WHITE PAPER

PEOPLE COUNTING AI FOR RAPISCAN'S CARVIEW TECHNOLOGY

AUTHOR – CHARLES LAMB & ANDREA CRISTINI

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Contents

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Introduction

Member states across the European Union are facing increasing challenges in maintaining the security of their borders. Conflict, political turmoil and economic uncertainty compound with evermore technologically advanced, criminal methods of subverting border enforcement. Classical counter-immigration and contraband detection practices can have blind-spots and are hugely dependent on time, manpower and funding to be effective. In addition, meticulously screening cargo and vehicles with currently available methods becomes antithetical to strongly held principles of freedom of movement, particularly within the Schengen area.

This white paper, developed as part of the Odysseus project (Project ID: 101073910 Unobtrusive Technologies for Secure and Seamless Border Crossing for Travel Facilitation funded by the EU under the Horizon Programme), aims to demonstrate how Rapiscan's people counting artificial intelligence will complement existing technologies.

As part of the Odysseus project Rapiscan hopes to demonstrate novel technology which can tackle the border enforcement challenges of today. New developments in Rapiscan's Car View imaging system (shown deployed in figure 1) aim to provide a way of unobtrusively, yet effectively, screening vehicles and AI tools are being developed to augment this new procedure such that it is both more potent and less manpower intensive. Since there are many EU regulations around border control, this white paper focuses on the AI tools as they are used for occupancy detection within the Car View imaging system.

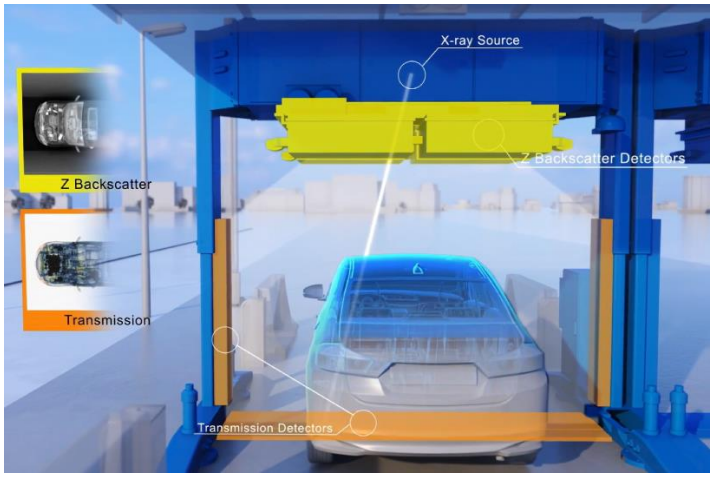

Figure 1: CVIL imaging system installed on the US-Mexico border.

Figure 2: Graphical rendering demonstrating some basic components of a standard CVIL system.

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Abbreviations

CVIL – Car View in Lane (imaging system)	WSS – Wave Shifting Sheet	ALARP – As Low as Reasonably Practicable
SiPm – Silicon Photomultiplier	PMT – Photomultiplier Tube	AS&E – American Science and Engineering inc

Overview

Figure 3: Transmission image from Rapiscan's Carview system. Shows how transmission X-ray scans can be used to detect hidden objects, in this case firearms.

Rapiscan's CVIL imaging system is already being employed today, for example at the US-Mexico border where its primary goal is to tackle drug smuggling. Shown in figure 2, the basic platform utilises an X-ray source mounted above the vehicle thoroughfare which traces a rapidly moving X-ray beam across a fan shaped area. Transmission detectors are installed below the vehicle thoroughfare (and optionally mounted on the vertical supports). Transmission X-ray scanners are a long-established technology for Rapiscan and are excellent at identifying inorganic threats or dense organic cargo, best demonstrated by the scan shown in figure 3. To supplement the traditional transmission X-ray technology, backscatter detectors are secured above the thoroughfare (again, optionally also on the vertical supports). Backscatter X-ray scanning is an advanced screening technique and detects radiation scattered from a subject and utilises an array of backscatter specific detectors, along with knowledge of the position of the moving X-ray beam to resolve recognisable scan images. As seen in figures 4 and 5, backscatter is especially effective for detecting organic or low-Z material since it operates in a low energy regime.

The CVIL system has been using PMT based backscatter detectors, as part of the Odysseus project, these will be phased out in favour of detectors using WSS and SiPM technology. The new detectors predominately aim to reduce the system's spatial footprint allowing many CVIL systems to be installed next to one another, maximising potential throughput.

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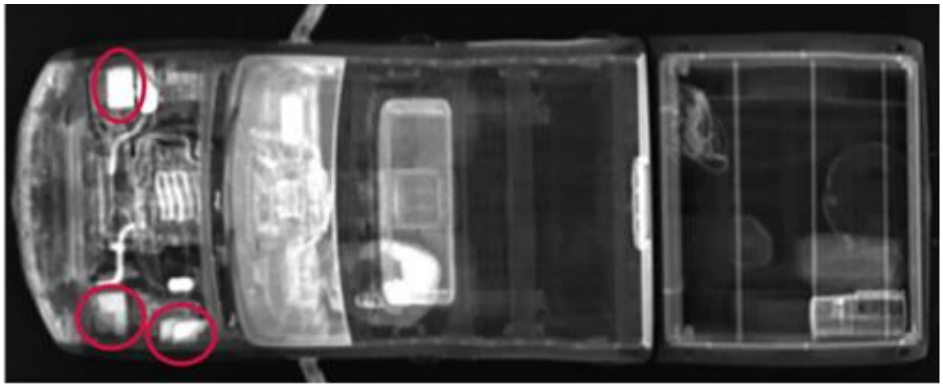

Figure 4: Backscatter image from Rapiscan's CVIL system. Shows how backscatter X-ray scans can be used to detect hidden organics, e.g. illicit drugs.

With a high potential throughput, CVIL innovations as part of the Odysseus project allow for a novel use of backscatter technology: occupancy detection. People counting algorithms take advantage of backscatter's ability to detect organic objects and the distinct shape of the human body to detect and count any and all occupants of a vehicle – minimising the requisite time required by a border enforcement officer to undertake such a task. One use case might include tackling human trafficking, but the people counting should also drastically improve border enforcement authorities' ability to manage the general administrative tasks of legal border crossing.

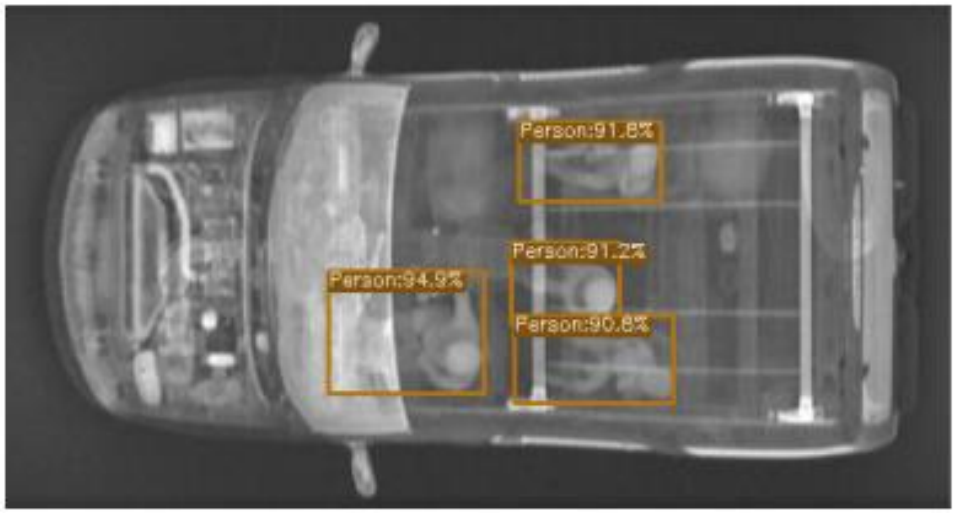

Figure 5: Backscatter image from Rapiscan's CVIL system. Shows people counting algorithm in action with the percentage certainties of current image processing AI.

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Applicable Legislation

European Union Artificial Intelligence Act

Annex III: High-Risk AI Systems Referred to in Article 6(2) Establishes border control management as a field in which AI systems could be high risk, meaning further points of legislation are applicable.

Article 6: Classification Rules for High-Risk AI Systems Describes what makes an AI system high risk. Since Rapiscan's people counting algorithm is intended only to assist operators rather than to wholly automate border enforcement this section indicates that it is not prohibited.

Article 49: Registration Indicates registration is required for low-risk AI systems before such a system is placed on the market and the additional steps required for high-risk systems.

Article 71: EU Database for High-Risk AI Systems Listed in Annex III Describes how the European Commission is required to maintain a database of active AI systems.

Annex VIII: Information to be Submitted upon the Registration of High-Risk AI Systems in Accordance with Article 49 Lists the information required to be supplied for registration. The list of documentation is extensive but does not include anything Rapiscan could not supply.

European Union Directive on the Processing of Personal Data for the Detection of Criminal Offences

Article 3: Definitions Defines what is deemed personal data. Backscatter scans only provide generic silhouettes and do not identify specific people, so the additional legislation described therein should not be applied.

Article 4: Principles Relating to Processing of Personal Data Describes the additional points relevant if backscatter scans were determined to be personal data.

Conclusions Based on Applicable Legislation

This white paper gives an overview of the people counting AI in Rapiscan's CVIL and briefly lists the most relevant legislation. It is the opinion of the authors of this paper that the key takeaways from the applicable legislation are as follows:

1. The people counting AI system should be registered with the European Commission before being put into service under Article 49 of the EUAI act.
2. AI legal experts should be consulted to complete a strong risk assessment and determine the appropriate risk level for this algorithm.

This overview should underscore the value of implementing the people counting algorithm. Border enforcement agencies should see great improvements to throughput and efficiency with the innovation described herein and the applicable legislation describes no barrier to its implementation.

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