DOCUMENT INSPECTION CAPABILITIES AT THE BORDER
Strengths and Weaknesses of Humans and Machines

ICAO Regional Seminar on MRTDs and Traveller
Identification Management
Madrid, 24-27 June 2014

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2014-06-09

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The European Agency for the Management of the **Operational Cooperation** at the External Borders of the Member States of the EU (EU Council Regulation (EC) No 2007/2004 of 26 October 2004)

- Mission: *"Intelligence driven operational cooperation at EU level to strengthen security at external borders"*

- **Tasks:**
  - carry out risk analyses;
  - coordinate operational cooperation;
    - joint operations
    - support with technical and operational assistance
  - assist EU Member States with training their Border Guards (Common Core Curriculum);
  - **follow up and contribute to research relevant for the control and surveillance of external borders.**

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DOCUMENT CHALLENGE II Basic Facts

- **Simulation of Document Inspection in the First line** (Lisbon SEF Headquarters: 19 September – 1 October 2013; Joint Action Lusitania)

- Evaluation of performance and usability

- Participants (Humans and Machines) tasked to correctly classify genuine and false documents :
  - ◊ 42 Officers
  - ◊ 7 document inspections systems
  - ◊ 3 different test-sets (a total of 215 documents)
  - ◊ 3 scenarios:
    - – A) Machine Only,
    - – B) Human Only (with/without time constraint),
    - – C) Human with Machine

Document Inspection System
AU10TIX
Morpho
Regula
ARH
Keesing
Bundesdruckerei GmbH
Foster&Freeman

In cooperation with:
PT SEF, UK National Document Fraud Unit, NL Royal Marechaussee,
DE Forensic Science Institute (Bundeskriminalamt),
Frontex Joint Operations Unit (Air Border Sector)

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DOCUMENT CHALLENGE II: Rationale

- Lack of reliable data concerning the security performance (accuracy, errors etc.) of document inspection systems <u>and</u> border control officers :

  ◇ **How do we know how good we are (detection dilemma)?**

  ◇ **How do we know how bad we are and what type of <u>capacity building</u> is needed? (Training? What type?; New Equipment? Upgrade?)**

- Lack of standard methodology to assess operational performance of document inspection capacities in the first line (... and beyond)

- Lack of standards on performance of document inspection systems (+certification etc. etc., BSI but...)

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DOCUMENT CHALLENGE II: Objectives

- Contribute to the development of a **usable metric to assess operational performance of document inspection capabilit<u>ies</u>** (!)

- Understand **current performance levels and vulnerabilities**(how many false documents pass undetected - falsely accepted as genuine - and why)

- **Recommend solutions** for technical vulnerabilities to participating <u>DIS providers </u>in order to contribute to the **overall fight against document fraud**

- **Recommend solutions** for human/operational vulnerabilities to <u>Frontex and MS </u>in order to **strengthen the security at the first line** of control

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Main Findings

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A. Machine Only Use Case

- **Human Factor always plays a role**
  - Presentation of document

  - Interpretation of result on front-end application (interface)

- **Inconsistency in results**
  - Hypotheses:
    - Subjective interpretation of Machine Decision (Due to front end App?) – **Human Factor**

    - Variability in Machine results when scanning same doc several times by the same user – **Machine Inconsistency (Technical)**

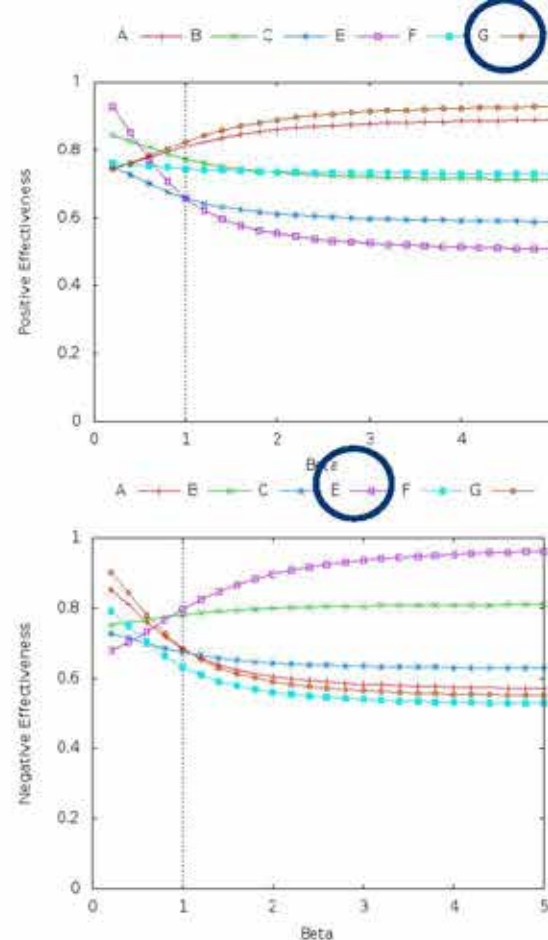Analysis of **Front-End App** and language used by Machine (**USABILITY**)

Analysis of logs to check for machine inconsistency and/or presentation issues (**RELIABILITY**)
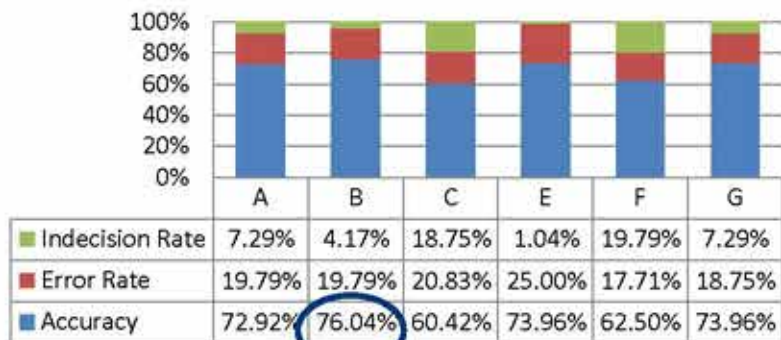
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A. Machine Only Use Case:

- No clear best (it depends on the objective)

- Trade-off security (negative Effectiveness) and Facilitation (Positive Effectiveness).

- Balance (accuracy) at the cost of slightly higher errors in both (FPR/FNR aka false acceptance/false rejection)

Test121(96)(MT2) Classification Success

	A	B	C	E	F	G
Indecision Rate	7.29%	4.17%	18.75%	1.04%	19.79%	7.29%
Error Rate	19.79%	19.79%	20.83%	25.00%	17.71%	18.75%
Accuracy	72.92%	76.04%	60.42%	73.96%	62.50%	73.96%

Machine D excluded !

Document Challenge

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B. Human Only Use Case

- Time Restricted: 60 seconds to take decision on 4 docs at a time

- Some officers with very high accuracy (>90%) and very low errors (FPR/FNR)

Wizards ?

- Big variations across groups (high standard deviation): issue of subjectivity/consistency

- What affects human performance?

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C. Human-Machine Use Case:

Test:
- Machine gives result and Tester records it
- Tester records whether he/she agrees
- Tester records final result

- **Accuracy increases when humans disregard machine results and take their own decisions** (except than for non-experienced)

- **Humans tend to win against the machine** (correct answer) when they don't accept (trust) the machine result (except for non-experienced)

ACC HM
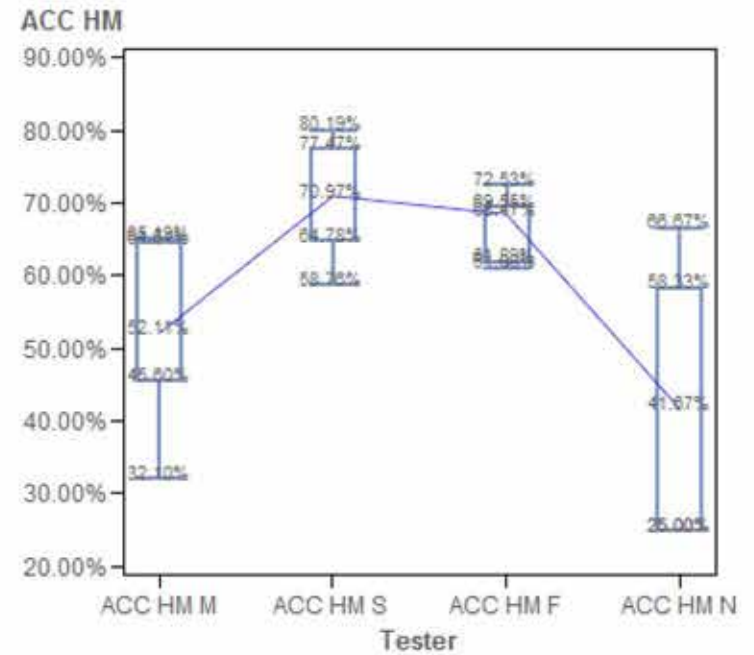
Human-Machine WIN-LOSE in case of disagreement

Machine D included !

Document Challenge

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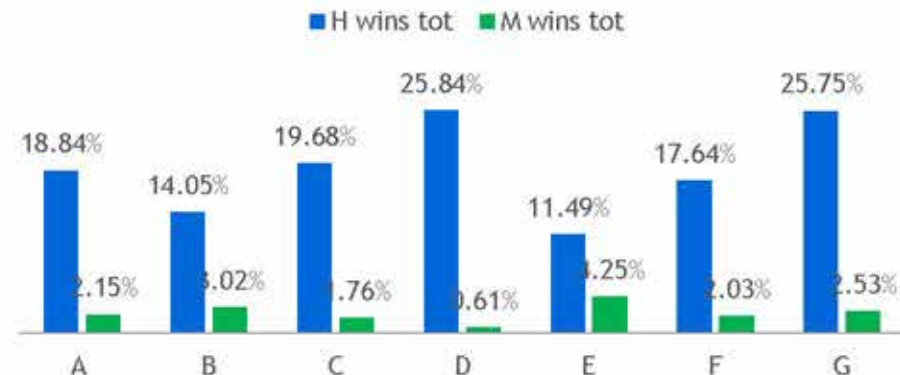
Comparison Human-Machine Performance
Study of difficult and easy documents to detect

Issue of Function Allocation

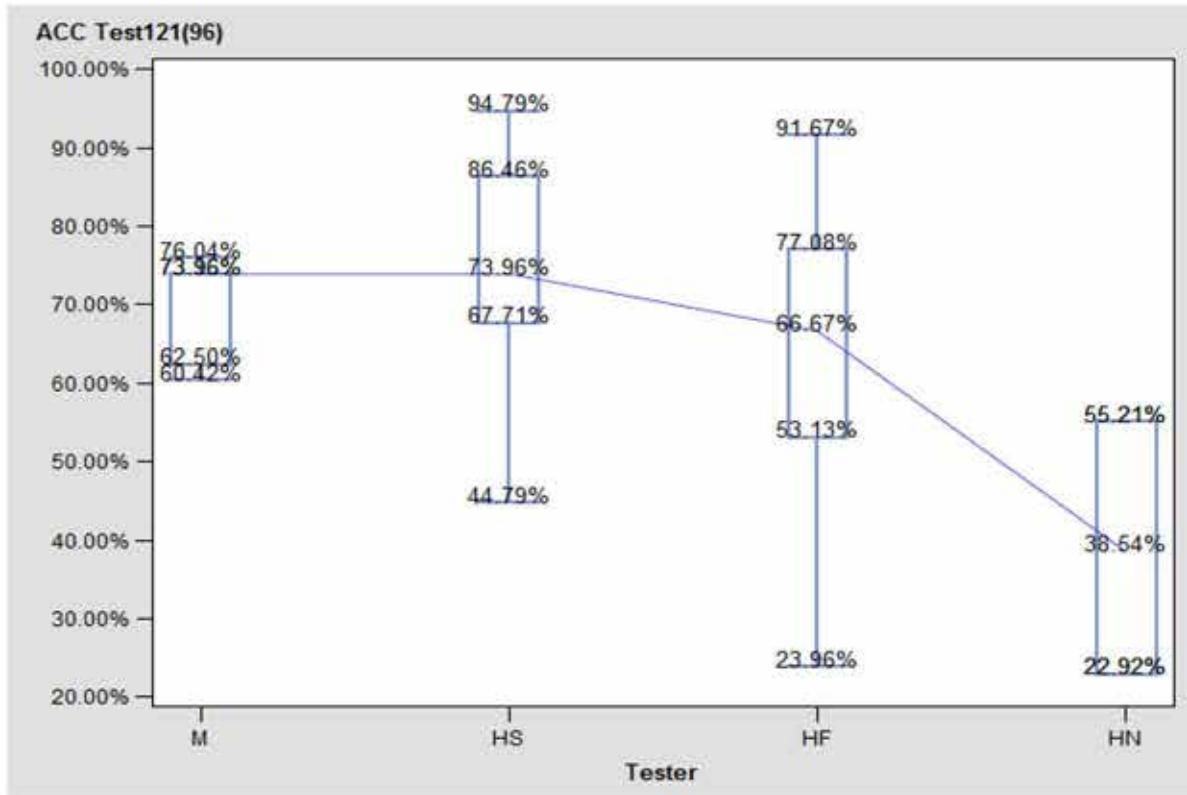| Humans are Better at	Machines are Better at
Inspecting Physical integrity of booklet	Field comparison (including chip/viz-mrz)
Inspecting Substrate features	Mathematical checks (check digit)
Dealing with exceptions (especially if object of alerts etc.)	Electronic authentication
Dealing with operational praxis (ex. stamps/visa etc.)	
tbc	tbc

General observations related to weaknesses identified for Machine Authentication
(based on classification outputs)

- Difficulty in verifying certain **substrate** (watermark etc) and **optical features** (translucent, IPI, laminates and glare, total UV luminiscence etc.)

- Different **illumination intensity, exposure, angles** (UV, IR, VIS) affect correct identification and especially false document detection. Only 2 machines used glare compensation.

- Difficulty with dealing with **ICAO non-compliant documents, production errors and exceptions**

- Difficulty with identification of some genuine documents (**reference database?**)

- Difficulty in identifying wrong **printing techniques**

- **Field comparison**: not all compare portrait and photo on chip

- **Check digits**: not all calculate the optional digit

- **ID cards**: not all check both sides

- Different strengths of the **pattern recognition algorithm used**

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Overall Comparison of Accuracy Test121 (96) Machines vs Humans by type of experience

ACC Test121(96)

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Thank you for your attention!

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