Potter Clarkson

IS AI ABOUT TO REVOLUTIONISE AGRITECH?

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Farming is one of the world's most important industries. Arguably as the food crisis worsens, it will continue to become even more important. As it does, farmers will need help to increase crops yield and livestock growth. A large part of this help will come from technology and, more specifically, from artificial intelligence (AI) and machine learning (ML).

To put just how important AI and ML are to farming into context, BI Intelligence Research estimates global spending on smart, connected agricultural technologies as a whole will triple in revenue by 2025, reaching $15.3 billion.

Meanwhile, spending on AI alone in the agriculture sector is predicted to rise from $1bn in 2020 to $4bn in 2026 according to Markets&Markets. During the same period IoT (Internet of Things)-enabled agricultural (IoTAg) monitoring will be, PwC predicts, agriculture's fastest-growing technology with the potential to reach $4.5bn of global spend by 2025.

The reason agriculture is such fertile ground for AI and ML is that farms cover such a vast and differing surface area that it is very difficult to keep up with what is happening across what could be hundreds or even thousands of acres.

BI INTELLIGENCE RESEARCH ESTIMATES GLOBAL SPENDING ON SMART, CONNECTED AGRICULTURAL TECHNOLOGIES AS A WHOLE WILL TRIPLE IN REVENUE BY 2025, REACHING $15.3 BILLION.

Those responsible for keeping agricultural land in top healthy and productive order need to know how weather, seasonal sunlight, animals, birds and insects will impact them at any point during their crop or livestock's annual cycle.

They also need to know how to generate the optimum return from their fertilizers, insecticides, herbicides, and planting irrigation cycles. Even the smallest adjustment can have a major effect on output.

These conundrums are perfect for AI and ML.

Algorithms can analyse huge amounts of data with complete accuracy, extrapolating the answers required to give famers, co-operatives, agricultural development agencies and even national governments the direction they need to improve agricultural yields and quality.

In this special report we will look at the ways AI and ML are helping the agricultural sector and, given the vital role innovation will play in enabling technology to do even more for farmers, how best to protect the new ideas that will inevitably shape agritech over the next decade.

ALGORITHMS CAN ANALYSE HUGE AMOUNTS OF DATA WITH COMPLETE ACCURACY, EXTRAPOLATING THE ANSWERS REQUIRED TO IMPROVE AGRICULTURAL YIELDS AND QUALITY.

HOW IS AI IMPROVING AGRICULTURE?

AI has already proved that the output from its real-time analysis of vast amounts of data from an equally vast breadth of sources and sensors can increase agricultural efficiencies, improve crop yields, and reduce food production costs.

Given the United Nations expect the world's population will increase by 2 billion people by 2050, food production will need to increase by 60% to feed them.

This means every opportunity to increase agricultural efficiencies, improve crop yields, and reduce food production costs must be taken.

AI and ML are already helping farmers achieve these aims. Outlined over the following pages are some of the practical applications that will yield the desired results:

- **PRICE FORECASTING**
- **IMPROVED CROP YIELD PREDICTION**
- **SMART TRACTORS, AGRIBOTS AND ROBOTICS**
- **YIELD MAPPING**
- **PEST MANAGEMENT**
- **HELPING GET CROPS TO MARKET MORE QUICKLY AND MORE SAFELY**
- **FINDING THE RIGHT MIX OF AND BEST USE OF PESTICIDES AND HERBICIDES**
- **BETTER WATER MANAGEMENT**
- **MONITORING LIVESTOCK HEALTH**
- **REAL TIME SURVEILLANCE AND ALERTS**

PRICE FORECASTING

Analysing the yield rates and quality levels of crops can help agricultural businesses at all levels negotiate for the best possible prices for their goods by determining the total demand for a crop against its pricing.

Signs are this single application of AI could save agricultural businesses millions in lost revenue every year.
Given the current state of the economy this cannot be ignored. This is why this point heads our list.

IMPROVED CROP YIELD PREDICTION

Data captured by smart sensors and drones in real-time offers farmers a depth of data they have never had access to before. Once combined with data on moisture, nutrient levels and fertilizer taken by in-ground sensors, farmers have the insight they need to adapt their approaches on a field-by-field basis to optimise crop yields and work out how best to use specific fertilizers to maximise different crops and different areas of the farm.

SMART TRACTORS, AGRIBOTS AND ROBOTICS

Large-scale agricultural businesses often can't find or afford enough employees. Robotics offers the perfect solution.

They can irrigate and secure hundreds of acres of crops. They can accurately distribute fertilizers, pesticides, and herbicides depending on the individual needs of each row of crop which cuts cost and increases productivity. Using AI and lasers, state-of-the-art autonomous robots can even identify and kill weeds in real time, cutting time spent in the field and minimising herbicide requirements. The rapid steps forward in terms of the sophistication of these 'agribots' will only make their contribution more valuable in the future.

Agricultural robotics can also collect invaluable data that can be added to the other data sets AI solutions are using for other purposes.

YIELD MAPPING

Yield mapping is an agricultural technique that uses algorithms to find patterns from large volumes of data taken from in- or on-ground sensors and drones. The conclusions can then be used to improve the crop planning process to maximise potential soil yields for any given crop.

PEST MANAGEMENT

Infrared camera data from drones can be combined with data taken from sensors on fields to give a highly accurate assessment of the plants' relative health levels and the current and potential threat posed by pests so that AI can future-model for pesticide use and deployment based on the findings.

HELPING GET CROPS TO MARKET MORE QUICKLY AND MORE SAFELY

Track-and-traceability in all agricultural supply chains is now a must. Knowing exactly where things have come from and how long they have been in transit is key to preventing food wastage.

The most advanced track-and-trace systems now employ advanced sensors to gain greater knowledge of every aspect of each shipment's condition. This not only prevents the quality of food suffering at any stage of the supply chain, it also provides the data the transporters need to optimise the length, cost, and conditions of transporting particular foods area by area.

FINDING THE RIGHT MIX OF AND BEST USE OF PESTICIDES AND HERBICIDES

The combination of data collated from sensors and drones can be hugely effective in detecting crops' most vulnerable areas then use this insight to ascertain the optimal combination of pesticides and herbicides to reduce the risk of pests and weeds damaging or stunting any part of a healthy crop.

BETTER WATER MANAGEMENT

AI can be used to optimise irrigation systems. It can not only measure and model crop irrigation to improve yield rates, but also find irrigation leaks to minimise the cost and impact of water wastage to help preserve what is becoming a more and more scarce natural resource.

MONITORING LIVESTOCK HEALTH

One of the fastest-growing aspects of AI and machine learning in agriculture is the monitoring of livestock's vital signs, daily activity levels, and food intake. Better understanding of how every type of livestock reacts to diet and boarding conditions is helping farmers improve the way they are treated long-term, so they can deliver the best quality products.

REAL TIME SURVEILLANCE AND ALERTS

One of the biggest threats to crops comes from domestic and wild animals. Until now they could destroy an entire crop in a remote field. Today, AI and ML driven video surveillance systems offer farmers an extra layer of protection for their fields and buildings, identifying and alerting you to breaches and even identifying employees versus unknown individuals.

IS MIXED REALITY THE FUTURE OF AGRITECH?

Mixed reality (MR) is a term that is continuing to gain in popularity. It is the term for a combination of two different virtual environments where two worlds coexist together. Mixed reality makes it possible for users to experience a virtual environment and real world together as a single whole. This allows users to place virtual objects into the real world so the object can affect and interact with their land as if it was in place.

A good example of mixed reality in the agricultural sector is 3D-mapping.

3D technology makes it possible for farmers and other agricultural bodies to create virtual versions of real growing areas. They can then use these 3D maps to generate different scenarios of crop cultivation using different models and parameters to investigate how to maximise the performance of different areas.

As you can imagine, AI and ML is central to mixed reality.

It makes it possible to analyse and apply the complex data sets involved, identify consistent patterns, and develop the required forecasts. It has also eased the burden of task assignment as, once the programme has been developed, the computer will be able to solve the required tasks on its own.

3D TECHNOLOGY MAKES IT POSSIBLE FOR FARMERS AND OTHER AGRICULTURAL BODIES TO CREATE VIRTUAL VERSIONS OF REAL GROWING AREAS.

The opportunity this affords the agricultural sector is huge.

Mixed reality could provide a level of visualisation the farming industry has never previously had. It will only become more powerful as the algorithms improve and the software becomes smarter with every input.

And as it becomes smarter, it will play an even greater role in tackling some of the crucial puzzles agriculture must find a way to solve:

- The growing demands of a growing population
- A reduction in the use of natural resources like water
- The need to develop meaningful methods of city farming
- Improved crop monitoring and yield predictions so the action can be taken before issues arise

While it may seem like science fiction to some, the combination of gaming tech with agriculture could produce a whole new level of a crop management and livestock control. Agritech will make it easier to implement and achieve the unprecedented reach farmers require if they are to make the massive contribution towards alleviating some of the critical challenges we all need them to.

IF YOU ARE INCORPORATING AI INTO YOUR AGRITECH INNOVATIONS, HOW CAN YOU PROTECT IT?

Formulating an effective strategy for protecting and developing intellectual property (IP) can be critical to the value of your company, regardless of the specific field of technical innovation you are involved in.

IP protection can take many forms. These include patents, copyright, trade secrets, and trademarks. It is important you select the optimal type of protection for each of the different types of IP in your portfolio. This is the only way to maximise the commercial value of your innovation and, by extension, your business.

It is also always advisable to consult an IP professional to make sure you have the right and most effective IP protection strategy.

Obtaining patent protection is often seen as the ‘gold standard’ for protecting technical developments and a granted patent is a very powerful form of IP protection. However, one of the requirements for obtaining patent protection is that the innovation must be disclosed during the patent application process. This will place your innovation in the public domain, regardless of whether the application is successful or not.

Consideration should therefore always be given as to the likelihood of successfully obtaining protection, since an unsuccessful (or a successful but narrow) application may risk placing key details of the innovation in the public domain without gaining any significant benefit.

Artificial intelligence (AI) and machine learning (ML) are powerful tools for manipulating data and, as we've seen, they are being used in an increasing range of applications in the agritech arena.

This has inevitably led to interactions between AI, ML and IP; whether through the use of AI and ML in the research and development of IP, or in the generation of IP directly related to the AI and ML techniques being used in agricultural innovations.

However, it is important to remember serious questions surrounding the patentability of AI developed innovations remain unresolved around the world. A number of 'test case' applications have been filed around the world listing an AI program called "DABUS" as the sole inventor. The question as to whether an AI can be listed as an inventor have largely been met with a "no" by courts. This has led to these applications being rejected. However, appeals are ongoing so the situation is unlikely to be finally determined for some time yet.

So, what does this mean for protecting IP relating the use of AI/ML, either in the development process of non-AI related inventions, or in inventions relating to improved AI/ML techniques?

While listing an AI as an inventor for a patent application does not appear to be a good idea (at least for the moment), this does not mean that IP relating to AI/ML cannot be protected. However, care must be taken to ensure that effecting protection can be obtained for the key innovations relating to this subject.

HERE ARE SOME TIPS THAT WILL HELP YOU DEVELOP AN EFFECTIVE STRATEGY FOR PROTECTING IP RELATING TO AI/ML INNOVATIONS

01 DON’T BE PUT OFF AND ACT QUICKLY!

02 WHERE IS THE INVENTION?

03 PATENTS VS. TRADE SECRETS

04 INNOVATIONS RELATING DIRECTLY TO AI/ML

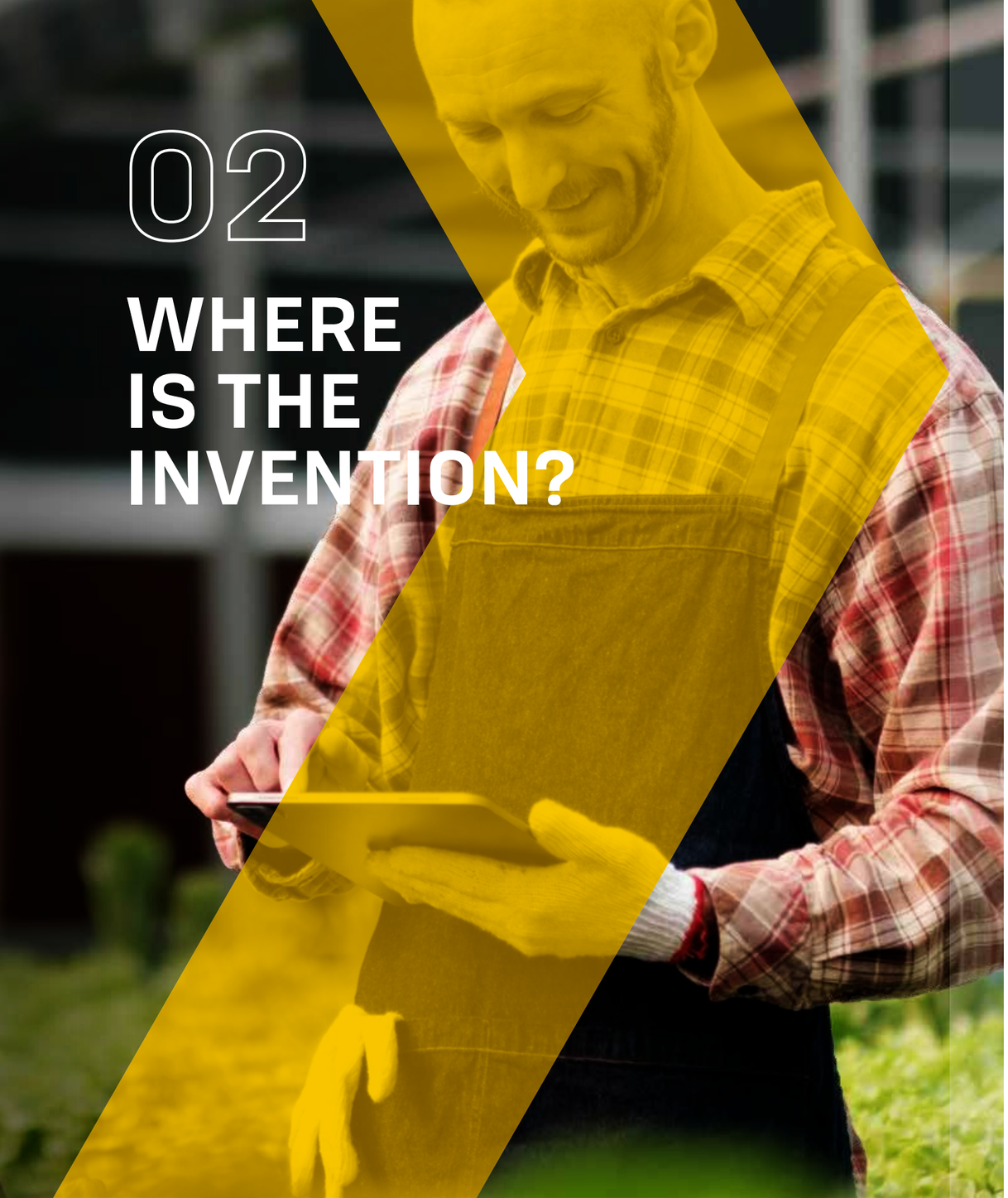
05 INNOVATIONS DEVELOPED USING AI/ML

01

DON’T BE PUT OFF AND ACT QUICKLY!

Although the process of protecting IP relating to AI/ML can be difficult, this does not mean that an effective protection strategy cannot be found!

It is important that a strategy be considered as early as possible in the development process, to ensure that all the key innovations are correctly and effectively protected before any potential disclosures occur.



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WHERE IS THE INVENTION?

With AI/ML related developments, it is very important to determine what exactly the innovation is.

For example, does the innovation lie in an improvement to the AI/ML itself?

Has the use of known AI/ML techniques facilitated a development of a non-AI/ML related technology?

Does the innovation lie in manipulation of input data that has been used to train AI/ML algorithms?

In each of these cases, a different IP protection strategy (or combination of strategies) may be the most appropriate.

03

PATENTS VS. TRADE SECRETS

Patents and trade secrets each give protection to developed IP, however they do so in very different ways.

Patents require that the innovation be disclosed to the public by way of a patent application, in order for protection to be obtained.

Trade secrets, however, keep the details of the innovation secret.

To qualify for trade secret protection, a company must identify the information to be kept secret, and then develop and put in place internal company policies to keep the information private.

This may involve, for example, isolating the secret information in particular development spaces and restricting access to the spaces to certain employees.

04

INNOVATIONS RELATING DIRECTLY TO AI/ML

Innovations that relate to improvements made directly to AI/ML algorithms or training data may be patentable. As such, developments could result in a technical benefit to the execution of the AI/ML algorithms.

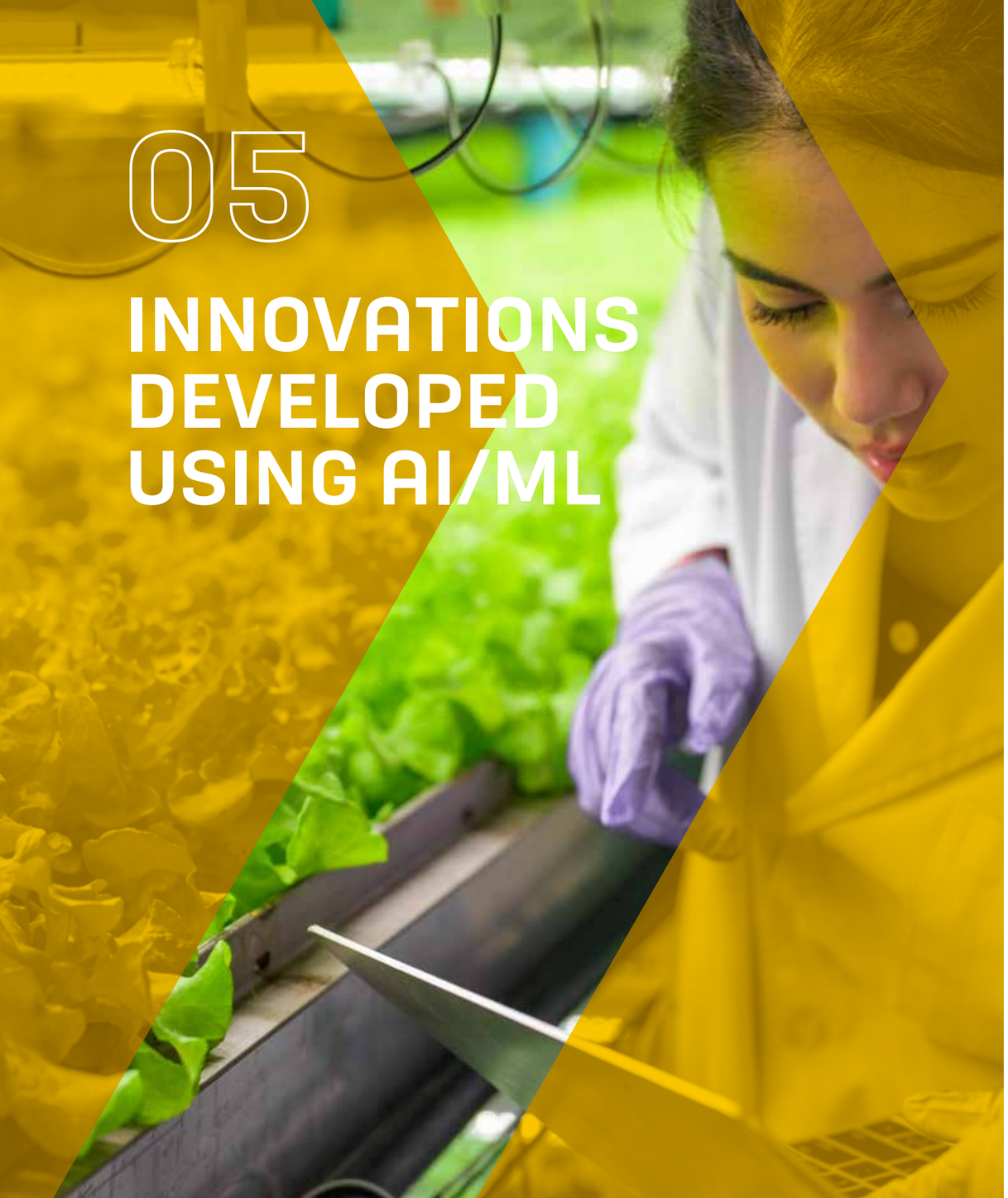
In such cases, patent protection may be worth considering as part of the IP protection strategy, although as noted above – the barrier for obtaining patent protection for software innovations in Europe and the UK is particularly high.

Consideration should therefore be given as to the likelihood of successfully obtaining a granted patent, given the public disclosure of the development that would be required during the application process.

It should also be decided exactly where the AI/ML innovations will be implemented by the company.

If the computer code comprising the innovations will be executed exclusively by the company, then simply keeping the code secret, and making use of trade secret protection, may be the best strategy. Alternatively, if the code is to be made available to people external to the company, such that the innovations will be more publicly available, then patent protection may be a more effective strategy.

A final option to consider if the code comprising the innovations is to be provided to people external to the company is the use of code obfuscation, and an agreement in the end user license agreement (EULA) not to attempt to reverse engineer the code. Such a strategy would likely be successful if the end users are a business. Businesses are less likely than private individuals to risk the potential legal consequences of an EULA breach.



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INNOVATIONS DEVELOPED USING AI/ML

Innovations that are developed using AI/ML, but do not directly involve AI/ML in the actual invention are generally much easier to protect than innovations relating to the AI/ML process in and of itself.

In such cases, the fact that AI/ML has been used in the innovation process is often irrelevant, and so may not need to be considered when pursuing patent protection for the innovation.

If the AI/ML contribution to the innovation has been particularly beneficial, it is generally more advantageous to keep the details of the AI/ML contributions secret, as the AI/ML may lead to further potentially patentable innovations in the future.

An example of such a situation could be the use of AI/ML in the design of pesticide and/or herbicide cocktails tailored to particular field conditions, which was touched on above.

The AI/ML may identify many different combinations of pesticide and herbicide depending on the conditions in a particular region or season, each of which could lead to the development of a patentable pesticide or herbicide formulation.

While it might be possible to obtain patent protection for the AI/ML implementation itself, a better commercial strategy may be to keep the details of the AI/ML secret (for example, by making use of trade secret protection), while obtaining patent protection for each tailored cocktail identified using the AI/ML.

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