# Who's in My Archive? An End-to-End Framework for Automatic Annotation of TV Personalities

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# Introduction

# Who we are

- RAI is the Italian public broadcasting company
- Production Centres in Milan, Naples, Rome, Turin
- Widespread presence across the country
- The Centre for Research, Technological Innovation and Experimentation (CRITS), supports the Company in fulfilling the RAI - Italian State service contract as regards in particular the technological research activities

# RAI archives

RAI holds important and valuable collections, covering a wide period of the contemporary Italian history

Radio broadcasting started in 1924
TV broadcasting started in 1954
Most of the content has been preserved

Main archive in Rome
4 Production Centre sites with middle sized archives
16 Regional sites with local archives

# The AI4Media project

AI4Media* is a 4-year EU funded project. The Consortium consists of 30 leading partners in the areas of AI and media.

AI4Media designed seven use cases that demonstrate the use of AI in the media industry, including aspects of human-centric, ethical, and trustworthy.

Rai is leading the use case *"AI in Vision: high quality video production and content automation"* based upon three main business areas of activity media people usually accomplish during their everyday job, namely ***Content Access***, ***Content Production*** and ***Content Monitoring***.

(*) www.ai4media.eu

# AI in Vision: context


- *Content preservation*
- *High-quality content production*
- *Content automation*


Archives

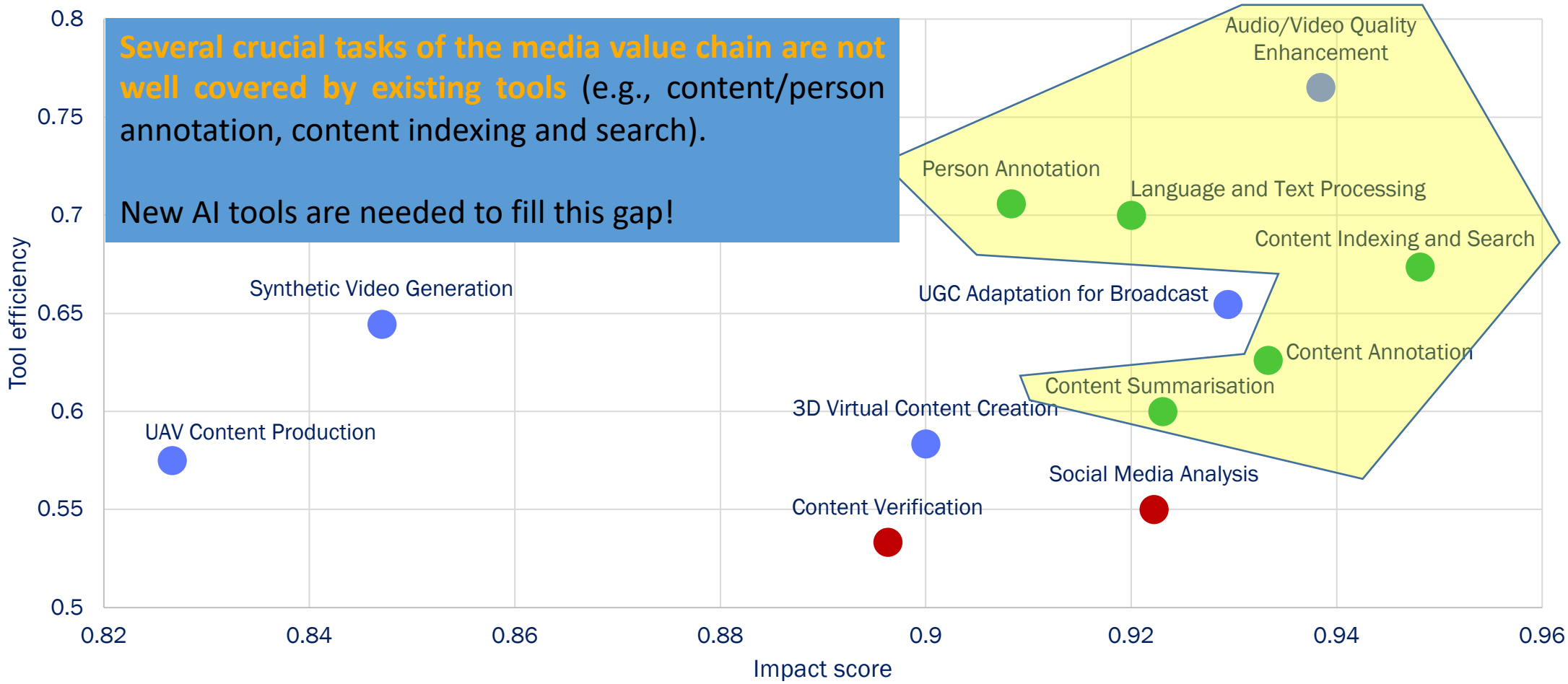
*(train and fine-tune AI systems)*

AI-driven tools

*(exploit and valorize archived content)*

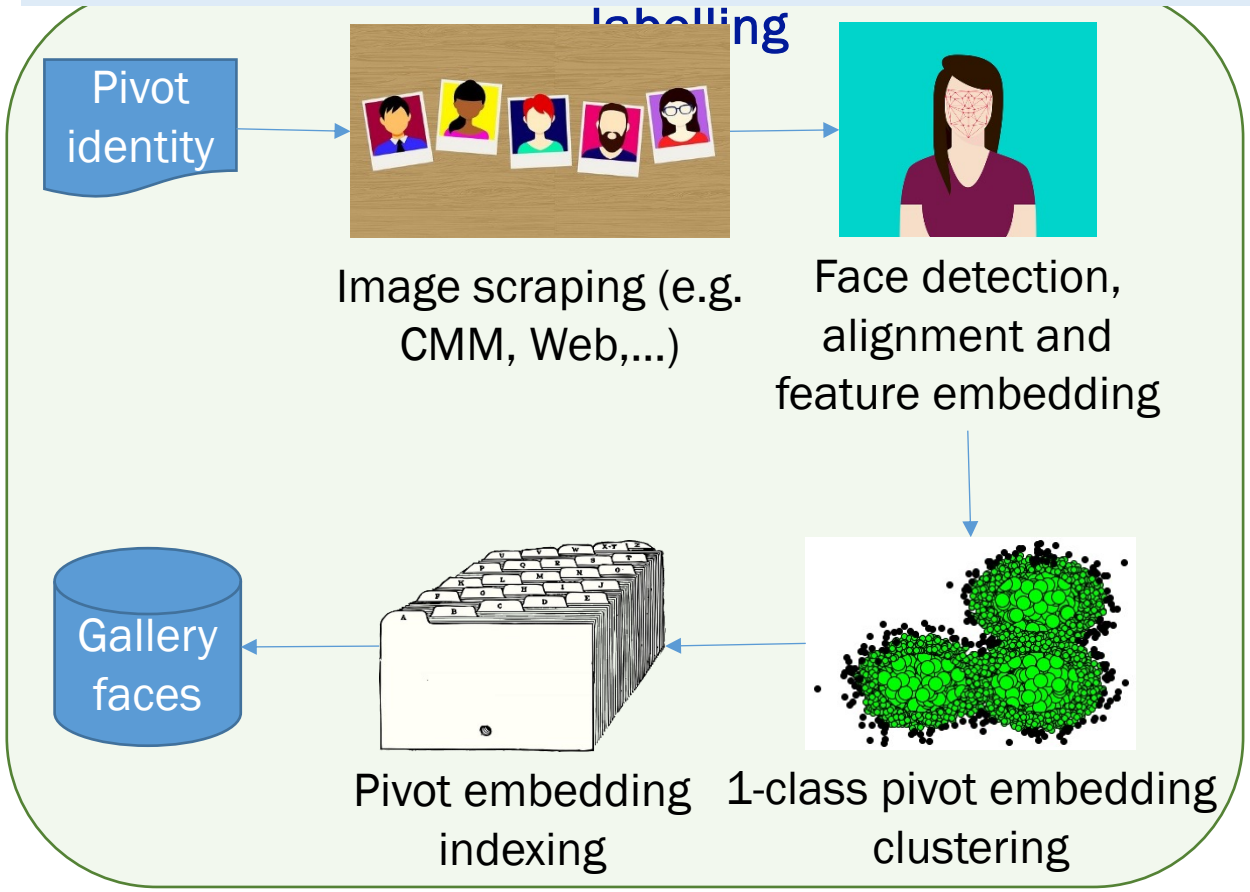

Some of these workflows are already in place.
Is this enough?

# Are current tools efficient?



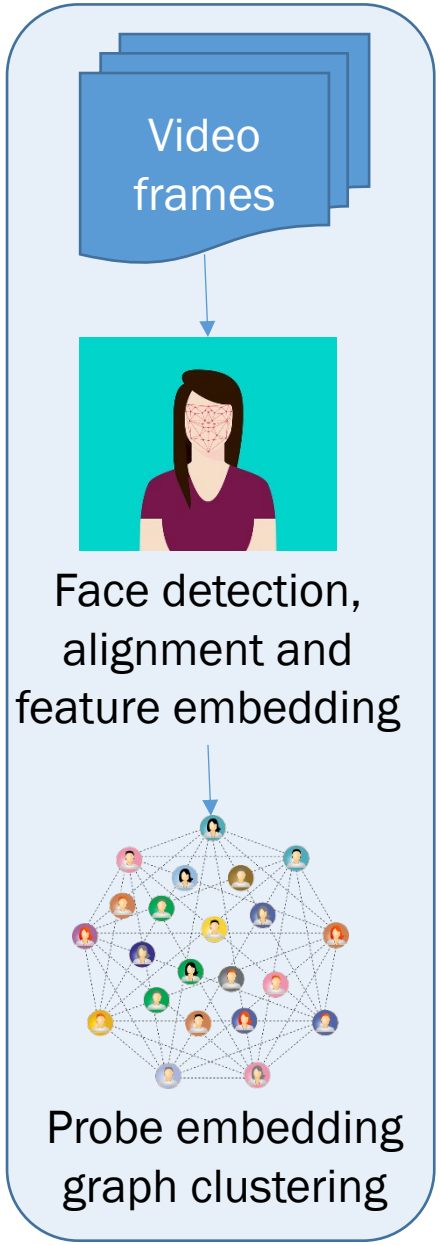
# Implementation

# The Face Management Framework:
# 3-step end-to-end process based on state-of-the-art algorithms for face representation, grouping and labelling



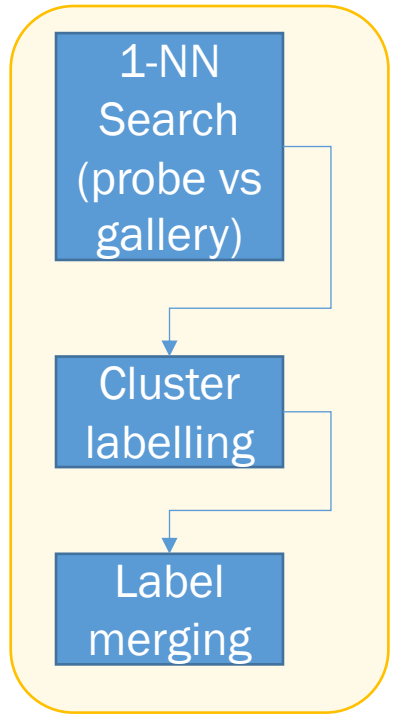

## 1. Gallery face creation

It uses content metadata (e.g., archival annotation) to get a list of pivot individuals to be identified within video streams




## 2. Probe face creation

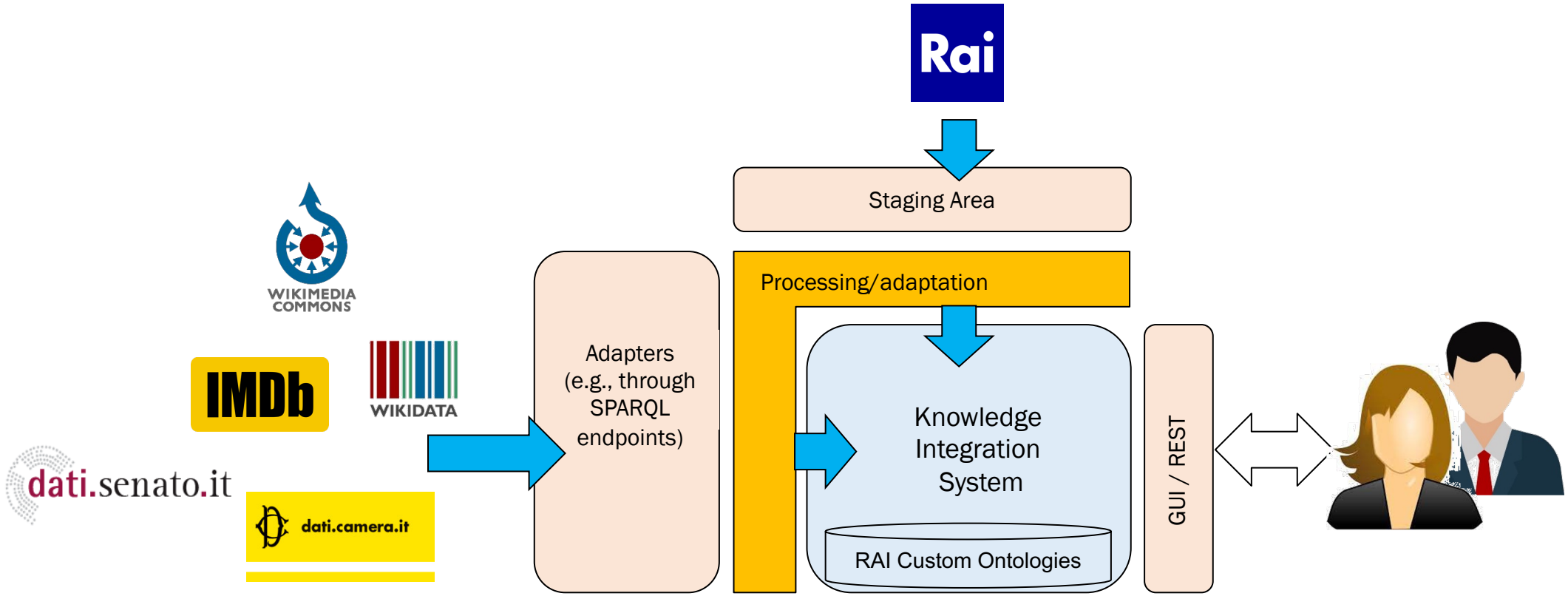
It uses a fully parameter-free clustering algorithm to group similar faces appearing in video frames



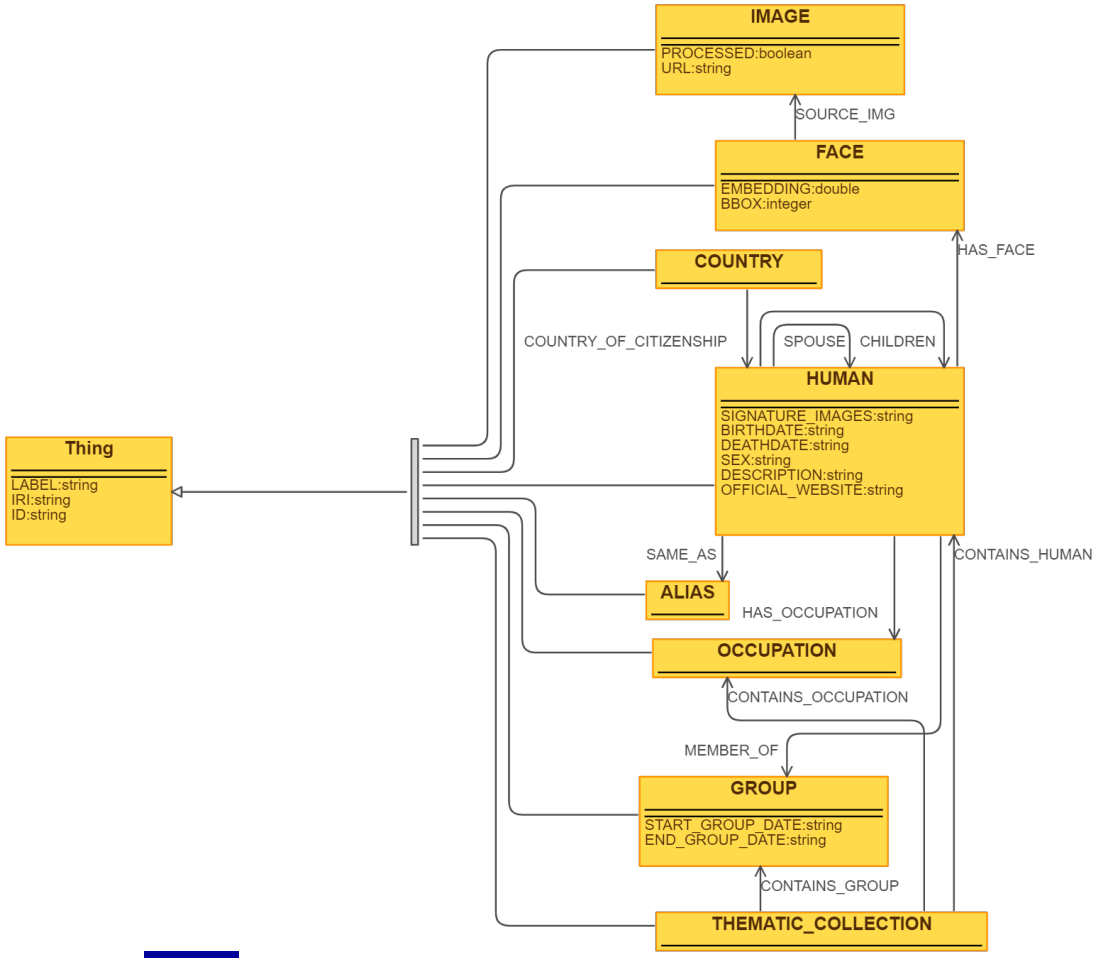

## 3. Face labelling

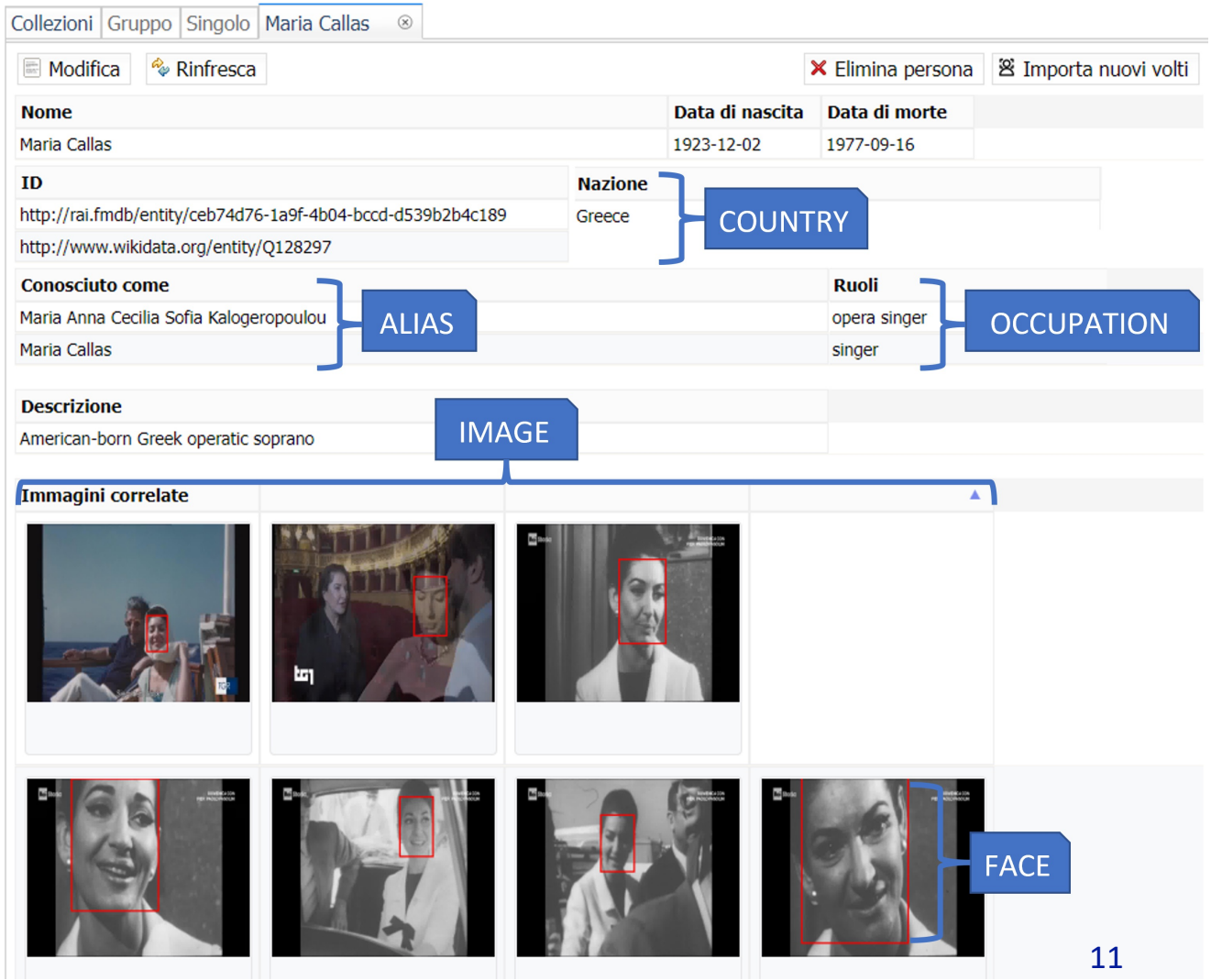
It applies a retrieval-based open-set face identification strategy to assign each cluster (i.e., a group of probe faces) the identity of the corresponding individual

# Gallery Manager architecture



# Gallery Manager data schema



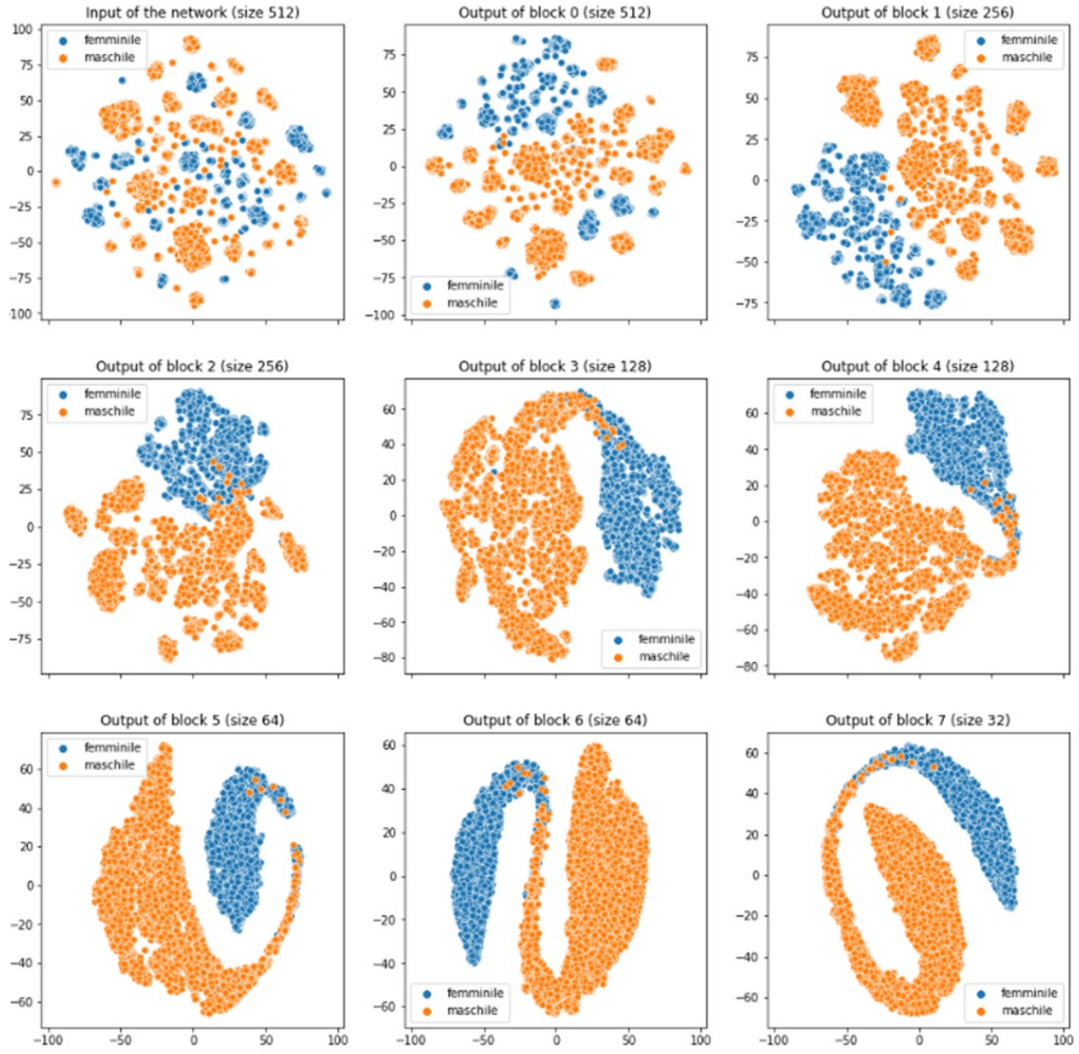



# TV personality recogniser functionalities


| Expert Role | Functionality | Description |
|---|---|---|
| Documentalist | Person gallery management | Add/Remove a person to/from the gallery and visualise reference images |
| | Video annotation | Automatic video annotation based on the appearance of people |
| | Annotation export | Export of annotation metadata |
| Documentalist<br>Journalist<br>Programme Editor<br>Marketing Analyst | Annotated video browsing | Browsing of annotated videoclips through keyframes visualisation where bounding boxes underline the position of the referenced people |
| Journalist<br>Programme Editor | Person-based search in video | Search the archive for videoclips containing a given person, possibly with smart data integration (e.g., biographies) coming from reliable web sources |
| Programme Editor<br>Marketing Analyst | Stream selection and statistics visualisation | Visualisation of statistics and charts (e.g., audience score, programme schedule and people) for a video stream by broadcast date/time/channel |
| Programme Editor<br>Marketing Analyst | Statistics export | Export of statistics |

# (Biological) gender estimation

- What: analysis of facial-related gender features
- Why: examine the presence of women and men in TV programmes
- How: FMF face embeddings + Residual MLP network

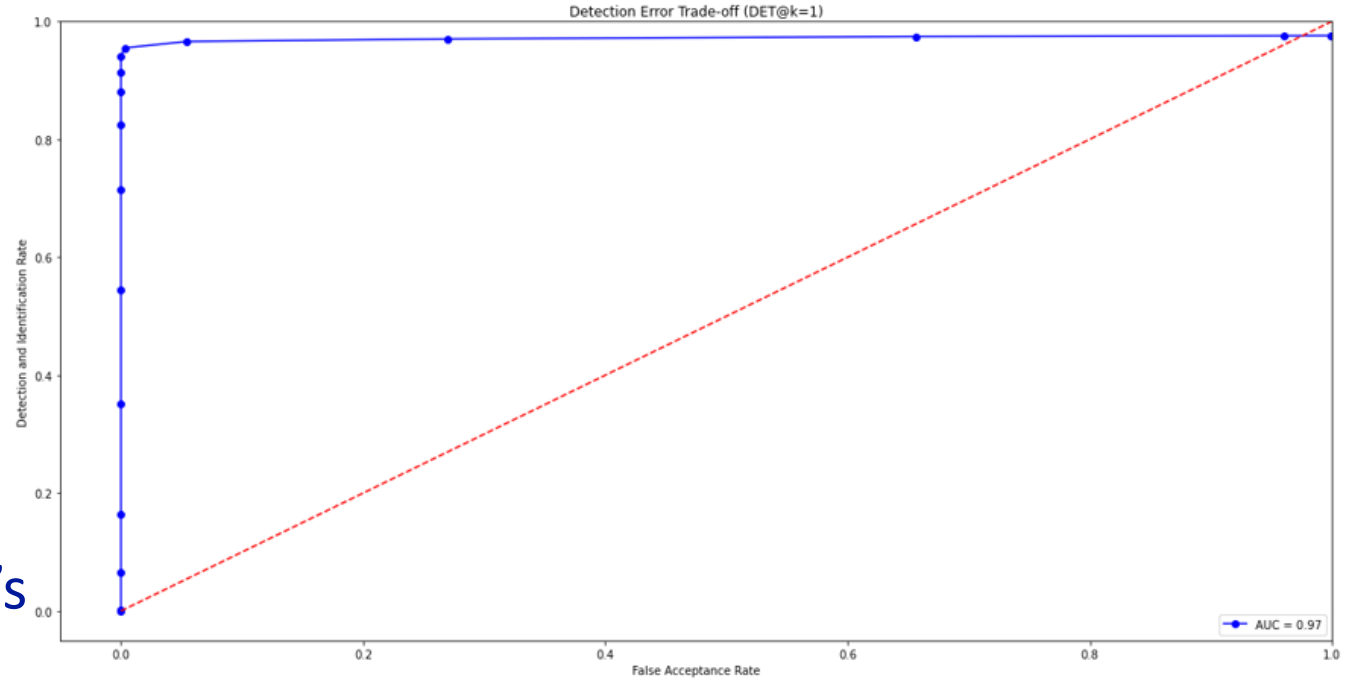


# Objective & subjective evaluation

# Face clustering & identification

- Face clustering
  Dataset of 1099 frames extracted from RAI's programmes
  30 international and national TV personalities
  Average completeness = 0.92
  Average homogeneity = 0.99

- Face identification
  Gallery of 66 RAI's anchor-persons
  Probe set of about 10K faces from RAI's newscasts
  Performance measured as DIR vs FAR plot



# Biological gender estimation

More than 7K keyframes extracted from RAI's programmes of various TV genres (in-depth journalism, talk show, entertainment)

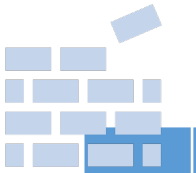
TABLE III
COMPARISON OF DIFFERENT BIOLOGICAL GENDER ESTIMATION TOOLS APPLIED TO TV STREAMS

| Library | Precision | Recall | F-score |
|---|---|---|---|
| InsightFace [71] | 0.962 | 0.962 | 0.962 |
| FaceLib [72] | 0.924 | 0.924 | 0.923 |
| DeepFace [73] | 0.942 | 0.939 | 0.938 |
| Commercial | 0.983 | 0.983 | 0.983 |
| This | 0.979 | 0.979 | 0.979 |

# Subjective evaluation: main findings

## GUI

- More options for filtering based on broadcast metadata
- Further statistics about persons and faces, e.g., face size vs frame size



## New functionalities

- Recognise speaking people
- Identify camera shot types
- Search by facial-related attributes
- Search by persons and context, e.g., a certain person in the street

## The most popular

- Need for cross-reference between faces and other information, e.g., landmarks, speech transcriptions

# Conclusions

# Summing up

- We presented a system for automatic annotation of TV personalities in archival content and live streams
- Developed assumptions were validated by both objective evaluations based on standard information retrieval and data mining measures, and subjective user studies addressed to practitioners working in the media sector at various professional levels
- Collected feedbacks help to prioritise research and development efforts
- Experimental campaigns demonstrated how existing media workflows could greatly benefit from the developed tools and the efficiency improvements they bring

# Thank you!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