

PhD Position 5 - Understanding a Collection of Historical Manuscripts

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Location: Synchronmedia Lab, ETS, Montreal, Quebec, Canada

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Keywords: Data-driven, Patch representation, Spatial graphs, Multiscale graphs and networks, Object-oriented modeling.

Context

Understanding of a manuscript, and more importantly the trends and thoughts developed and carried by a collection of manuscripts along time and societies, is a challenge that goes beyond the linear approach to make a one-to-one map between manuscript's content and its visible artifacts. This would require a hierarchy of representations and models at various scales and levels to achieve a semi-complete equivalent of a manuscript. Developing such a complex representation and also analyzing and interpreting it would require knowledge and also development of state-of-the-art machine learning methodologies.

Objectives

This PhD position could be seen as a 'bridge' among various other PhD positions of the VLP program. With a focus on being data-driven and objective while addressing a large number of manuscripts and variations in their associated styles and content, this research/proposal will develop document image representations from small scales of the region of a few strokes to large scale of a collection of manuscripts. Hierarchical methodologies will be used to make a smooth and coherent transition and integration among these at-first-seem-to-be incompatible representations along various dimensions, including spatial scales, year written in, manuscript time (page number, as an approximation), and spectrum, among others. In this perspective, everything is considered as an object toward an object-oriented framework for image processing and understanding for collections of manuscripts. Similar to the other PhDs proposals, patches would be one of the fundamental objects used to build and represent the other high-level objects. The developed representations will be equipped with associated methods and techniques toward enhancement, restoration, and transliteration of manuscripts in large numbers and scales in an objective and semi-automated approach. In particular, development of analytical and graphical approaches for patch representations toward understanding non-local relations among spatial graphs will be foreseen with the final goal of developing network-based methods of similarity and comparison measurement at the level of manuscripts. This would be approached by studying and extracting vast volume of hidden relations among low-level objects, i.e., patches and text chunks, toward discovering content-driven relations among high-level objects, i.e., manuscripts.

Research Question

What would be a graph-based hierarchical image representation capable to carry the information of a document image? What would be the role of Region-of-Interest (RoI) and spatial graphs in such a representation? What would be the associated operations considering high level of overlapping among Rols? How the complexity of such a representation would grow when it is used to represent a manuscript image or a collection of manuscript images? What would be the associated reduction methods to

summarize it into high level abstract relations and models? What would be an object-oriented approach that can visually model the content of a manuscript using interaction and information-exchange perspectives?

Domains

Machine Learning; Concept Learning; Information Fusion; Context Modelling; Statistics; Spatial Graphs; Graph Theory; Network Analysis; Image Processing; Signal Processing; Mathematics; Scientific Programming;

Requirements

A master in a relevant major; A CV of skills and experience in the relevant Domains; Possible published or under preparation papers relevant to the context of this PhD position.

References

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