

# Inspector Computer

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## Abstract

Inspector Computer is a tool assisting the user by finding stolen goods in the internet. All the user has to provide is a reference image and a short, accurate description of the articles. When initialized Inspector Computer searches several well known search engines in the internet. After searching a picture comparison of the reference picture and the located pictures is initialized, to find out, which of the pictures shows the same object as the reference picture. After comparison a sorted list of the most likely hits as result is delivered. From this list the user could retrieve his stolen goods by looking at the first entries in the list, when the implied article is in the list.

## 1 Introduction

If the owner of stolen goods wants to retrieve his properties without Inspector Computer, every auction house has to be manually observed, i.e. every offer has to be manually compared with the stolen goods until both match. To do this a image search must be done and the located images must be checked, if they show the especial property. But because of the expected enormous hit rate (up to several thousands images) and because the offers change every day or even every hour, the effort for monitoring the online market manually is too high. Particularly if the search was not successful and has to be restarted several times until the properties are found.

Inspector Computer is a tool helping the user to find stolen goods in the internet by searching several well known search engines and performing a image comparison with a reference image. This tool becomes necessary because of the expanding spread of auction houses and the corresponding propability, that receiver of stolen goods uses this medium to resell the stuff. For the receiver it is very easy to resell, because of the elementary usage of the auction houses and the great anonymity of the users.

After comparing the images, Inspector Computer delivers a sorted list of the most likely hits as result, from which the user could see his properties very fast. Therefore he only has to take a look at the first few images in the list. If one of his properties is found, it is very easy to backtrace the receiver from the auction. This is the reason why the work of receivers will become more complicated and the resell of stolen goods could be embanked.

## 2 Methods and Architecture

The approach of Inspector Computer is nearly the same, as if the search is done manually. But Inspector Computer facilitate the manual monitoring drastically, by reason that the biggest part run automatically. Only necessary is a image of the stolen goods and a short and accurate description. The given image is used as reference image for the following image compare and the description is used for the image search at the online auction houses.

With the given description firstly a image search in the internet is done by query several well known search engines. For example by ebay, to name just one. For the conservation of evidence the images are stored with meta information (URL to the image, date when it was found, ...) in a database. The storing is also necessary, because the auctions are usually visible only a few days. After that it is very difficult to get the data for a special auction which is not running any more.

After searching a image comparison between the reference picture and all located images is initialized. The goal of the comparison is to find those images, which shows the same object as you could see on the reference picture. The problem by comparing the images is, that they can not be compared pixel by pixel. It is necessary to exactact and compare the objects, which are shown on the images, because individual images could be taken under completely different conditions. For example on some images the objects are rotated or taken under different lightning conditions, as you can see in figure 1.



Figure 1: The 3 images show the huge problem of the image comparison and the need for extracting the objects from the images. On all you could see the same car, but rotated and under different lightning conditions. For a human it is very easy to say, that all pictures contains the same car, but for a algorithm it is very complicated lesson.

The next problem by comparing is, that we do not only want to compare some specified objects. We want to compare every possible object (cars, aircrafts, watches, ...) which could be seen on a image. To solve this problems we are using an existing algorithm and modified him, to be usable with our problem. The used algorithm is called Autopano-Sift [1] and was primarily developed to make panorama images.

The Autopano-Sift algorithm for the image compare needs a lot of computing power and would exceed the resources of only one computer, because of the thousands of comparisons which must be done. The enormous computing power which is needed, is provided by a Grid. That is why the calculation time will be abbreviated by a multiple. The used Grid is provided by the Globus Toolkit 4 (GT4) [2], a wide spread Grid middleware. There we mainly use the GRAM (Grid Resource Allocation Management) service [4] to run our jobs on the resources provided by our Grid. We also use Grid technologies to communicate with our database. Therefore we are using OGSA-DAI (Open Grid Services Architecture Data Access and Integration) [3].

After the comparison is proceeded the user gets a sorted list. The first entries in the list shows the images which objects have the biggest analogy to the reference image. When take a look at the first few entries, you can easily see, if your goods are located by the search.

Figure 2 shows the principal schema of Inspector Computer. You can see the main parts of the execution, starting with searching the internet with the given description, storing the data in a database, making the image comparison and finally get the results list.

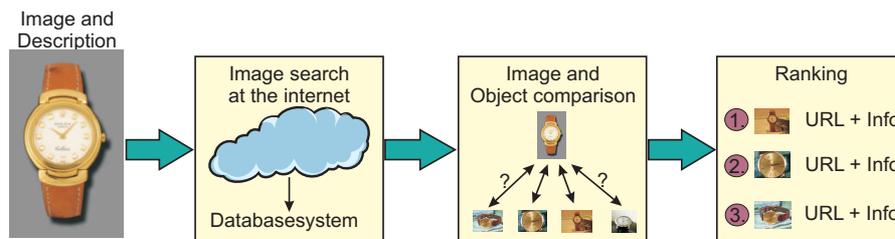


Figure 2: The procedure of Inspector Computer. First a reference image and a description of the article is given to him. With the description a search at the internet is done by using several search engines. The located pictures are stored in a database. After the search a compare of the located images and the reference image is performed. Afterwards the user gets a sorted list of the most likely hits as result.

### 3 Conclusion

Inspector Computer is a tool to assist people finding their stolen goods in the internet. It is easy to use and make it possible to search in thousands of online auctions for one especial article. Possible is this because of the usage of Grid technologies to provide the enormous amount of computing power.

The biggest advantage of the described method is the high reduction of the necessary image comparison for the victim. Instead of comparing thousands of

images manually, he only have to take a look on the first 10 images in the list, for example. This is an significant advantage compared to the manual searching for the articles. So it is possible to make the search for one article again and again until it is found. This is necessary because on the online auction platforms the offers change every few minutes.

With the collected information of every auction it is also possible to backtrace the auction to the vendor of the stolen goods. So there is a much higher risk for the vendor to be caught, which will increase the amount of stolen goods in online auction houses.

## References

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