Determining the Influence of Papyrus Characteristics and Data Augmentation on Fragments Retrieval with Deep Metric Learning

Master's Thesis in Computer Science

submitted
by

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Zusammenfassung

Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. It has survived not only five centuries, but also the leap into electronic typesetting, remaining essentially unchanged. It was popularised in the 1960s with the release of Letraset sheets containing Lorem Ipsum passages, and more recently with desktop publishing software like Aldus PageMaker including versions of Lorem Ipsu. Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. It has survived not only five centuries, but also the leap into electronic typesetting, remaining essentially unchanged. It was popularised in the 1960s with the release of Letraset sheets containing Lorem Ipsum passages, and more recently with desktop publishing software like Aldus PageMaker including versions of Lorem Ipsu. It has survived not only five centuries, but also the leap into electronic typesetting, remaining essentially unchanged. It was popularised in the 1960s with the release of Letraset sheets containing Lorem Ipsum passages, and more recently with desktop publishing software like Aldus PageMaker including versions of Lorem Ipsu.

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Abstract

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Chapter 1

Introduction

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1.1   Structure

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1.3 Outline

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Chapter 2

State of the Art

In this chapter, we present an overview of the state-of-the art for this thesis. The common research field is computer vision and pattern recognition for cultural heritage. State-of-the-art presents the results of recent publications. Since numbers alone are not meaningful, the methods and exact contexts are also discussed. This includes approaches based on deep unsupervised metric learning, graph theory and data argumentation. Table 2 summarizes the key results and characteristics.

2.1 Deep Metric Learning

As indicated in the introduction, DML is a comparison-based algorithm and is therefore well suited for a field in which there is little ground truth. Pirone and his colleagues were the first who used DML in domain of papyri fragment retrieval. In their 2019 paper "Papy-S-Net : A Siamese Network to match papyrus fragments", they presented a so-called Siamese network that was able to correctly match 79% of the papyri fragments. In 2021, they further improved their approach. A dataset under a public domain was generated to better evaluate their results. Through certain experiments with different models and preprocessing steps, a top-1 accuracy of 0.73% was achieved. Because the authors communicated clearly what data was used, how it was prepared, and what metrics were used, the results from 2021 are much more reliable.

2.2 Graph Neural Networks

even nice results it seems that it is supervised on artificial data was just.

Task	Publication	Year	Method	Dataset	Public	Train Data	Val Data	Test Data	Metric	Result
Fragment Retrieval	Self-supervised deep metric learning for ancient papyrus fragments retrieval	2021	Self-supervised deep metric learning	Michigan	yes	800 papyri	100 papyri	100 papyri	Top-1 Accuracy	0.73
Fragment Retrieval	Self-supervised deep metric learning for ancient papyrus fragments retrieval	2021	Self-supervised deep metric learning	Hisfrag	yes	9000 papyri	1000 papyri	100 papyri	Top-1 Accuracy	0.87
Fragment Retrieval	Papy-S-Net: A Siamese Network to match papyrus fragments	2019	Siamese Network	B500	no	8500 patches	2000 patches	1000 patches (50 fragments)	True Pos. / Accuracy	0,79
Position Estimation	Using Graph Neural Networks to Reconstruct Ancient Documents	2021	Graph Neural Networks	B500 (subset)	no	3394 imgs	500 images	200 images	Accuracy	0.85
Data Argumen-tation	Data Augmentation Generative Adversarial Networks	2018	Generative Advesarial Networks	EMNIST	yes	-	-	-	Accuracy	+0.13

Table 2.1: The table summarizes the state-of-the-art publications for this thesis. In addition to the results and metrics used, other features are also presented.

2.3 Data Augmentation

Until now there is no specific paper about that topic. But its suggested by prirone et al to do it.

Chapter 3

Algorithms as Puzzle Helper

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3.1   Goals and Questions

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3.2 Methods

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3.3 Results

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3.4 Evaluation

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Chapter 4

Separating Text and Papyrus Fibers

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Chapter 5

Generating Historical Documents

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Chapter 6

Exploding Papyrus Fibers

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6.1   Goals and Questions

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6.2   Methods

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6.3   Results

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6.4   Evaluation

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Chapter 7

Discussion

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7.1   Impact of Text and Fiber Separation

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7.2   Impact of Generating Artificial Data

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7.3 Impact of Exploiting the Fibers

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Chapter 8

Conclusion

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8.1   Learnings and Findings

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8.2 Future Work

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Bibliography

Appendix A

Appendix

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