A visual analytics framework for discovering temporal patterns in large scale artistic collections

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Abstract: In this research work we have come up with a framework for the visual analysis of temporal large scale artistic images. The goal of the research paper is to understand and discover the patterns in collections of art. The key technical aspect will be to adapt a standard model/framework and applying it on the specific art collection. Spatial consistency between different feature matches will be used. This will lead to having a more accurate style-invariant matching, and identification of patterns. The approach will be evaluated on selected artistic images. The findings have given us the understanding as to how the visualization of the large-scale paint image dataset can be made while finding relationships among different paintings through similarities and semantic information. This included tracking patterns, finding features with elements and principles in images by using image features. These observations have led to the understanding of influences of artists on each other based on patterns and origins of the paintings.

***Keywords*:** Artistic Collections Visual Analysis, Temporal Patterns, Visualizing Art.

1. INTRODUCTION

When we visit to any world-class art museum, we tend to think that each drawing is accurate and unique without realizing that the things are a lot complex and need thorough analysis and deep insight. While working with paint, a painter creates drawings for a variety of different creative reasons. At the time of the renaissance, it was not unusual for an artist to use the same physical objects in many drawings with little or no difference. Art historians have a strong desire to produce such a map, a visual connection between arts, to gain in depth insight into the artistic analysis of famous painters [1].

At present, these tasks are done by hand where researchers spend months or years in the archives of the museum expecting familiar visual patterns [2]. This research work proposes a framework or method that detects recurring viewing patterns in art collections. This task is very challenging as it requires analyzing the color changes, style, art media, geometric transformations, etc. thus requiring a dataset containing sufficient variance. Based on this, the paper presents a framework and develops a system to find a way to address these analytical issues. This requires visualization of available image or images on a single screen for the ease of user using the system. This is followed by the identification that if this image is a painting or a normal image and then comparing the input image with other available images to find and list similarities and patterns for the knowledge of the user [3]. To achieve this, the system needs to be trained for different kind of artistic images by using machine learning and deep learning algorithms. The algorithms

should be capable enough to find influences of different artists on each other in their work. The main objective of this research contribution is to provide a framework and platform for the visualization and discovering of large-scale artistic images. Hence the researcher proposes a learning approach which involves analyzing visual patterns across works of art within a dataset.

2. LITERATURE REVIEW

A survey of recent developments reveals that the tools designed for image processing for improving the toolboxes of art historian are in the earlier expansion processes. A variety of image processing methods can be used to classify and document the enhancements by historians for the analysis purposes at different spectral wavelengths. It is to noted about the depictions of the statistical consistencies in the real world was firstly explored by the researchers working on imaging techniques. The definitive study of natural luminance was introduced by Jones and Condit in 1949, while results of spatial statistics were reported by Kretzmer in 1952. Until today, vision researchers carried out a huge amount of the realistic work in this area exploring effective coding. It is fascinating to know that technologists are informed that art contains a variety of evidence about the interpretations of the natural scenes [1].

The collaboration of Computer vision with art works has a long-standing. On the design side, the results are promising as far as the transfer of art style to image is concerned [2], or even attempting to produce art [3]. On the analytical side, there are many options available in the collection and interpretation of the masterpiece databases [4,5], and then using them for classification [6]. Others focus on finding and applying methods to paint using both classical [7, 8], and deep [9] ways. Somewhat related to this research work is the work of Jin et al, where the same Brueghel data was used for annotating it to train five classes of items (carrots, cows, air mills, motorboats and boat ramps). Our goal, however, is to continue to focus on a critique of art galleries Seguin et al [10] who recommends discovering visual relations in the painting collections. However, the focus should be on finding new features for the research work. This allows us to focus on production of details, rather than the usual general idea similarities, which is what most art historians have pointed out in relation to a particular function of the Brueghel family.

In research, many computer vision tasks related to geometry, information or instance retrieval use spatial consistency. Sivic et al. [11] in his work directed towards the performance relating to the instance retrieval which is based on the extraction of spatially uniform local feature matches. This has additionally been created with particularly designed features for place recognition across significant visual changes [8,12]. Further this idea has been expanded to finding the object classifications [13] and then its segmentations. The repeated patterns through correspondence consistency are discovery as indicative of the work line on discovery of midlevel visual element [14]. In the broader context of spatial and temporal image collection analysis the above ideas have been used to find out the element's characteristic of a particular position [15], or the` enhancement of these elements over time [16]. To find out deep visual features for object classification in a self-controlled way spatial consistency can be benefited from either by predicting the spatial configuration of patches [17] or predicting the patch given its context [18].

Feature vectors comprised of wavelet decomposition coefficients were used by Lyu and colleagues [19] to split sketches by Pieter Bruegel the Elder from those of Bruegel's identified impersonators. Pertinent studies have used sparse coding models which were first established to examine effective coding in the essential visual context to predict the prospective historical dating of three Van Gogh paintings whose production date is debated by art historians [20]. Learning from collections typically involves pleasing artist-aware stylization [21] for reference images. StyleBabel[22] is a unique natural language captioning and tagging opensource dataset which is used for describing the style of art. A digital classification model [23] was developed by Todd Dobbs et.al to authenticate the proposed artwork with an artist. Haibo Chen et al proposed a style transfer method in [24] using deep neural networks to determine style to style relations. Milani and Fraternali [25] introduces a dataset for iconography classification using Convolutional Neural Network(CNN) to classify the icons from artwork.

Our conceived framework will propose a standard model for extracting the semantics from the artwork, finding the relations among different pieces of art and tracking patterns from the artworks. An artistic database and an art image browsers will also be the part of the proposed solution.

3. FRAMEWORK

To do the analysis, a research frame is developed which will provide a standardized approach towards the visualization of large-scale paint image datasets, finding relationships among different painting, tracking patterns in images, finding artistic features and identifying influences of artists on each other based on patterns and origins of the paintings.

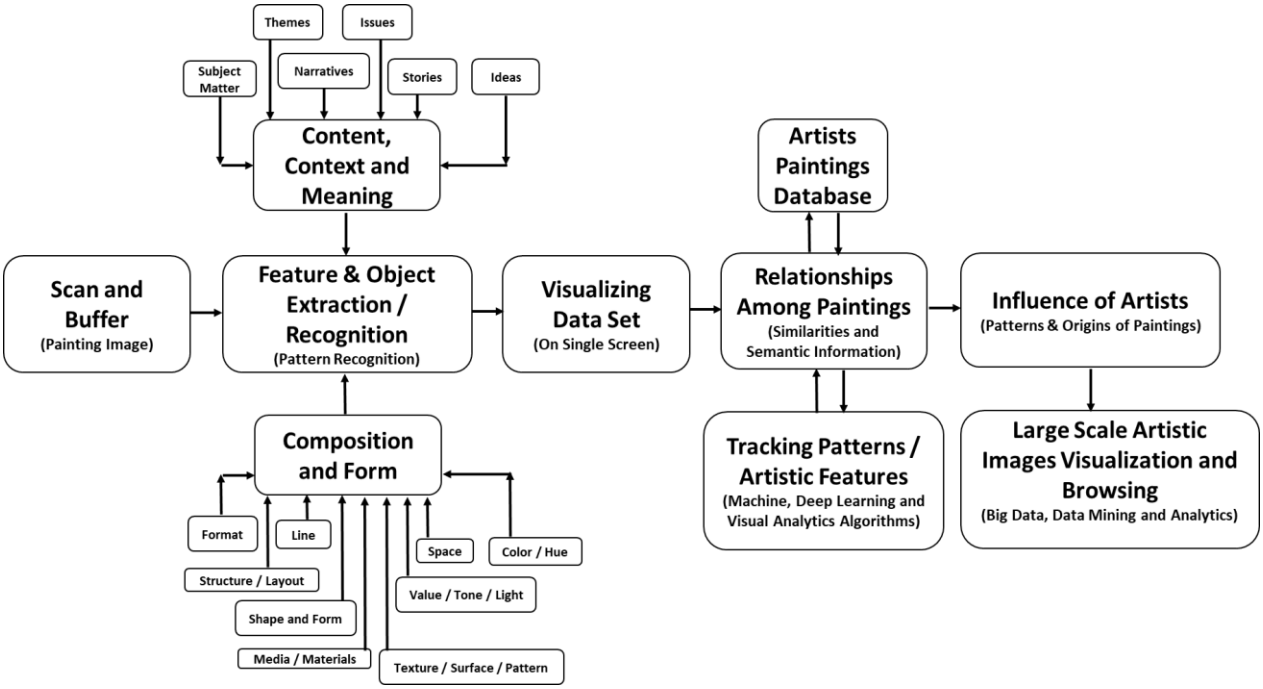

Fig.1. Conceived Framework

Fig.1 evaluated which involves the identification of format, structure, layout, shape, form, line, media, materials, value, tone, light, space, color, hue, texture, surface and patterns. Visualization of the large-scale artistic collections will be done and the relationships among the paintings by identifying similarities and semantic information. Artist's paintings database will provide a channel for doing the respective comparisons which will be aided by machine, deep learning and visual analytics algorithms to track patterns and artistic features. This in turn will provide the insight into the influence of artists in relation to patterns and origin of paintings.

The final objective is to have virtualization of large-scale artistic images through browsing by employing big data, data mining and advanced analytics. The conceived framework if adopted will provide the requisite baseline that can be used by any artistic art historian to analyze works of art with greater insight into painter's creativity and impressions embedded in various layers of artwork.

4. CONCLUSION

In this work we have proposed a comprehensive visual analytics framework for pattern detection in artistic images based on context, composition, and relationship among various paintings. The proposed method enables the users to find visual information regarding large scale paint images. The designed framework can be adopted by any researcher or historians to come up with a system which can easily identify similarities and attributes of millions of paintings across the work. Its future application can also be to identify fake copies or copying of the painting elements by other painters in their artworks thus compromising the originality and creativity of the artistic minds.

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