

# Competition results

ICDAR 2021 Competition on Historical Map Segmentation

ICDAR 2021  
Competition on

Historical Map Segmentation

Official website

<https://icdar21-mapseg.github.io>



# Organised by



French engineering school in computer science



French national mapping agency



French graduate schools of social sciences

*Everything is available here*

*Flash me!*



# Focused on a series of Paris Atlases (1860's-1940's)

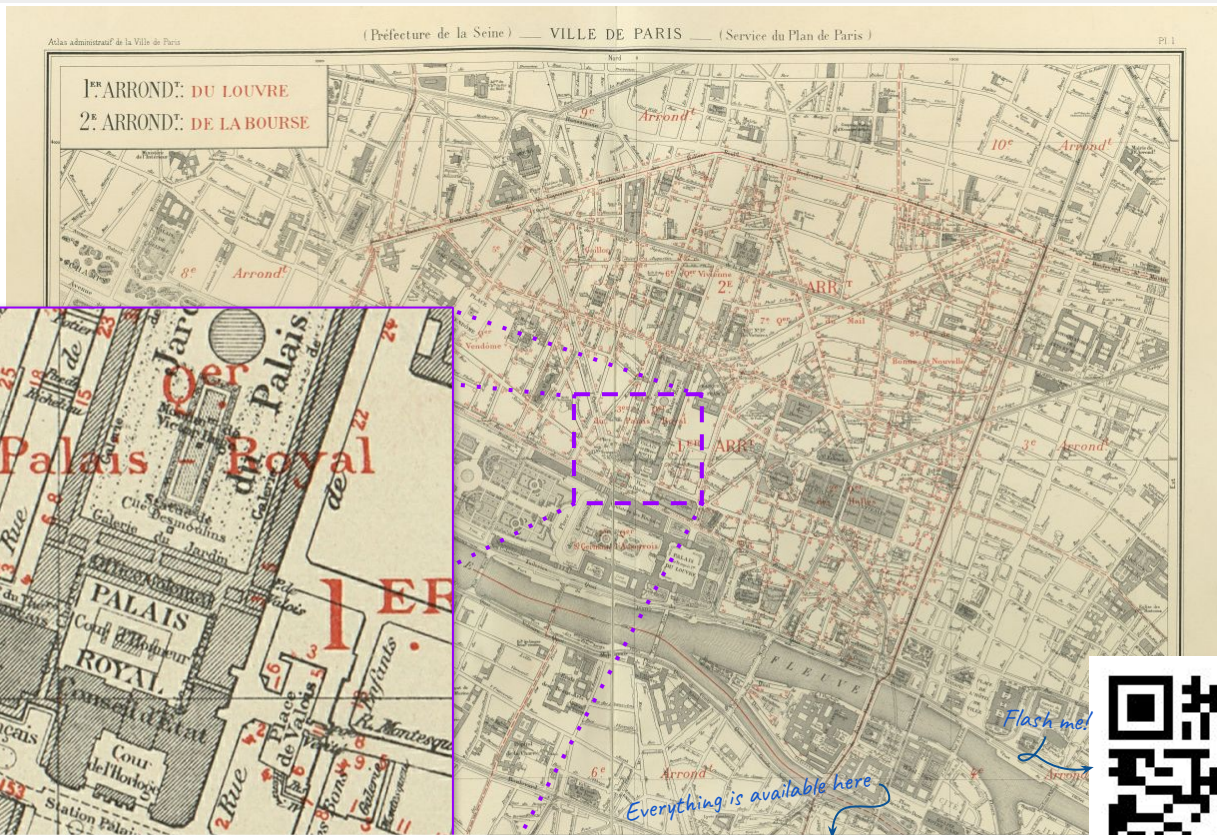
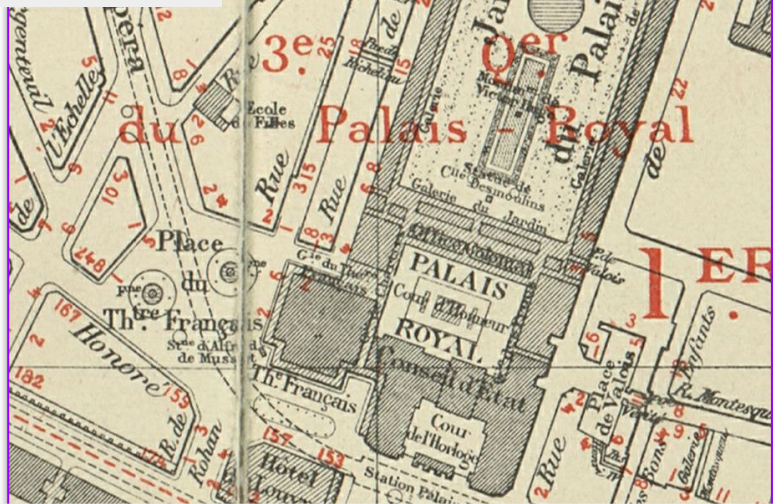
Sample sheet (1925)

11136 x 7711 px



Detail

1 px  $\approx$  45 cm

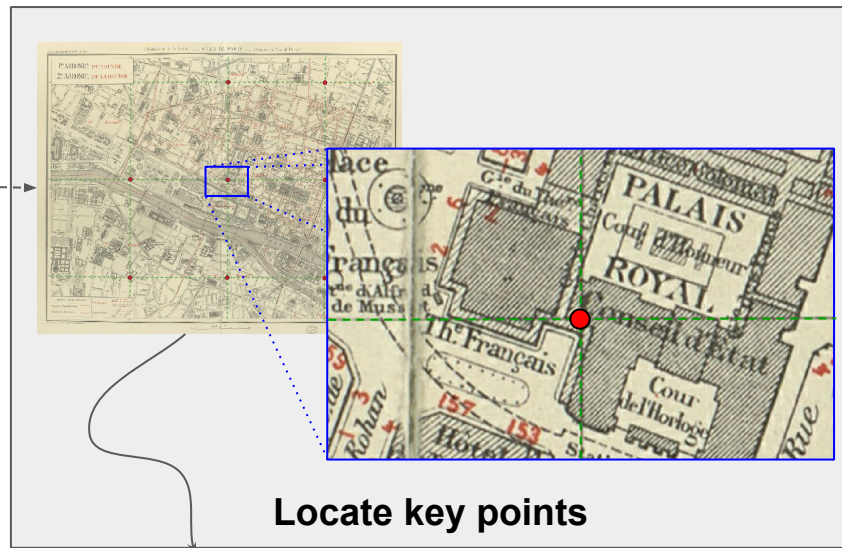
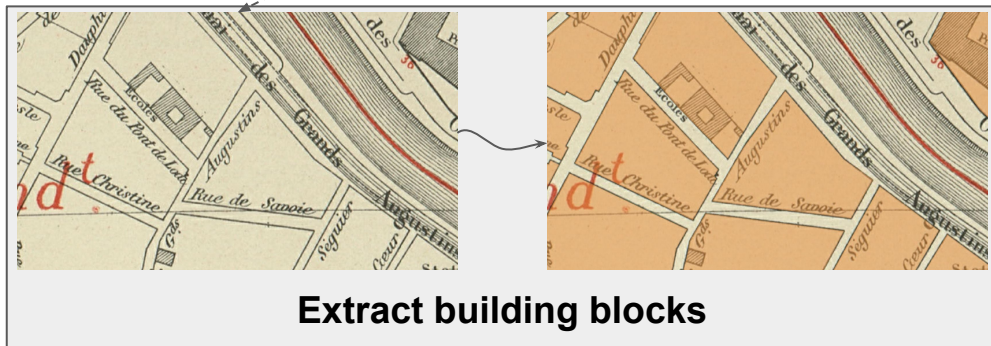
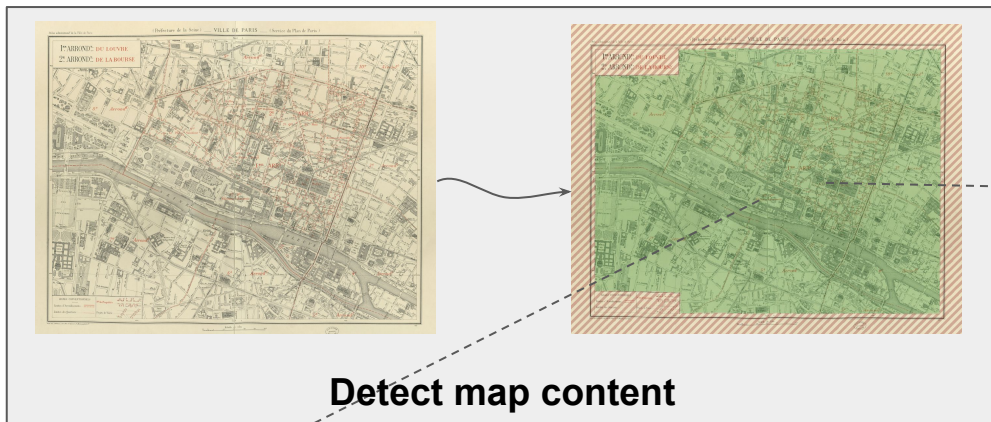


Everything is available here

Flash mol



# Motivated by the need to digitize historical maps

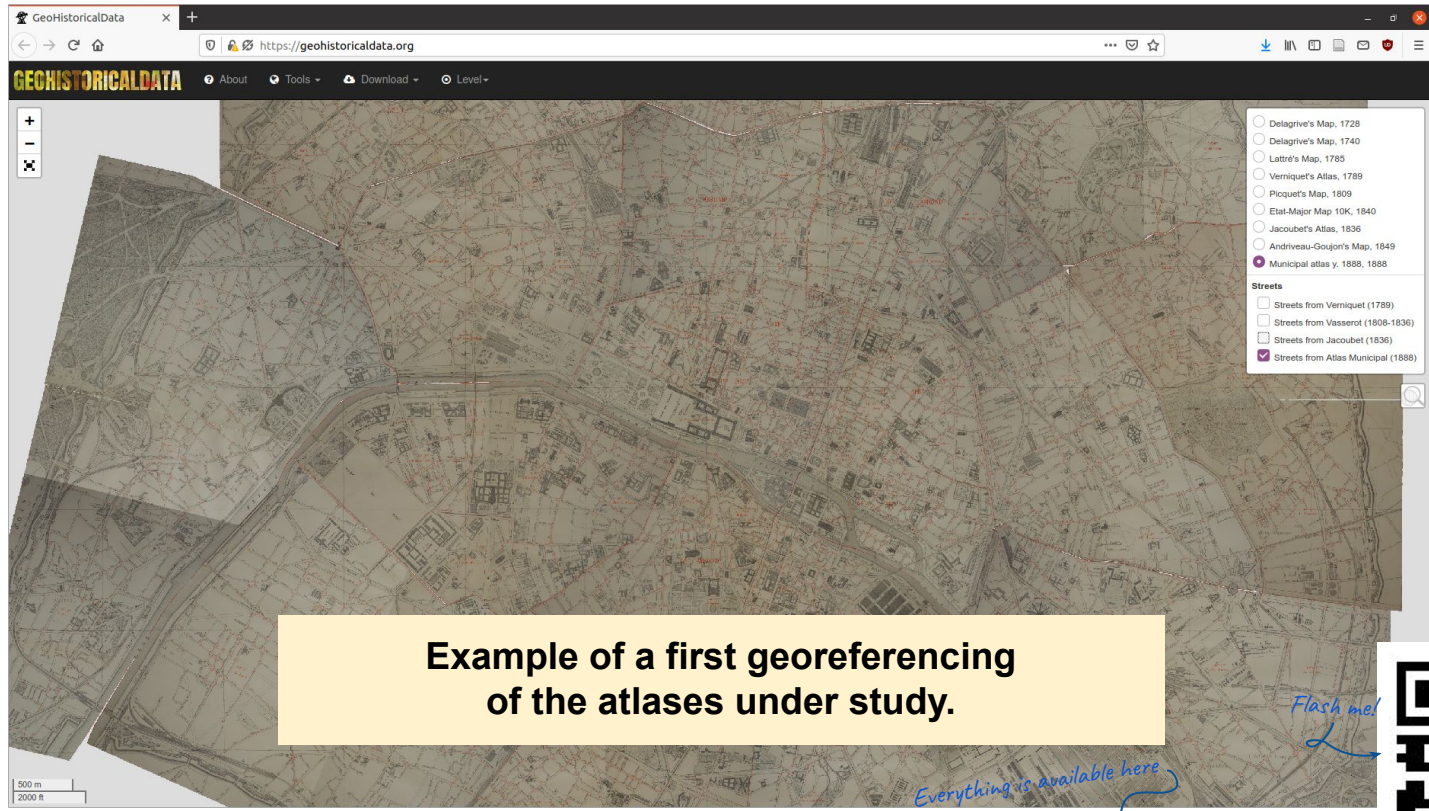


Everything is available here

Flash me!



# Motivated by the need to digitize historical maps



# Participants

**CMM Team** — *Center for Mathematical Morphology, Mines ParisTech, PSL Research University, France*

<http://smil.cmm.minesparis.psl.eu> - <https://github.com/MinesParis-MorphoMath>

**IRISA Team** — *IRISA/Université Rennes 2, Rennes, France*

<http://www.irisa.fr/intuidoc/>

**L3IRIS Team** — *L3i, University of La Rochelle, France; Liris, INSA-Lyon, France*

<https://gitlab.univ-lr.fr/nnguye02/weakbiseq>

**UWB Team** — *University of West Bohemia, Univerzita, Pilsen, Czech Republic*

[https://gitlab.kiv.zcu.cz/balounj/21\\_icdar\\_mapseg\\_competition](https://gitlab.kiv.zcu.cz/balounj/21_icdar_mapseg_competition)

**WWU Team** — *Münster University, Germany*

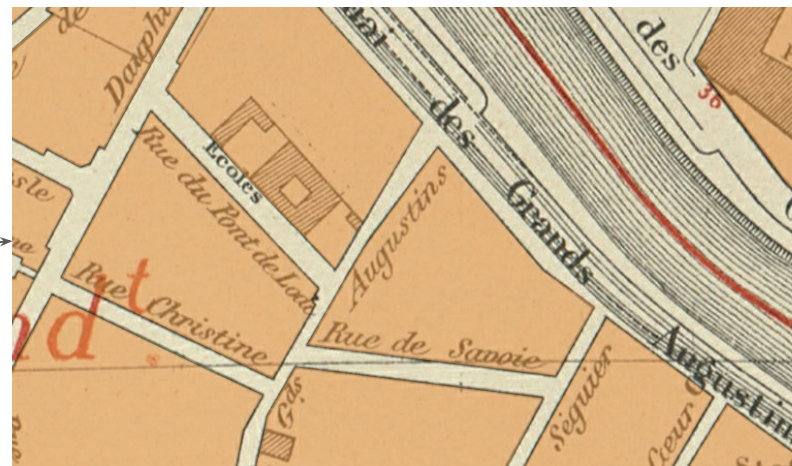
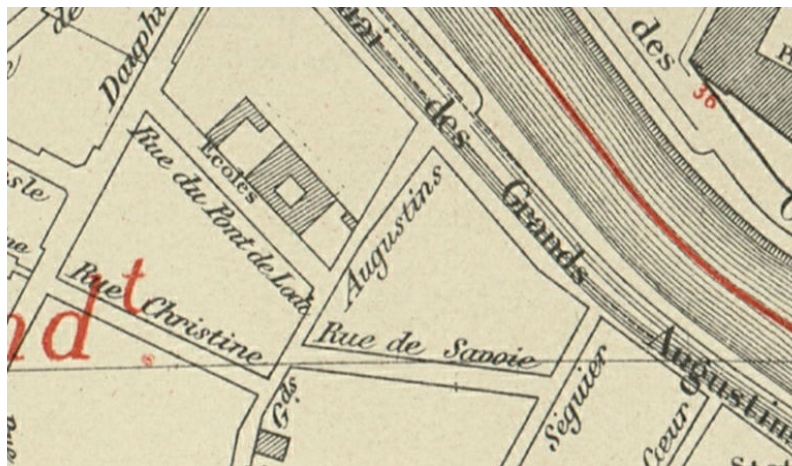
<https://dhistory.hypotheses.org/346>

Everything is available here

Flash me!



# Task 1: Detect building blocks



🏆 **Winners** 🏆

Vincent Nguyen and Nam Nguyen  
L3i, University of La Rochelle, France  
LIRIS, INSA-Lyon, France

ICDAR 2021  
Competition on

**Historical Map Segmentation**

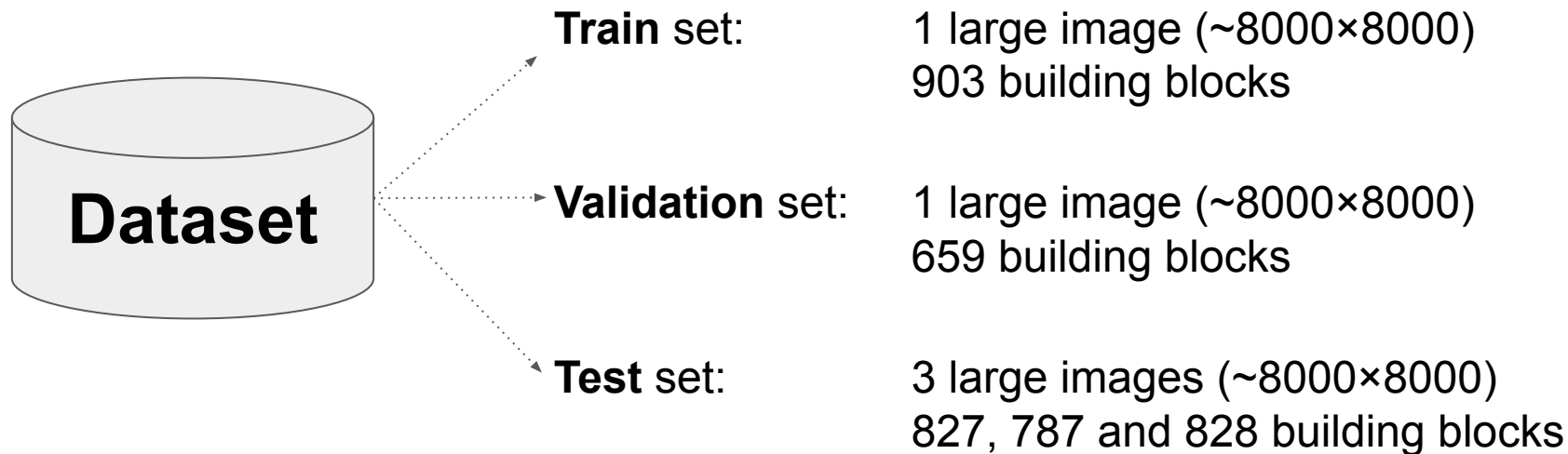
Official website  
<https://icdar21-mapseg.github.io>

*Everything is available here*

*Flash me!*



# Task 1: Detect building blocks



*Everything is available here*

*Flash me!*





# Task 1: Detect building blocks



## COCO Panoptic + Extensions

*Kirillov, A., He, K., Girshick, R., Rother, C., Dollár, P.: Panoptic segmentation. CVPR 2019*

$$PQ = \underbrace{\frac{\sum_{(p,g) \in TP} \text{IoU}(p, g)}{|TP|}}_{\text{segmentation quality (SQ)}} \times \underbrace{\frac{|TP|}{|TP| + \frac{1}{2}|FP| + \frac{1}{2}|FN|}}_{\text{recognition quality (RQ)}}$$

*Flash me!*

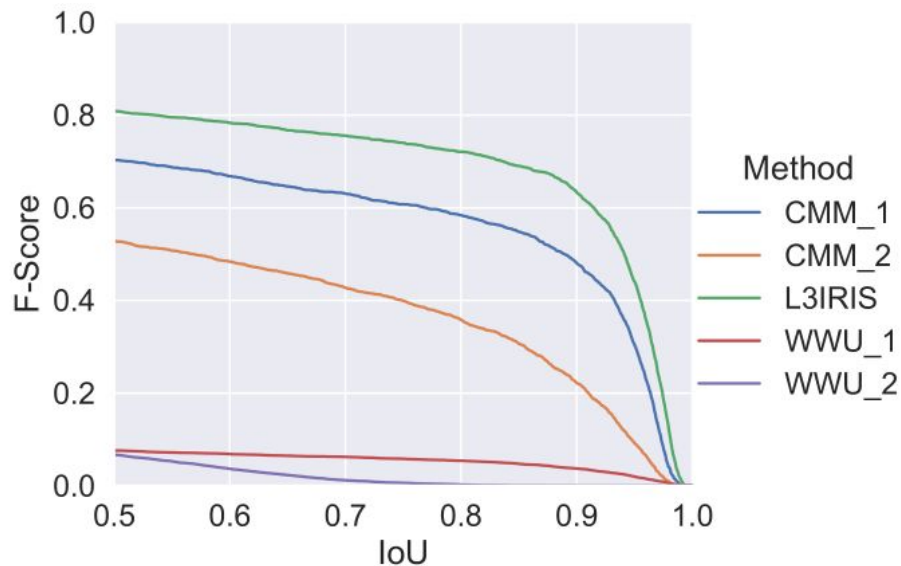
*Everything is available here*



# Task 1: Detect building blocks

🏆 **Results** 🥇 🥈 🥉

| Rank | Team (method) | COCO PQ (%) ↑ |
|------|---------------|---------------|
| 1    | L3IRIS        | 74.1          |
| 2    | CMM (1)       | 62.6          |
| 3    | CMM (2)       | 44.0          |
| 4    | WWU (1)       | 06.4          |
| 5    | WWU (2)       | 04.2          |

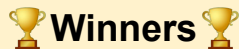


Everything is available here

Flash me!



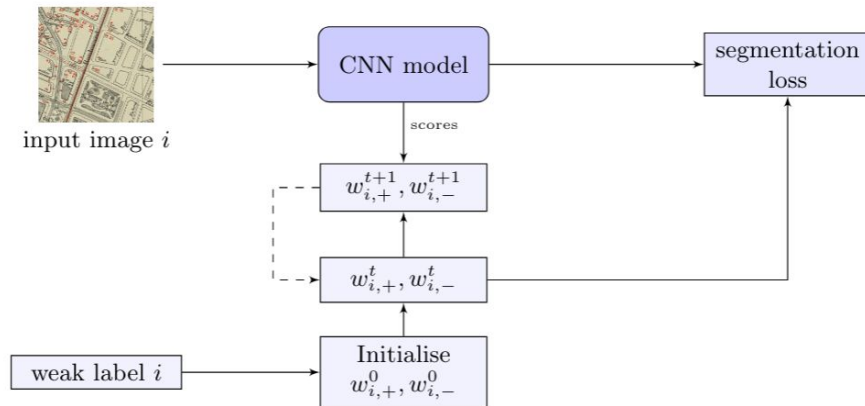
# Task 1: Detect building blocks



**Winners**

Vincent Nguyen and Nam Nguyen  
L3i, University of La Rochelle, France  
LIRIS, INSA-Lyon, France

Their approach:  
**semi-supervised CNNs**



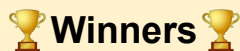
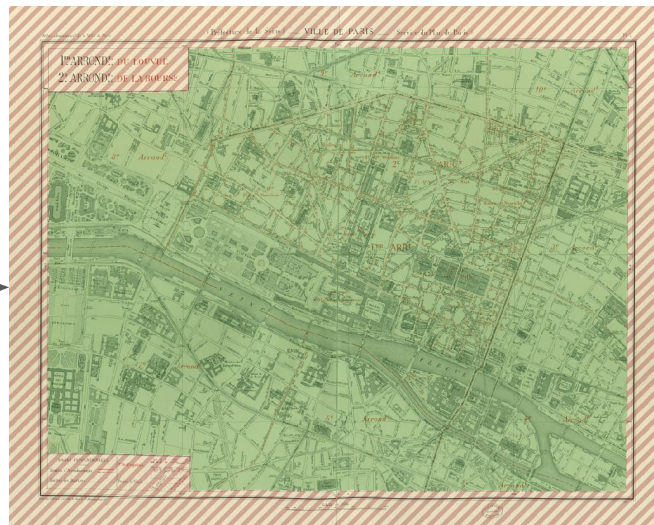
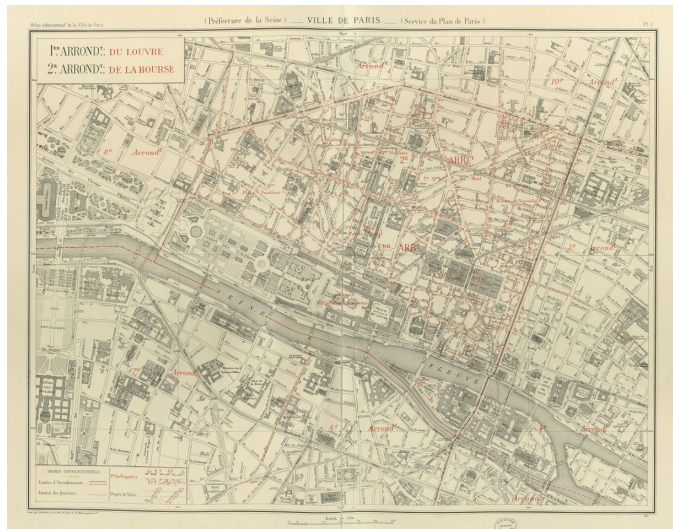
© Nguyen and Nguyen

*Everything is available here*

*Flash me!*



# Task 2: Segment map content within map sheets



**Winners**

Josef Baloun, Ladislav Lenc, and Pavel Král  
University of West Bohemia, Univerziti, Pilsen,  
Czech Republic

ICDAR 2021  
Competition on

**Historical Map Segmentation**

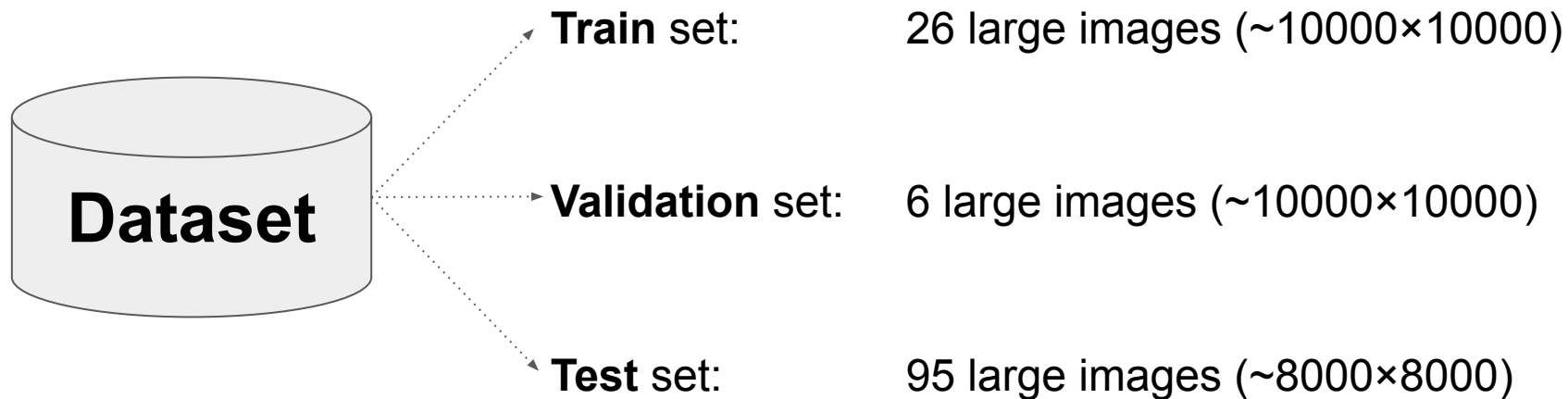
*Everything is available here*

Official website  
<https://icdar21-mapseg.github.io>

*Flash me!*



## Task 2: Segment map content within map sheets



*Everything is available here*

*Flash me!*

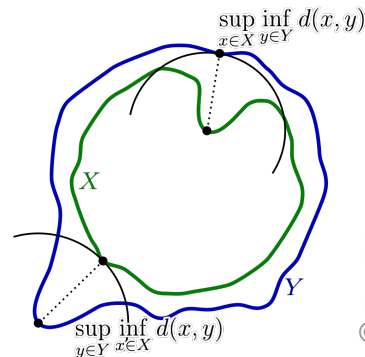


# Task 2: Segment map content within map sheets



## Hausdorff 95

1. Compute Hausdorff distance between target and predicted shape for all points in target boundary
2. Retain the 95<sup>th</sup> percentile



Everything is available here

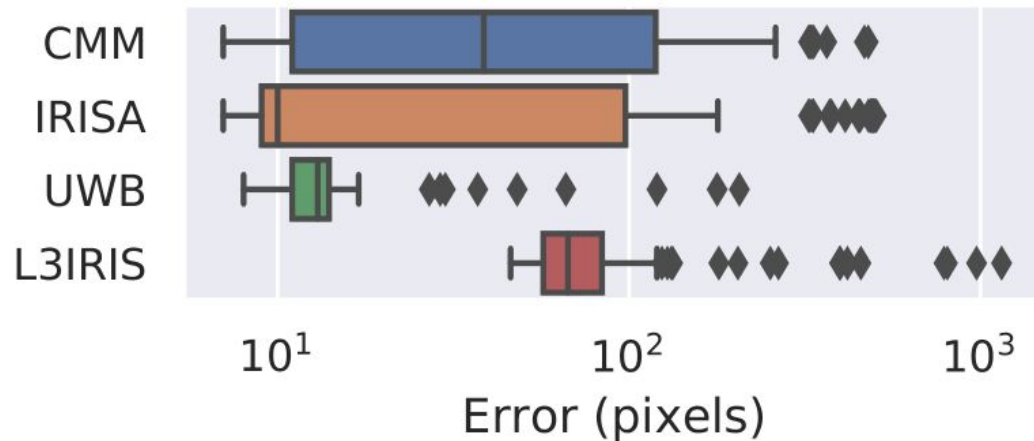
Flash me!



# Task 2: Segment map content within map sheets

## 🏆 Results 🥇 🥈 🥉

| Rank | Team   | Hausdorff 95 (pix.) ↓ |
|------|--------|-----------------------|
| 1    | UWB    | 19                    |
| 2    | CMM    | 85                    |
| 3    | IRISA  | 112                   |
| 4    | L3IRIS | 126                   |

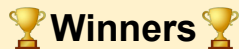


Flash me!

Everything is available here



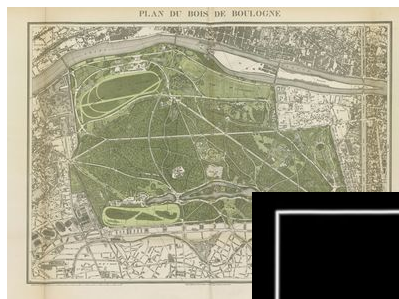
# Task 2: Segment map content within map sheets



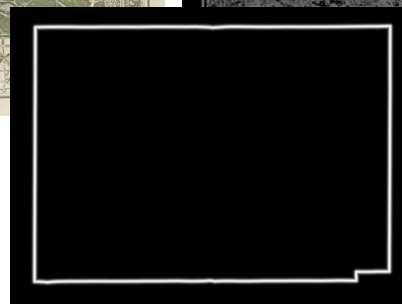
Josef Baloun, Ladislav Lenc, and Pavel Král  
University of West Bohemia, Univerzitní, Pilsen,  
Czech Republic

Their approach:

1. Coarse detection of map content with a CNN
2. Boundary refinement using custom Otsu binarization + morphological post-processing



© Baloun et al.



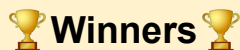
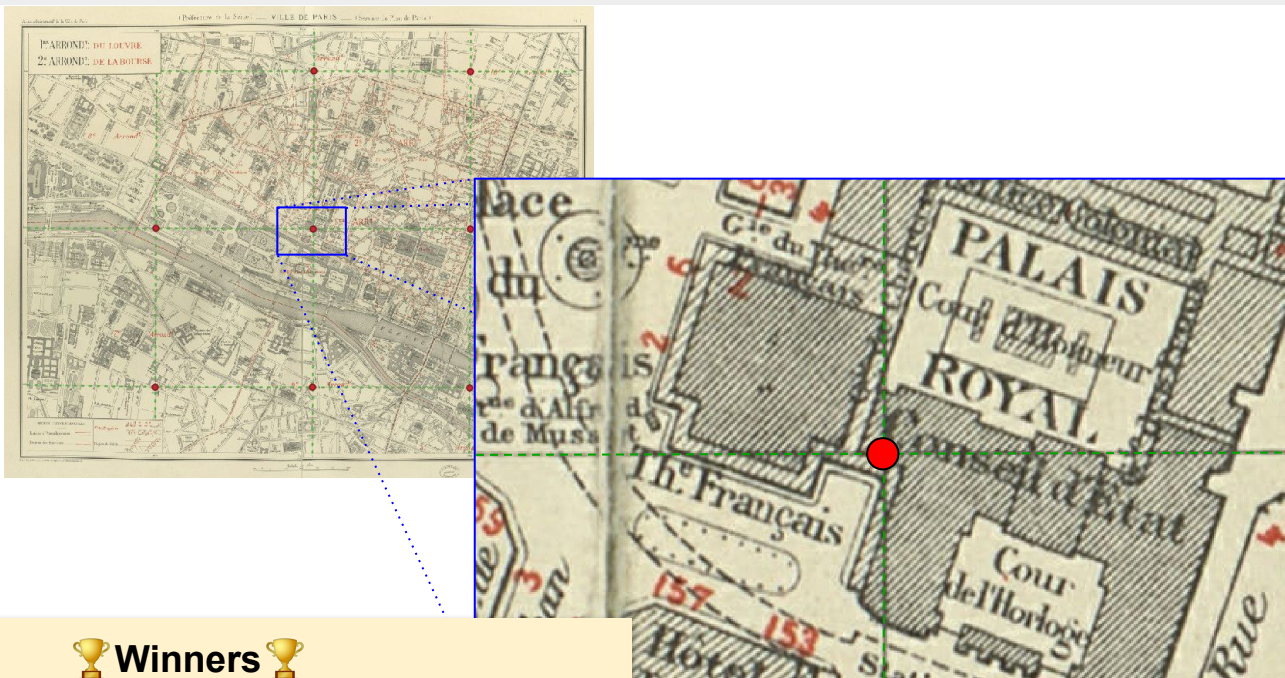
Everything is available here

Flash me!





# Task 3: Locate graticule lines intersections



**Winners**

Josef Baloun, Ladislav Lenc, and Pavel Král  
University of West Bohemia, Univerzitiní, Pilsen,  
Czech Republic

ICDAR 2021  
Competition on

**Historical Map Segmentation**

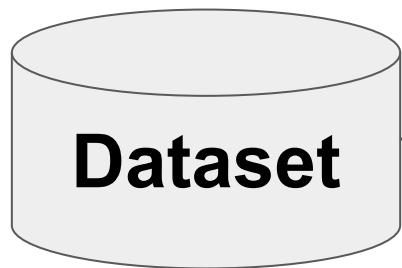
Official website  
<https://icdar21-mapseg.github.io>

*Flash me!*

*Everything is available here*



# Task 3: Locate graticule lines intersections



□ Same inputs as task 2

**Train set:**

26 large images ( $\sim 10000 \times 10000$ )  
265 intersections to detect

**Validation set:**

6 large images ( $\sim 10000 \times 10000$ )  
84 intersections to detect

**Test set:**

95 large images ( $\sim 8000 \times 8000$ )  
817 intersections to detect

*Everything is available here*

*Flash me!*

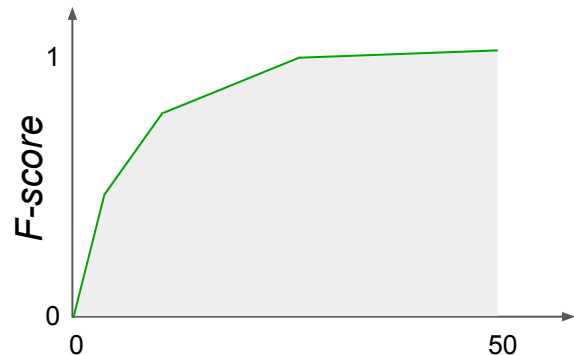


# Task 3: Locate graticule lines intersections



## Custom point detection metric

1. Plot detection F-score curve for all distance thresholds between 0 and 50 pixels
2. Report the area under this curve (AUC)



*Everything is available here*

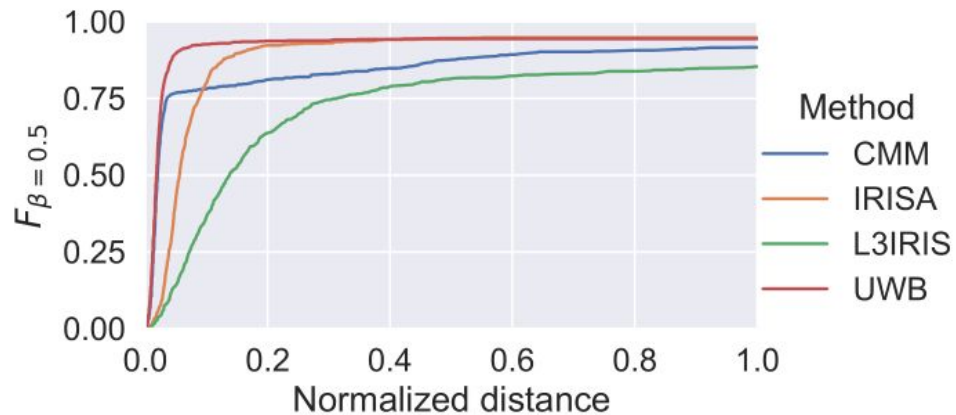
*Flash me!*



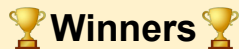
# Task 3: Locate graticule lines intersections

## 🏆 Results 🥇 🥈 🥉

| Rank | Team   | Detection score (%) $\uparrow$ |
|------|--------|--------------------------------|
| 1    | UWB    | 92.5                           |
| 2    | IRISA  | 89.2                           |
| 3    | CMM    | 86.6                           |
| 4    | L3IRIS | 73.6                           |



# Task 3: Locate graticule lines intersections



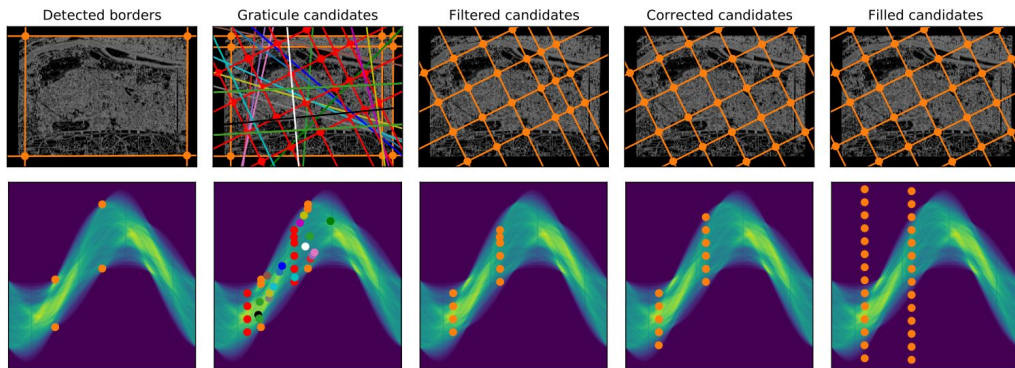
**Winners**

Josef Baloun, Ladislav Lenc, and Pavel Král  
University of West Bohemia, Univerzitiní, Pilsen,  
Czech Republic

Their approach:

1. Focus on map content  
(system for task 2)
2. Binary preprocessing
3. Coarse Hough transform
4. Refinement using template matching  
(cross shape)

Graticule candidate generation example



© Baloun et al.

Candidate rating:  
4.333086966293679

*Everything is available here*

*Flash me!*



# Check our [website](https://icdar21-mapseg.github.io)

→ <https://icdar21-mapseg.github.io> ←

cs.CV [arXiv:2105.13265](https://arxiv.org/abs/2105.13265)

Competition report

DOI [10.5281/zenodo.4817662](https://doi.org/10.5281/zenodo.4817662)

Dataset  
with ground truth

DOI [10.5281/zenodo.4818228](https://doi.org/10.5281/zenodo.4818228)

Participants'  
submissions,  
detailed descriptions  
and evaluation  
reports

DOI [10.5281/zenodo.4818401](https://doi.org/10.5281/zenodo.4818401)

Evaluation tools

✓ Open licenses

*This work was partially funded by the French National Research Agency (ANR): Project SoDuCo, grant ANR-18-CE38-0013.  
We thank the City of Paris for granting us with the permission to use and reproduce the atlases used in this work.*

*Everything is available here*

*Flash me!*



ICDAR 2021  
Competition on **Historical Map Segmentation**

Official website  
<https://icdar21-mapseg.github.io>