CZECH TECHNICAL UNIVERSITY IN PRAGUE
Faculty of Information Technology

Reading The Burned Parchment Scrolls From Herculaneum

Dissertation

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June 14, 2024

Agenda

Introduction

Personal info:

- 22 years old, TUKE | ELTE | ČVUT

Master's study results:

- Major: Software Engineering
- Diploma thesis: A (“*System for Signal Manipulation on Automotive Ethernet*”, in collaboration with Porsche)
- Overall classification of the final state examination: A
- Arithmetical / weighted grade point average: 1.75 / 1.88
- Total ECTS: 140

Publications:

- Video Resolution Upscaling Using Neural Networks (Medium.com, 2022)

Honors & Awards:

- Dean's award for outstanding diploma thesis (2024)

Problem Description

The Herculaneum scrolls, buried and carbonized by Mount Vesuvius' eruption in A.D. 79, represent the only classical library discovered in situ. Due to their fragile state, physical attempts to open the scrolls have caused damage, leaving many unreadable. A sequence of modern techniques is applied to allow their "*reading*":

1. **Scanning:** creating a 3D scan of a scroll or fragment using x-ray tomography
2. **Segmentation and Flattening:** finding the layers of the rolled papyrus in the 3D scan and then unrolling them into a flattened "surface volume"
3. **Ink Detection:** identifying the inked regions in the flattened surface volume using a machine learning model

Source: https://scrollprize.org/

Current Status

By 2024, 300 scrolls are preserved, 4 scrolls were scanned and 0% to 5% of one scroll were segmented & *"read"*: total lines: 240, complete lines: 206, (maybe) readable lines: 137.

ἀρ ἀπεχόμεθα τὰ μὲν κρίνειν, τὰ δὲ κατέχειν καὶ ἐμφαί νοιθ' ἡμῖν ἀληθῆ λέ- γειν ὥσπερ πολλάκις ἂν ἐμφανείη{ι}.	*"... for we do [not] refrain from questioning some things, but understanding/remembering others. And may it be evident to us to say true things, as they might have often appeared evident!"*
ἑκάστης κριτηρίων θεωροῦνται. πρὸς δὲ οὔτε καθόλου περὶ ἡδονῆς ἐχόντων τι λέγειν οὔτε περὶ τῆς κατὰ μέρος, ὅτε ὡ- ρισμένον τι, ἀλλ' οὖν	*"have nothing to say about pleasure, either in general or in particular, when it is a question of definition."*

Source: https://scrollprize.org/

Motivation

- Preservation of history
- Technological advancement
- Personal interest & *eternal glory* ☺
- Prizes: 1000-200000 $

Expected Outcomes / Contents of Dissertation*

- Reproduction of existing results (ink detection)
- Analysis, comparison & improvement of ink detection methods
- Application of pattern recognition techniques to reveal new pieces of text
- Development of the machine learning software & mathematical (statistical) models
- Contribution to the open-source society

*Actual contents and outcomes may vary depending on the circumstances; source: https://scrollprize.org/

Science Community (1)

Conferences:

1. ICCIT (International Conference on Computer and Information Technology)
2. CVPR (Conference on Computer Vision and Pattern Recognition)
3. ICCV (International Conference on Computer Vision)
4. ECCV (European Conference on Computer Vision)

Journals:

1. *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI):* Impact Factor: 24.31
2. *Journal of Machine Learning Research (JMLR):* Impact Factor: 4.091
3. *Pattern Recognition: Impact Factor:* 7.196
4. *Computer Vision and Image Understanding (CVIU):* Impact Factor: 4.654

Experts: Cristopher Bishop (Microsoft Research), Andrew Ng (Stanford University), Prof. Ing. Michal Haindl, DrSc. (ČVUT), ...

Webpages: https://scrollprize.org/, https://arxiv.org/, https://www.semanticscholar.org/, https://kaggle.com/, ...

Science Community (2)

Publications:

1. Mou, Farzana Sharmin and Tanvir Ahmed. “Ink Detection from Carbonized Herculaneum Papyri using Deep Learning.” 2023 26th International Conference on Computer and Information Technology (ICCIT) (2023): 1-6.
2. Quattrini, Fabio et al. “Volumetric Fast Fourier Convolution for Detecting Ink on the Carbonized Herculaneum Papyri.” 2023 IEEE/CVF International Conference on Computer Vision Workshops (ICCVW) (2023): 1718-1726.
3. Parsons, Stephen et al. “EduceLab-Scrolls: Verifiable Recovery of Text from Herculaneum Papyri using X-ray CT.” University of Kentucky. ArXiv abs/2304.02084 (2023): n. pag.
4. Parsons, S., Parker, C. S., Chapman, C., Hayashida, M., & Seales, W. B. (2024). EduceLab-Scrolls: Verifiable Recovery of Text from Herculaneum Papyri using X-ray CT. Parsons, Stephen, "Hard-Hearted Scrolls: A Noninvasive Method for Reading the Herculaneum Papyri" (2023). Theses and Dissertations — Computer Science. 138.

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Subjects*

- **PI-ROZ | Pokročilé rozpoznávání**
- **PI-NSV | Neuronové sítě a výpočetní intelligence**
- **PI-ANM | Aplikovaná numerická matematika**
- **PI-AWR.1 | Academic Writing**

*Provided subjects are oriented and may differ depending on the circumstances

THANK YOU FOR YOUR ATTENTION

QUESTIONS?