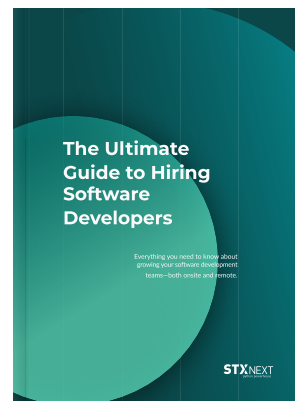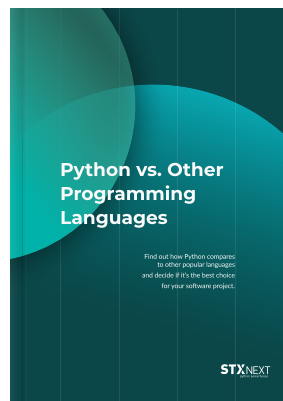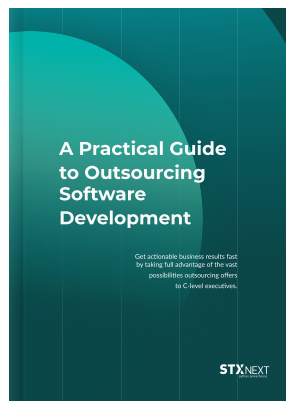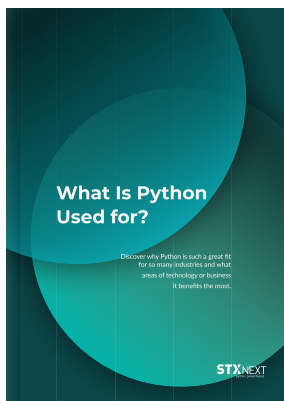Katowice ◉
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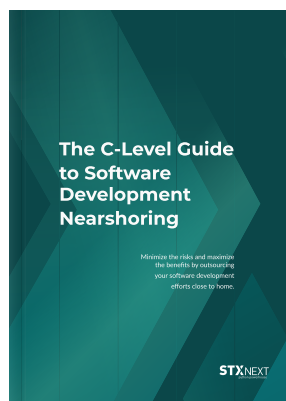of software development experience.

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