Manuscript Fragments, Reused in Bindings, as Untapped Genealogical Sources

Opportunities for Family History and Manuscript Studies to Easily Provide Information for One Another, All With the Help of Machine Learning

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However, this research is personal and not promoted by nor tied to FamilySearch

1. Introduction

We present a novel use of computer vision with the objective of searching for untapped information written on bindings made from previously-used manuscripts. The main data for which we are searching are instances of a trash piece of parchment or paper having a manuscript – such as a contract, deed, arrest record, roll call of monks, or part of a literary or theological work – as part of its binding.

It is important to note that many advances in computer vision currently come from the use of foundational models[1][2][3] that incorporate the latest advances in neural networks for image classification. Our main procedure consists of training a Residual Neural Network to identify cases of reused manuscript fragments from collections of document images. The collections may contain images from one codex, i.e. one book, or from many codices.

Specifically, as to our usage of a ResNet, we use the *ResNet-50* model[4]. Using the pre-trained weights from the huge ImageNet dataset as a starting point, we trained on over 600 images, about 1 in 10 of which contained examples of Reused Manuscript Fragments.

With a random 95:5 split between training and test sets, we obtained a 96.77% accuracy on the training set after 30 epochs of training.

To further test the applicability of such an approach in finding other interesting objects in manuscripts, we used a set of over 200 images, about half of which showed pages containing stitching used for parchment repair, to train and test. Again using a 95:5 split between training and data sets, we obtained a training accuracy of 100%.

We conclude that such transfer learning from ResNet-50, using initial weights from the ImageNet dataset, is capable of finding information that is new and useful to both genealogists and experts in manuscript studies. A tool to find such information has a very cheap price in training.

It is our hope that large, archival and family-history databases such as those held by FamilySearch and similar corporate organizations will be searched for genealogically relevant fragments as well as for fragments of literary, theological, and other works that are interesting to the manuscript studies community. As far as we know, no searches for Manuscript Reuse Fragments have been performed on the genealogical and archival databases. Along with this search, it is hoped that we can search the university and state libraries used by those in manuscript studies; we would find new material for them and would also have new sources of names, dates, and relationships to forward our work in family history.

2. The Manuscript Fragments: Definitions and Examples

We first show example document images where part of an old and unwanted

manuscript has been detached from its original codex and used to help bind and protect another document. (We will continue to refer to such detached parts as Reused Manuscript Fragments, also sometimes using the initialism, RMF, and sometimes using phrases such as "examples of reuse".) These images, their sources, and their usage information are available (and are bigger) at the GitHub of David Black, specifically at https://github.com/bballdave025/manuscript -waste-reuse-finder. They follow in Figure 1.
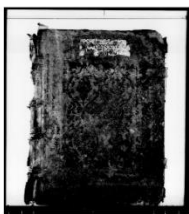
Fig. 1a (reuse)   Fig. 1b (no reuse)
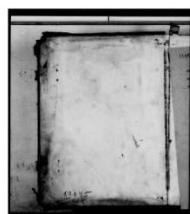
Fig. 1c (no reuse) Fig. 1d (no reuse)

Fig. 1e (no reuse) Fig 1f   (reuse)

Fig. 1g (reuse)

I will continue to refer to such detached parts as Reused Manuscript Fragments, also sometimes using the initialism, RMF, and sometimes using phrases such as "examples of reuse". A whole field, known as fragmentology, deals with such materials. An

open-access and peer-reviewed journal, appropriately named Fragmentology[5], has been publishing a yearly issue since 2018. Many consider the work of Ker to be foundational, especially his *Fragments of Medieval Manuscripts Used as Pastedowns in OxfordBindings with a Survey of Oxford Binding c. 1515-1620*[6]. It has been a known concern, if not a defined area of manuscript studies and codicology since, at latest, the dissolution of the monasteries in England (1536-1540), as noted by A. Reynolds[7].

There are several international efforts, whose names I give here, and whose websites I will list in the references, to catalog RMFs and to reconstruct as much of the originals from which they came as possible, inspired to use then-emergent technological tools. However, to our knowledge, the searches are done manually, with some reference to the metadata kept by libraries and collections. The only reference to AI we found in the field of manuscript studies was the mention of a grant to help use handwriting recognition and similar technologies to catalog Hebrew Manuscript Fragments, supported, among others, by the National Library of Israel and the European Research Council[63].Also, to our knowledge, no attempts to find, catalog, and reunite RMFs use such collections as those at FamilySearch and Ancestry®. We have the opportunity to add powerful tools and a huge dataset to such efforts, as well as to receive information about fragments with genealogical value.

This leads me to a favorite example of the new and important information that can be gleaned from REM. Librarian C. de Hamel bought some dirty old fragments in 2001 that turned out being a lost part of the Justinian Law Code[8][9].

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