

# Detection of comic characters in comic books and manga

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( research stay in IMP group until November 7<sup>th</sup> )

# Presentation

## Advisers

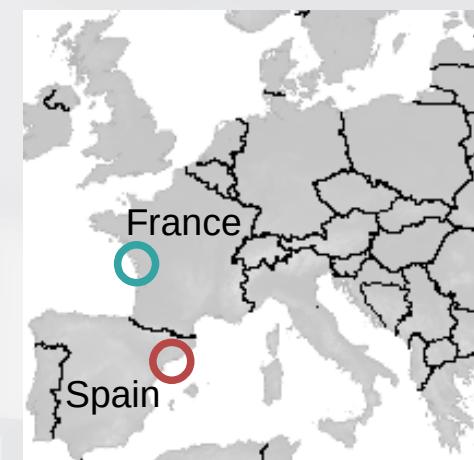
- Jean-Christophe Burie & Jean-Marc Ogier (L3i, La Rochelle, France)
- Dimosthenis Karatzas (CVC, Barcelona, Spain)

## eBDtheque project

- **Comic book** image processing and understanding
- **Cultural heritage** in many countries
- **Paper ↔ digital** comic book conversion enhancement
- New usages using the **new technologies**

## Applications

- Text/image search, augmented reading, reflowing...



# What researchers can do for the paper to digital transition?





Image credits: contributors of the eBDtheque dataset

# Scene understanding

Balloon classification

## Layout analysis



## Panel retrieval



## Reflowing

Researchers

## De-hyphenation



## Speech synthesis

Pose retrieval

## Language analysis

# PANELS



## Translation assistance



Speaker localization



Text timestamps



Tone and pitch



Relationship retrieval



Facial expression



Character localization and recognition

Scene understanding

Balloon classification

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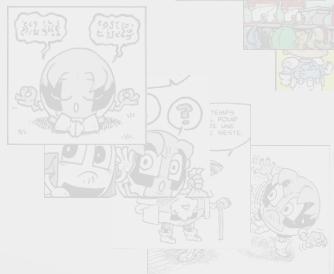
Translation assistance

Character localization and recognition

Scene understanding



Layout analysis



Panel retrieval



Reflowing



De-hyphenation



Speech synthesis



Language analysis



Translation assistance



Balloon classification



Speaker localization



Text timestamps



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Facial expression



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Character localization and recognition

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# CHARACTERS

Panel retrieval

Text timestamps

Reflowing

Tone and pitch

De-hyphenation

Pose retrieval

Speech synthesis

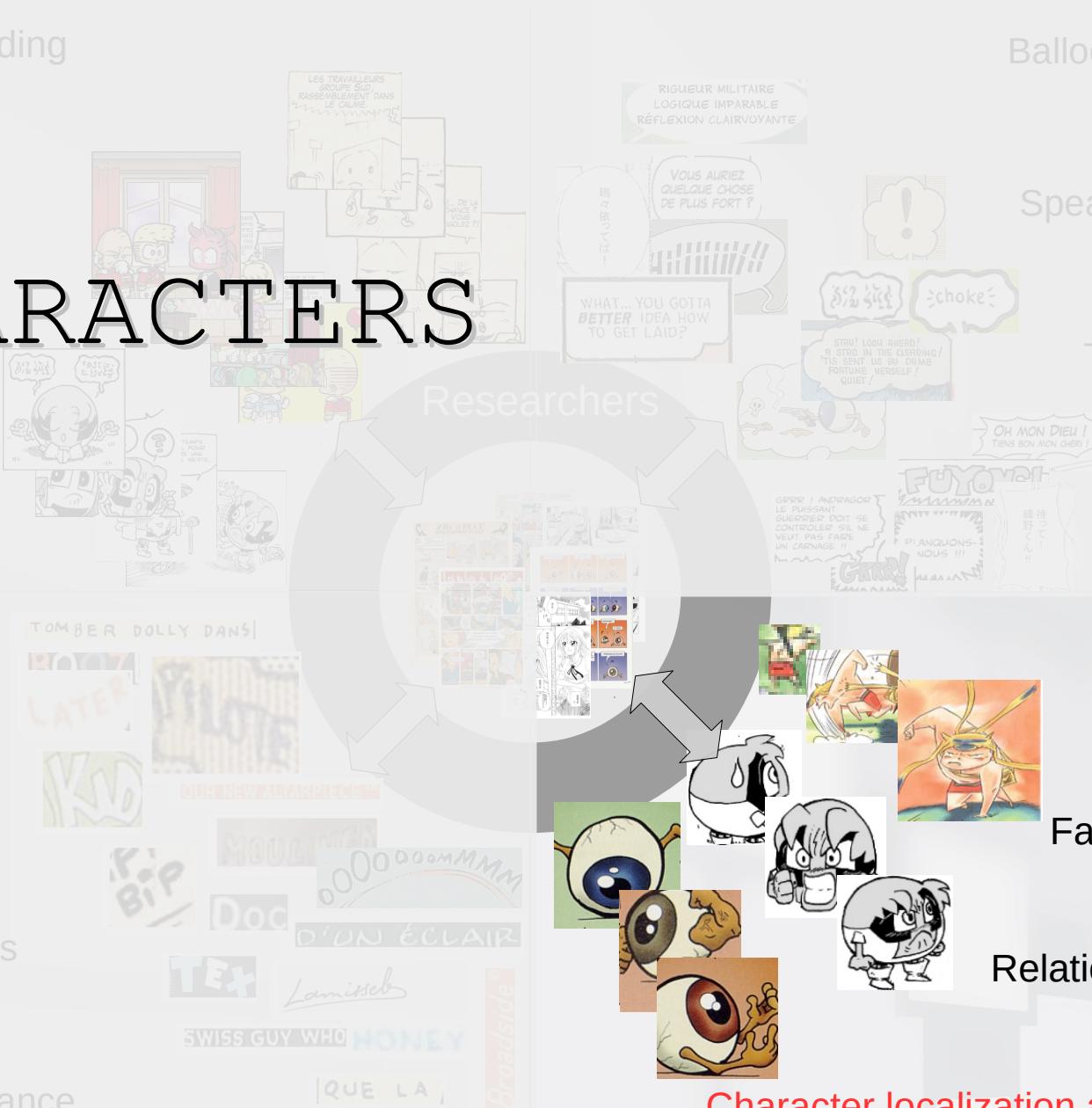
Facial expression

Language analysis

Relationship retrieval

Translation assistance

Character localization and recognition



# Challenges of comics analysis

- Variation of **comic book styles**
- **Printing & scanning** method changes over time (press, ink-jet, computer-based)
- **Diversity of information** to extract
- A lot of **semantic relations** to retrieve (element's relationships, text meaning)

# Summary of comic character extraction

- Supervised approaches
  - Character **spotting** given an example
- Unsupervised approaches
  - Hypothesis from speech **balloon tail** position and orientation
  - Region of interest from simple **object removal**
  - **Graph-based approach** (Nam)

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# Character spotting given an example [5]

- Aim: retrieve all the instances (apparitions) of a given character in all the pages of a comic book title/album/collection
- Method summary:
  - 1) Reduction of the number of colors
  - 2) Get the colors of the query example (user interaction)
  - 3) Compute the user query descriptor
  - 4) Spot similar character instances

[5] C. Rigaud, D. Karatzas, J-C Burie, J-M Ogier Color descriptor for content-based drawing retrieval DAS'14

# 1) Color reduction/quantization

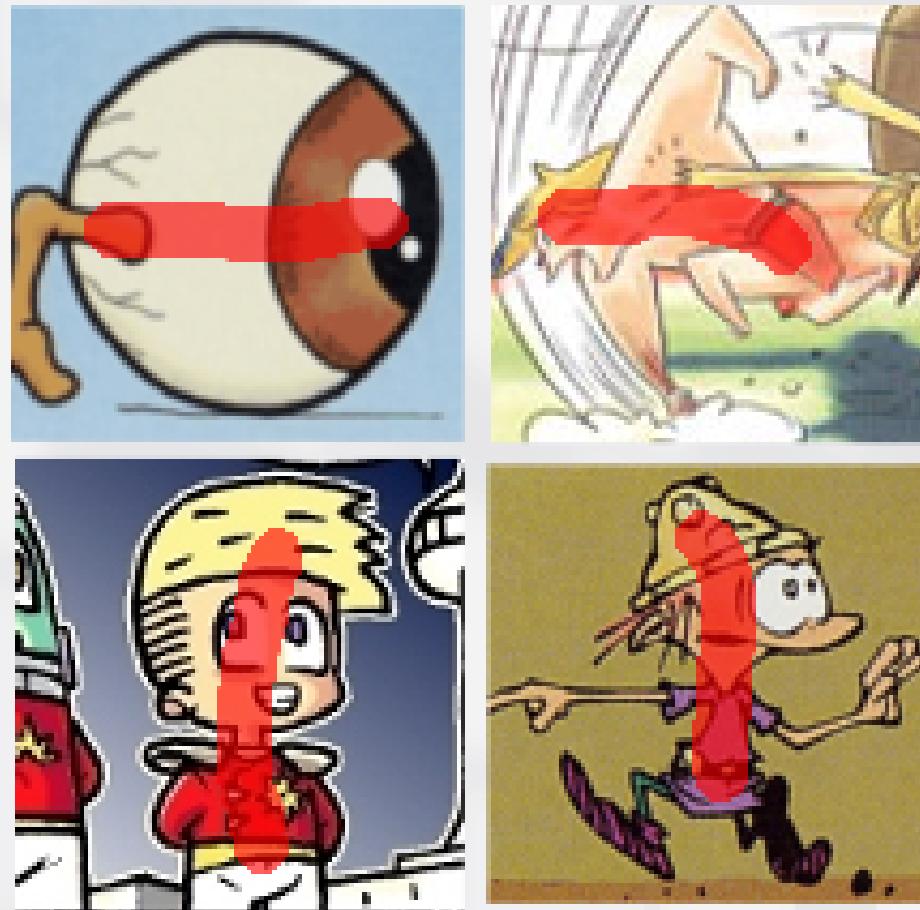


N>10000

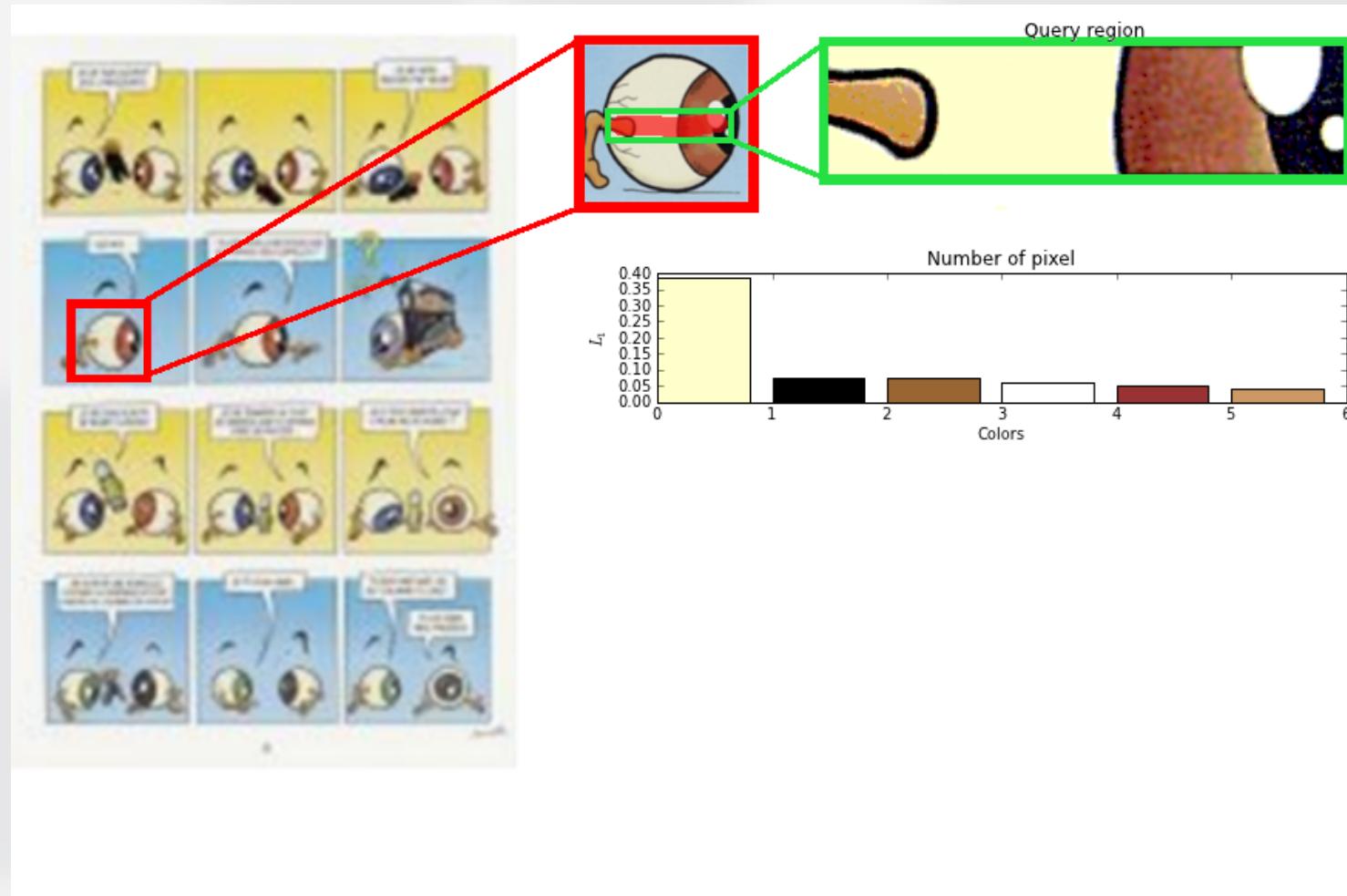
N=256

N=32

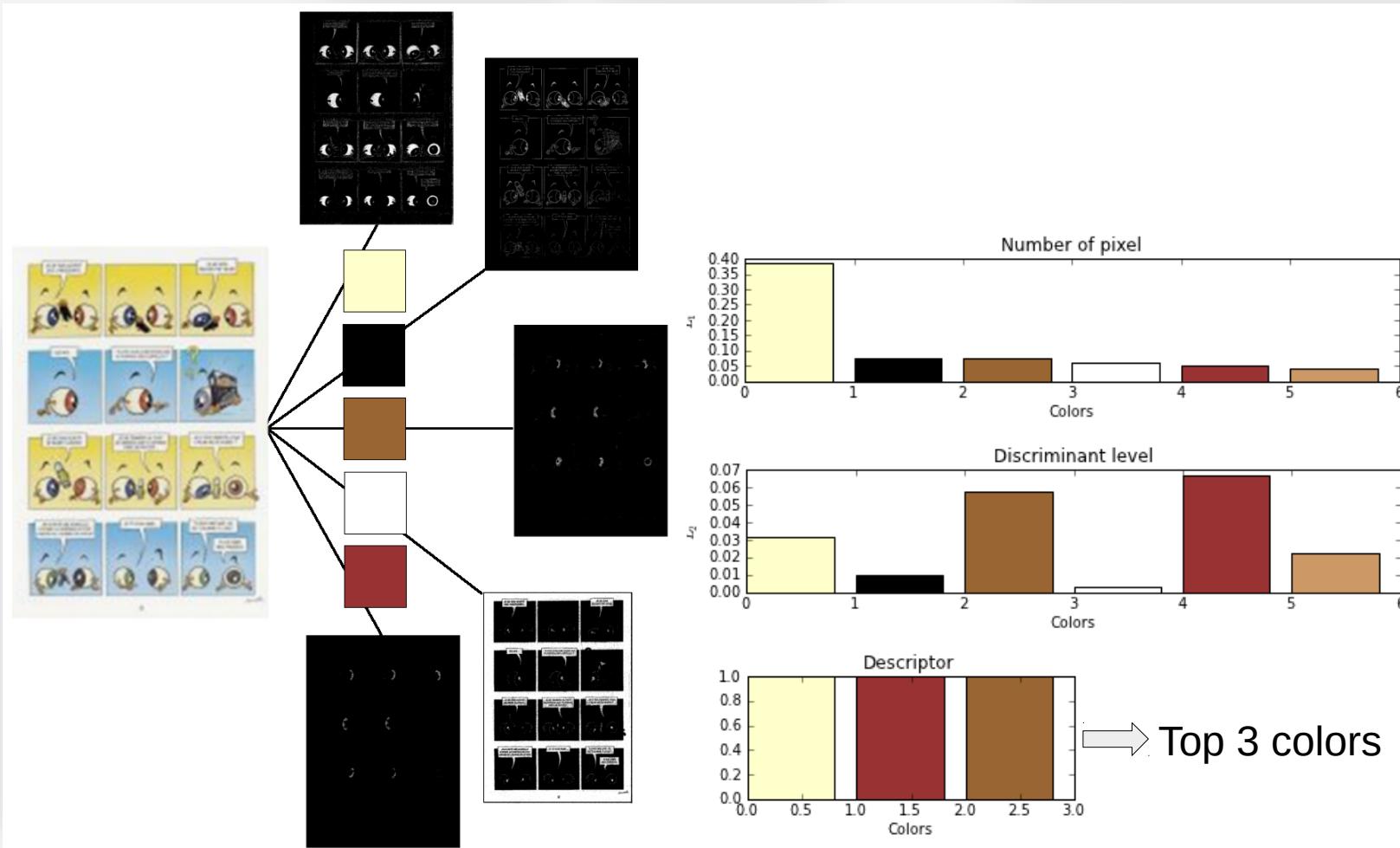
## 2) User query



### 3) Color selection: occurrence level



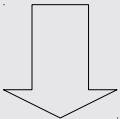
### 3) Color selection: occurrence + discriminability levels



## 4) Character spotting: example



User input

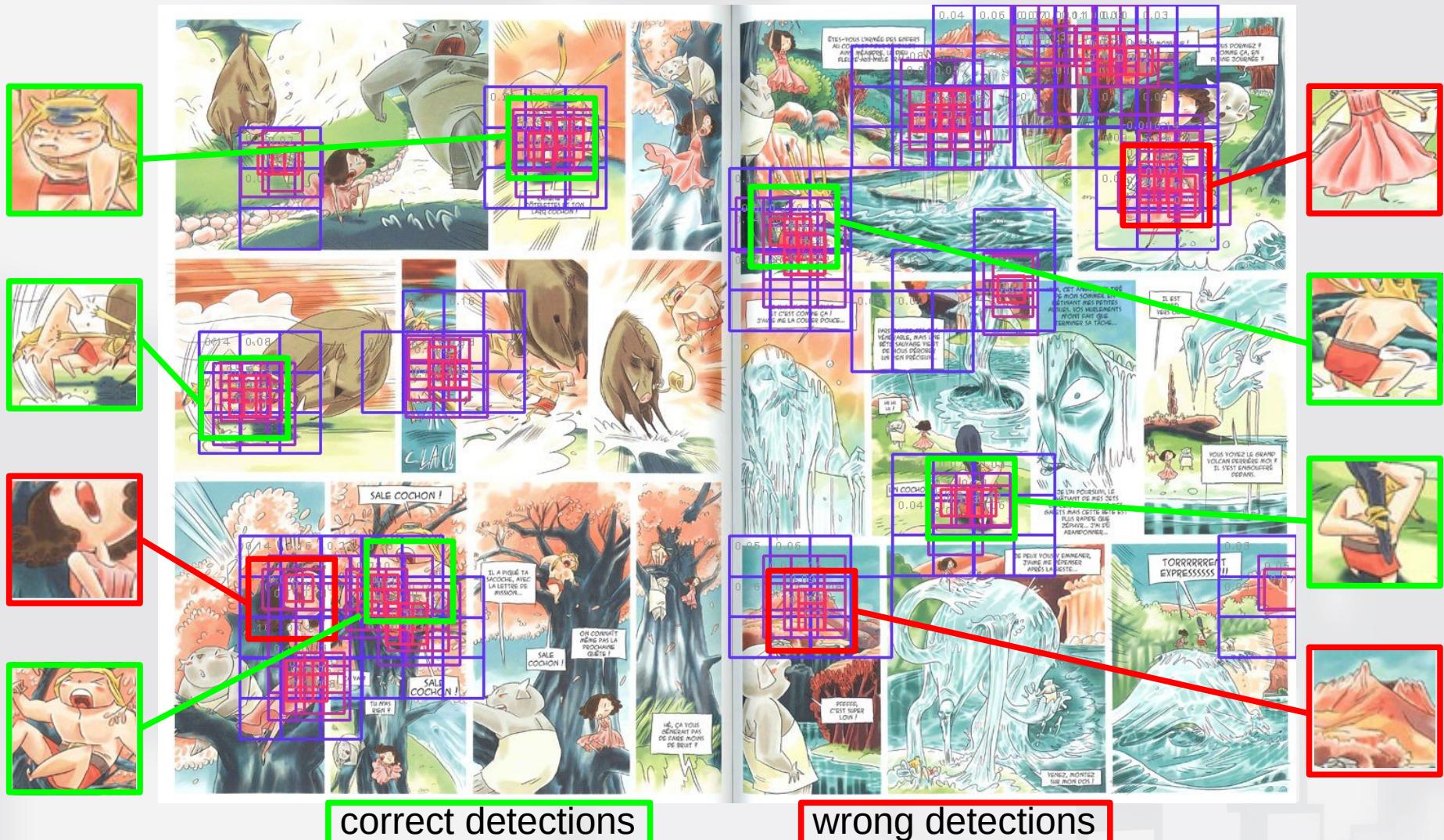


Descriptor



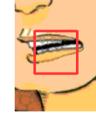
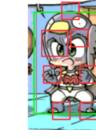
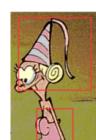
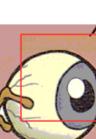
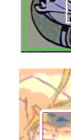
Image credits: (Prunelle, la fille du cyclope, Ankama, 2010)

## 4) Character spotting: example



# Conclusions

- Contributions
  - Content Based Drawing Retrieval
  - Color descriptor robust to scale, rotation, translation, deformation and occlusion
  - Benefit of redundant information
- Limitations
  - Colored comics
  - Number of color (quantization)
  - Requires one example of each character

Query	Correct	Wrong
		
		
		
		
		
		

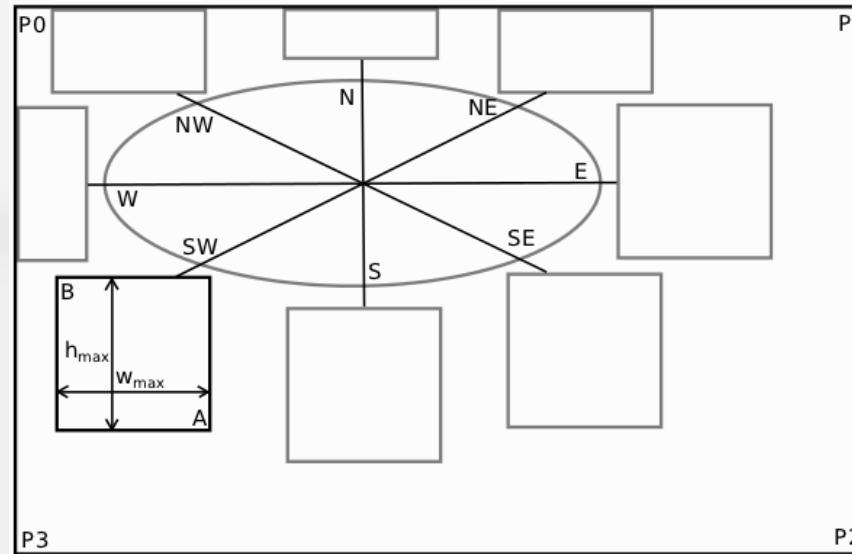
Result examples

# Summary of comic character extraction

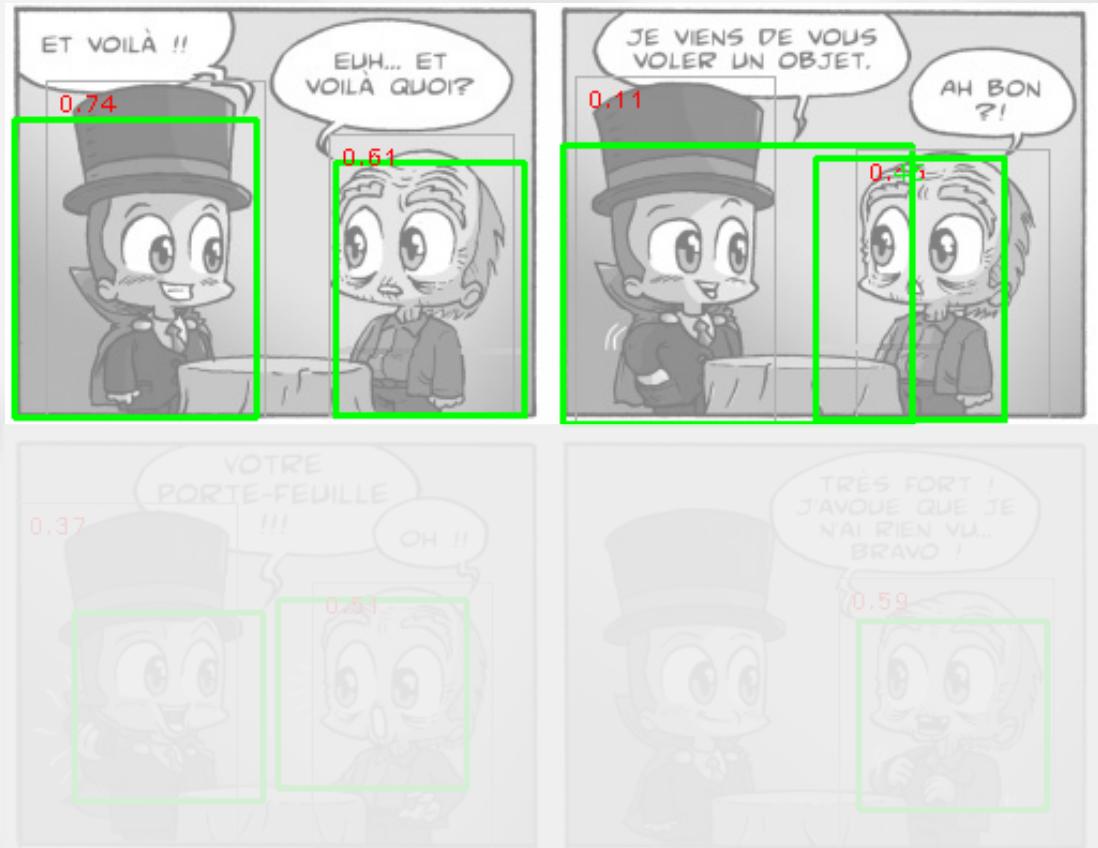
- Supervised approaches
  - Character spotting given an example
- Unsupervised approaches
  - Hypothesis from speech balloon tail position and orientation
  - Region of interest from simple object removal
  - Graph-based approach (Nam)

# Hypothesis from speech balloon tail position and direction

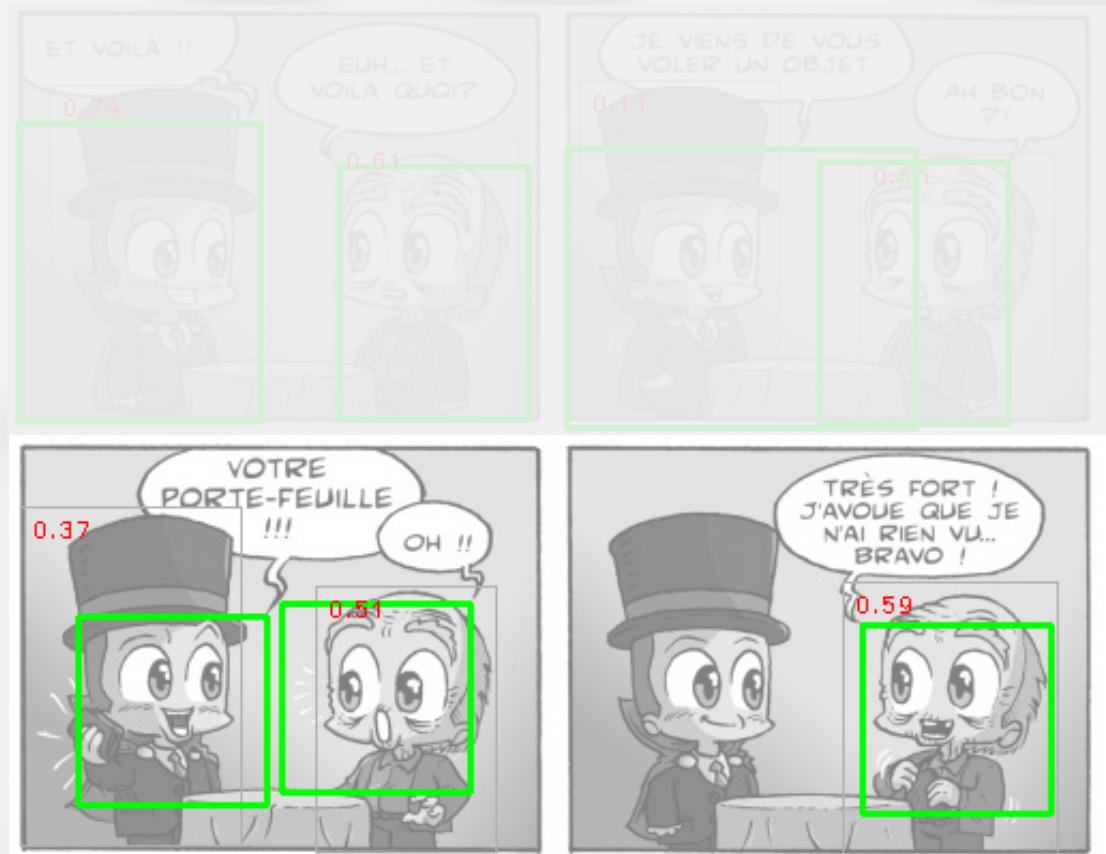
- Given balloons in a panel, where are the (speaking) characters?



# Example



# Example



# Conclusions

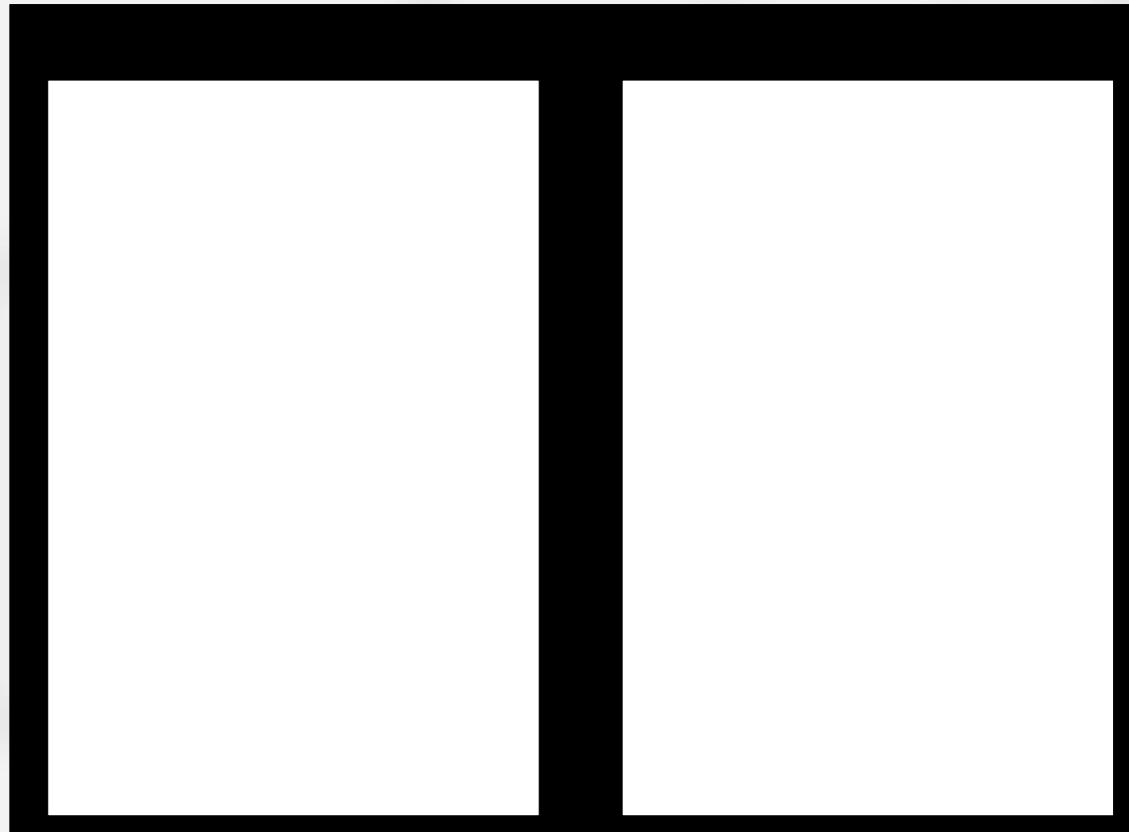
- Preliminary results
- Highly relies on the quality of the **tail** detection
- Only for “**speaking**” characters  
(others can be spotted)
- Implicitly retrieves the  
**relationship** between balloon and  
character

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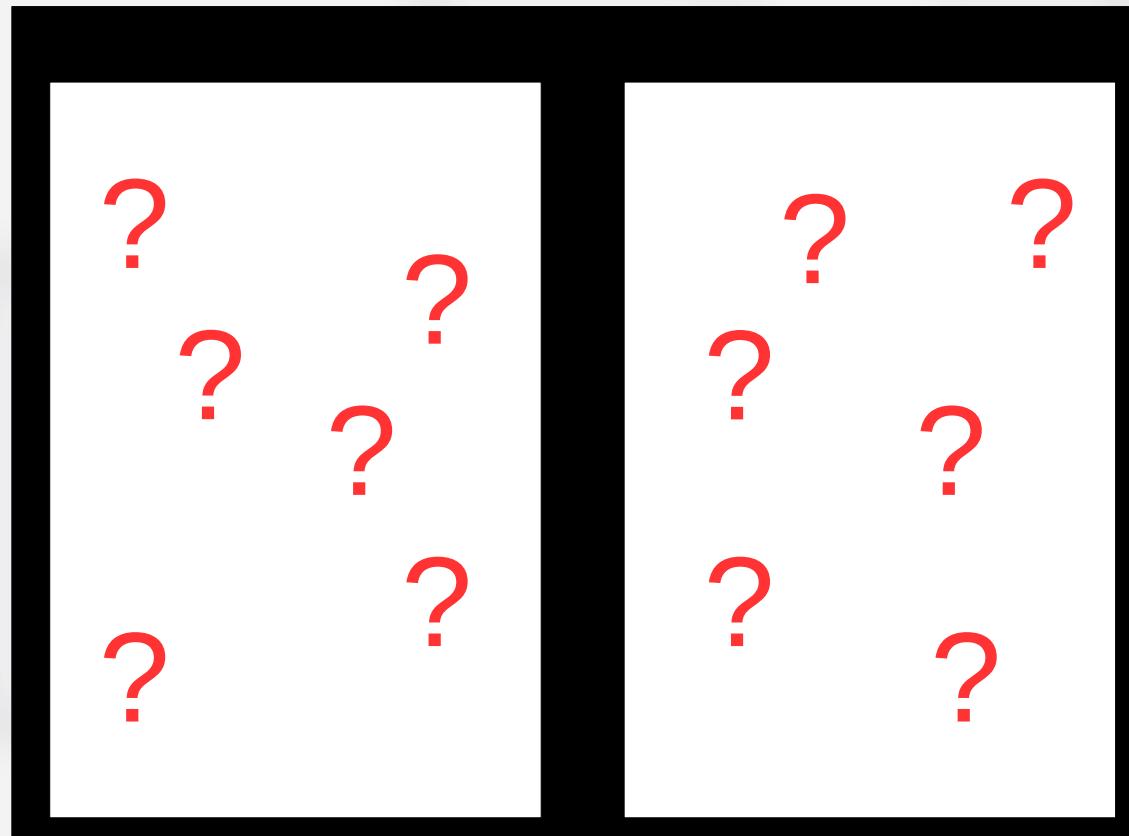
# Region of interest (ROI) from simple object removal

- Given an image from a double page of manga, can you predict where the characters are?



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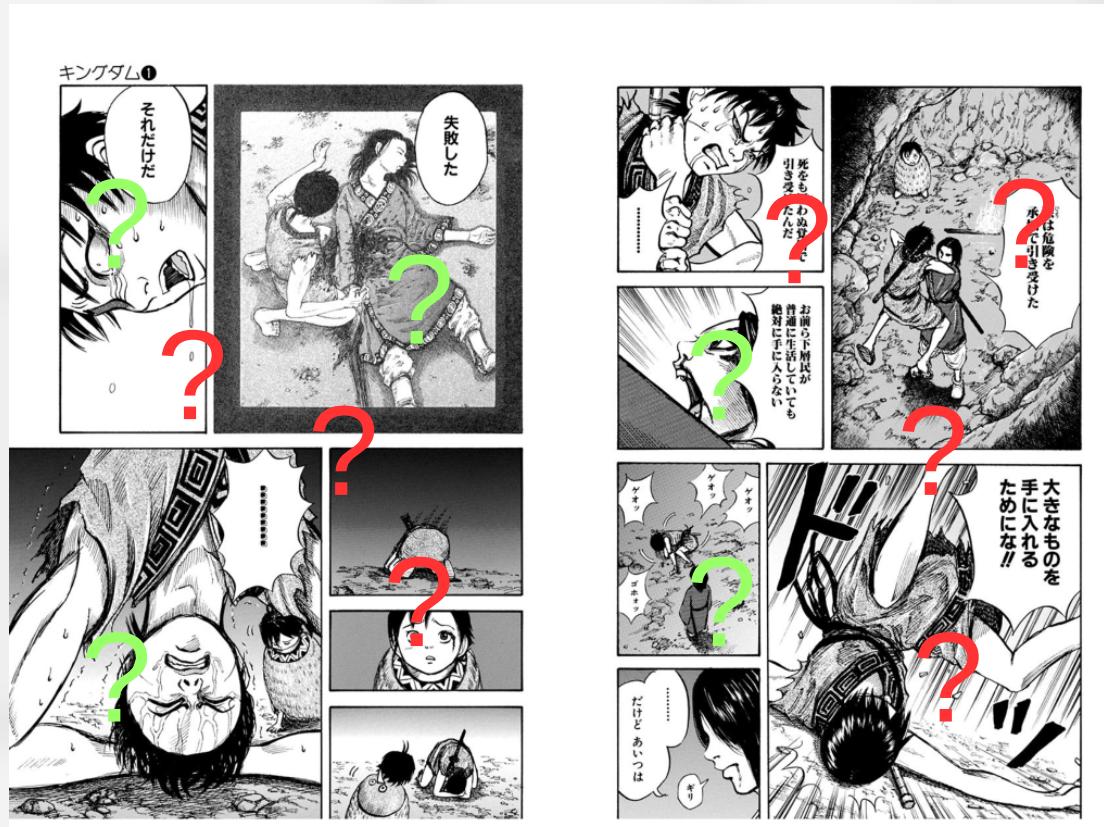
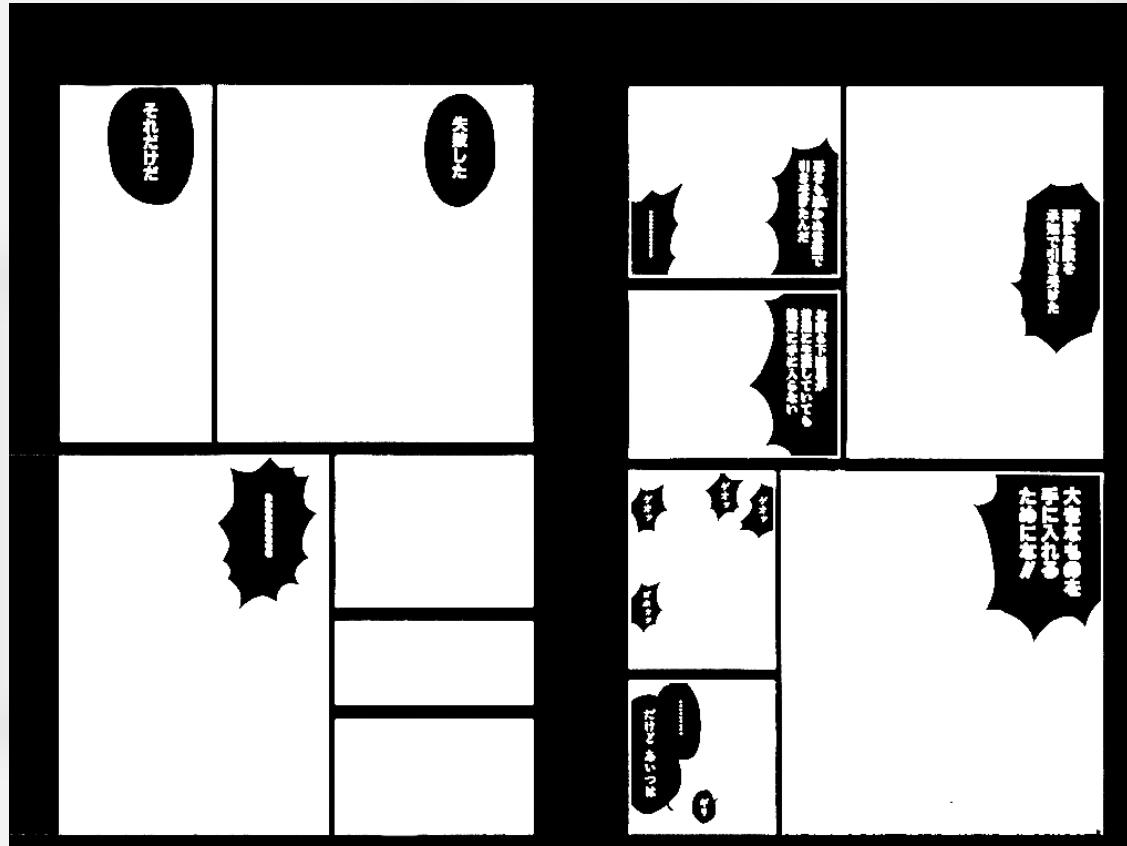


Image credits: Yasuhisa Hara, "Kingdom", Shueisha, since 2006.

42%  
correct

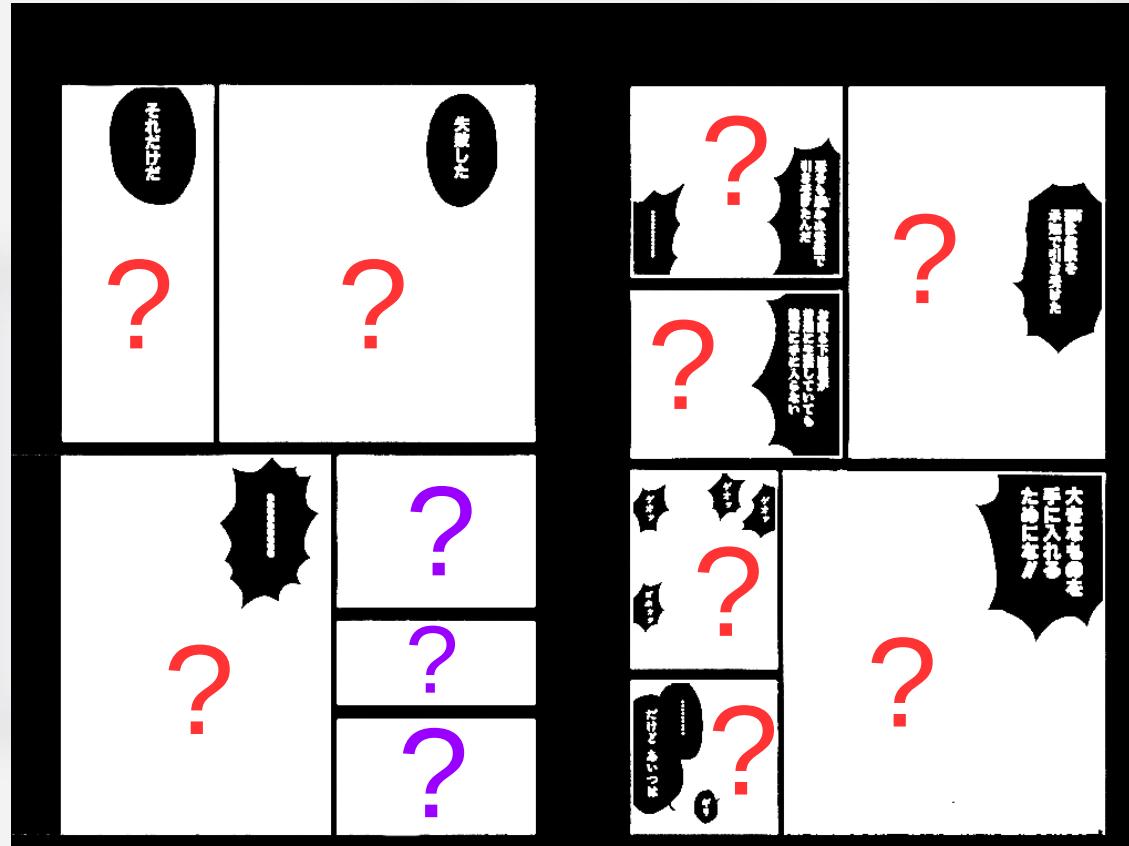
# Region of interest (ROI) from simple object removal

- In the same image, knowing the **position of panels and balloons**, can you predict where the comic characters are?



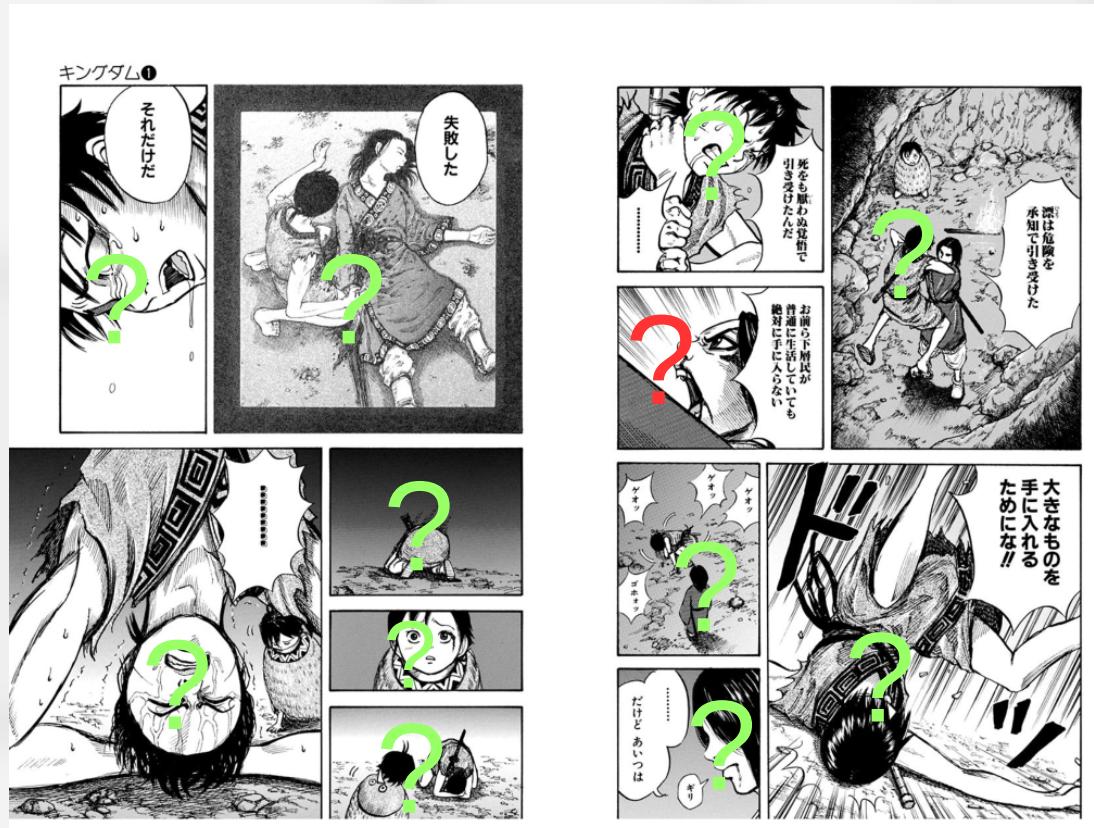
# Region of interest (ROI) from simple object removal

- Knowing the position of **panels** and **balloons**, can you predict where the comic characters are?



# Region of interest (ROI) from simple object removal

- Et voilà !

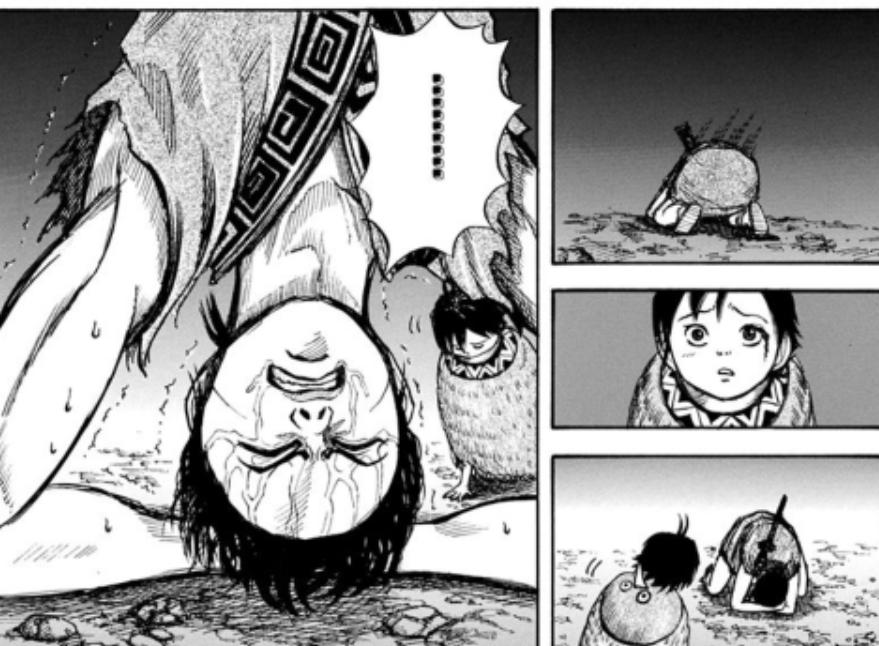


83%  
correct

# A first test from automatic panels and balloons extraction...

# Original image

キングダム①

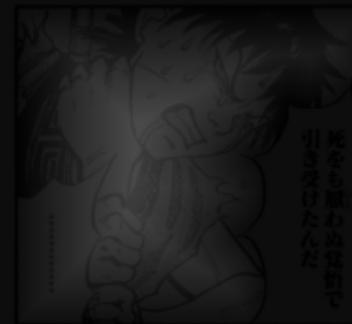
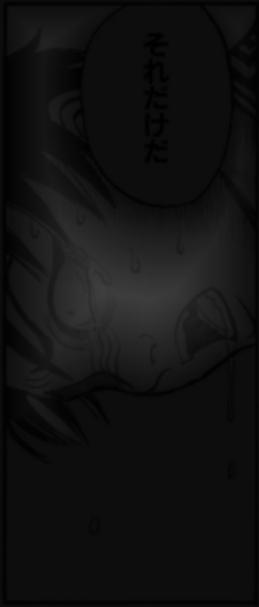


# Image masked



# Image masked + distance transform

キングダム①

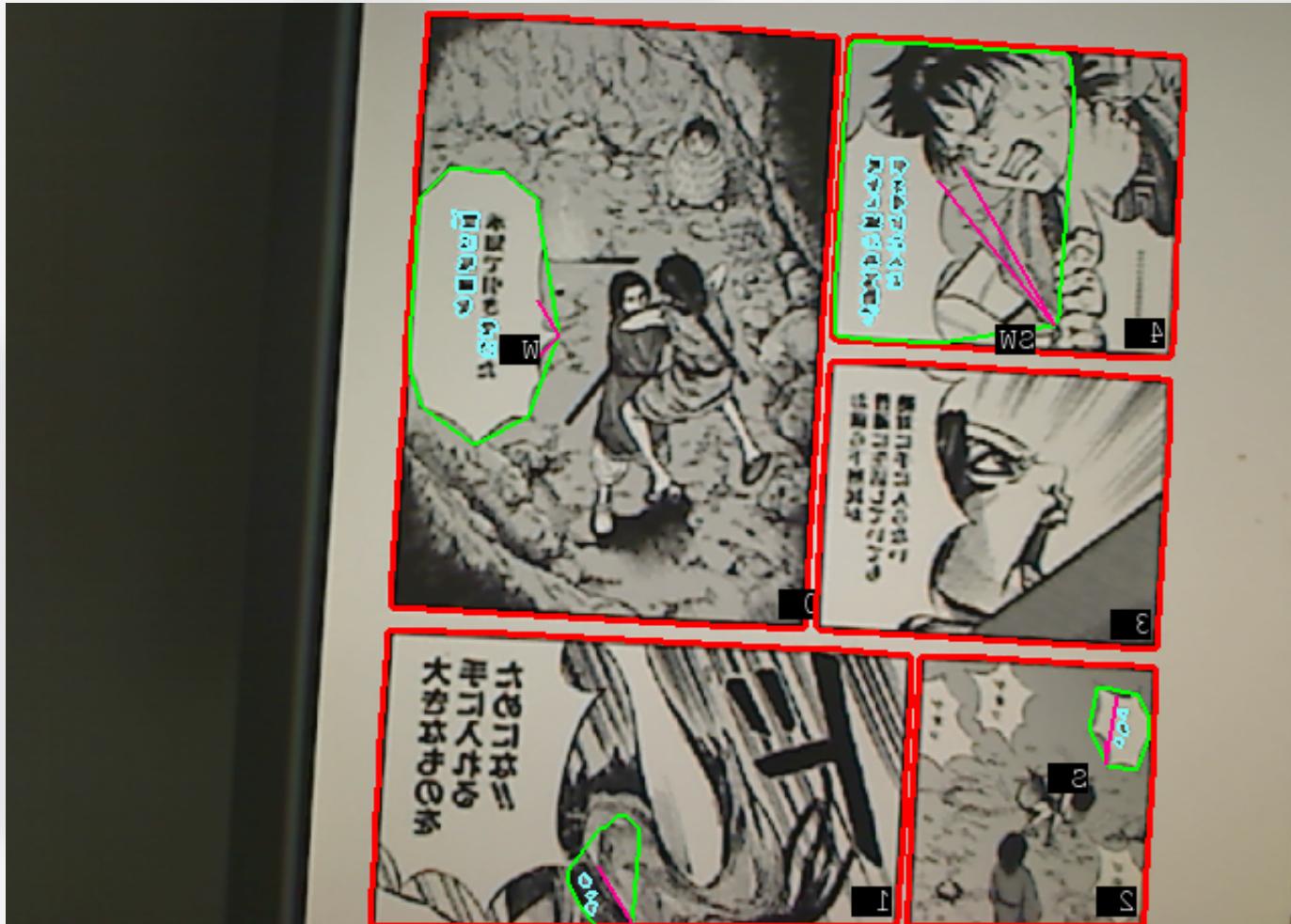


# To be continued...

# Graph-based approach

- Presented by Nam Le Thanh

# Live demo: real time panels and balloons extraction



ありがとうございました  
*Thank You Very Much*

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[https://github.com/crigaud/publication/tree/master/2014/TALK/intelligent\\_media\\_processing\\_group](https://github.com/crigaud/publication/tree/master/2014/TALK/intelligent_media_processing_group)