Centre de Visió per Computador

A Few-Shot Learning Approach for Historical Ciphered Manuscript Recognition

Mohamed Ali Souibgui

Alicia Fornés

Yousri Kessentini

Crina Tudor

UPPSALA UNIVERSITET

VETENSKAPSRÅDET THE SWEDISH RESEARCH COUNCIL

DE CRYPT

Centre de Recherche en Numérique de Sfax

UAB Universitat Autònoma de Barcelona

Generalitat de Catalunya

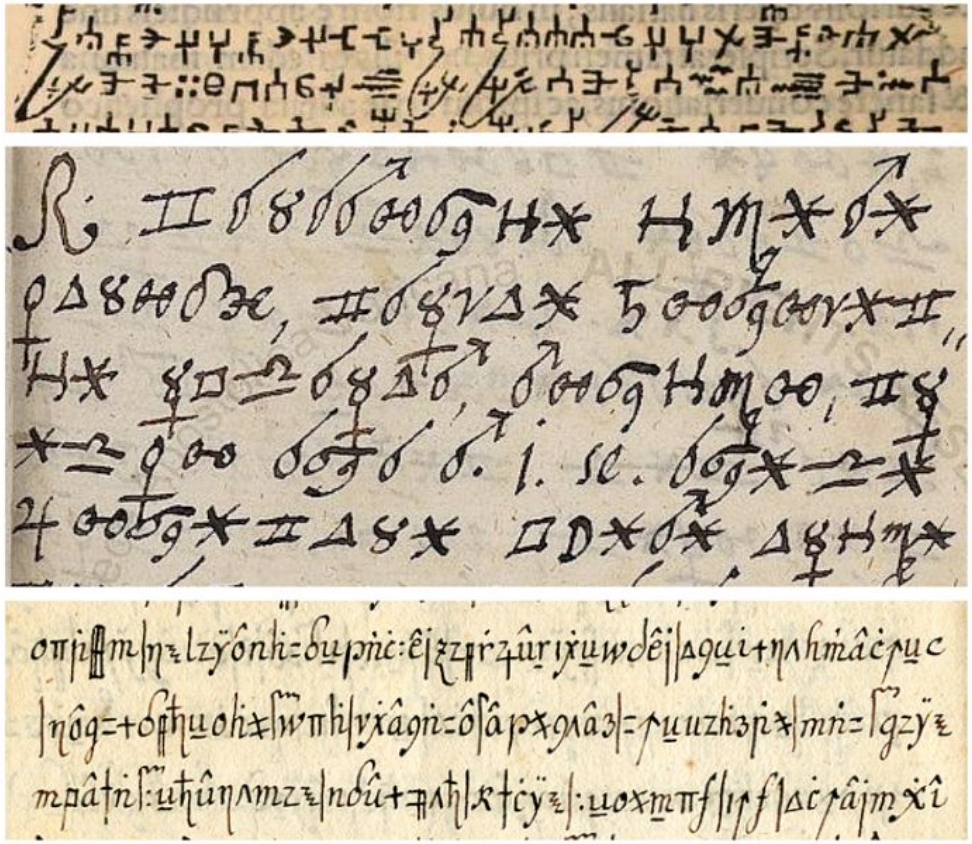
Parc de Recerca UAB

Motivation: Historical ciphered manuscript

Recognition process:
Transcription → Cryptanalysis

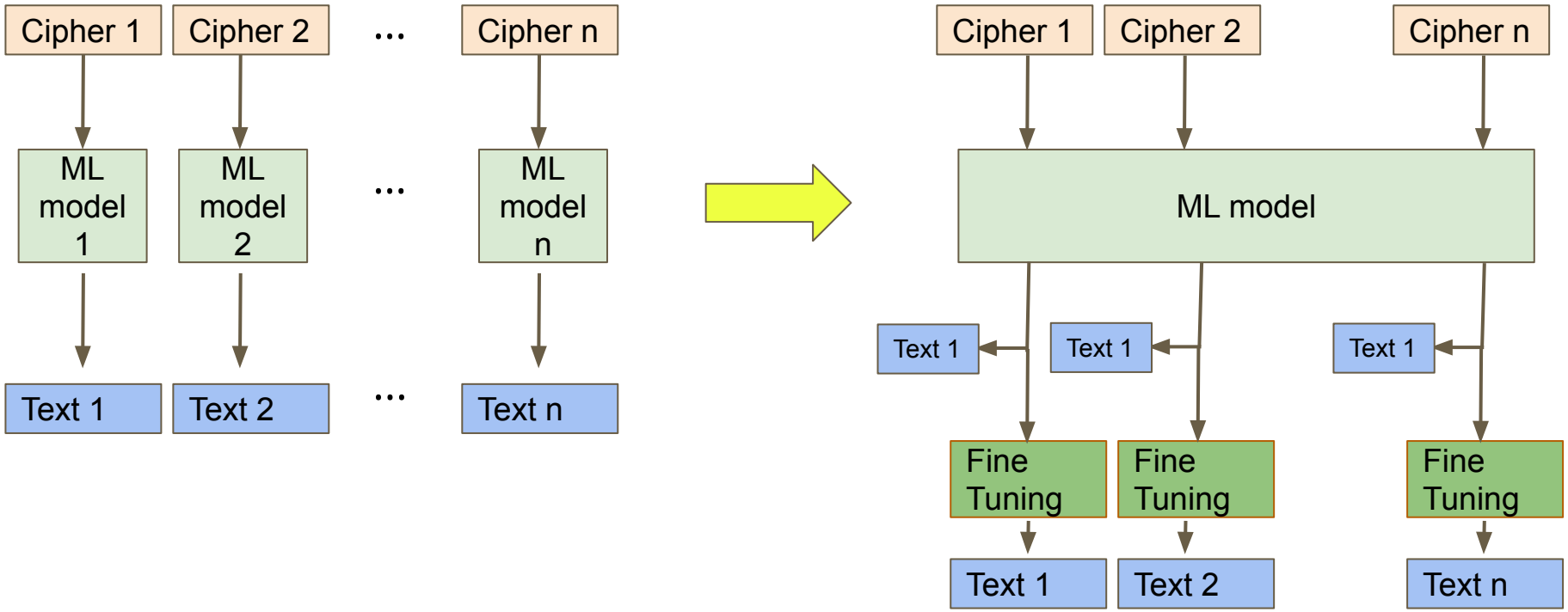
Difficulties:

1. **Unknown alphabets** (No dictionaries, or language models)
2. **Changeable Symbols** from a cipher to another.
3. **Few resources** (No labeled similar documents)
4. **Hard to be segmented** (To apply the classic unsupervised methods)
5. Etc ...



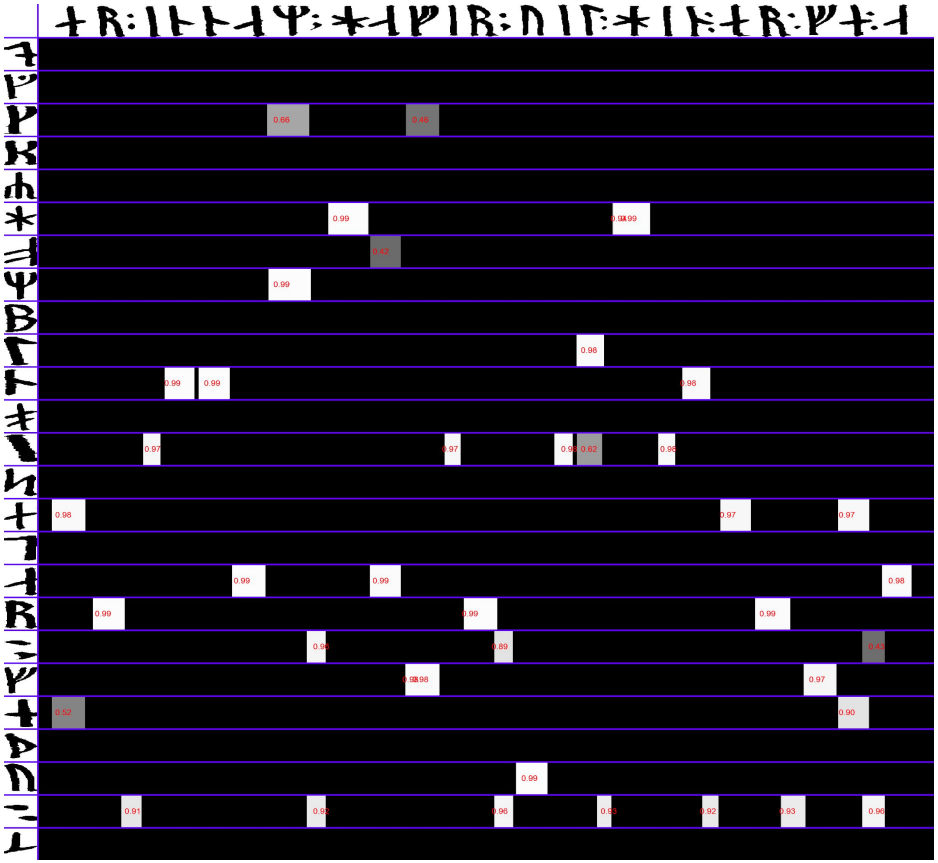
Document created using invented symbols to encrypt the content

1 System to Read All Alphabets



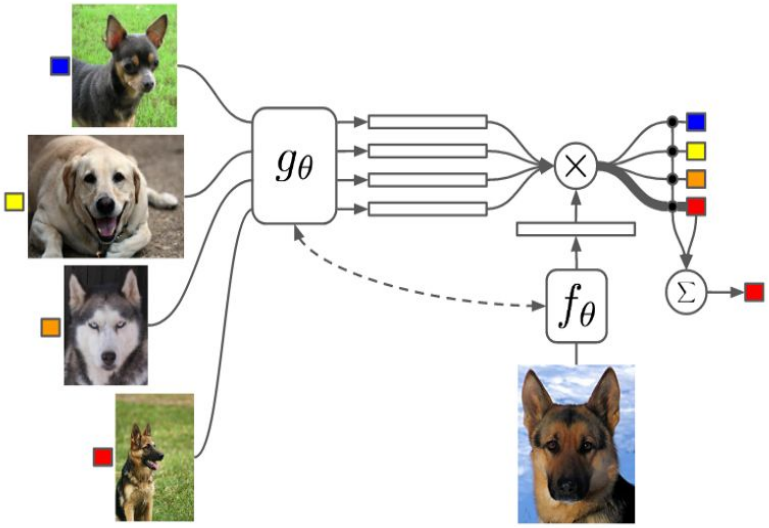
Read By Matching/Spotting

- Input:
  - Ciphered text line
  - Cropped alphabet symbols
- Output:
  - Similarity regions
- Goal:
  - Handling different alphabets (different training/ testing sets)
  - Segmentation free method
  - Use a few data

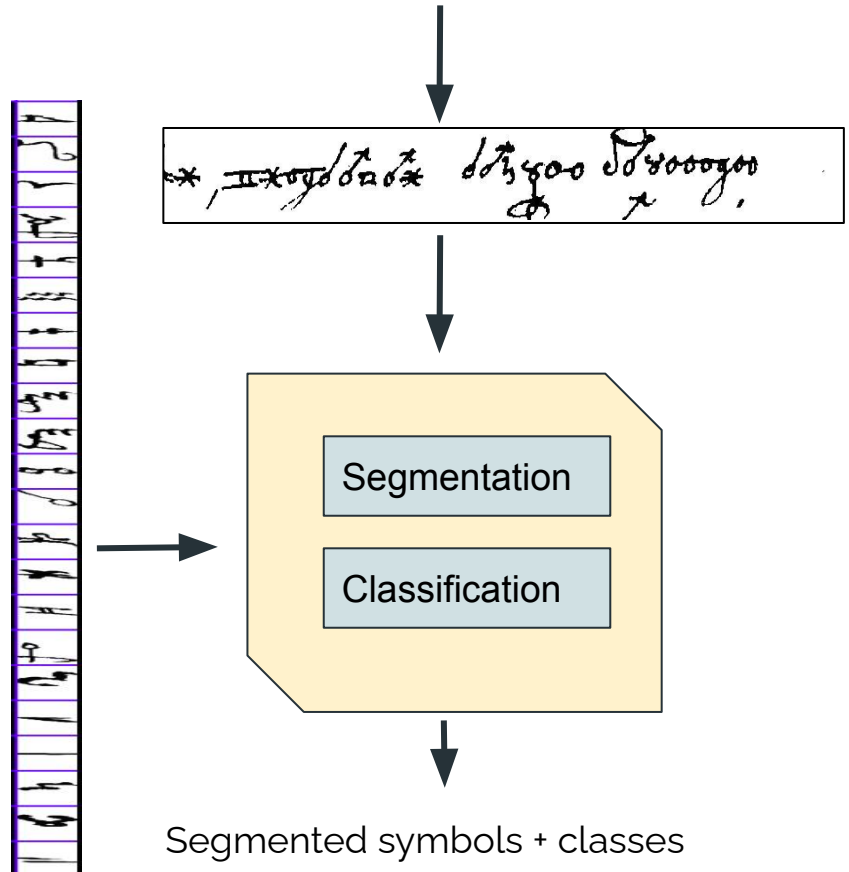


A few shot learning approach for text matching ?

Few-shot text recognition

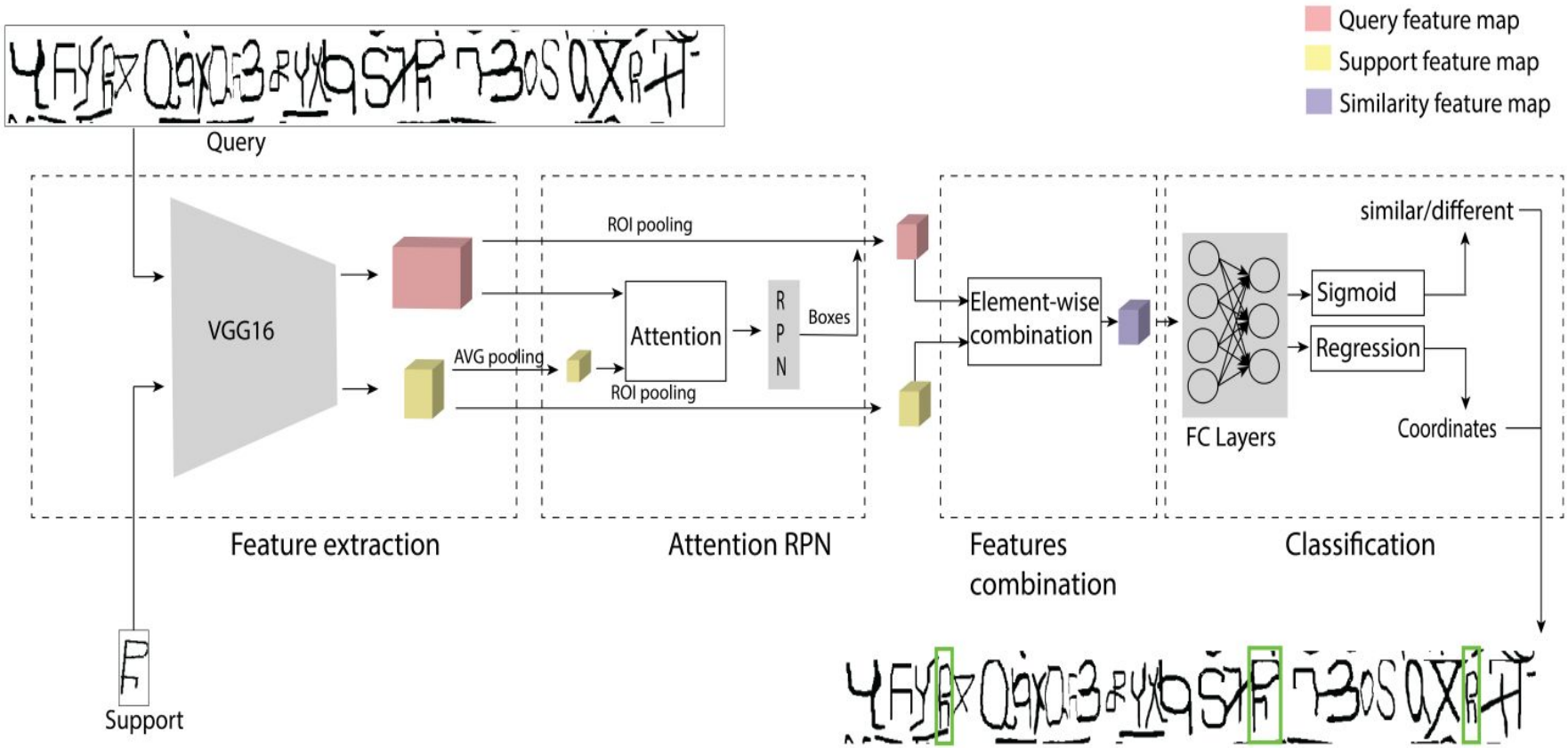


Few-shot Classification



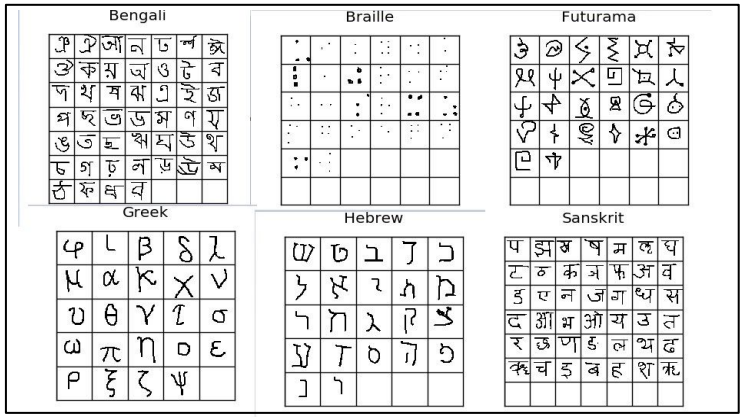
Few-shot Detection

Proposed Approach

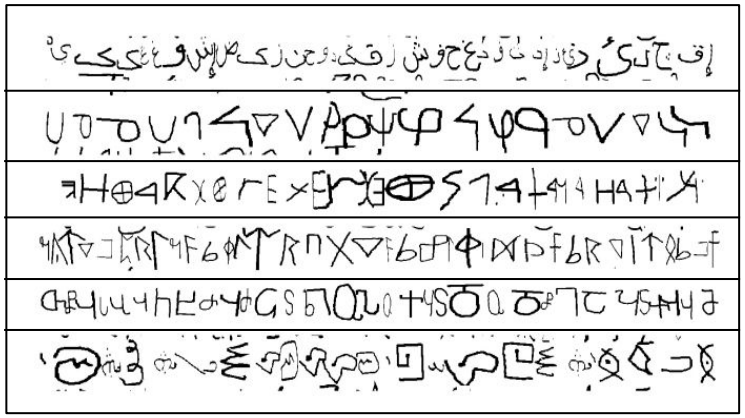


Experiments: Data

Training

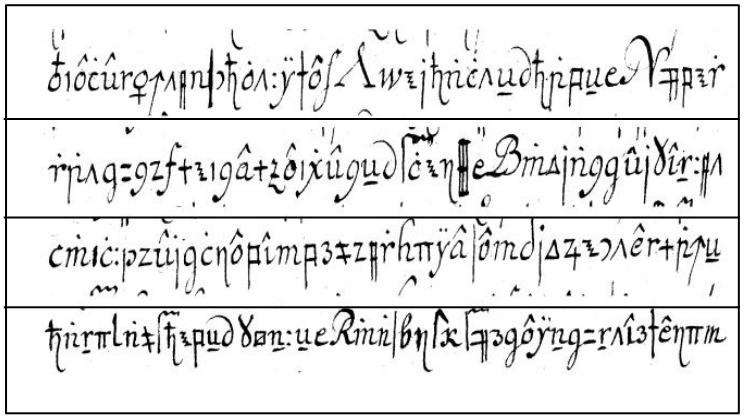


Omniglot dataset: few examples (20 per character) from 50 alphabets.

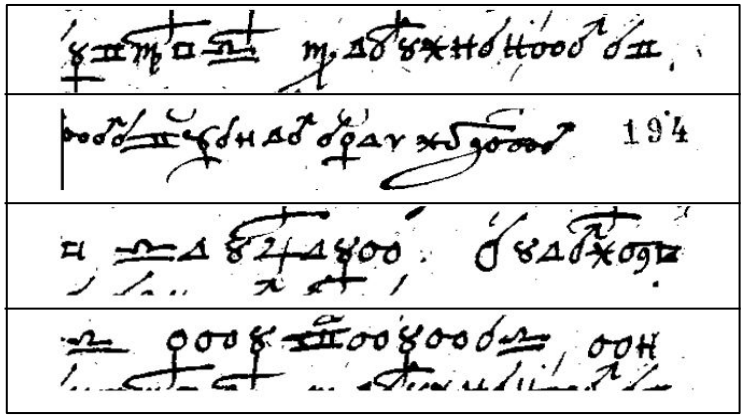


Synthetic Lines

Testing



Copiale Lines

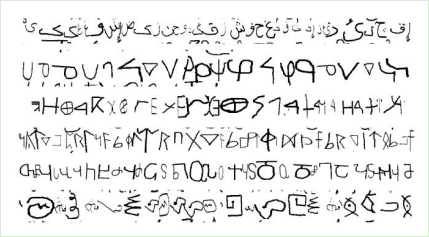


Borg Lines

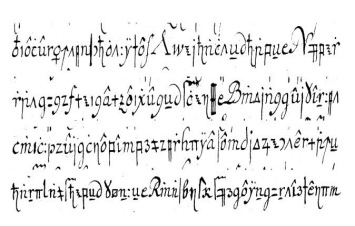
Results: Without fine tuning

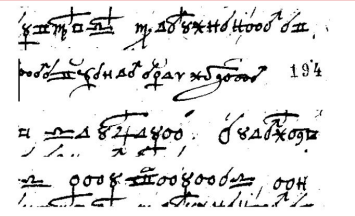
Method	Description	Copiale SER	Borg SER
1	SNN features + GMM	0.44	0.57
2	Manual Segmentation + 1	0.37	0.22
3	SIFT+ KNN + Label propagation	0.44	0.54
4	3 + Manual clusters cleaning	0.20	0.52
5	Ours (1 shot)	0.38	0.66
6	Ours (5 shots)	0.33	0.51

Training (Synthetic)



Testing (Ciphers)

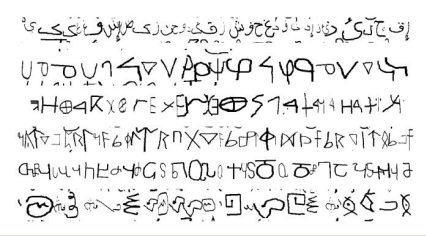




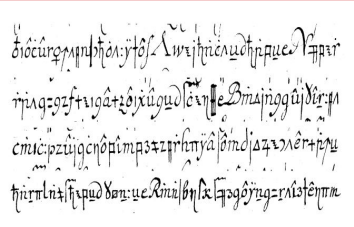
Results: With fine tuning

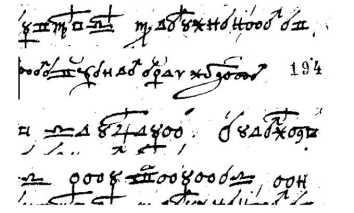
Method	Description	Copiale		Borg	
		Training Pages	SER	Training Pages	SER
1	MDLSTM	25	0.13	7	0.71
		34	0.12	9	0.66
		42	0.08	11	0.69
		51	0.07	14	0.55
2	Ours (1 shot)	2	0.10	2	0.20
		5	0.09	5	0.19
3	Ours (5 shots)	2	0.10	2	0.21
		5	0.09	5	0.19

Training (Synthetic)



Fine tuning & Testing





Conclusion and Future directions

Using the proposed approach we were able to:

- Recognize **different alphabets** using **one model** in a **segmentation free fashion**.
- **Generalize to unseen** data in term of alphabet and writing styles with, or without a **few labeled lines**.

As Future work:

- Adding language models for some ciphers to improve the decoding.
- Detection in full pages.
- Detecting all the symbol alphabet in one time.

Thank You !