Automated X-ray image interpretation

Customs Administration of the Netherlands
Ministry of Finance

ALERT CBP-ADEPT 05

Tuesday, July 25, 2023 - Day 1

Summary

- "… to work smartly and adequately to protect our society… and to optimally facilitate legitimate trade"
- Fraud, drugs, dual-use, precursors, weapons, goods under sanction, CITES, cultural goods, IPR, liquidity, etc.
- Challenges
  - Developments in declarations prompting change to IT systems and inspections
    a. Increasing amounts of declarations/ inspections
    b. Increased need for real-time processing
  - Staff shortage and staff background
- Effective and efficient solutions are sought in a.o. the use of a wider array of technology, automation and external data
- Automated X-ray image interpretation delivered some promising Customs applications we will bring to the field, but requires international cooperation to make it more widely applicable

Automated X-ray image interpretation, our journey

- **Enforcement vision 2014**
  - Do more per time unit, automation in support of Customs inspections ("autodetection")

 European funded (FP7) research and innovation project ACXIS 2013-2017
  - Close cooperation between industry, academia, institutes and end-users
  - 1st X-ray image interpretation on containers

- **Internal innovation project, since 2020**
  - Collecting and annotating X-ray images
  - Training algorithms for X-ray image interpretation
  - Deploy algorithms in non-operational test environments

- **Multi-annual strategic plan 2022-2025**
  - Making sure internal and external requirements for a just, secure and robust operational deployment are met
  - Autumn 2023: semi-operational testing of working with models planned

Automated X-ray image interpretation, our results

- Algorithms trained on
  - Recognition of general goods/ items
    a. High energy (containers): top 300 goods
    b. Low energy (parcels): 6 often under-valued items
  - Recognition of threat items/ materials
    a. Low energy (post, parcels): pills
    b. High energy (containers): low prevalence threat material in cargo
  - Anomaly detection
    a. High energy (reefer containers): drug associated anomaly
  - Preparations for required IT infrastructure

"When it's visible in the image, it can be trained into an algorithm",
 provided you have sufficient well-annotated image data

Automated X-ray image interpretation, our needs

- Sharing and standardisation
  - Sharing of annotated X-ray images (seizures!), preferably in unified file format (WCO UFF)
  - Sharing or co-production of models, common pre- and post processing, preferably in a common format
  - Common approach deployment of algorithms, stemming from different sources, by Customs
  - Unified dossier for European AI regulation and national compliancy

- IT infrastructure support
  - Availability of images at multiple positions in the infrastructure
  - Interconnected algorithm development environment (image, declaration, and inspection result data)
  - Ability to process image data in combination with declaration data in operation
  - Options to use fully automated, partly automated and human interpretation in one user interface

- Cooperation with vendors, through European tender procedures

Automated X-ray image interpretation, cooperation

- Since November 2022 a cooperation between American, Australian, Belgian, British, Canadian, New Zealand and Dutch administrations

  - Come to share relevant data

    - What level of restrictedness does annotated X-ray image data have with the participating administrations?

    - What existing information security routines and products facilitate secure sharing of large image data volumes?

    - In what format should we make X-ray images available?

    - How do we annotate X-ray images in a widely usable way?

    - What should uniform X-ray image metadata look like?

    - How do we know what administration has what available?

  - Structure work/ co-production to train algorithms

  - Commonalities in deployment of trained models

3:Deployment of trained models

1:Availability of annotated X-ray images

2:Training of algorithms