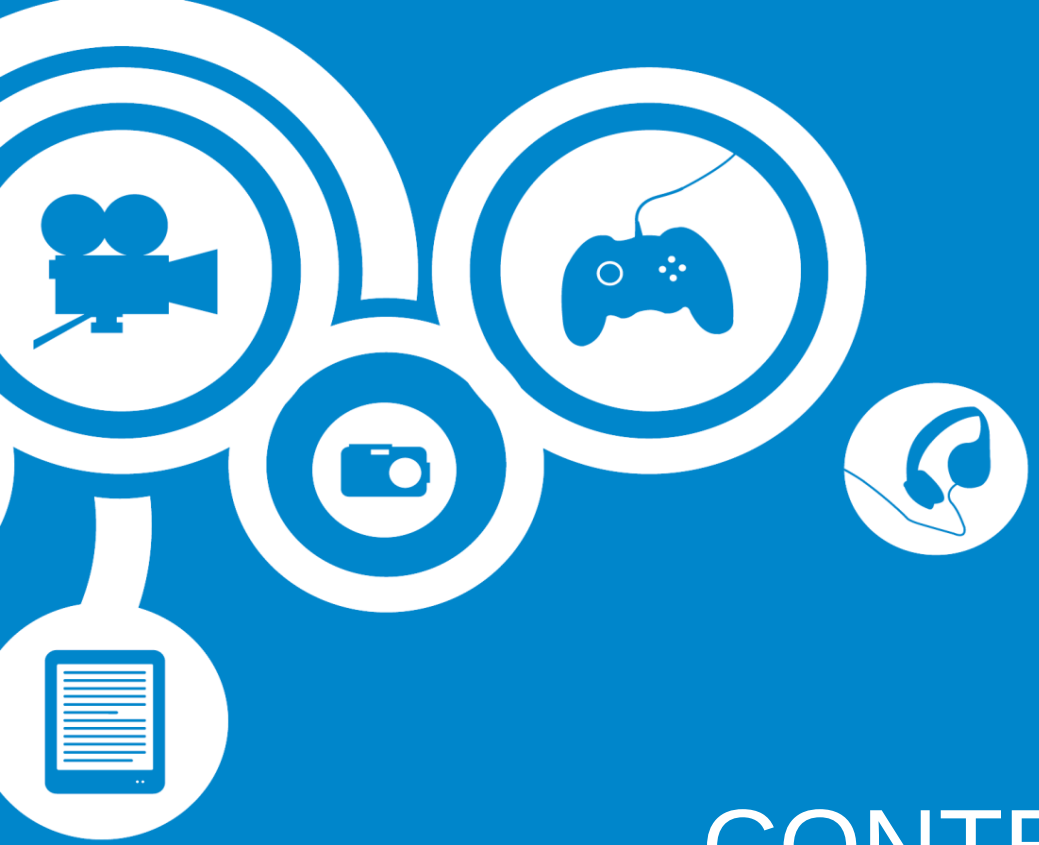
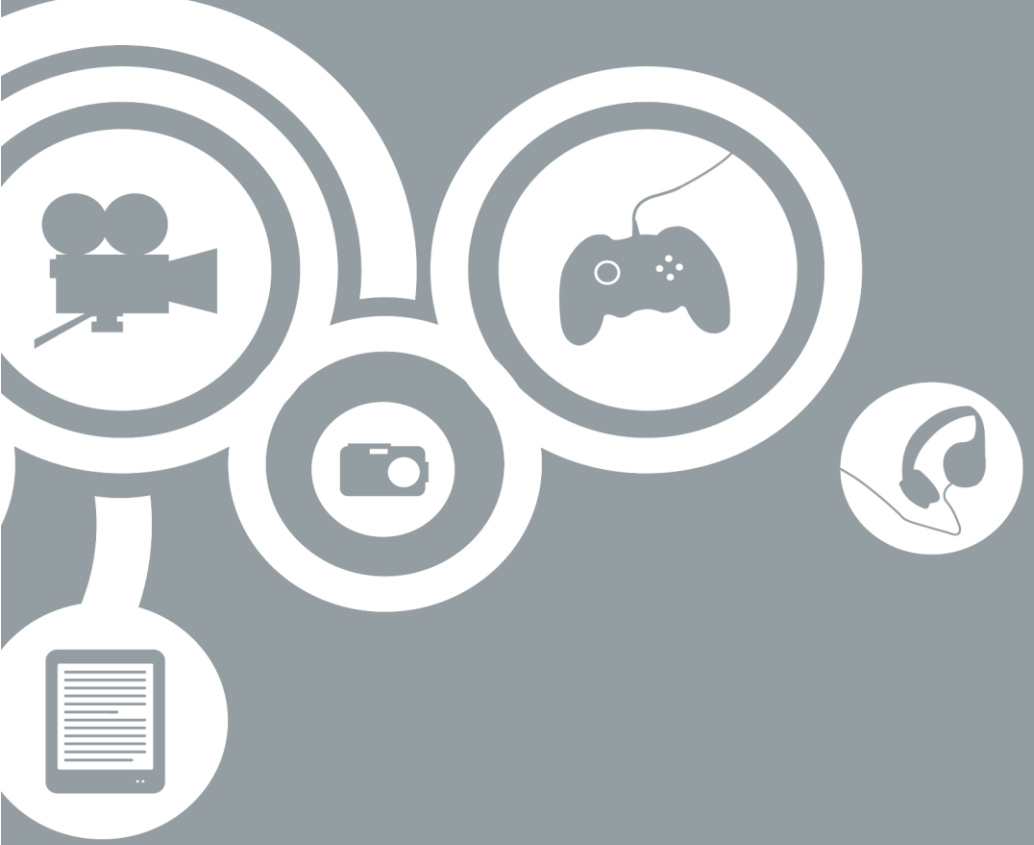


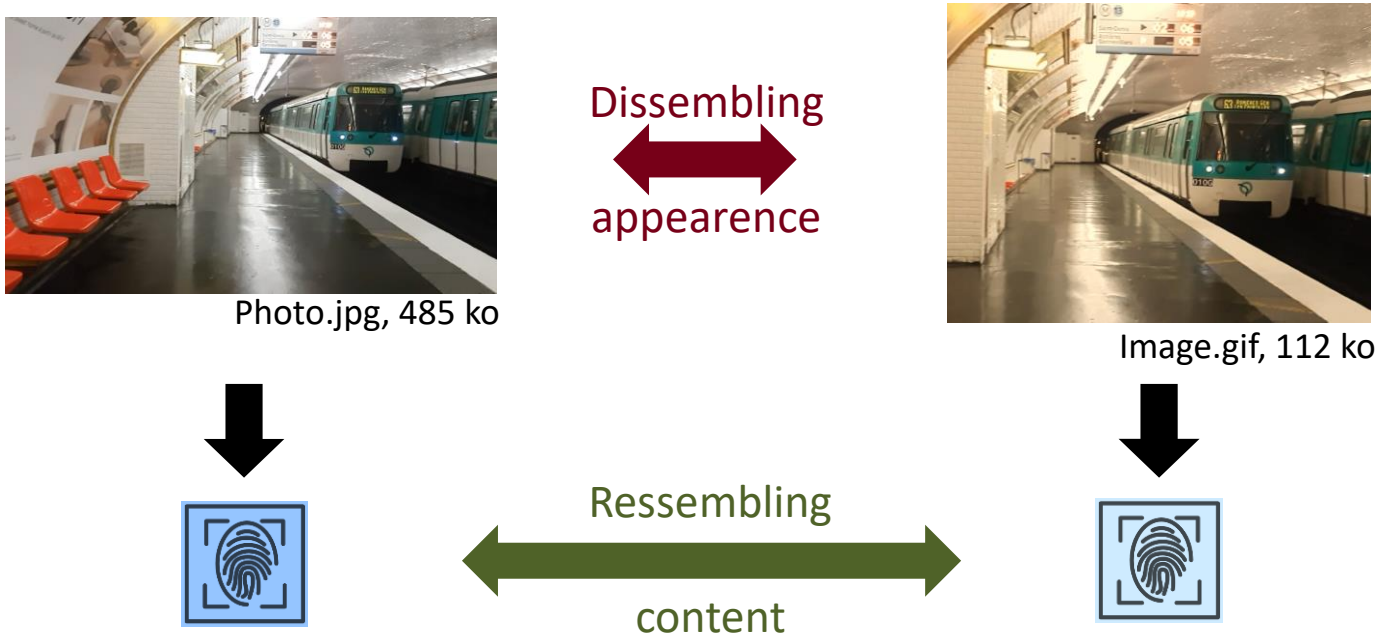
CONTENT RECOGNITION TOOLS: STATE OF THE ART AND DEPLOYMENT



CONTENT RECOGNITION TOOLS

CONTENT RECOGNITION BASED ON DIGITAL FINGERPRINTS

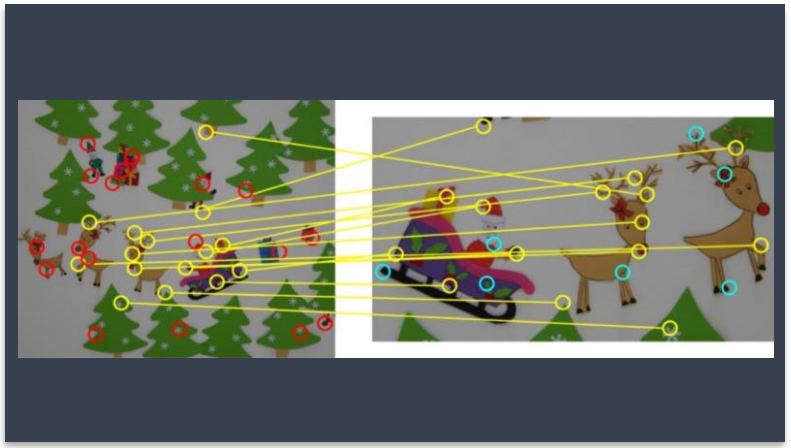
- Content comparison based on the comparison of digital fringerprints.



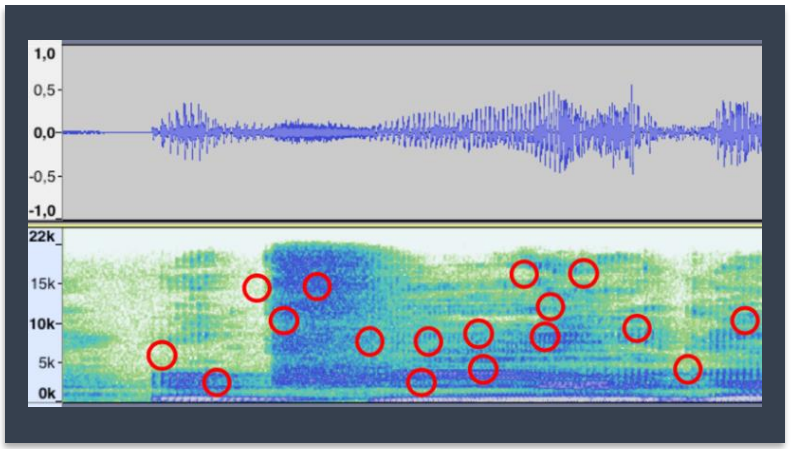
- A digital fingerprint is a simplified representation of a content.
- Fingerprinting technique applies to audio, video and still images. It can also work for text and possibly for software and applications (video games).

CONTENT RECOGNITION BASED ON DIGITAL FINGERPRINTS

Conceptual illustration of image fingerprinting



Source : CNRS-IRISA (L. Amsaleg)



Source : CNRS-IRISA (L. Amsaleg)

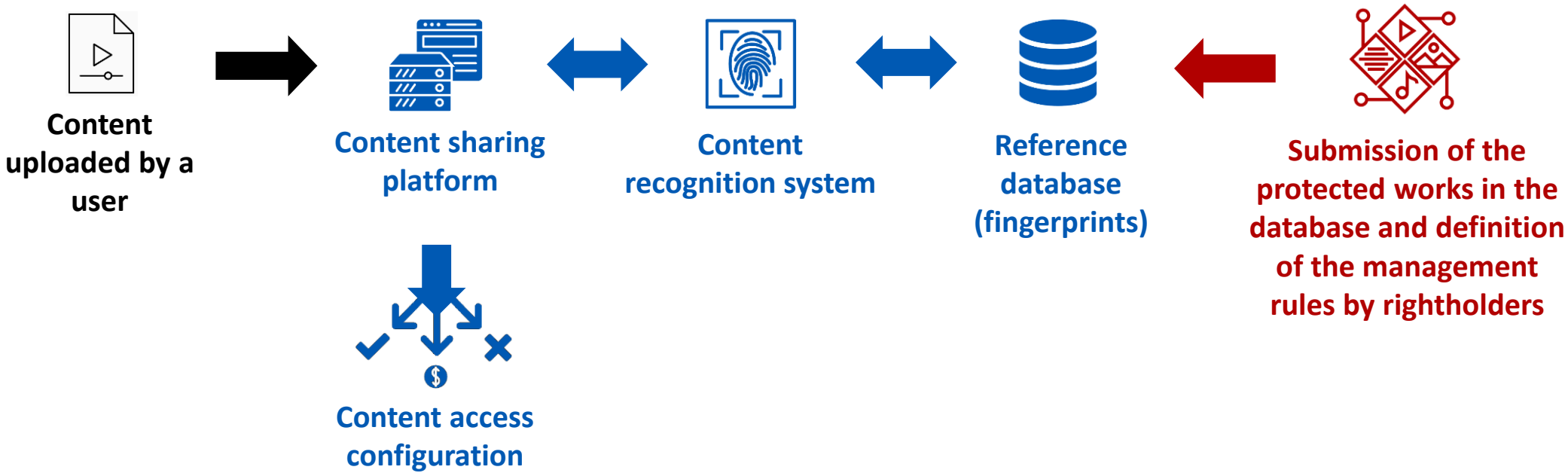
Conceptual illustration of audio fingerprinting

Conceptual illustration of video fingerprinting

Source : Ina – Institut National de l'Audiovisuel

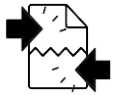
Conceptual illustration of fingerprinting as possibly applied to text

SIMPLIFIED FUNCTIONING OF FINGERPRINTING SYSTEMS



THE DIFFERENT STEPS OF THE PROCESS

1. Generation of the reference fingerprints



Point of attention : conflicts between fingerprints

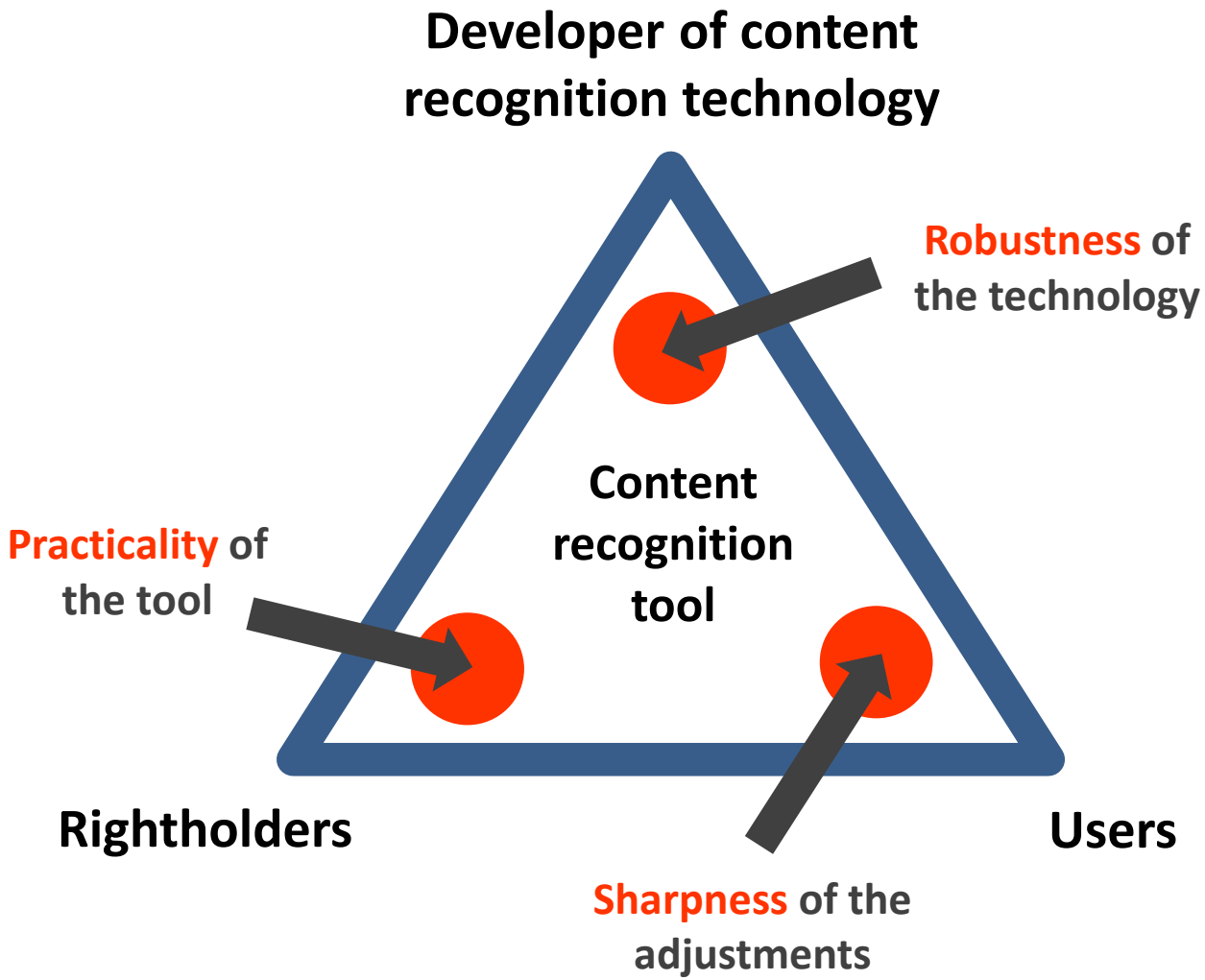
2. Definition of management rules

Point of attention : contradictory rules

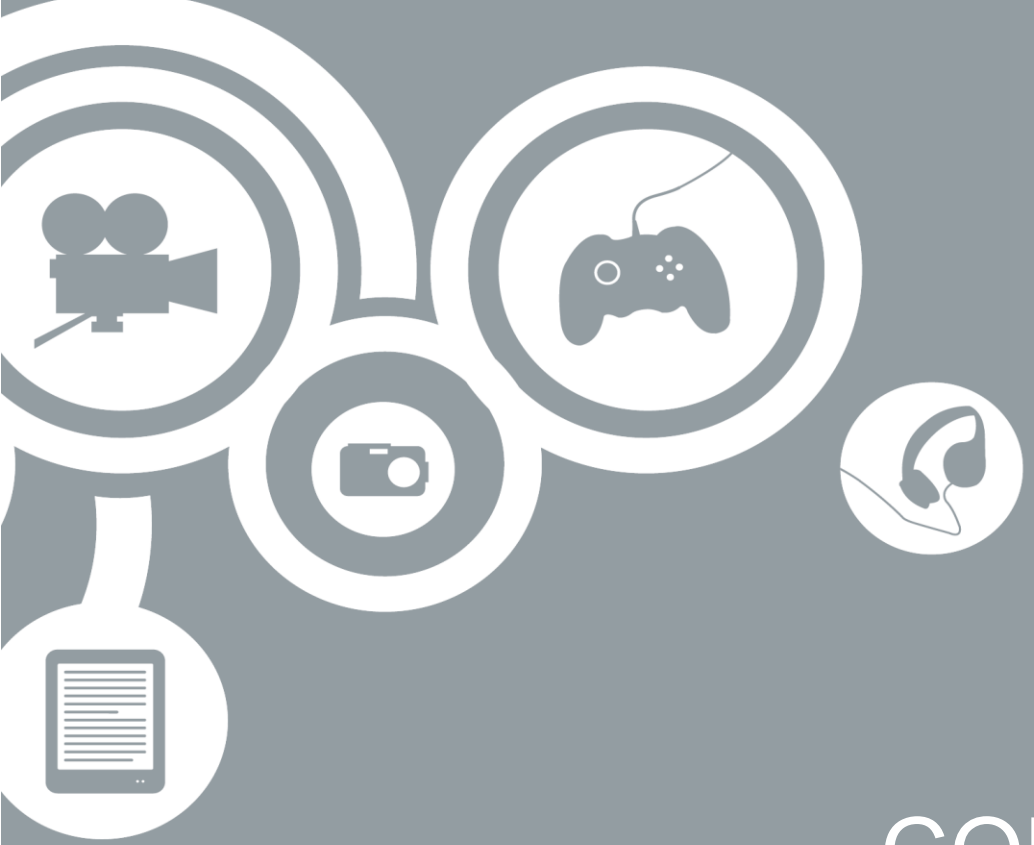
3. Disputes management or claims resolution

It is sometimes possible for users to truncate uploaded material in order to remove litigious content

ASSESSMENT OF CONTENT RECOGNITION TOOLS



- The capability and the robustness of the technology are just one facet of the content recognition tools' assessment.
- For complete evaluation, the following aspects must also be observed:
  - The functionalities offered to rightholders and the practicality of their implementation.
  - The sharpness that rightholders demonstrate in the way they use tools, taking into account copyright exceptions.



CONTENT RECOGNITION TOOLS' ASSESSMENT

GLOBAL METHODOLOGY

- Public and private evaluation protocols exist in order to assess the efficiency of content recognition tools.
- The goal is to test tools in an exhaustive or targeted way and compare the observed results with the expected ones.
- However, not all methodologies (and not all results) are published.

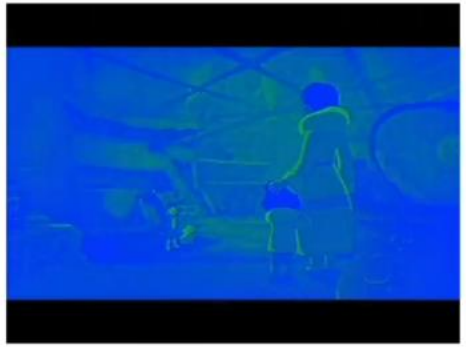
METHODOLOGY CHOSEN FOR THE STUDY

- Stress test rather than a global evaluation protocol (since a global evaluation of the tested tools had already been performed).

- Set of tests inspired by practical observations and by particular cases.

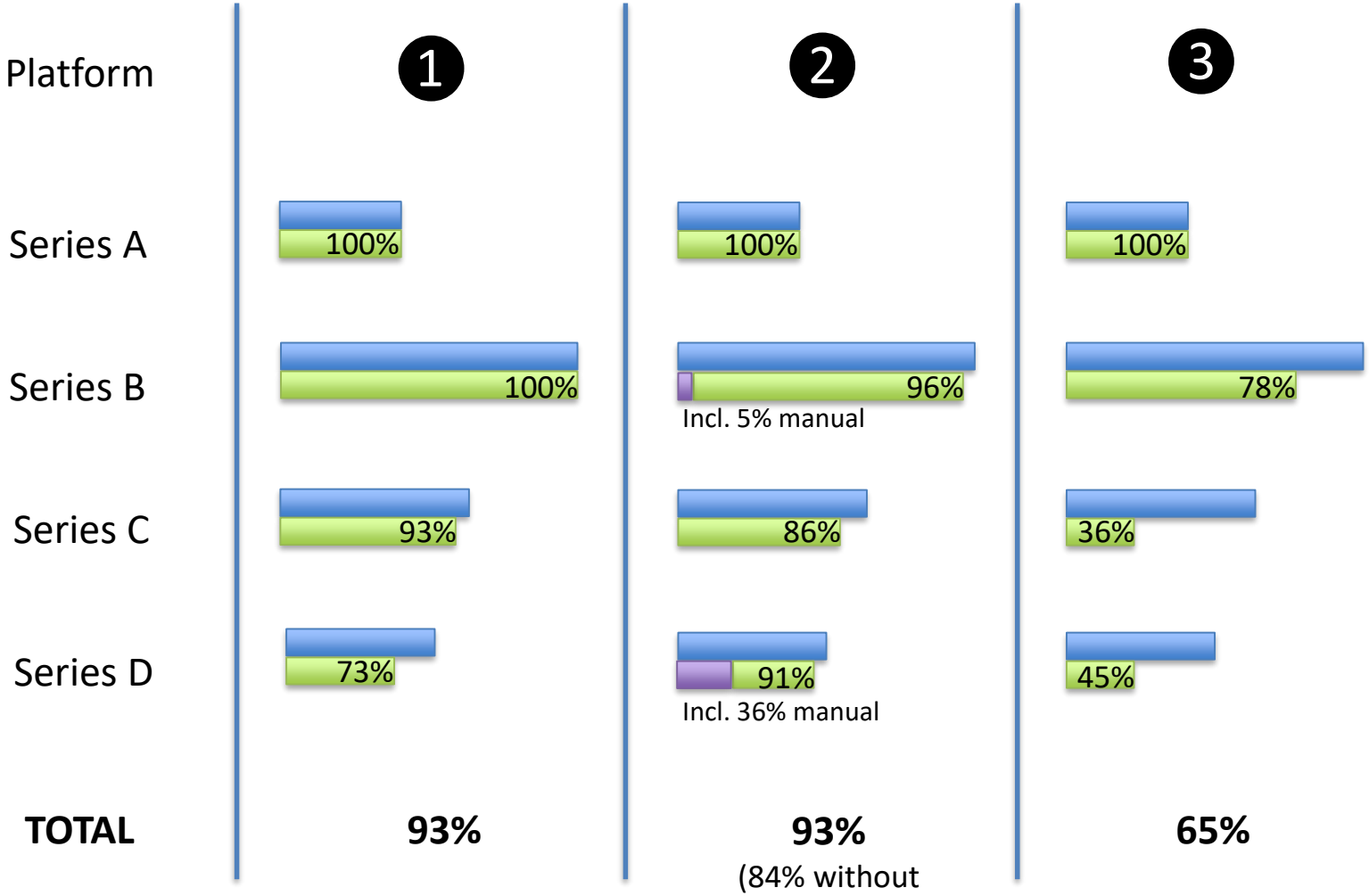
- 4 sets of tests with increasing complexity:
  - A : simple excerpts
  - B : application of basic effects
  - C : application of complex effects
  - D : cumulated effects or extreme alterations

SETS OF TESTS

Series A	Series B	Series C	Series D
			
			
			

Sources : Gaumont and TF1

EXAMPLES OF RESULTS



MUSICAL CONTENTS

- YouTube, Facebook and Shazam have been tested as a user of the platform and Audible Magic has been tested directly without the intervention of a platform (Type-3 i20 solution).


Normal excerpt


Speed variation

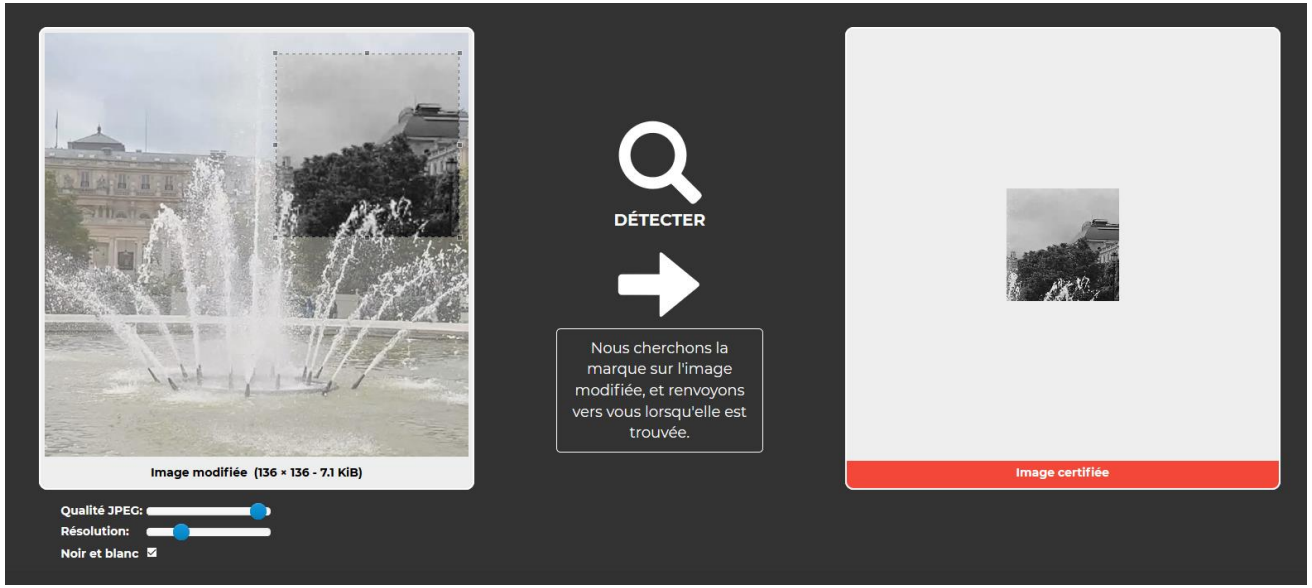

Tone variation


Multiple alterations

- Varying results… but for a reason:
  - Strong alteration tolerance with tools that are intended to be flexible in the way they work (but occasional false positives).
  - Good alteration tolerance on mainstream platforms, where uploaded contents are often of average quality.
  - Lower alteration tolerance with tools that are intended to be more precise (but no false positives).

STILL IMAGES

Basic tests done with the IMATAG and Videntifier technologies with regard to the recognition of still images.

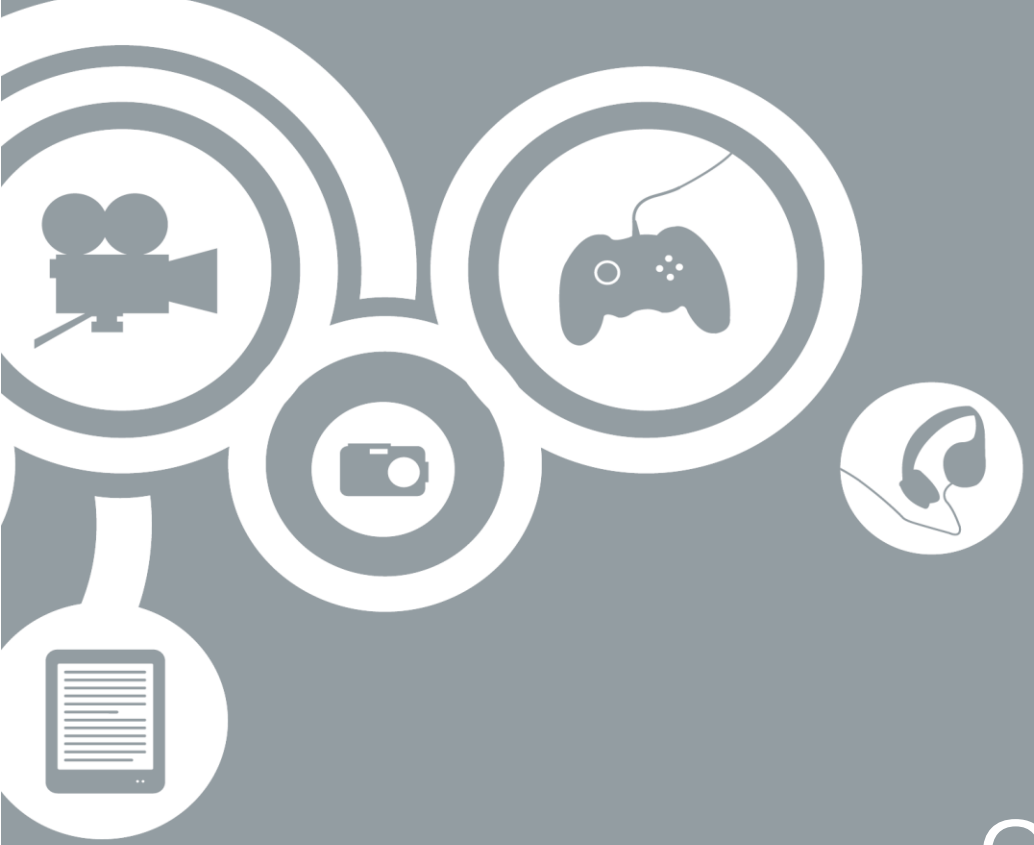


Source : IMATAG

Example of fidelity check (identical content)

Source : Videntifier

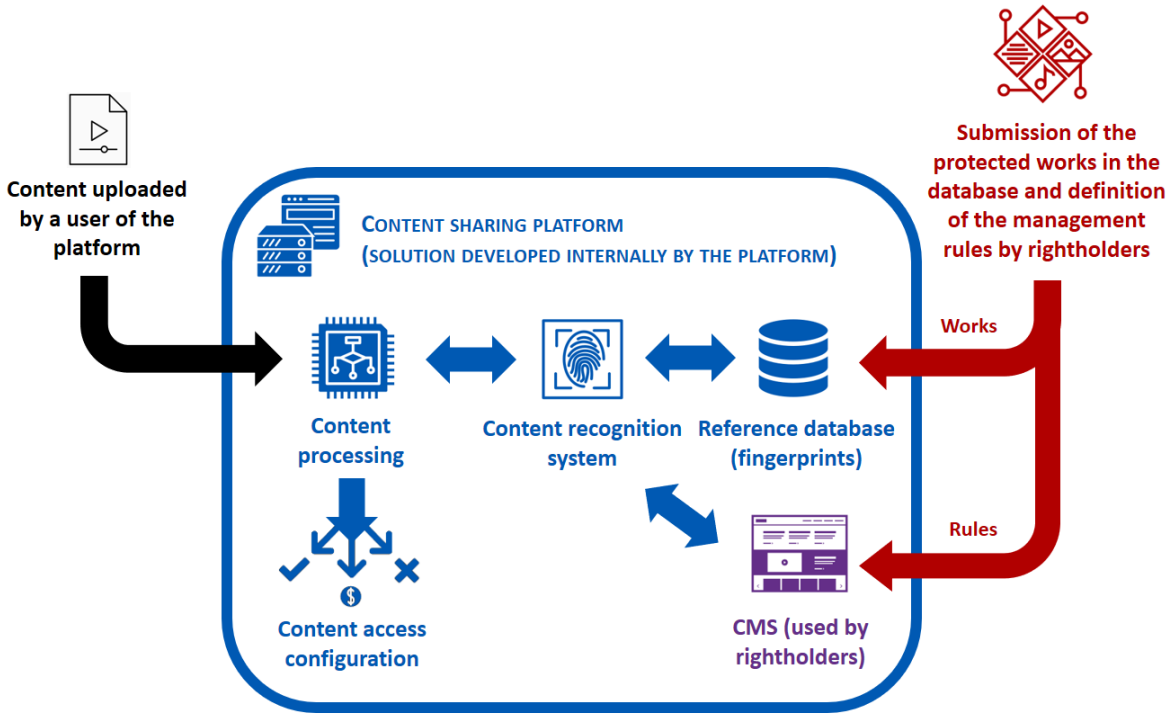
Example of similarity check (similar content)



ORGANISATIONAL MODELS OF FINGERPRINTING TOOLS

TYPICAL ORGANISATIONAL MODELS

Tools developed by the platforms

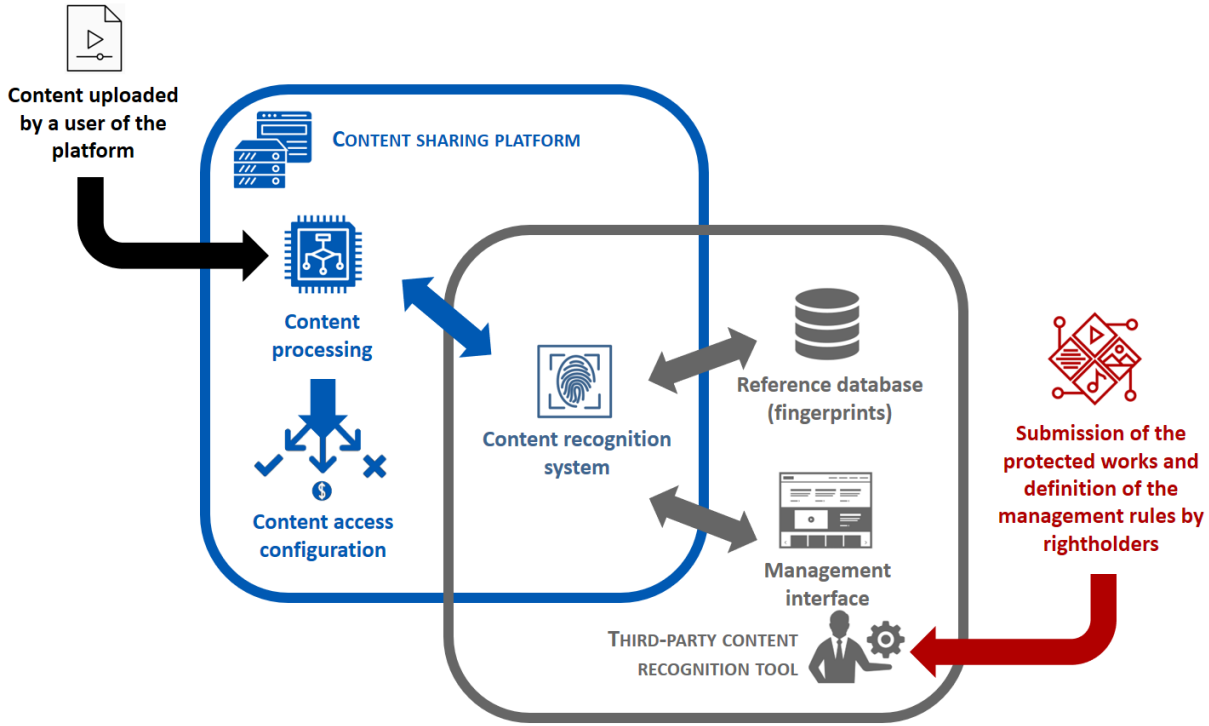


Examples :

YouTube Content ID

Rights Manager

Tools developed by third parties



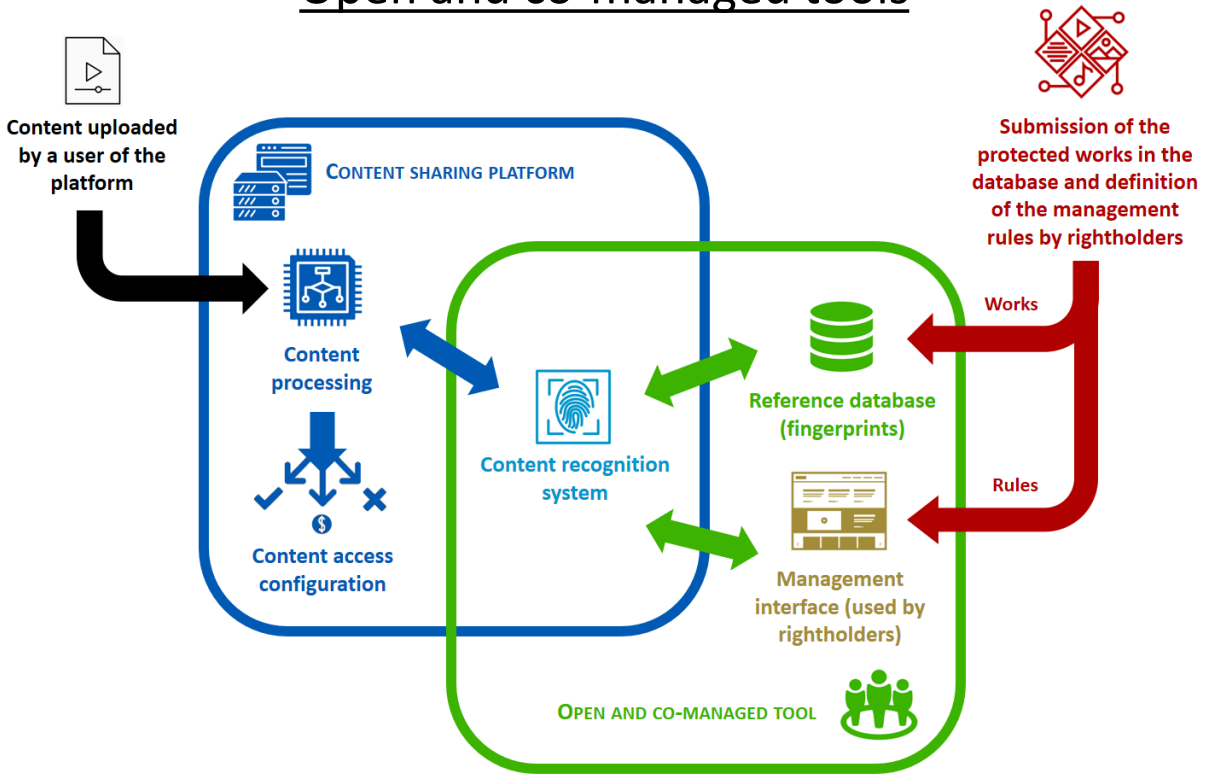
Examples (used by dailymotion, twitch, SOUNDCLOUD, etc.) :

Audible Magic

ina-signature
TAKE THE FINGERPRINT OF YOUR CONTENT

ALTERNATIVE ORGANISATIONAL MODELS

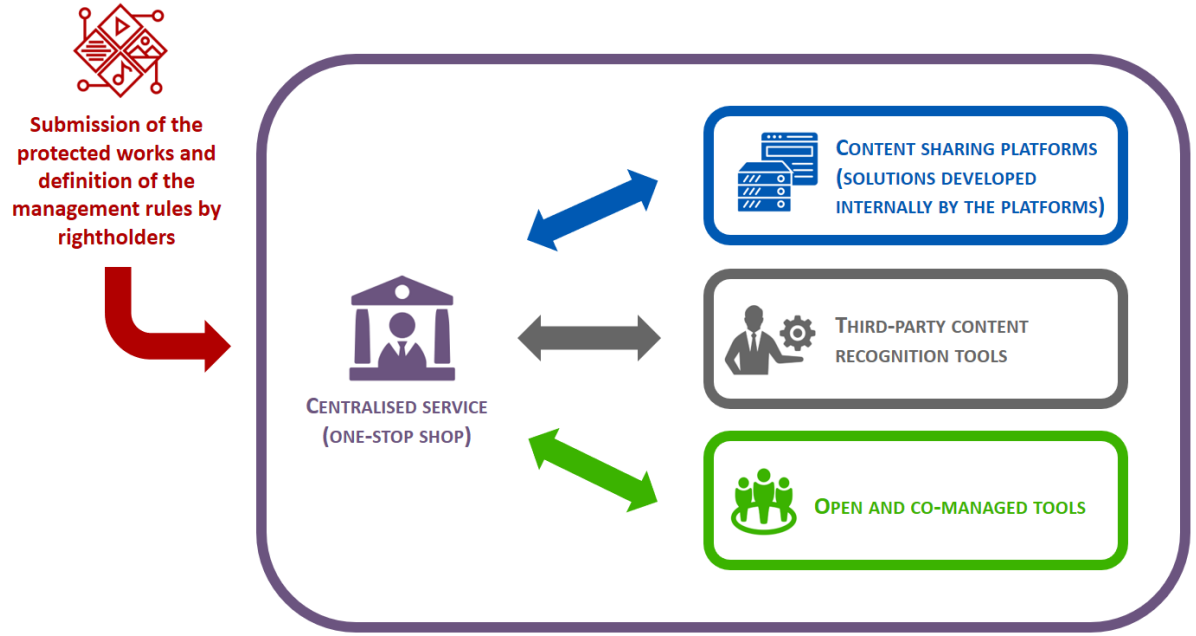
Open and co-managed tools



Example :

Qwant (project)

Centralised service provision



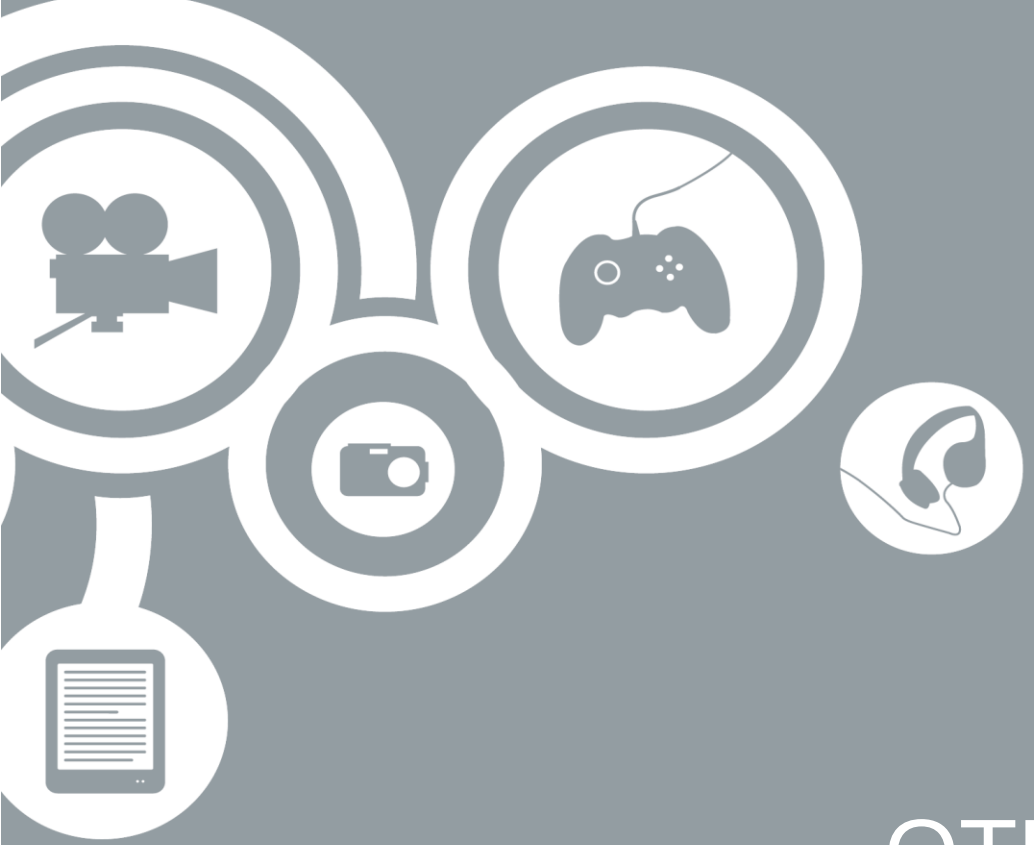
Examples :

ALPA – ASSOCIATION DE LUTTE CONTRE LA PIRATERIE AUDIOVISUELLE

GUICHET UNIQUE

Blue Efficience

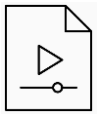
Le service d'empreinte universelle

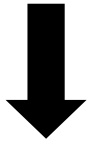


OTHER CONTENT RECOGNITION SOLUTIONS

OTHER EXISTING SOLUTIONS

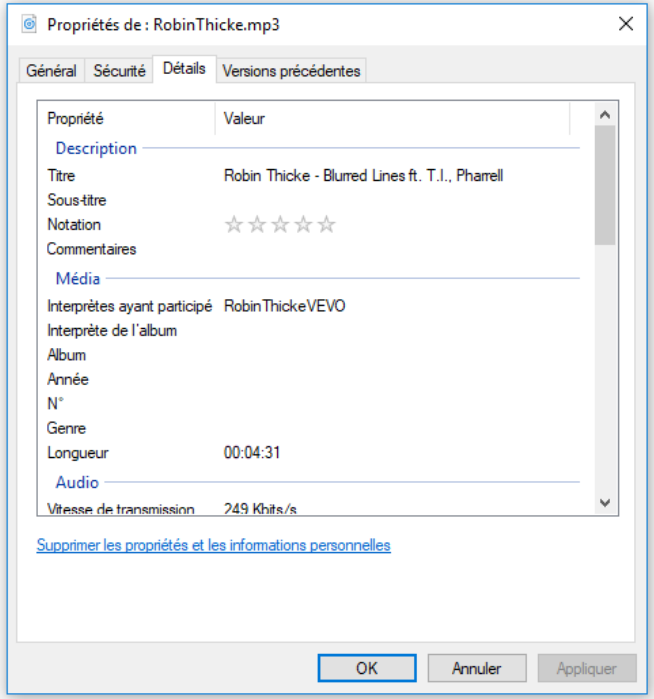
Hashing : to recognise easily identical files.





d1921aa0ca3c1146a01520c04e6caa9e

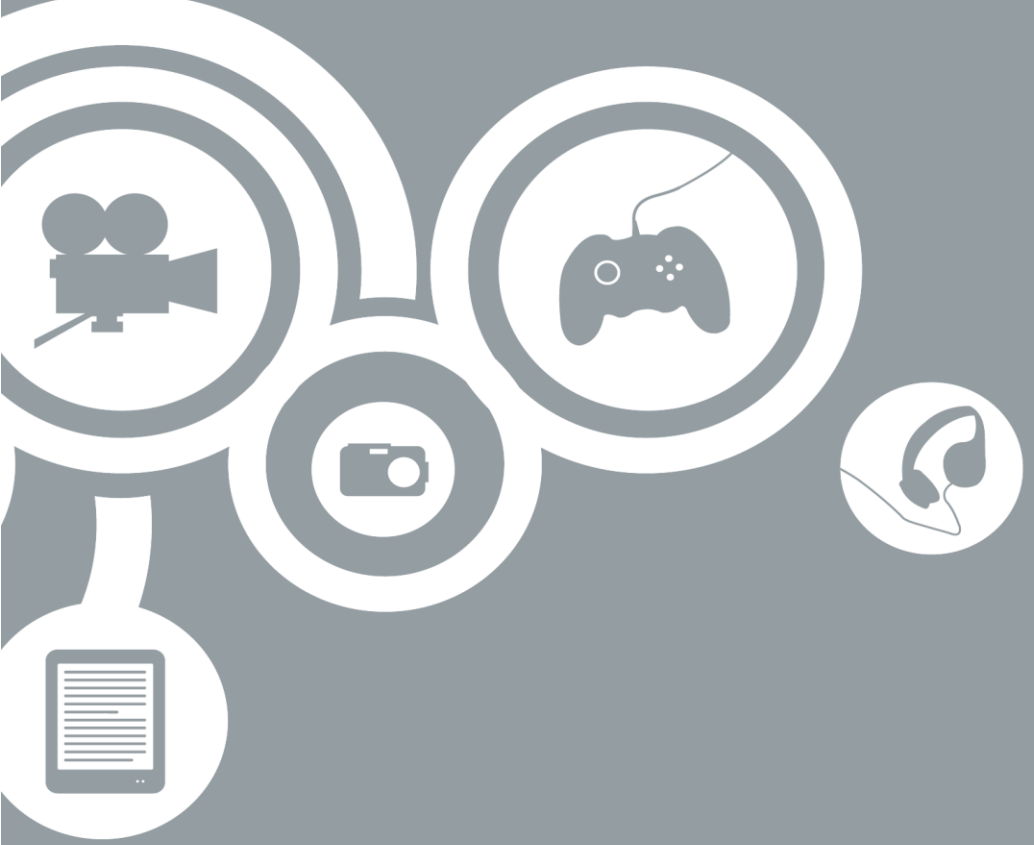
Metadata analysis : a basic but fragile method.



Digital watermarking: an interesting but still underused alternative.

User-ID **Network-ID**

Content-ID

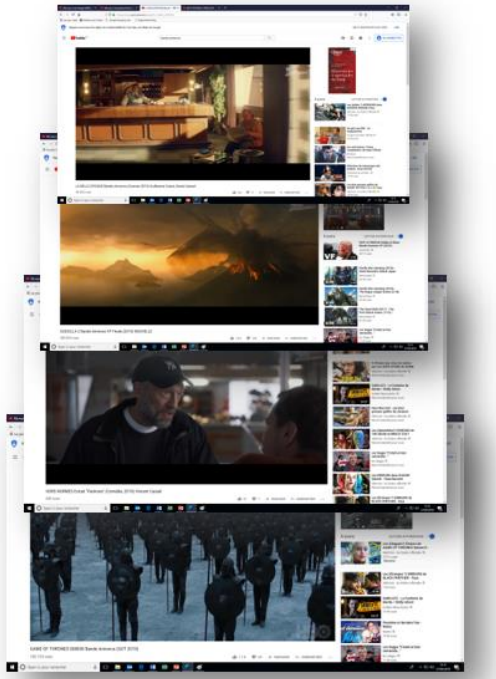


PROSPECTS AND COMPLEMENTARY OR ALTERNATIVE SOLUTIONS

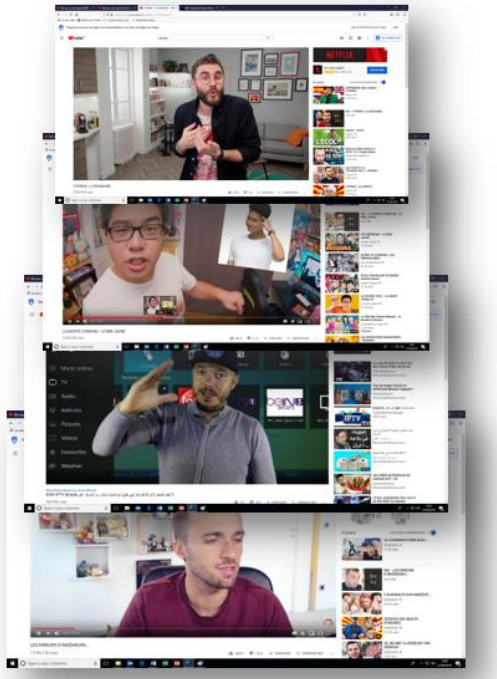
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

- Machine learning can help to improve current technologies. It can also help to recognise content types without requiring fingerprints but this technique has inherent limits and constraints.

Sport



Drama



"YouTubers"

AUTOMATED SPEECH RECOGNITION

- Already widely used by YouTube (at least for automated subtitling, as of today)

- Possible use: comparison of a video's transcribed audio track with a database of audiovisual copyrighted scripts.

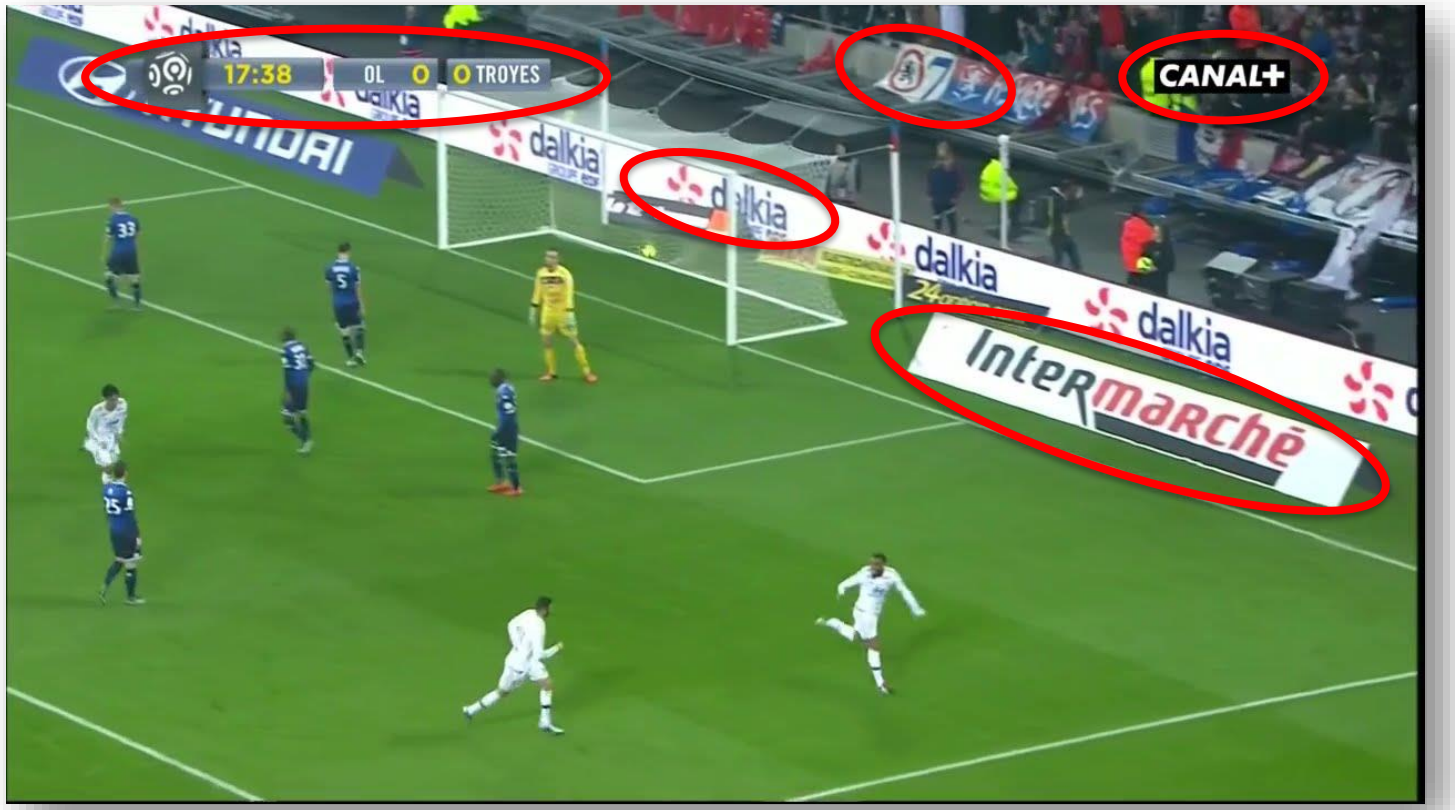
OPTICAL CHARACTER RECOGNITION

- Possible use: recognition of songs' lyrics on musical video clips or on karaoke videos.

Source : Twentieth Century Fox

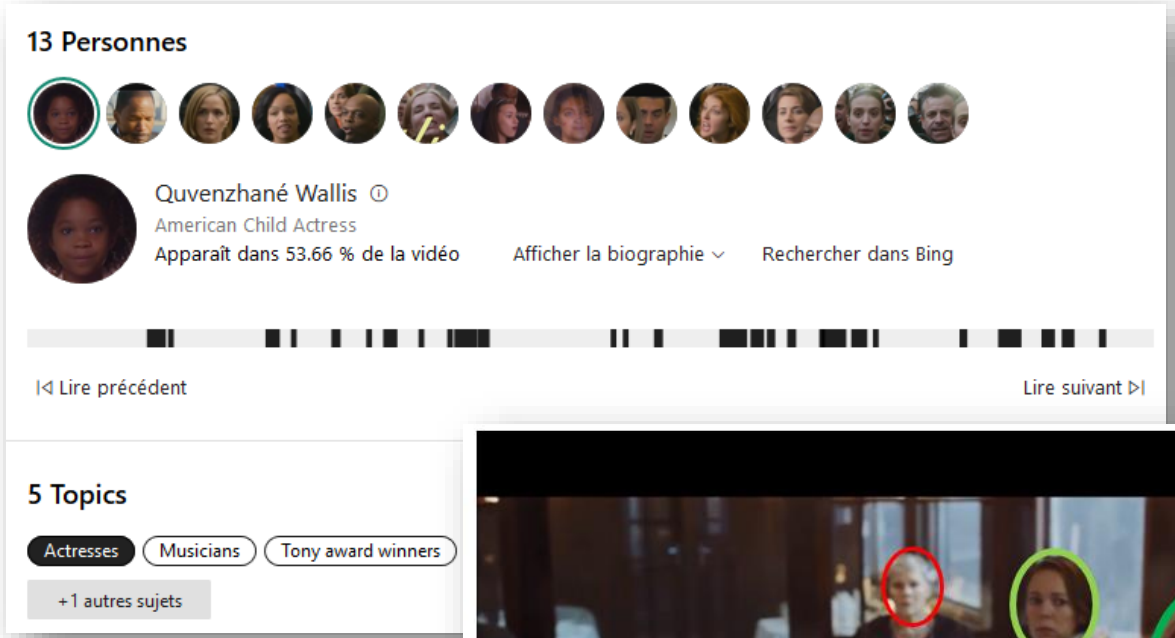
LOGO OR TRADEMARK RECOGNITION

- Possible use: recognition of specific TV channels programs or sports events.

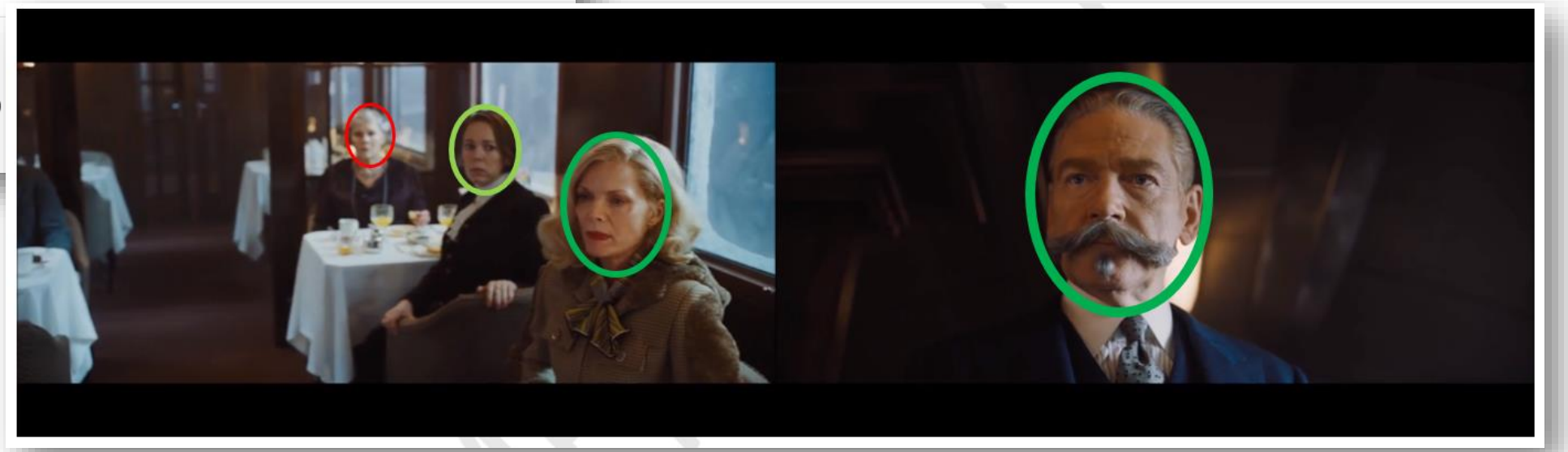


Source : Canal+

FACE OR CHARACTER RECOGNITION



- Possible use: recognition of actors (or sports players) appearing within a video, so as to compare identified persons with databases containing photographs and lists of casts.



Source : Twentieth Century Fox

COMPUTER VISION

- Possible use: description of scenes and situations, in connection with reference databases (synopsis, summaries, etc.)
- This technique is still experimental as of today, but already used by Facebook.

Mots clés

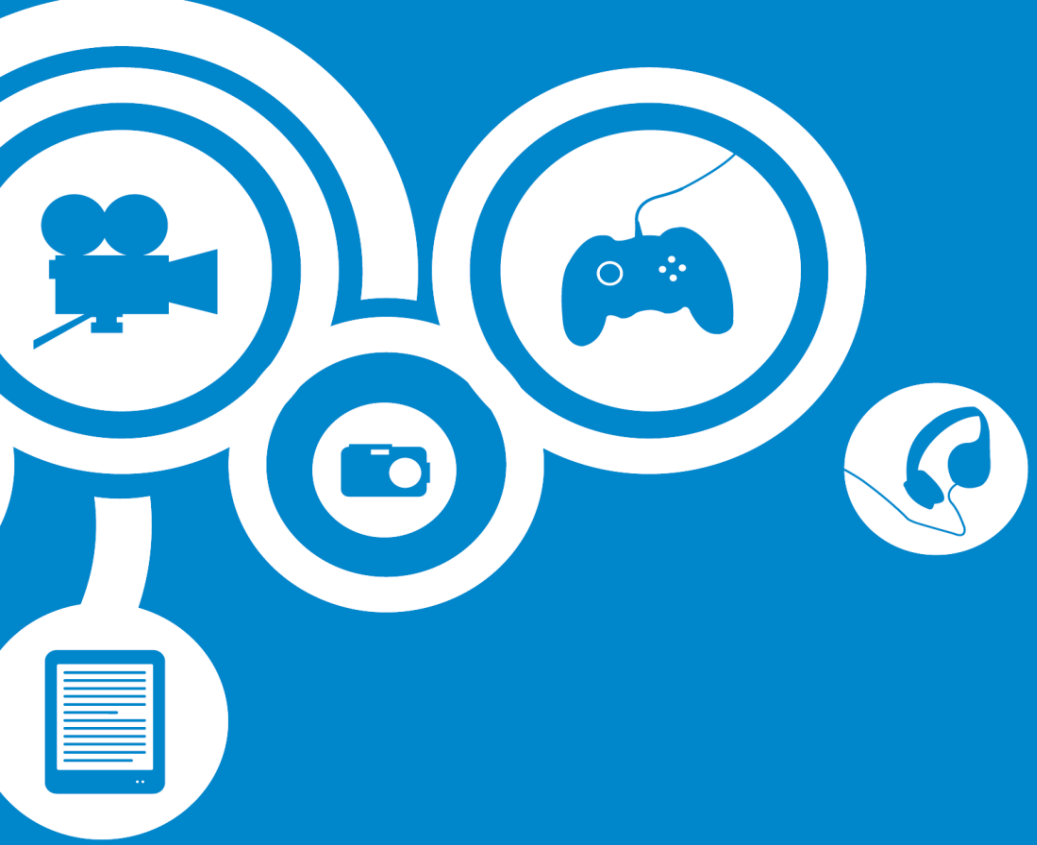
[{ "name": "sky", "confidence": 0.9992124 }, { "name": "tree", "confidence": 0.9959882 }, { "name": "flower", "confidence": 0.9929396 }, { "name": "statue", "confidence": 0.9907961 }, { "name": "outdoor", "confidence": 0.9896541 }, { "name": "sculpture", "confidence": 0.8675272 }, { "name": "plant", "confidence": 0.5808741 }, { "name": "building", "confidence": 0.550438941 }, { "name": "garden", "confidence": 0.509021 }, { "name": "square", "confidence": 0.15288505 }, { "name": "crowd", "confidence": 0.00515389629 }]

Description

{ "tags": ["flower", "outdoor", "building", "garden", "large", "front", "sitting", "tower", "clock", "middle", "standing", "light", "bushes", "statue", "white", "table", "green", "field", "street", "park", "vase", "city", "tree", "people", "tall", "display", "wedding", "group"], "captions": [{ "text": "a close up of a flower garden in front of Palais-Royal",

IN THE LONG TERM

- Description and analysis of actions and dialogues (called « story analysis » or « action analysis »).
- Plagiarism, reappropriation and resemblance detection.
- Multiformat content recognition (example : texte v. video, etc.)



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