Identification System Concept Design for Illegal Transfer of Strategic Items

DongHoon Shin[*], Seung-hyo Yang, and Sung-ho Yoon

Korea Institute of Nuclear Nonproliferation And Control, 1534 Yuseong-daero, Yuseong-Gu, Daejeon, Korea

[*]nucleo@kinac.re.kr

1. Introduction

Strategic Items means goods and technologies that can be used for the development, production, and use of weapons of mass destruction such as nuclear weapons and biological and chemical weapons, etc. The international community manages these strategic items to maintain international security and peace. In general, the management methods of strategic items consist of controlling the export of strategic items, identifying or confirming that the strategic items are illegally exported or transferred, and also conducting strategic items handlers. Among the above-mentioned methods, the method of identifying or confirming on-site that the strategic items are illegally exported or transferred involves raiding the spot according to the intelligence, or confirming whether it is authorized according to the legitimate procedure in the course of customs clearance. However, police, military or customs officers (usually called field officers) involved in this process often lack knowledge of strategic items and it is not easy to identify the illegal transfer of strategic items. Therefore, this study aimed to develop an identification system that can assist the field officers in identifying the strategic items in the field.

2. Concept & Results

2.1 Analyzing On-site Requirements

The identification system to be developed in this study should implement the following functions, according to the on-site requirement.

First, identification system has the function of confirming whether the items found in the field corresponds to the strategic items, managed by the international regimes or domestic law. That is, this function should provide the function of confirming whether one item is a strategic item by analyzing only the appearance of the specific item when the field officer lacks the ability to identify the strategic items.

Second, a function of confirming whether one item is a strategic item or not should be implemented, when the items are not opened or officers can see only the documents for items' specifications, this function should provide the function of confirming whether one item is a strategic item, through analyzing the text or numerical information, etc., on the specification documents, not analyzing the items' appearance.

The first and second functions are complementary to each other and should be able to provide the user with an indication that the item to be identified is a strategic item, even though one function is not working properly.

The third function is necessary by the situation of on-the-spot execution, and identification system should provide the identified results to the field officers in real time or very short time. In general, the time required to identify strategic items at customs or PSI (Proliferation Security Initiative) is very short, and if the identification system takes a considerable amount of time to determine what the product is, the value of the use of the identification system will be significantly reduced.

2.2 Investigating the Applicable methods

According to the above-mentioned requirements, this study considered the application of two artificial intelligence techniques.

The technique required to implement the first function is a technique that can measure the similarity between the image of the target item and the images of the strategic items by utilizing only the features of the image such as appearance, texture, color, etc. In general, there are technique such as HOG (Histogram of Oriented Gradient), Shape Context, and so on. Recently, Deep Learning technique is appeared [1, 2].

The technique required for the implementation of the second function is a technique for extracting specific texts or keywords on images related to the specification document or clearance report, searching or comparing those text in the database. In general, these technique are called as like searching, semantic searching or similarity retrieval [3].

The above-mentioned techniques are generally known

in the field of artificial intelligence and can be utilized in the construction of identification system.

2.3 Gathering the information and DB Development

Although the selection of artificial intelligence techniques has been completed and these techniques can be implemented in the development of systems, it is inevitable to construct a database in order for this system to operate properly. In order to implement the necessary functions in this study, first of all, it is necessary to construct a database containing text information related to strategic items and images associated with each text.

So, textual information could be collected from laws and explanatory notes related to strategic items, and specialized books related to nuclear power plants. However, in the case of collecting image information, there is not much information published for the nuclear fields, and even if a lot of images related to the nuclear fields are collected in the open source domain, it is not easy to get exactly the same images related to the strategic items that are actually exported. Therefore, it was necessary to acquire a large amount of images for specific products such as reactor vessels, pressurizers, etc., through companies manufacturing and exporting nuclear related products.

2.4 Results

The conceptual design results are shown in the following figure. As mentioned above, this system is composed of a function of comparing the similarity of images and a function of comparing the similarity of texts. First of all, in order to extract images and text, it is necessary to take a picture of the target item. When a photograph is taken, text information and the image features should be extracted from the photograph. And it is necessary to compare the database with such information. If there is no information retrieved, the users need to enter image related information into the database. Through this procedure, this system can be used to confirm or identify the illegal export and the performance of identification system can be improved gradually.

Fig. 1. Concept of Identification System.

3. Conclusion

As mentioned earlier, in order to ensure that export control of strategic items works properly, it is essential to license strategic items' export based on the law as well as confirm or detect the illegal export. Therefore, the conceptual design of the identification system that can confirm or detect the illegal export of strategic items was carried out to support confirming or detecting activities in this study.

As a result of the conceptual design, the algorithms or techniques required for the identification system were image and text similarity techniques and it is confirmed that an accurate and vast amount of database is necessary for each module to operate properly. At the concept design phase, the algorithms for text similarity were chosen, but the image similarity algorithms have not yet been selected due to image's complexity or uncertainty for each algorithms' suitability to our system. But the result of this study can be applied to the development of the identification system, though there will be some modifications. And if the identification system is developed and operated properly based on our concept design, it can contribute to strengthening export control system in ROK.

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