Italian National Agency for New Technologies,
Energy and Sustainable Economic Development

Artificial Intelligence Methods for Historical Documents Transcription

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ENEA TERIN ICT HPC

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Outline

1. Introduction
2. Project pipeline:
   - 2.1 Text Detection
   - 2.2 HTR
   - 2.3 Table Recognition
3. Work in progress

Introduction

AI project using an archive of eighteenth-century ledgers, a combination of letters and numbers in a complex format.

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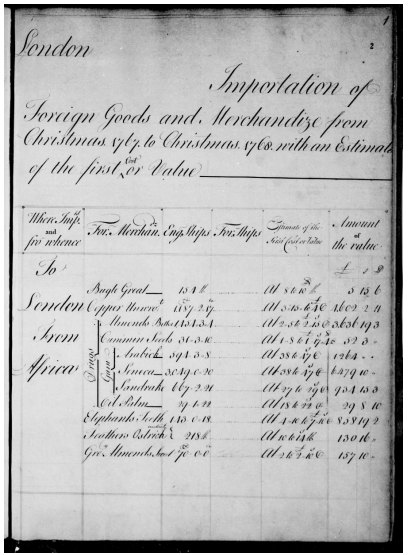
ERASMUS UNIVERSITEIT ROTTERDAM

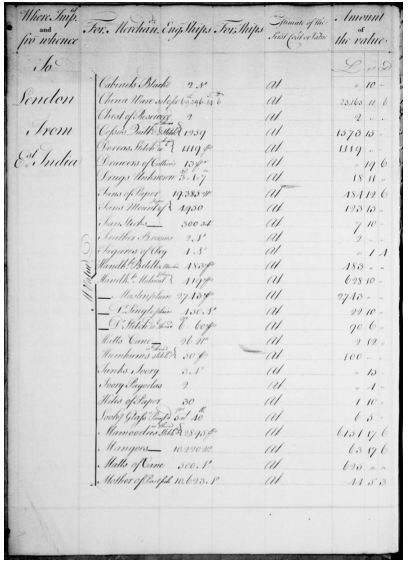
Essential impact on the community of the historian: it will allow a fast and deeper analysis of the historical ledgers.
Societal impact: this AI work will allow disclosure and spreading of historical knowledge.

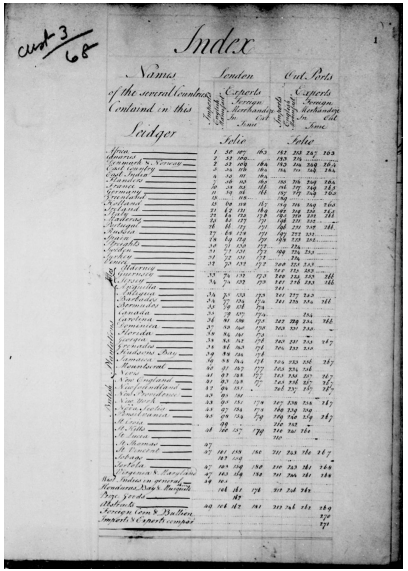
Introduction

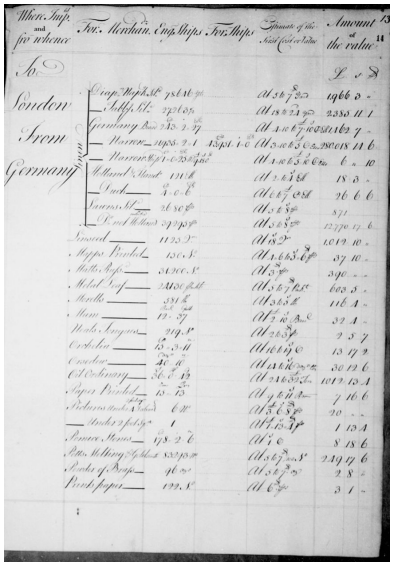
Our dataset consists of thousands of scanned historical documents (XVII and XVIII century).

Each document contains handwritten information structured like table.



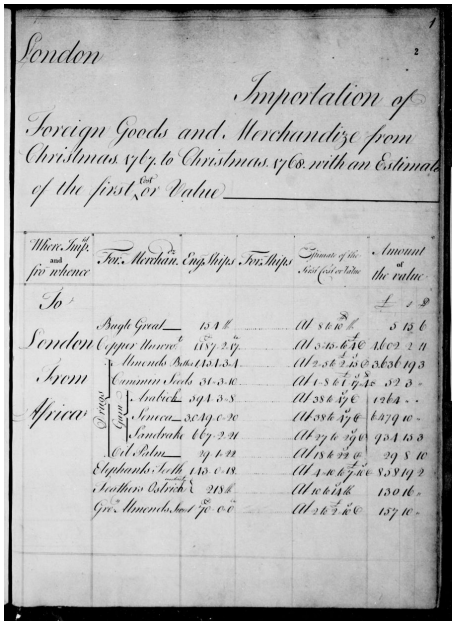






Introduction

The main goal is to transcribe the scanned ledgers into a digital format while keeping the original table structure.



London

Importation of Foreign Goods and Merchandize from Christmas 1767 to Christmas 1768 with an Estimate of the first cost or Value

Where Imp. id and fro whence	For Merchan. ez			Eng Ships	For Ships	Estimate of the first Cost or Value	Amount of the value
To London From Africa	Bugle Great			154		at 8 to 10	5 15 6
	Copper			1187 2 87		at 3 15 to 40	4602 2 11
	Drugs	Almond Butter		1454 3 4		at 2 5 to 2 15	3636 19 3
		Cumin Seeds		31 3 10		at 1 8 to 1 17 4	52 3
		Gum	Arabic	594 3 8		at 38 to 47	1264
			Seneca	3049 0 20		at 38 to 47	6479 10
			Sandrake	667 2 21		at 27 to 29	934 15 3
		Oil Palm		29 1 22		at 18 to 22	29 8 10
	Elephants Theeth			143 0 18		at 4 to 7 10	858 19 2
	Feathers Ostrich			218		at 10 to 14	130 16
	Gro Almonds Seed			70 0 0		at 2 to 2 10	157 10

Project Pipeline

TEXT DETECTION | HTR | TSR | FINAL STEP

Prediction of bounded boxes around the text with Deep Learning techniques trained on digital documents. From .png to .json file.

Automatic Handwritten Text Recognition via DL method. From the crops of the words in the image to their digital transcription.

Table Structure Recognition. Detect the structure of the table starting from the image. The goal is to understand the positions of the table blocks.

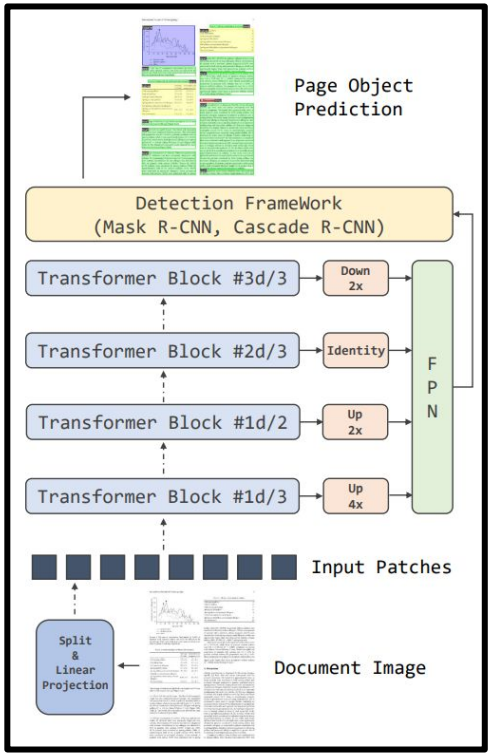
Construction of the digital archive, merging together the output of the previous steps.

Text Detection

DiT: Self-Supervised Pre-Training for Document Image Transformer

Trasformer-based architecture pretrained on FUNSD dataset for Text Detection task.

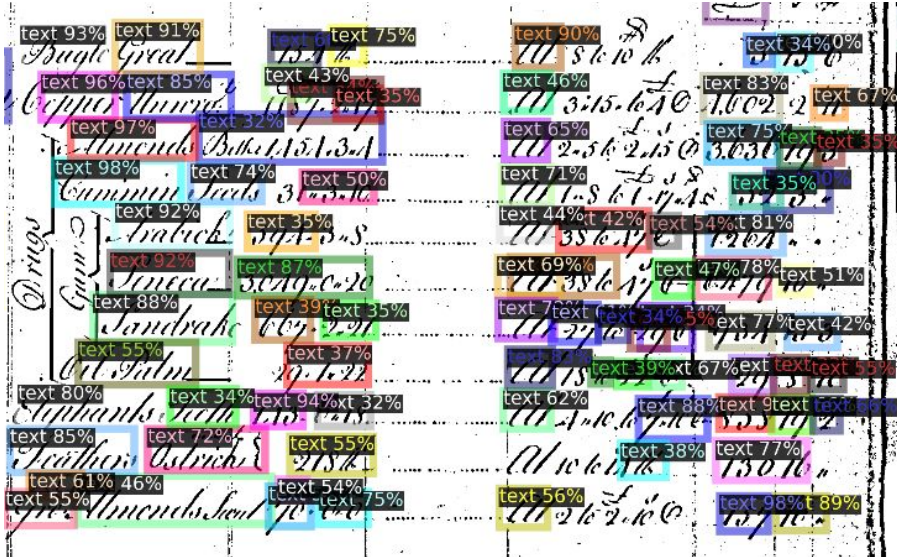
The online learning has been developed using an external annotation web tool: **Label Studio**.



Text Detection

Comparison of the predictions

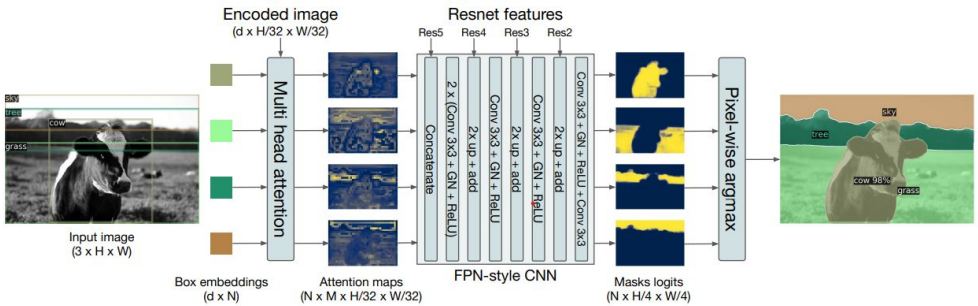
Pre-trained model

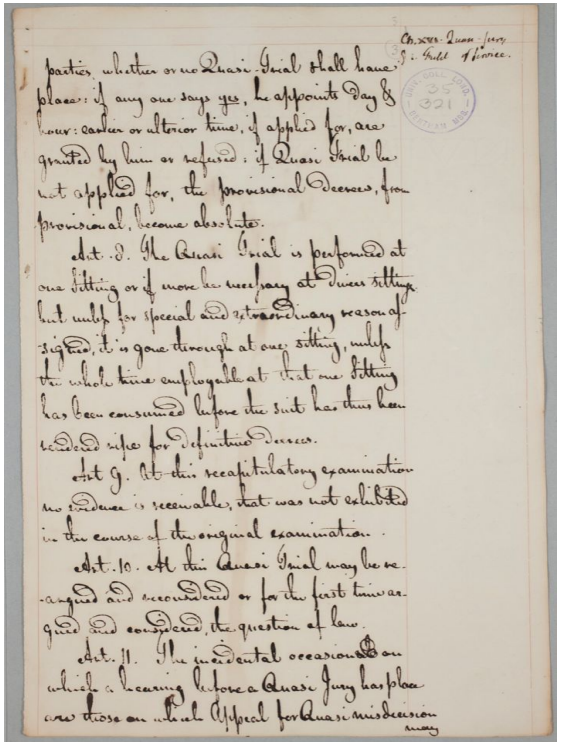


Retrained model

Handwritten Text Recognition

A transformer based Neural Network for handwritten recognition.
It is inspired by a Transformer OCR repository[1] based on End-to-End Object Detection with Transformers.
Network pretrained on Bentham dataset.

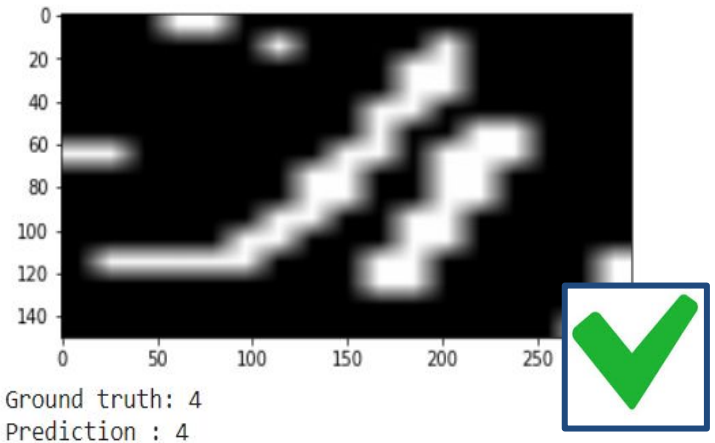




1. *https://github.com/him4318/Transformer-ocr*

Handwritten Text Recognition

First experiments with numbers and words. The labelling of the dataset is under construction.



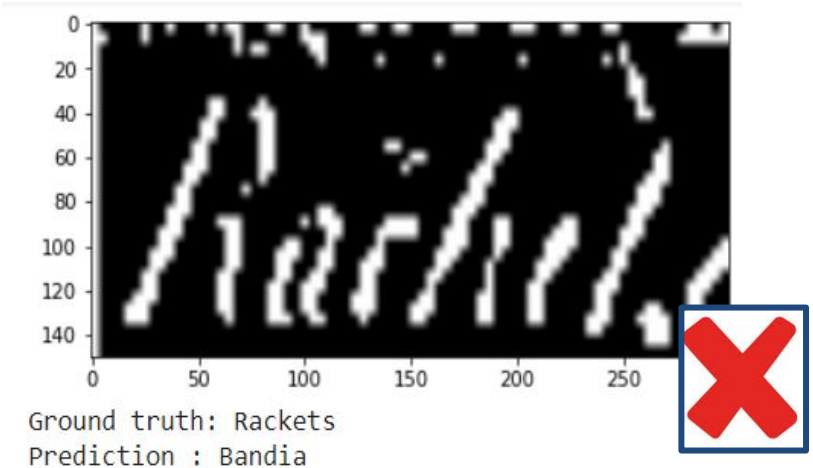
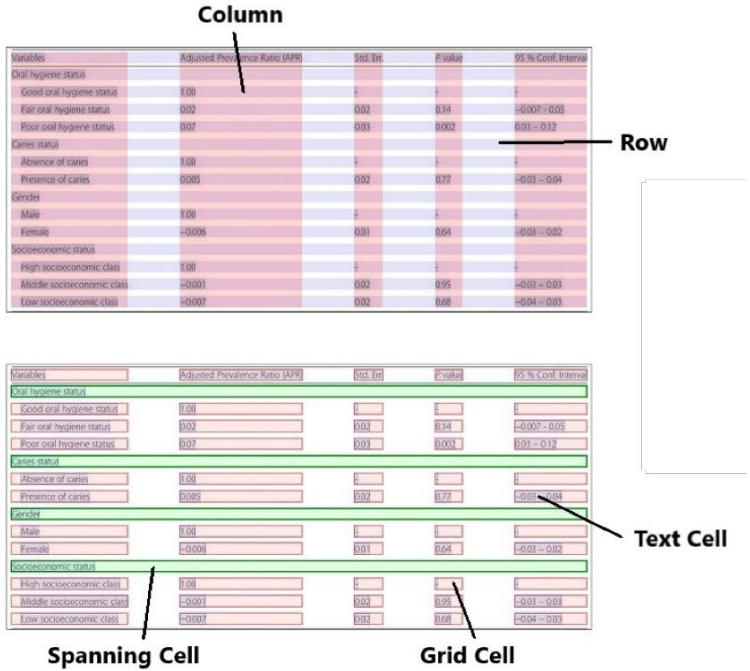


Table Recognition



PubTables-1M and GriTS

Transformer based structures which allows the recognition of the table structure.

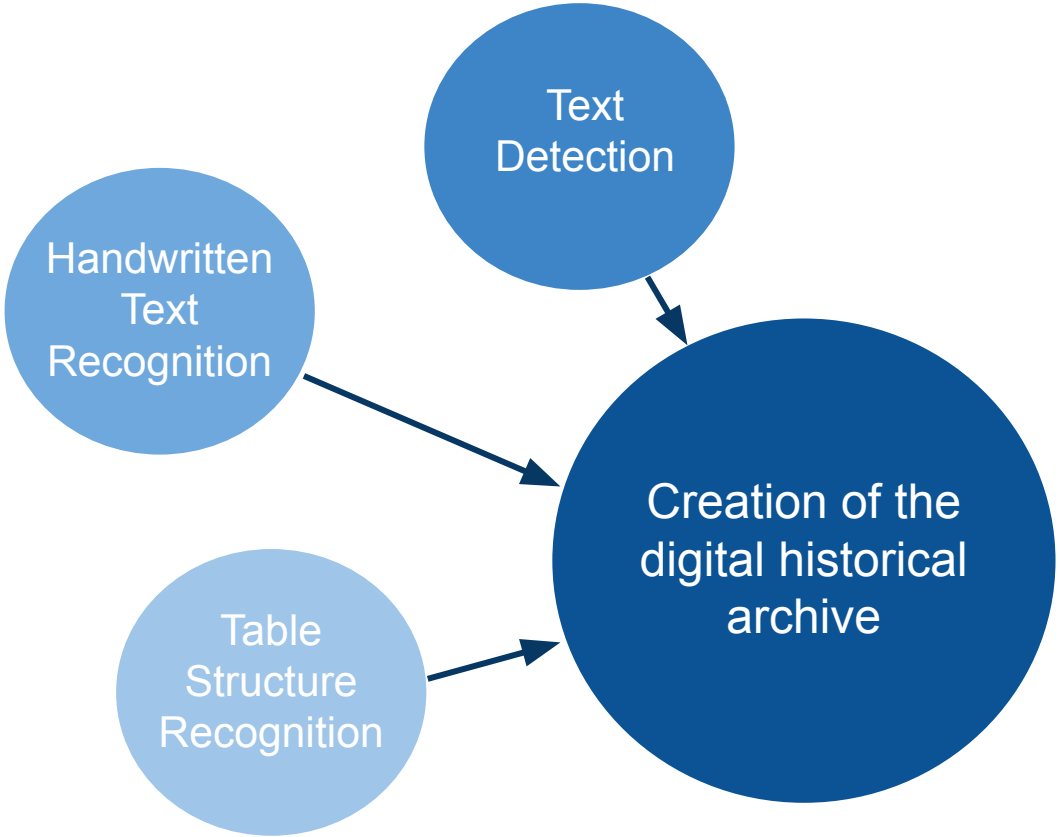
Work in progress!

		ΔSDM			
		better	**equal**	**Worse**	**Sum**
ΔSCA	**better**	19457 (28.9)	12 (0.02)	14654 (21.8)	**34,123 (50.8)**
	equal	1158 (1.7)	21989 (32.7)	1024 (1.5)	**24,171 (36.0)**
	worse	3755 (5.6)	2 (0.003)	5183 (7.7)	**8,940 (13.2)**
	Sum	**24370 (36.2)**	**22003 (32.7)**	**20861 (31.0)**	**67,234 (100.0)**

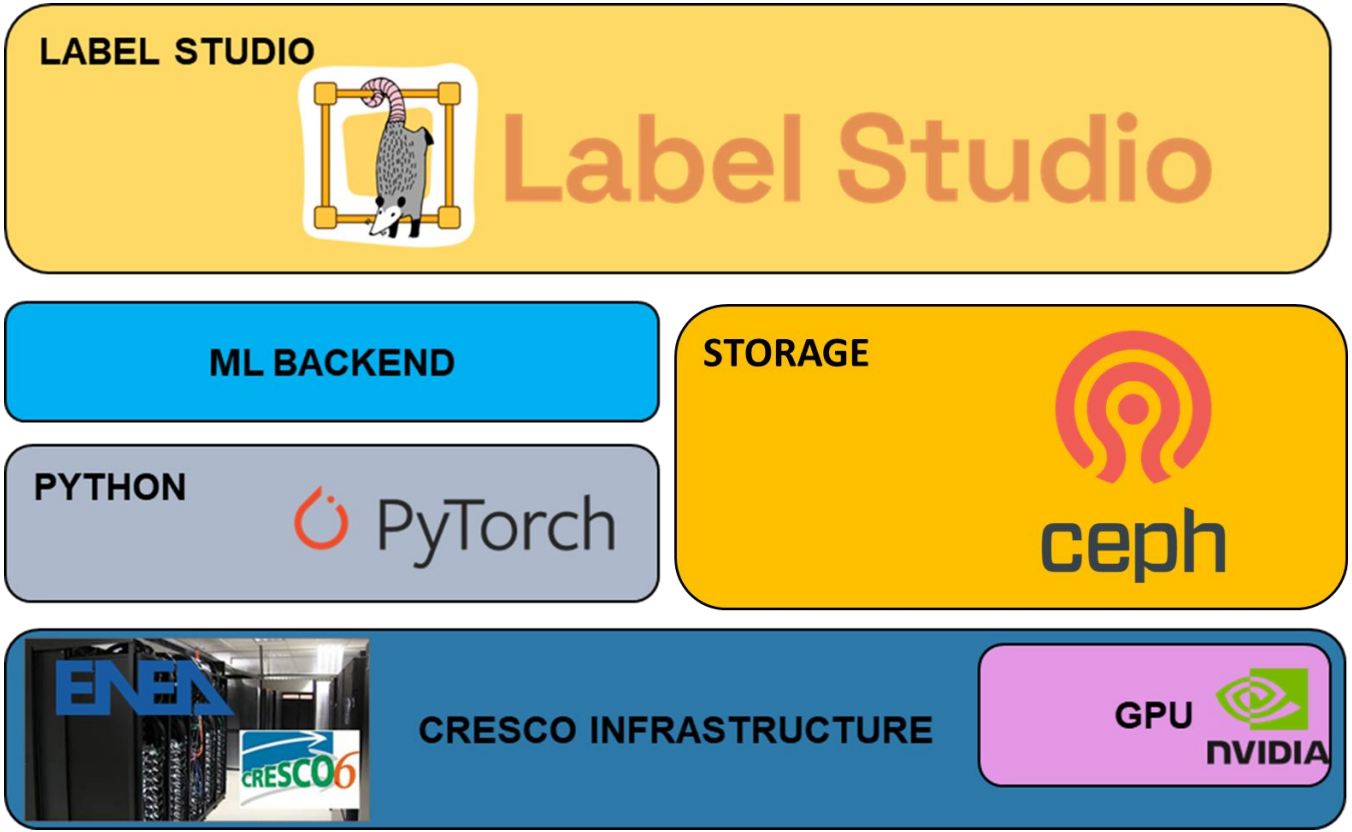
Final Step

Our guess is to obtain the digital historical archive with a deterministic way.

Question:
Is it convenient to do it with a ML approach?



Digital platform



Work in progress

- **Text Detection**:
  - Increase annotated dataset using Label Studio web tool
  - Improve accuracy of DiT model
- **Handwritten Text Recognition**:
  - Transcript words cropped in Label Studio
  - Retrain DETR-based model with large size dataset
- **Table Recognition**:
  - Develop the solution using either AI or no-AI method
- Integrate all solutions together

References

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4. Transformer OCR repository: https://github.com/him4318/Transformer-ocr
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Acknowledgements and contacts

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The End

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