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Detection of counterfeit by the usage of product inherent features

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Abstract

One aspect of the economical dimension of sustainable business development is the protection of high value products from counterfeiting. This holds especially true for consumer goods since the sustainable manufacturing process gains a more and more important role, e.g. in the creation of a brand image. In this paper we propose a method for detecting counterfeit by capture of inherent features indissolubly linked with the product induced by the production process itself. Since a counterfeiter gains margin by the use of inferior production processes and material the differences between genuine product and counterfeit can be captured in an automated fashion. The proposed method not only renders the application of artificial security tags obsolete which helps reducing the material usage but also gives enhanced protection against counterfeiting as the inherent characteristics cannot be removed from the article.

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1. Introduction

Figure 1, taken from the annual "Report on EU customs enforcement of intellectual property rights" of the European Union in 2012 [1], shows a continuous upward trend in the number of shipments suspected of violating intellectual property rights for the last years. In 2011 more than 90 thousand cases of detained articles were reported. The value to their equivalent genuine products is estimated to be over 1.2 billion Euro and this covers only Europe. To get an idea of the worldwide amount of economic damage for the last years the report "The Economic Impact of counterfeiting and piracy" [2] of 2008 estimates a total loss of 250 billion dollars in the year 2007. This report covers the analysis of international trade in counterfeit and pirated products, but these estimates do not include domestically produced and consumed counterfeit and pirated digital products being distributed via the Internet. If these were also considered, the magnitude of counterfeiting and piracy worldwide could be several hundred billion dollars more in 2007. Furthermore, if we compare these numbers to the amount of cases reported in Figure 1, they probably doubled in 2011. The effect of counterfeiting and piracy is an intermission of innovation and thus impairment of economic growth. The economic damage affects in particular countries that use advanced production and manufacturing processes based on intensive research and development to produce high quality goods.

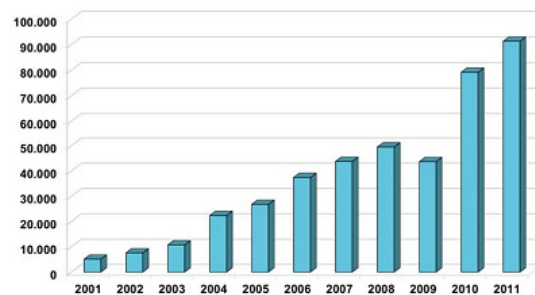


Fig. 1. Cases of customs enforcements of intellectual property rights at the European border, from [1]

Another very important argument to enable the differentiation between brand products and their counterfeits is safety. It is stated in the OECD report that the products counterfeiters and pirates produce and distribute are often of minor quality and can even be dangerous and health hazards. Common standards that ensure the safety of products can be ignored by product pirates and the used materials can be dangerous.

With the magnitude of counterfeiting and piracy in mind, these reports emphasize the need for more effective enforcement to combat the counterfeiting and piracy on the part of governments and businesses alike.

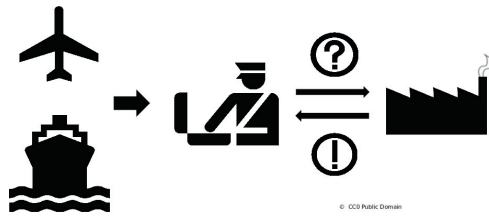


Fig. 2. Current scenario for counterfeit detection through customs officials



Fig. 3. Desired scenario for counterfeit detection through customs officials

A key component for this enforcement is the development of new methods for automated counterfeit detection.

The review of copyright infringement of registered trademarks and products is not easy to implement. Due to the high number of pending trademarks and constantly added new applications it is very difficult for the executive bodies, such as customs, to register violations of trademark rights immediately and in a comprehensive manner. The awareness to all registered brands and products is for the executive organs not possible and therefore necessarily, trademark infringement remains unnoticed. The current scenario for products entering a market in a foreign country is displayed in Figure 2. Here it is shown how customs officials usually handle the inspection of products at the border. First the goods arrive at a specific check point, usually via sea- or airfreight. If the customs officer notices some anomaly in the paperwork, he will check the cargo containers. As discussed earlier the officer is often not an expert for the shipped product, so he could not detect a counterfeit. Instead the company producing the genuine product is contacted to send their own expert, which can verify the product. This is a time-consuming and expensive process, therefore most containers in question often remain unnoticed.

To overcome these limitations in the checkup routine an automated expert-system is necessary that can support the customs officials, as shown in Figure 3. Given that the officer could verify the shipped cargo by himself while the company issues the authentication system for their products. This idea was adopted more recently through an application of artificial security features to products. The issues of such security labels are in part the high cost, and additionally the integration into the product.

On the other hand high-quality branded products, as the target of counterfeiting, have usually, due to the production processes and materials used, and in view of its processing machinery and equipment, a grade of high quality. The specific conditions of production, manufacturing technologies and materials generate specific features, which identify the product uniquely. These features may be detected multimodal by man, including tactile (plasticity, elasticity, thermal conductivity, surface structure), visual (shape, color, surface texture, transparency), olfactory (smell) or acoustic (sound) perceptions. In general, only the person familiar with the manufacture of the product can combine these inherent characteristics in their entirety so that it can differentiate the genuine product from a clear counterfeit. The innovation of this text is the detection of these features in an automated fashion through the combination of digital sensing and machine learning, rendering the application of artificial security labels obsolete.

2. State-of-the-Art Technology

Common automated counterfeit detection methods require nowadays additional security features at the product itself. Several methods have been developed, but main advantages and disadvantages remain similar.

Additional security features require further steps in production to add these features to the product. This raises expenses, manufacturing time and development efforts, which is clearly a disadvantage. On the other hand the security is enhanced and an original brand is easy to detect in an automated fashion, since there is a specific feature to look for. But this could also be a main disadvantage, if the security feature itself is easy to reproduce and could be added to any forged product. Another challenge is to link the security label to the brand product in a way it cannot be removed or stolen. This way product pirates could label their counterfeits easily as an original with an original security label. Counterfeit detection without artificial security tags is a solution to these problems, if the counterfeit is distinguishable from the original brand.

3. Product-Inherent Features

The Inherent ID Project adopts a novel approach to protecting high-value products from counterfeiting. The approach is based on the stationary and mobile capture of key product features indissolubly linked with the product which enable its production process to be traced. This not only renders obsolete the application of security tags but also gives enhanced protection against counterfeiting as the inherent characteristics that the high-quality production process impregnate in the genuine product are combined with one another to serve as proof of product identity. They form the basis on which electronic certificates of authenticity can be issued without the need for complicated explicit security markings. Methods for the capture and control of identity characteristics are being elaborated in the Inherent ID project for system integration using intelligent cameras and an electronic nose. The identity characteristics captured by this range of sensors serve both for the product identification and product authentication. At the same time this also offers opportunities for improving documentation of product flows in the supply chain. Full documentation serves as a complement to the inherent characteristics of the authentic product and offers valuable information of verification of the genuine article, thus serving to safeguard against counterfeits.

Optical 2D and 3D characteristics as well as olfactory characteristics are combined with one another to serve as proof of product identity. They form the basis on which electronic certificates of authenticity can be issued without the need for complicated explicit security markings. The identity characteris-

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