An Embedded Microscope Image Processing System for Authenticating and Verifying Watch Production

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Presentation

The Swiss watch industry, as well as most high-quality and luxury industries, suffers dramatically of losses due to forgery. It has been estimated that **worldwide counterfeits amount to US$300 billion a year**, and that number steadily increases with time. The Federation of the Swiss Watch Industry (FHS) estimates that over 40 million fake Swiss watches are made each year, which is staggering compared to the total of only 26 million authentic watches exported in 2008! As a result, the profit loss due to this **black market** is around US$ 1 billion per year.

Moreover, the whole watch industry is also threatened world-wide nowadays by the existence of an ever-growing **gray market** activity. The term gray market is used to describe several situations that do not involve forgery or even illegal commerce, but rather unauthorized re-selling and/or un-authorized pricing. Let us give a concrete example. In order to maintain an authorized dealer relationship and obtain volume discounts, re-sellers must make large initial investments in inventory and continue to purchase minimum quantities of watches over time. However, frequently, smaller dealers find themselves with excessive amount of merchandise from a single brand. Thus, authorized dealers then sell off at wholesale prices the surplus to the 'gray market' of unauthorized dealers, who then sell the watches at heavier discounts than authorized dealers are allowed to. Typically, gray market dealers will sell through the web, using price tags of cheaper countries, but targeting customers world-wide. Though not explicitly illegal, this activity usually violates the authorized dealer agreements with the watches manufacturer.

Furthermore, this practise is negative for customers' level of satisfaction, as buying on the gray market affects the warranty of the watches and the rights of the customers. Manufacturers are obliged to refuse warranty services on gray market watches to protect their official dealers.

It is thus key to develop new technologies and solutions that efficiently (and at low cost) verify the authenticity of a watch but also track the original dealer for each watch to determine if it has been sold within the gray market products and, hence, locate the source of the breach.

Goal

The purpose of this project is to develop an integral verification embedded system (cf. See image above) for fine watches with minimal cost and maximal reliability for the industry. The embedded system works on images of watches taken on the production line by a microscope camera. Instead of marking watches with a special signature, we rely on the microscopic defects (on the image above we check the letter 'W' engraved in the analyzed watch) that necessarily arise while manufacturing watches, which indeed constitute a unique characteristic of every single watch. Then, we have developed an image processing algorithm for our system that uses these images and, based on a set of predefined attributes in the images, identifies the corresponding watch (more than 95% effective) in a database, accessible world-wide through the Internet using a mobile phone. Thus, only these attributes need to be stored and compared, which allows for fast and efficient search in very large databases.