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ProductFingerprint^{TM}

Forensic Timber Identification Using Tree Ring and Bark Matching

Abstract

Illegal logging is a global problem fueled by high lumber prices and an increasing international demand for timber. According to experts, it is estimated that up to 30% of all internationally traded timber products are illegally sourced and illegal timber makes up over 70% of timber exports in many underdeveloped countries. Illegal logging is a global problem and one of the major challenges in combating illegal logging is the lack of access to and use of forensic identification methodologies and technology to track the movement of timber.

This paper focuses on **ProductFingerprint**^{TM}, a modern method to identify, track and trace timber from the point of harvest. **ProductFingerprint**^{TM} can be used by law enforcement, environmental agencies and the forestry supply chain to identify, track and trace timber back to its origin.

Introduction

With the increase in illegal logging, it is even more important to be able to identify, track and trace timber as it moves within the timber supply chain. To date there are a few methods in use within the industry to identify timber. The identification method employed is dependent on whether the timber has been processed and the extent of the processing.

For unprocessed logs and timber there is the analysis of wood anatomy (also known as dendrochronology) and for more processed wood and wood products there is chemical analysis (including stable isotope, radio-carbon testing, near infrared spectroscopy and mass spectrometry) as well as DNA bar-coding.

A few of these methods are able to track timber back to a specific region or geography (such as stable isotope analysis), however *ProductFingerprint*^{TM} is the only method that can track timber back to the point of harvest (the originating tree stump).

# The AI *ProductFingerprint*^{TM} Technology

ProductFingerprint^{TM} is similar to the forensic science commonly known as fingerprinting. Just as each of our fingers has a unique pattern, the tree rings found on the inside of logs and the bark are unique to each log. It is this unique ring and bark patterning found on all trees which is used to determine a *ProductFingerprint*^{TM}. A *ProductFingerprint*^{TM} is created with the use of computer vision and artificial intelligence. This architecture developed is based in the cloud and offers full scalability for any size project. To create a *ProductFingerprint*^{TM} an image of the log cross section and/or bark are analyzed. The analysis takes into account the unique characteristics of the log which includes the distinct ring, bark, knot patterning found in the log as well as other data points such as the size, shape, diameter, proportions and any unique markings.
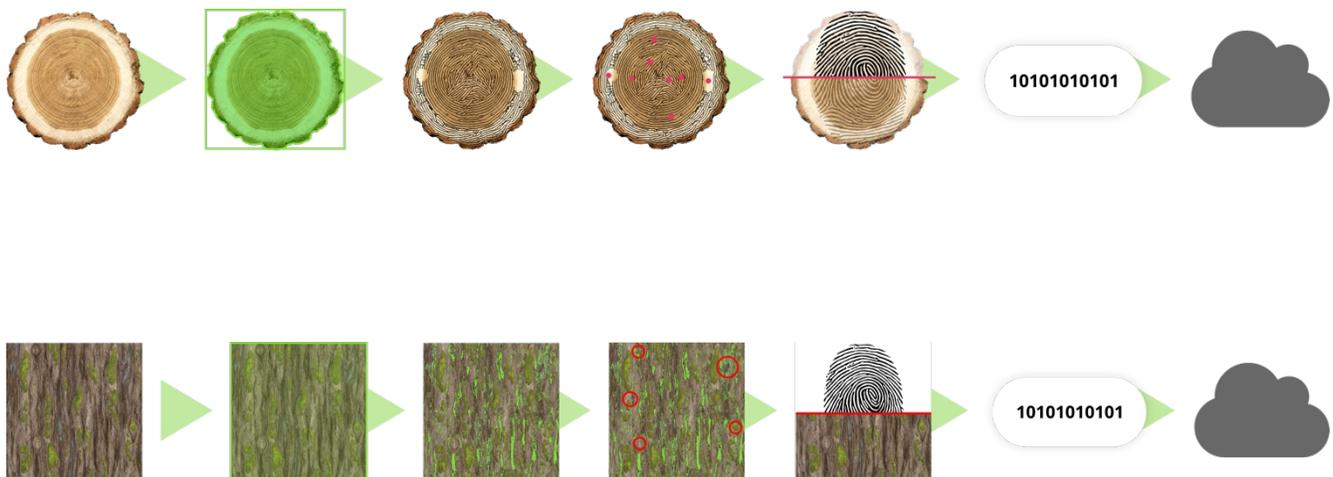
How it Works – Forestry Supply Chain

In the selected logging area scans of every and each tree are taken through 3D dronesor other techniologies. At the point of harvesting an image of the cut timber is captured. The image as well as meta data such as the geolocation, date and time of harvesting is also included. This data is then sent to a database in the cloud.

Each cut log is given a unique profile and this data is stored and accessible from a central database. The data for each log can include the geolocation, size, time and date of harvest, image and any other meta data deemed necessary.
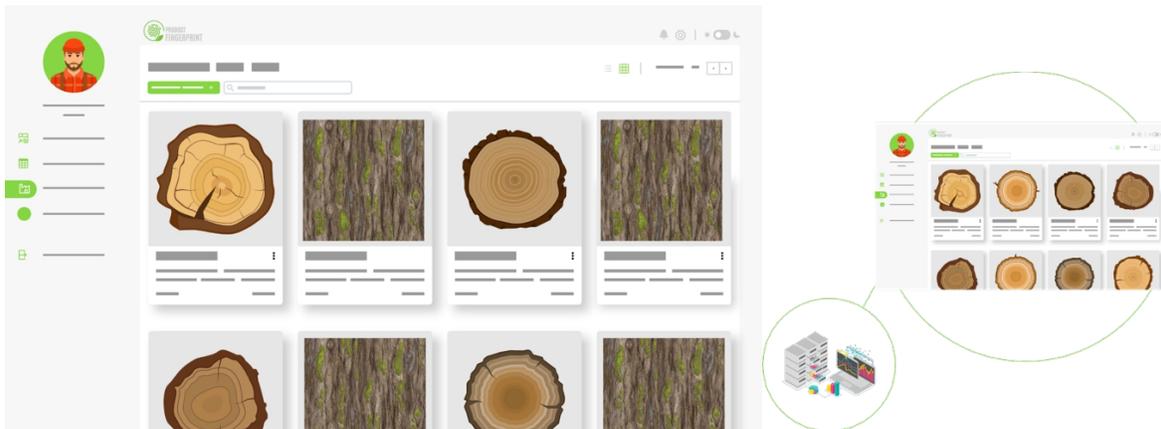
Access to the database can be provided to partners which can include logging companies, timber producers and exporters, law enforcement, environmental agencies and non-profit groups.

The Forestry Supply Chain

 ProductFingerprint^{TM} offers the ability to track and trace the movement of unprocessed timber throughout the supply chain. From the point of harvest until processing individual logs can be identified, offering a chain of custody within the supply chain.

Timber Source Top Industries

The three primary industries **ProductFingerprint**™ would apply and include the construction industry, pulp and paper industry and the furniture industry.

Construction Industry

Processed timber is often referred to as lumber when used within the construction industry. The construction industry is a major consumer of processed timber and is used in the construction of houses and buildings. **ProductFingerprint**™ offers the ability to track and trace unprocessed logs from the point of harvest until its processed at the mill. This can provide the mill with a chain of custody and source verification at the time of processing.

Pulp & Paper industry and Paper Mills

Increasingly consumers and producers are looking to provider greater assurances to their clients the environmental considerations taken into account during the harvesting and processing. **ProductFingerprint**™ offers these producers a chain of custody back to the point of harvest.

Furniture Industry

Wood furniture, especially exotic wood is very popular around the world and also subject to a high level of illegal harvesting. **ProductFingerprint**™ offers the ability for these wholesalers and retailers to provide assurances on the source of origin and location of harvest. This information is becoming increasingly more valuable for both end consumers as well as the supply chain that supports it.

Manufacturers and producers would have a certificate of origin and would be able to match the final product to its source timber.

Law Enforcement (Matching Algorithm)

The **ProductFingerprintTM** matching algorithm can be used by law enforcement and other agencies to match found logs to known stumps. This can provide immense time saving for law enforcement as this is process is currently done manually. The online app (with internet access) can provide the user with near real-time access to the database and determine whether a match was found.

Timber Image Capture

An important component of this process is the capturing of the unprocessed timber as it travels through the supply chain. At various stages throughout the process, images of the unprocessed logs are captured and those images are uploaded to the central database and appended to the profile of each log. At the point of harvesting an image of the log and stump is captured. When the timber is received, images of the timber inventory are taken and updated to the central database. Mobile app is available for inspection and audit purposes. To ensure the best fingerprint capture multiple stages of processing take place. The stage of processing is to ensure the input image quality unification. The mobile device at the time of capture will indicate the image quality assurance. The next stage of processing is multidimensional image analysis from the quality unification and standardization to the fingerprint hash code creation. The fingerprint hash code is then compared with the database of fingerprint hash codes to determine if a match exists.

At any point in time throughout the supply chain images of the logs can be captured and added to the profile for each log in the database.

Global Certification & Traceability

The timber certification of origin and traceability from the point of harvest until final industrial processing of wood products.

The data collected by **ProductFingerprint**^{TM} could be used to assist with determining the chain of custody and certification for these producers and industry leaders. There are industry standards for North American and Europe regarding certification and wood product traceability and audit requirements to fulfill this certification.

Cloud Based Architecture

ProductFingerprint^{TM} technology is based in the cloud and offers a robust API to allow for a close to real-time processing and analysis. This can include other partners and supply chain members to add, update or query the database with the intent to provide identification and traceability throughout the supply chain.

Multidisciplinary Timber Identification

Tree rings are unique and form the basis of the **ProductFingerprint**^{TM}. It's important to realize tree rings offer much more than a unique classifier. Tree rings can provide a wealth of information such the length of seasons, weather and atmospheric conditions over a period of many years.

There have yet to be a considerable analysis or study of the relationship between tree rings and the other forensic identification methods such as stable isotopic analysis.

It is possible that these other identification methods, such as stable isotopic analysis when combined with fingerprinting and analyzed by AI can offer a greater insight, new identification markers and relationships when combining different forensic identification methods.

Furthermore, drones can be used to capture videos and 3D imaging of a tree for the image source processing input. Tree bark, incl. branches, shape, diameter size are additional areas for the multidimensional visual analysis. This can be a complementary method to the tree ring identification and the unique fingerprint code creation to achieve the highest level of authentication proof, the timber logging origin.

Conclusion

ProductFingerprint^{TM} is the only identification method that is able to provide timber identification to the point of harvest. This technique can offer all parties to the supply chain a method to track, trace and chain of custody from the point of harvest.

ProductFingerprint^{TM} technology allows for the rapid matching of unprocessed logs and offers a new identification tool for use within the field. This can include helping local and international enforcement agencies identify stolen timber, environmental and conservation groups identify and record illegal logging as well as assisting log exporters with the verification and authentication of logs within the supply chain.

There is increasing consumer and supply chain interest in wood and wood product certification and **ProductFingerprint**^{TM} is one such approach that can offer a chain offer custody and fulfillment of wood origin certification requirements.

This technology and approach are well suited for use by law enforcement and organizations helping to combat illegal logging as well as the participants within the supply chain (such as log exporters).

About *ProductFingerprint*^{TM}

Deeplai P.S.A. is a European software startup based out of Poland, a *technological company driving digital transformation and creating value by automating multiple processes through innovative solutions.*

This project is developed by the same team that developed OptiwAI solution delivering image enhancement at scale.

ProductFingerprint^{TM} is using computer vision and artificial intelligence to identity the uniqueness in objects.
To learn more about **ProductFingerprint**^{TM}, visit productfingerprint.com/use-cases.