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RESEARCH ON AND APPLICATION OF ADVANCED TECHNOLOGICAL MEANS TO REDUCE THE IMPACT OF HUMAN FACTORS

(Presented by the People's Republic of China)

SUMMARY

This discussion paper presents the recent research on and application of AI image reading technologies of prohibited items on X-ray machines. With trials on different equipment, and in various scenarios and modes at multiple airports, the capability of AI image reading has been preliminary verified. Nonetheless, the technology is expected to further enhance the performance of detection rate so as to reduce the pressure of screeners. In light of the ICAO initiative to boost technological development and innovation, this paper calls for the promotion and sharing of AI image reading standards and testing methods.

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1. INTRODUCTION

1.1 Background

Security screeners are core positions for aviation security on the ground, and their performance directly affects the effective implementation of security measures. Currently, the common challenges in airport security include screeners being easily distracted in a busy and noisy environment, resulting in reduced efficiency and vigilance; a growing list of prohibited items increasing the difficulty in image identification; long time of concentration and repetitive work causing mental fatigue and low work efficiency; the needs of making decisions within seconds generating enormous pressure, among others. These problems pose a major challenge to security screening that need to maintain high efficiency and accuracy, and also make it difficult to meet the demand from the current fast-growing air transport industry. Ensuring continued effectiveness and efficiency in security screening is the priority of all Member States.

With the rapid development of artificial intelligence (AI) technology, deep learning, being one of the important branches, shows great potential in the field of image reading, especially in the key area of security screening. Utilizing deep learning-based target detection algorithms to identify prohibited items has become an effective way to improve efficiency.

2. DISCUSSION

2.1 Technology Introduction

Although it was not possible to use AI for security screening a few years ago, significant progress has been made in recent years. AI can automatically perform repetitive and well-defined tasks while learning complex rules that only humans could understand before. AI image reading algorithms automatically identify potential prohibited items by learning a large number of X-ray 2D/3D images and analyzing features such as the shape, material, and density of objects. It can make comprehensive image analysis in a few seconds and avoid problems such as lower efficiency of human screeners due to fatigue or distraction; it does not get tired and can keep working at high efficiency; and it has self-learning and updating capabilities which enable quick adaption and performance optimization in case of changing environment and demand for screening. These advantages empower AI with a key role in reducing the impact of human factors and improving the performance of security efforts, which would greatly improve efficiency and accuracy, and is expected to further optimize the security process in the future.

2.2 Research and Application

At present, some states have tried to solve human factor-related issues and improve efficiency by using AI image reading technology. Some leading developed countries have promoted the use of CT equipment, focusing its research on using AI algorithms to analyze and identify the physical features of objects in the three-dimensional images generated by CT equipment for cabin baggage, in assistance to security screeners in image analysis. However, the vast majority of states still use conventional dual-view X-ray as the mainstream equipment, it is a common difficulty for us to solve the problems related to the application of AI reading to two-dimensional images and in multiple scenarios, to enhance the overall global capability of aviation security screening and control.

In the past two years, China started research on AI reading for X-ray images. Through lab research and testing, as well as on-site trials at 10 typical airports, we applied AI algorithms on dual-view X-ray and CT in two application modes of assisted image analysis and quality control for three screening scenarios which are the screening of passengers' cabin baggage, checked baggage and air cargo. Such efforts aimed at understanding the capability and effectiveness of AI image reading algorithms, objectively evaluating the algorithms and making comparison to image reading by screeners, exploring the application scenarios and modes of AI, and assessing its impact on the overall efficiency and safety of security screening. By far, the trials have achieved early result, and the capability of on-site AI image reading has generally met the expectation with some performance beyond the expectation.

2.3 Recommendations

At present, there are three mainstream AI algorithm application modes worldwide: assisted image analysis (to assist screeners in making decisions), quality control (to review the images) and automatic image analysis (to send images which cause AI alarms to screeners). We recommended that Member States strengthen research and sharing on AI image reading, and jointly explore and discuss the application scenarios and modes of AI to reduce the impact of human factor.

The Open Architecture (OA) for security screening systems has received wide attention from the industry once proposed. It is recommended Member States discuss the feasibility and future development of OA and explore more opportunities for international cooperation in it to find out whether OA-based AI image reading algorithms (i.e. third-party algorithms applied on security screening devices) have better performance compared with original AI algorithms.

3. ACTION BY THE CONFERENCE

3.1 The Conference is invited to encourage Member States to:

a) strengthen research and sharing on AI image reading, and extensively explore and discuss the application scenarios and modes of AI;

b) develop and share the standards, testing methods, and experience in AI application, as a means to turn the ICAO initiatives of technological development and innovation into reality; and

c) Attach importance to the application and improvement of X-ray computed tomography (CT)、Millimeter wave technology and corresponding new Security Screening Model to enhance both security and efficiency.

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