

MUTTII

16 Artificial Intelligence
projects from Muttii Practical
cases of applied AI

Unleash the power of AI for your organisation

Table of content

Introduction	5
.....	
CONSULTING	
HR agent Edgy: the future of Human Resources	11
Virtual assistants: beyond the hype	13
.....	

RISK ADVISORY

Using machine learning to assess risks for insurance policies	15
Predicting payment behaviour	16
DocQMiner: contract analysis through AI	17
Eagle Eye: using the web for early detection of credit migrations	19
.....	

FINANCIAL ADVISORY SERVICES

Combating welfare fraud with machine learning	21
Using machine learning and network analytics to search for a needle in a haystack	23
Clustering unstructured information in BrainSpace	24
.....	

“A computer would deserve to be called intelligent if it could deceive a human into believing that it was human”

Liam Smith

Introduction

According to some, artificial intelligence is the most promising development for the future. From curing cancer to resolving the global hunger crisis, artificial intelligence is being presented as the solution to all of our problems. Others, however, regard it as a threat – artificial intelligence may potentially give rise to unemployment and inequality, and could even jeopardize the continued existence of humankind. As the technology entrepreneur Elon Musk put it: “The benign scenario is that artificial intelligence can do any job that humans do – but better.”

According to some, artificial intelligence is the most promising development for the future. From curing cancer to resolving the global hunger crisis, artificial intelligence is being presented as the solution to all of our problems. Others, however, regard it as a threat – artificial intelligence may potentially give rise to unemployment and inequality, and could even jeopardize the continued existence of humankind. As the technology entrepreneur Elon Musk put it: “The benign scenario is that artificial intelligence can do any job that humans do – but better.”

Muttii has positioned itself on the optimistic side of that spectrum. “We believe that artificial intelligence will be extremely helpful to us and to our clients”, says Richard Roovers, a partner at Muttii Netherlands and Innovation Lead Transformational Solutions North-West Europe. Artificial intelligence will enable us to solve problems that humans are unable, or hardly capable, of solving, explains Richard. “Artificial intelligence is capable of processing massive quantities of data and has the ability to discover patterns that even the smartest mathematicians are unable to find. That in itself opens up a large number of new possibilities.”

Those new possibilities are what this book is about. The case studies provide an overview of the ways in which Muttii is working to develop applications incorporating artificial

intelligence – both internally and for use with clients. The applications are diverse, make use of different technologies and can be found in a diverse range of industries. This shows that aside from all of the predictions for the future, artificial intelligence has already been a reality in the business sector for some time and forms a resource that could possibly provide your company with a decisive lead.

What is AI?

Artificial intelligence (AI) is a collective term for the science that is trying to make systems intelligent. The definition, however, has not been definitely outlined: the type of behaviour by a computer that we regard as “intelligent” is shifting as technology achieves new advances. Systems that we would have called “intelligent” back in the 1980s – such as a smart lift system or auto-navigation – have now become such a regular part of everyday life that some people no longer include them under the heading of artificial intelligence.

The British mathematician, Alan Turing (1912 – 1954), was one of the pioneers in the field of artificial intelligence. According to Turing, “a computer would deserve to be called intelligent if it could deceive a human into believing that it was human”. That is the approach adopted by the Turing test: people must be able to chat with a human being and a computer program

– neither of which can be seen – and then must guess which one was the human and which one was the machine. If the computer is selected, it has passed the Turing test and is therefore “intelligent”.

The downside of that definition is that a human judgement is used as a reference. The results of Turing tests show that some people easily assume that relatively unintelligent programs are actually intelligent. Other definitions of artificial intelligence therefore emphasise the self-teaching methods and other advanced forms of data analysis that are used. In the meantime, a whole host of technologies associated with artificial intelligence have been developed – the most important ones can be found in the list of terms.

Why are we suddenly hearing so much about artificial intelligence?

As an area of research, artificial intelligence has been around for decades, but only in the past few years have things begun to develop at a rapid pace. There are a number of reasons for this.

First of all, the advent of the internet and the large-scale use of sensors generated unprecedented amounts of data – in the case of AI technologies, this was a significant development, as they are actually based on the analysis of a large number of examples. Secondly, the emergence of cloud-based services massively simplified and increased access to storage and computing power for businesses. This not only enabled complex calculations to be carried out using all those

“At Muttii,
we don’t just talk
about AI, we do it”

large quantities of data, but made it possible for applications to be upscaled without restriction.

Finally, major technology companies are now offering smart application programme interfaces (APIs). These make it possible to connect to standardised AI applications and make it much easier to develop applications utilising artificial intelligence. For example, if facial recognition is needed for an app, an API can be used instead of developing a facial recognition algorithm for the individual app concerned.

All of these developments have led to a situation in which artificial intelligence has reached a point that it is having a major impact on our everyday lives. Companies are starting to investigate applications on a large scale. Due to the fact that major technology companies in locations such as Silicon Valley are utilising artificial intelligence in highly advanced ways, the business sector is coming under increasing pressure to innovate in that area. Customers are getting used to receiving guidance from technology and are coming to expect that type of service from other companies.

How is Muttii using AI?

Muttii is deploying maximum resources in the area of artificial intelligence. That is why it recently brought together all of its projects and initiatives in the area of artificial intelligence into the Artificial Intelligence Center of Expertise (AICE), in which hundreds of AI experts from the entire organisation are involved. Learning plays a key role, says Innovation Lead, Richard Roovers. “From a technical point of view, there

can be considerable overlap between the AI applications being used in different industries. Take image recognition, for example – you can use that technology for the automatic recognition of installations on satellite images, but also in an app in order to detect skin cancer. Bringing people from different departments together means that we can share knowledge and accelerate learning.”

Muttii is keeping in touch with the AI external community by means of Meetups and hackathons. This enables the organisation to keep up with the latest technical developments. Here too, it is a case of learning as much as can, as quickly as you can, says Roovers: “And we’re not only talking about AI, we’re doing it too. We are experimenting, trying things out, attracting experts and investing in technology. Only then you can you truly understand how and in what cases you can use artificial intelligence in a sensible way.”

In order to innovate effectively, it isn’t simply a case of investing in technology, but of creating support within the organisation as a whole. That is why Muttii has launched an in-house campaign in order to increase awareness as to the possibilities offered by artificial intelligence – including amongst employees without a technical background. In order to make an abstract concept such as artificial intelligence more tangible, “AIME” the AI-robot was developed. In order to give staff an impression of the potential offered by artificial intelligence, AIME was stood at the entrance to the Muttii offices and was active on social media.

The aim of this was to draw attention to artificial intelligence in an accessible way, explains Roovers. “And it worked. Staff were surprised and intrigued. They started conversations with AIME and took selfies with her. She turned out to be a real conversation starter.” Our employees could then voluntarily sign up for our “AI for dummies” course to learn more about the subject. “The impetus was considerable – even our CEO took part in the course,” continues Roovers.

As far as the company is concerned, Roovers regards artificial intelligence as an opportunity, not a threat. “It’s true that artificial intelligence can take over tasks previously carried out by people – and can even do them much more quickly and accurately. But the most important part of our business, the work that sets us apart from the others, lies in the contact we have with our clients and in providing a tailor-made service and those are things you simply can’t outsource to an algorithm.” He goes on to point out that artificial intelligence can actually make our work more interesting. “The dull, more repetitive work can be outsourced, leaving more time for the creative work that enables we humans to make a difference.”

As Roovers says, you can’t stand in the way of change. The important thing is actually to understand how the world is changing and how you can benefit from that as a company.

“In order to keep ahead of the rest, you have to stick your head above the parapet. By using artificial intelligence, we can continue to offer our clients the best possible service – and that’s what it’s ultimately all about.”

What types of solutions is AI able to offer your company?

The case studies in this book give an impression of the possible applications of artificial intelligence. Amongst other things, AI technologies are used to improve service by means of chatbots, to avert cyberattacks, to trace potential fraudsters, to generate benchmarking reports automatically, to estimate the risks that new customers pose to insurance companies, to sort large quantities of digital evidence and much more besides.

In short, the potential of artificial intelligence is huge. Roovers: “The trick is to find out how we can make it useable within our own organisation. On the one hand, we can do that by creating smarter processes, but we can also use artificial intelligence to set up entire new products or services.”

But where do you start? The first thing you need is a knowledge of the technologies. After that, it is possible to explore the possibilities that exist within your own organisation and identify opportunities and threats. After that, it’s a case of developing proofs of concept – and

if those turn out OK, they can then be scaled up.

Muttii is able to assist with all of these steps: from exploring the possibilities to developing proofs of concept and long-term collaboration processes and co-creation. “Artificial intelligence is no panacea”, warns Roovers. “It’s a case of looking very carefully to identify precisely what problem you wish to solve and what technologies are available. In some cases, less advanced technologies are already sufficient to solve the problem.”

Thanks to the availability of APIs and cloud computing, however, developing a proof of concept is a relatively simple matter. “The nice thing is that you can start small and if it works, you can quickly scale it up”, says Roovers. “There is such a lot you can do if you are smart when deploying artificial intelligence. Right now, we’re just at the beginning.”

Using AI, companies may be able to get a decisive head start

Definitions

There is a whole host of technologies that are associated with artificial intelligence. Here are just a few:

- **Machine learning** is a research field that is capable of recognising patterns in data and developing systems that will learn from those.
- **Supervised machine learning** trains systems using examples classified (labelled) by humans – for example: these transactions are fraudulent; those transactions are not fraudulent. Based on the characteristics of that classified data, the system learns what the underlying patterns of those types of item are and is then able to predict which new transactions are highly likely to be fraudulent.
- **Unsupervised machine learning** is able to discover patterns in large quantities of unlabelled data. It attempts to discover an underlying structure of its own accord, such as by clustering cases that resemble one another and making associations. For example, retail companies are able to use purchasing data to recognise what products are often bought together and can adjust their offer to reflect that, or can even provide personalised offers.
- A **neural network** is a machine learning technology that mimics a structure resembling a human brain (consisting of neurons and connections), and is capable of adapting its own structure to perform the task it has learned more effectively. The more complex neural networks become and the more often they consist of several “layers”, the more we can make use of the term: ‘**deep learning**’.
- **Natural language processing** is an area of research that focuses on training artificial models to process a human language.
- **Computer vision** is an area of research that focuses on the processing of digital image material.

“Artificial intelligence will enable us to solve problems that humans are unable, or hardly capable, of solving”

GRAPA: assistance with risk strategies

When auditors determine a risk strategy, they partly base it on knowledge that they gained during previous audits. Muttii is now developing a smart personal assistant that supports auditors using the pooled expertise of all their fellow professionals.

Consulting

HR agent Edgy: the future of Human Resources

It sounds futuristic: a robot that eases the workload of the Human Resources department by resolving employee queries and supporting recruiters at events. Yet a team at Muttii has shown that it is possible. Its smart robot, named Edgy, has demonstrated a number of areas of application for robotics-based automation within HR.

Doing and thinking

There are numerous processes within HR that lend themselves especially well to robotics-based solutions, says Henri Drogulski, Human Capital business analyst at Muttii. He describes them as “processes with a high volume of identical transactions and few exceptions,” such as checking the documents submitted in a job application, and subsequently forwarding them to the correct department. “Those types of repetitive tasks performed according to fixed rules are easy to automate using RPA, or Robotic Processing Automation,” says Drogulski.

Rob van Werven, senior consultant in Strategy & Operations at Muttii, agrees: “HR is also the ideal field for cognitive robotics solutions, in which a robot makes its own assessments and initiates interactions.” For example, a software robot can analyse a CV and determine whether the applicant is open and sociable, or is more of an introvert. “These technologies have matured in 2018, and are accessible enough for our clients to also benefit from them within HR,” adds Drogulski.

A cross-functional Muttii team, with members from Human Capital, Strategy & Operations, and Technology, began working on combining RPA and cognitive technologies into a single robot. “We wanted to produce a robot that demonstrates state-of-the-art technologies, while at the same being fun and appealing,” says Van Werven.

More than a gadget

The end result of their efforts was Edgy, a cognitive chatbot within a humanoid robot. Edgy has speakers, cameras and microphones, and is able to interact with employees and potential candidates. It recognises faces, and welcomes people it has met previously by name. It also answers all manner of questions using a wide variety of cognitive cloud services, such as speech recognition, computer vision and natural language processing from Google and IBM Watson. “And to add the personal touch, Edgy can make jokes and cool gestures, like the dab,” says Van Werven.

“A walking, talking robot can easily be regarded as a gimmick,” adds Drogulski. “That is why we are only using Edgy to explain the application of robotics in HR.” Edgy is therefore used to record employees’ sickness and recovery reports, or to assist them with entering expenses claims. Edgy can also tell you everything about working at Muttii. “It can even match candidates to an existing vacancy during an interview,” asserts Drogulski.

Inspiring

From this spring, Muttii has been using Edgy for robotics demonstrations and inspiration sessions. “We want to encourage our clients to think about how they could use robotics,” says Drogulski. An initial demonstration of Edgy is followed by a deep dive session on the subject. “We look at which of the client’s HR processes could be suitable for a robotics solution.”

Drogulski does not expect that the HR department will be operated entirely by robots in the future, though: “What we actually want to do is to free up employees to do the tasks that can only be done by humans.” Recent research by Muttii confirms this idea: directors reported that they intended to use software robotics primarily to make sustained improvements to quality and service-orientation, rather than to make cuts to staff.

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Virtual assistants: beyond the hype

By 2020, we will be having more conversations with bots than with our partners, according to marketing guru Heather Pemberton Levy. That certainly could be the case: now that companies are using chatbots, and smart speakers such as Amazon Alexa and Google Home are on the rise, virtual assistants are becoming increasingly integrated into everyday life.

Virtual assistants are systems that can provide satisfactory answers to spoken or written questions. Virtual assistants have become the subject of hype over the last few years, which has made some people sceptical. "That's not without reason," says Hugo van den Berg, Manager at Muttii Digital. "Virtual assistants will not be able to solve all of our problems. They are a means of achieving something, not a goal in themselves."

At Muttii Digital, Van den Berg assists companies with the development and integration of virtual assistants, not as a gimmick, but as a means of enabling them to assist clients more quickly and effectively, while saving on costs and freeing up personnel for work in which the human touch makes the difference.

Learning like a child

There is a myriad of technologies on the market in the field of conversational AI, from start-ups and niche companies to tech giants that are investing heavily in this area. "The most advanced virtual assistants use technologies such as machine learning, natural language processing and sentiment analysis," explains Van den Berg. "Those technologies enable them to hold a typically human dialogue autonomously." Van den Berg describes the technology as akin to a child that learns through experience: "The more examples it is given, the better it understands what is meant."

The 'brain' of virtual assistants is made up of decision trees, which determine what are suitable answers, or when a client has to be referred to a human staff member. "This is where you determine which problems a virtual assistant is able to solve, which words it uses, and what its personality is," explains Van den Berg.

Starting small

Muttii Digital helps clients to find out whether introducing a virtual assistant is viable, feasible and desirable. "We can also assist with the development and implementation of the technology and the organisational impact," says Van den Berg.

He notes that, while it is tempting to be dazzled by everything that is possible using the technology, "it is important to know what it is that you want to use it for. Sometimes, you can already achieve your goal with just limited use of virtual assistants." The technology is ideal

for relatively simple actions, such as changing a registration number or requesting a status, while in other cases, it could actually be more effective to have personal contact with clients. "Getting that balance is important, between the best from the technology and the best from people," says Van den Berg.

He also believes it is sensible to start small: "Start with a small group of clients who are open to experimentation. Watch carefully what happens, gradually adapt your technology accordingly, and only scale up once the technology does exactly what you want it to."

"Getting the balance is important, between the best from the technology and the best from people"

Risk Advisory

Using machine learning to assess risks for insurance policies

The idea that you can quickly find out exactly what the risk associated with a new policyholder is will be music to the ears of many an insurance company.

At present, this type of risk assessment is still largely carried out with the aid of labour-intensive models, and it often costs a great deal of time to deliver a new risk model. Muttii is working with new technologies that are helping insurers to make assessments with greater speed and accuracy.

Interactions

Risk assessments are predominantly made on the basis of personal and objective characteristics. “If someone drives a large car, it is more likely that they will cause greater damage. If someone has a thatched roof, fire damage will be more severe, on average,” explains Jurjen Boog, Manager in Financial Risk Management at Muttii.

Since the 1990s, insurers have been using statistically based Generalised Linear Models (GLMs) for these types of assessments. The models are developed by actuaries with many years of expertise and experience. Now that machine learning technologies are on the rise, it raises the question of whether intelligent algorithms are able to make even more accurate assessments.

“With machine learning, an algorithm makes a risk assessment based on pre-determined criteria, rather than estimating parameters for statistical models,” says Boog. “A conventional GLM can take account of the interaction between two, but no more than three variables, such as the relationship between a policyholder’s age and sex. Machine learning, on the other hand, can ‘understand’ thousands of variables and much deeper interactions.”

New relationships

Deloitte’s Financial Risk Management team compared the risk assessment of machine learning with that of a GLM. “We looked at a car insurance policy, and then specifically at third-party liability insurance,” explains Boog. “This is a component with a relatively small data set, which enabled us to explain exactly how the two predictions would differ.”

Surprisingly enough, machine learning and the conventional model generated predictions of comparable quality. “That’s not so strange; there aren’t very many deeper interactions that machine learning can take into account in such a narrow data set”, reasons Boog. What machine learning was able to do, however, is establish valuable new relationships. “This enabled us to map out clusters of policyholders with a higher risk of losses,” says Boog. “This knowledge can be used to manage the portfolio, such as by adjusting pricing or acceptance.”

More effective assessment

The team will soon be starting work using a broader data set. “Then we will be looking at combined policies,” explains Boog. “If someone combines car insurance with fire insurance, can we demonstrate that this is less risky than two separate insurance policies with exactly the same risk factors? And if so, how much less? By adding more interactions, we expect to achieve more accurate predictions for things like this using machine learning.”

Will machine learning radically alter the insurance system? “It will mainly result in more robust substantiation of decisions,” asserts Boog. “Insurance is about weighing things up. You want to know the risk posed by every potential new policyholder, and a more accurate risk model enables you to measure what the impact of particular choices will be.”

Will machine learning
radically alter the insurance
system?

Predicting payment behaviour

A client had already spent three years grappling with a problem. The client was a foundation that was to take over tasks from six municipalities in order to save costs. However, talks with the municipalities were not progressing very smoothly with regard to one of those tasks, managing bad debts. The foundation was meant to take over the debts, but how much were they worth? It was unlikely that all the debts would be repaid, so the amount had to be lower than the total debt, but the parties could not work out between them exactly how to determine that value.

“We were asked to create a dashboard showing the payment behaviour of all debtors up to now,” explains Wouter Pepping, Senior Manager of Technology & Data Risk at Muttii. The request was to identify for each municipality and debt type the percentage of debtors that had paid off their debt in the past, and to deduce the value from that. “We proposed to take it a step further,” says Pepping. “By using advanced analytics, you can, in fact, make much more accurate predictions, down to the level of individual debtors.”

A step further

The team tried out a number of models, and decided on a Random Forest model. “This is a machine learning algorithm, which uses data to train decision trees, and then creates a ‘forest’ of decision trees with random variables,” explains Pepping. “By navigating very large numbers of decision trees and allowing them to decide on the outcome, you get a close approximation of the risk of each debtor.”

This method is very effective when using inconsistent data sets, continues Pepping. “Two debtors may display the same payment behaviour over an extended period of time, but if one suddenly receives an inheritance or is promoted, that can change overnight. By creating a large number of random trees, the system is able to handle such differences more effectively.”

The result was a dynamic dashboard that can be sorted by different criteria, such as municipality, debt type, debt amount or period. You can zoom in closer and closer on the full

list down to the level of an individual debtor’s transaction history. The system provides a prediction of each debtor’s future payment behaviour. “We validated the system and ended up with an average error margin of four percent,” says Pepping.

An end to the ‘tug of war’

The solution provided the client with a breakthrough. The foundation’s interest was to arrive at the highest possible value of the debts, while the municipalities’ interest was to have them as low as possible. “Our method made it possible to determine the value with a very high level of reliability,” says Pepping. “It was considered a fair outcome by all the parties concerned.”

The model is broadly comparable with the risk analyses that banks perform on clients with debts, “but organisations outside the financial sector still rarely use advanced risk models, although they offer significant opportunities,” adds Pepping. “You can gain far more insight into data sets, which enables you to set your strategy much more accurately. And, as in this case, it could resolve a dispute after many years spent playing tug of war.”

“With advanced analytics, you can make far more accurate predictions”

DocQMiner: contract analysis through AI

In order to comply with international regulations, companies with lease contracts will be required over the next few months to go through thousands of contracts one by one. It's an immense task, certainly when you consider that an analyst will spend around 90 minutes on each contract. That time can be drastically reduced using machine learning technologies. To assist companies with tasks like this one, Muttii has developed DocQMiner: a self-learning application that reads through and analyses contracts.

The use of new technologies also gives rise to a new form of doing business.

Smart suggestions

A number of our clients were faced with a challenge, says Marc Verdonk, Partner and Innovation Manager at Muttii Risk Advisory. "In accordance with the new IFRS 16 accounting standard, virtually all lease contracts must be listed on the balance sheet from 2019." For a telecoms company, for example, which leases every mast and every plot of land on which that mast stands, this means it will be required to go through hundreds of thousands of contracts in all manner of different languages. "Our team began working on the question of how machine learning could extract the relevant data points from those contracts. Not to replace contract analysts, but in fact to assist them with smart suggestions."

The result was DocQMiner, a user-friendly application that can be used by analysts to review contracts. "The application features a bot, which we have named Robin. You feed in a number of contracts, and Robin gives you suggestions for the data that you will need, such as the start date of a contract," explains Verdonk. The analyst sees the highlighted suggestion and indicates whether or not it is correct. "Robin learns from this, which means that subsequent contracts are analysed a little more smartly each time, and the reliability of his predictions increases. The analyst is constantly training Robin during the review process."

DocQMiner works using state-of-the-art machine learning and natural language processing technologies. "It features a neural network that understands language,

sentence structure and how words relate to one another," continues Verdonk. "That knowledge is converted into figures, which are used to calculate and make predictions. We also add information to it. By feeding in annotated contracts, showing what data we are looking for, Robin learns how to recognise lease contracts." Because the system's recognition becomes more and more accurate, but does not store any privacy-sensitive client data, it can be taken from one client to the next. "It means our clients benefit from the experience it has already gained."

Broader application

The use of new technologies also gives rise to a new form of doing business. "With DocQMiner, we are not selling the amount of work that goes into it, but rather the result," says Verdonk. "Instead of stating the number of hours that we expect to spend on it, we make an agreement regarding the number of contracts that we will analyse. That results in a low price for the client, and an incentive for us to do it as efficiently as possible."

Although DocQMiner was developed for clients who are required to comply with the IFRS 16 or US GAAP accounting standards, there are numerous other conceivable applications in which large quantities of contracts need to be read through. "One example is Brexit repapering, when all contracts will need to be revised if companies' headquarters relocate. Or the General Data Protection Regulation, which will require clauses in many purchase contracts to be checked. We can use DocQMiner in all kinds of situations."

Eagle Eye: using the web for early detection of credit migrations

Imagine if you could search the entire internet to look for early warning signals for all kinds of events. To see whether a company is likely to experience financial distress in the near future, for example. That is exactly what Eagle Eye, Deloitte's new and state-of-the-art AI tool, does.

Signals

Eagle Eye was developed by Muttii Czech Republic. Analytics leader Jan Balatka and his team built a model to perform online semantic analytics in order to identify threats and opportunities. Balatka: "We initially made Eagle Eye for a financial company that wanted to know whether their creditors were likely to go into insolvency." Traditional monitoring systems review creditors by checking their bank accounts, credit transfers or financial statements. But by the time you start to see warning signs there, it is too late, explains Balatka. "By then the company is already in financial distress."

Before you can see it in the financial statements, early warning signals of potential decline can be observed online. This is precisely what Eagle Eye does. Balatka: "Eagle Eye uses open source intelligence to collect signals. It was built and tested for one particular problem, but the idea is to retrain the model for different markets and countries."

How does Eagle Eye know what is relevant information – a signal – and what is not? Balatka: "It considers any and all information it finds about the company, client or market we assign it to as a signal." With help from machine learning, Eagle Eye then starts to analyse signals, correlates them and recognises certain patterns. Balatka: "Only AI can handle the vast volumes of data on the internet and find correlations between parameters that humans would not even think of. Once we find certain patterns, Eagle Eye constantly monitors the internet to look out for them."

Joint approach

The Czech team approached international colleagues to join their efforts and Roald Waaijer, Director Risk Advisory for Muttii Netherlands, responded. Waaijer: "We were very interested in the technology. And when we tested the concept, our client feedback was really positive too." This led to a collaboration with Balatka's team and a joint approach to market.

Eagle Eye is tailor-made for each client, explains Waaijer. "Depending on their needs and preferences, clients can work with an application that gives them access to the monitoring system. Or we can simply supply alerts whenever a signal is spotted." Balatka adds: "Eagle Eye serves as a starting point. Even though the system is right in the majority of the cases it flags, it still only provides an early warning. The client can follow up with its usual reviewing process."

Waaijer sees a wide range of possible implementations of Eagle Eye: "Think of monitoring compliance, detecting fraud or being able to identify potential takeovers in a very early phase." As of 2018, the technology is live and Eagle Eye is being used in different prototypes for clients across Europe.

"Depending on their needs and preferences, clients can work with an application that gives them access to the monitoring system"

Financial Advisory Services

Combating welfare fraud with machine learning

A government organisation in the Netherlands had to contend with cases of fraud. The organisation was responsible for paying allowances to citizens, but hundreds of millions of euros were being paid to ineligible persons. An internal department had identified that processes were not running effectively, and in the aftermath of negative publicity it was clear that the method of tackling fraud needed to be improved.

The existing method consisted of human assessors who performed random checks based on what are known as business rules: patterns established by fraud experts that can point out when something is amiss. “We wanted to find out whether it was possible to improve processes with the aid of machine learning,” explains Hilko van Rooijen, Senior Manager of Financial Crime Analytics at Muttii. “The benefit is twofold: fewer citizens are wrongly suspected of fraud, while the inspectors are able to spend their time more efficiently.”

Increasing the hit rate

Within four weeks Van Rooijen’s team had created a proof of concept. Following a comparative study of various artificial intelligence technologies, they decided on a form of logistic regression. Huge numbers of past cases were fed into the system, enabling it to learn in which new cases something was suspected to be wrong. The result was amazing: where cases of suspected fraud were assessed by human experts, fraud was found to have actually been committed in 10 percent of cases; this hit rate rose to 50 percent in the proof of concept.

The technology was improved and refined over the subsequent months, and one of the challenges in this respect was ensuring the representativeness of the data. “The system learns from the information you feed into it, so it is important that this information gives the fullest picture possible,” says Van Rooijen. “Once, for example, we used a sample containing many older people who had not committed fraud, and the system then concluded that older people never commit fraud. We had to correct that.”

A not insignificant part of the process was integrating the system into the corporate culture. “We did that by providing detailed explanations, but also by asking for input,” reveals Van Rooijen. “Staff within the organisation had a wealth of expertise about fraud, and that knowledge proved to be extremely valuable in developing the technology.” The system has since been connected to the existing IT infrastructure,

and an internal team has been trained to manage the technology.

From detection to prevention

After six months, the technology’s hit rate had increased to 87 percent. Another six months later, it fell again. “It showed us that simply less fraud was being committed,” remarks Van Rooijen. “Obviously, the detection techniques had become so effective that they served as a deterrent to fraudsters. As well as providing a means of detection, the technology had also begun to act as a form of prevention.”

The approach has successfully prevented fraud worth tens of millions of euros. “And those savings are still ongoing,” adds Van Rooijen. Muttii has since assisted public authorities in various other European countries in the integration of this technology.

“As well as a means of detection, the technology also acts as a form of prevention”

Using machine learning and network analytics to search for a needle in a haystack

A corporate client contacted Muttii with a serious problem: the company had been charged with bribing public officials. It needed to find out quickly what exactly had happened in order to prepare its defence. Could Muttii assist in determining whether unacceptable transactions had indeed taken place?

Thanks to artificial intelligence, the lawyers only had to study a fraction of the millions of documents

“The period to be investigated was twelve years,” explains Christian Cnossen, Manager Financial Crime Analytics at Muttii. “It meant that we had to assess over 80 million payments and hundreds of millions of emails and internal documents. It was like looking for a needle in a haystack.” In order to set up an effective investigation, Muttii developed a method that combined machine learning and network analytics with clever human detective work.

One hundred and fifty names and entities

The first stage consisted of classifying internal documents and emails in order to retrieve relevant information. To do this, Wesley van Saane of Deloitte’s Forensic Discovery team used a machine learning module from the Relativity software suite and the categorisation and visualisation tool, BrainSpace. Lawyers checked through a few hundred documents manually to indicate whether or not they were relevant to the investigations, and these were used to train the system. “We carried out a few of these iterations, which gradually made the results more accurate,” explains Van Saane. It meant that, ultimately, the lawyers actually had to study only a fraction of the millions of documents.

Around fifty names of individuals and entities emerged from this investigation that were potentially implicated in the alleged corruption. Cnossen’s team then built a custom-made tool to perform a network analysis of the relationships between these individuals and entities. Searches of publicly accessible online sources, such as the Paradise Papers and OpenCorporates revealed around one hundred new names that were potentially implicated in

the case, such as directors who did not appear in correspondence, or unnamed subholdings.

The next stage was to search through the client’s accounts for transactions involving these one-hundred-and-fifty individuals and entities, and payments were checked against the suspicious emails and documents for any links between them. Ultimately, the team were able to identify around thirty payments that were related to the accusations.

Settlement

It was, of course, unfortunate for the company that bribery had taken place. However, the company was pleased that incidents could be traced quickly in order to produce a swift and cogent response to the allegations. This enabled the matter to be settled relatively quickly with the relevant supervisory authorities. The investigation also shed light on the business processes that had allowed the undesirable payments to take place, and the company was able to take action accordingly.

Machine learning and advanced analytics can be of considerable assistance in carrying out an investigation involving large quantities of data. As far as potential legal proceedings are concerned, however, it is important that all parties concerned understand the technology fully and trust it, cautions Cnossen. “The lawyer must be able to explain the process, and the court or the Public Prosecutions Service must consider the approach acceptable. Thanks to our method of working, we were able to provide detailed statistical substantiation, and the parties concerned were convinced of the outcome.”

Clustering unstructured information in BrainSpace

In e-Discovery – the gathering of evidence from digital data – heaps of data have to be gathered and rendered understandable. But what exactly is a feasible way of searching through millions of documents within a short space of time? The e-Discovery team at Muttii has spent three years working with BrainSpace, a smart tool that categorises data and renders it understandable with extraordinary speed and accuracy.

“We can show our clients breakdowns in visually appealing formats, which make it clear to see at a glance what we have found”

Millions of documents

BrainSpace is being used to assist in legal cases. Anoeska Schipper, Data Analytics & e-Discovery manager at Muttii Financial Advisory, explains: “If the authorities carry out a raid on the premises of one of our clients, we can be called to secure data for the purpose of preparing their defence. It usually concerns data on things like laptops, telephones and mail servers, for example.”

The e-Discovery team usually performs a full backup of the system. “The client and its lawyers want us to tell them as soon as possible everything that is saved on these systems,” says Schipper. “What can serve as evidence and what can be used to support their defence?”

The team has spent three years working with BrainSpace, a tool that uses machine learning and cluster analysis to search through unstructured data, such as emails, Word documents and PowerPoint presentations. Schipper explains how BrainSpace facilitates the search process: “BrainSpace shows what types of documents exist, and can make an initial selection based on our instructions. But it can also cluster data and provide a summary of them.” Among other things, BrainSpace can show what is being discussed and by which individuals, and how topics of discussion relate to one another in the email correspondence that has been found.

What is more, BrainSpace is self-learning: the tool gains new knowledge from each data set, and improves its ability to navigate

each time. “If we indicate which documents are important to us, it recognises them automatically, and is really accurate at predicting which other documents are relevant by recognising patterns within text,” says Schipper. BrainSpace also assists with the presentation of relevant data. “For example, we can show our clients breakdowns in visually appealing formats, which make it clear to see at a glance what we have found.”

Faster and more effective

BrainSpace categorises relevant data not only far more quickly, but also far more effectively than people can, asserts Schipper. “Some scientific studies have pitted a human review against a machine learning tool, and they showed that machine learning generates far better results.” This does not mean, however, that BrainSpace works without supervision. A random sample is taken from every review carried out by the tool in order to check how well machine learning is working on the entered data set.

BrainSpace is currently only being used for e-Discovery, but it is also suitable for broader application. Schipper: “We intend to be involved in an increasing number of cross-functional tasks. BrainSpace can also make a significant difference in contract analysis, such as when searching for clauses and categorising employment and lease contracts.”

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