Preserving the Integrity of Li Yu's Craft Aesthetics Using the Digital Information Technology

Shan Liu *

Ph.D. Candidate, Department of Fine Arts, Krirk University, Bangkok, 10220, Thailand
0121000389@ahcme.edu.cn

Article History	Abstract
	Preserving the integrity of ancient aesthetic works has become a greater matter of concern in the modern digital age. As the internet is streaming with data that are collected from multiple sources, it imposes a severe threat to the integrity and security of the original aesthetic of many craft works. This paper proposes a novel framework that attempts to preserve Li Yu's craft aesthetics, which can be explored from his wide range of literary collections. As the author is popular for his excellence in many art forms like gardening, theatre arts, etc, recreation of his work is a major problem of concern. The framework initially pre-processed the corpus to extract keywords, which are then subjected to a semantic vector to find the closely related as well as differing words. Then, these words are subjected to geometric perturbations to impart versatility to the training phase. The text under screening is fed to the classification phase to find whether it is an altered or modified work of Li Yu, thus isolating the author's work from being reproduced, which greatly affects the aesthetics. As a future extension, the work can be trained with different classifiers to develop a defrauding system.

1. Introduction

Recent developments in computing technologies in the context of storage, reproduction and networking has facilitated the voluminous amounts of digital information steaming into the hands of people. The streaming information can be of heterogeneous forms like text, images, aminations, audio, videos, etc. [1]. It can be observed that textual data are the primary manifestations with a high dissemination rate with the highest usage frequency [2]. However, this massive usage of data has some pitfalls, like copyright and other legal infringements [3]. Figure 1 shows the data activity happening in one minute on the internet.
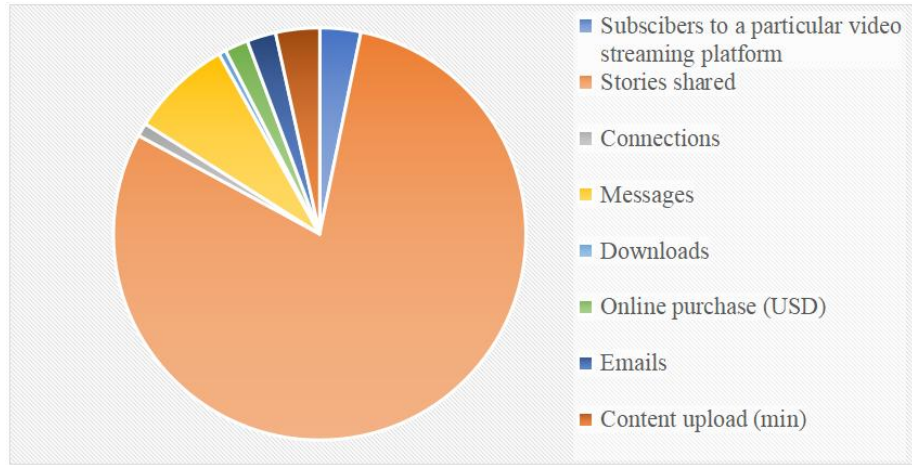
Figure 1. One-Minute Data Access on the Internet

The improved data availability has given rise to numerous legal disputes as well as illegal infringement problems that demand author identification techniques to resolve disputes. It can be observed that textual material authored by different authors has its unique writing styles, while versatile content written by the same person is said to exhibit many similarities, like the use of metaphors, vocabulary and other parts of speech [4]. The process of author recognition in the textual data extracts the features and counts them from a source of a large volume of texts authored by different people to learn the patterns [5], [6].

China is a country with a long cultural lineage whose history has witnessed many authors and ancient books [7]. The Restoration and Control of Ancient Books defines ancient books written in Chinese as books printed or written before the year 1912, with traditional binds and layouts. The medium of writing can be silk, bamboo slips, paper transcripts, manuscripts, woodblocks, rubbings, stone lithographs etc [8], [9]. Also, a few rare books exist with better collating, old block prints, hand-written manuscripts, etc, by popular authors. This subjective concept differs between people during different timelines. For instance, the Song Dynasty existed in the period of 960-1279, during which rare books were written based on the quality of intellectual content [10]. Also, the Ming Dynasty was well known for books for its formats and varied printing styles [11]. The Tsing Dynasty is demarked by books based on style and content [12]. These books have significant archaeological as well as artistic value [13]. Figure 2 shows a sample of Chinese block prints.

Figure 2. Chinese Ancient Prints

The quality of a book is very subjective and demands high-level expertise to assess its values [14]. It can be seen that present-day curators of ancient books cannot be claimed as fully qualified experts. Chinese libraries comprise nearly 27.175 million volumes of traditional and ancient books [15]. These books hold significant cultural value and serve as historical records that need greater maintenance and preservation.

1.1 Li Yu's Craft

Li Yu [16] is known as the maverick cultural entrepreneur of China who lived during the ancient Ming-Qing dynasty. The period was roughly estimated to be in the seventeenth century. Li Yu [16] had a well-known acquaintance among fellow authors and is widely accepted by the public. He is so popular that China claims all men, women and children in China would have heard of his works and fame. His works were accessible to the public and have managed to survive through generations. His work covered various literary works in different cultural forms, including theatrical performances, books on fashion, wellness, gardening, interior design, composition of letters, administrative documents, etc. His non-literary works are reshaped through woodblock-printed forms that are easily reproducible. Towers in the Void is concrete proof of the groundbreaking analysis of Li Yu's work across various fields [17]. This work comprehensively uses digital media to go through the art form, which exposes Li Yu's creativity. The author also claims that Li Yu's experimentation from the cultural perspective exploits the association between language and the tangible world.

His works were unique as they drew attention to the materiality of specific forms of media, thereby widening the media's scope by interweaving buildings, books, bodies, etc. His cultural entrepreneurship, augmented with the printed book technology, fostered the reproducibility of his works but with his distinct personal touch [18]. Li Yu's chief literary practice was very popular in his garden design, and he transformed them into vernacular short stories. To add support to his ideology on human body modification, he explored the usage of human bodies.

In the year 1651, he exhibited his first play at the urban centre of Zhejiang [18], located in the city of Hangzhou. In the pre-eminent period of around the 1650s, he published either a new play or a collection of short stories every year. His most popular works include Silent Operas, published in 1656; Priceless Gems, published in 1658; and Twelve Towers, published in 1658. In addition to this, Women in Love and nine other plays are also very famous. Table 1 lists a few notable works of Li Yu.

Table 1. Few Notable Works of Li Yu

S.No	Title	Genre	Year
1	Silent Operas	Play	1656
2	Priceless gems	Play	1658
3	Twelve towers	Play	1658
4	Gujin Shilue	Essay	1659
5	Lungu	Essay	1664
6	Zizhi Xinshu Chuji I	Essay	1663
7	Zizhi Xinshu Chuji II	Essay	1667
8	Xianqing ouji	Leisure notes	1671
9	Woman in Love	Short story	1658
10	Liweng yijiayan	Poetry	-

Li Yu started to expand the horizons of his literary productions by involving himself in projects which demonstrated his knowledge level and also spread his works in his wide social networks. Few of his projects written during his late years were perceived as collections of his own nonfiction prose work as well as compilations of notable contemporary writings. These works also included compilations of prose, court cases and letters. His writings were distinctive and witty but not comic. His essays on various subjects illustrate excellent observational skills in a wide range of subjects. A few of his interests include governance and history, as he wished to be a civil servant during his early phase of life. The work of Xianqing Ouji [41] is an experimentation that guides the readers about renewing their daily experiences in life. He also witnessed the publication of his selected prose works and even poetry in multiple genres, which were compiled under the title Liweng yijiayan.

Li Yu also constructed a garden residence of his own design, namely in Jiezi yuan, commonly known as Mustard Seed Garden, which also contains a residence, a publishing house, and a bookshop at the Zhengyang Gate. This place sold his own works and also woodblock-printed stationery. It was in this place he also directed a theatre troupe with his own concubines as the leads. Figure 3 shows his inscriptions as drama.

Figure 3. Silent Drama- Integration of Ancient Chinese Short Stories by Li Yu

Li Yu's ideas on self-revelation were further articulated by Yuan Hongdo [42]. This was very prominent in his works, as they manifested more of his values, interests, and attitudes. The most notable part of his writing is the aesthetic value. His approach to the crafts was very unique and had an artistic touch. He proved himself to be a skilled practitioner who could explain the aesthetics to even a novice. The analytical treatizes were on exceptional clarity on his dramas, arts, gardening and various other fields. Figure 4 shows the magical bath as described by Li Yu in his work.

Figure 4. A Magical Bath Transforms the Chou

1.2 Chinese Art Market

Mainland China has the biggest art market, with around 44% of collectors who are willing to spend more than $1 million for their artistic works. This has made Greater China the world's second-largest art market, and the sales have increased year by year, which is shown in Figure 5. This was further accelerated by auction businesses that have emerged fresh in many parts of China, and around 30 new art galleries were opened in the year 2021. The Chinese antique pieces will always remain popular in the market as new populations have embraced appreciation, especially in Western countries. Domestic Chinese art buyers are now connected to the world through education, the internet and personal travel. Hence, these products have acquired global attractions, and some of the forms are now missed with Western designs. The newly manufactured products are marketed and manufactured in many different places, which makes it difficult to distinguish them from contemporary Chinese art.

This massive production of aesthetic goods is also becoming very common in written literary works, where the aesthetic inscriptions are being copied and reproduced. This has created the necessity for extending the creator's claim of literary works with appropriate rewards for his work. This ensures protection as the exclusive use of the author's work. There is a severe need for restriction on the usage of any artistic work, which protects the author's wilful claim for ownership [19], [20].
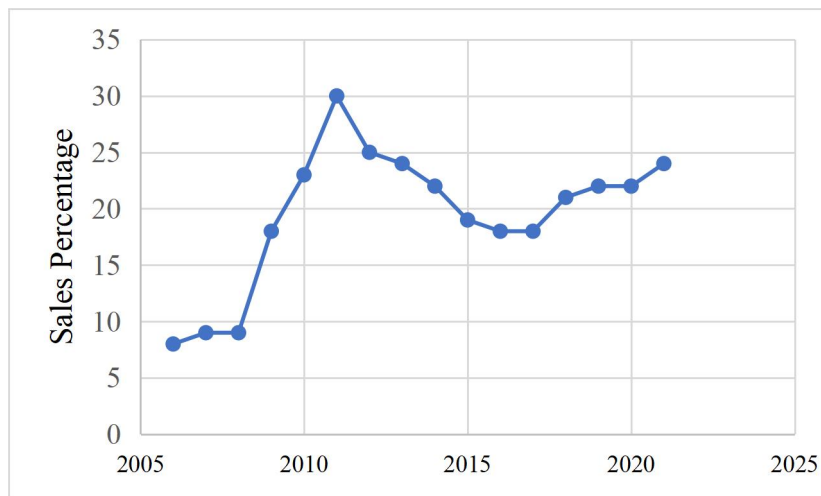

Figure 5. Art Market of China

As Chinese aesthetic elements have good global market value, there are many duplicates which closely mimic and reproduce the artistic works. This is very common in many artefacts like paintings, silk, fabrics, furnishings, wooden works, ceramics, and even literary works. This work focuses on protecting the literary works of Li Yu as his works have rich artistic and aesthetic appeal. Many infringements are made by trying to create exact replicas of the products and gardening ideas published by him in a variety of books [21]. The work integrates data mining and perturbation, adding technology to ensure the integrity and security of the literary works of Li Yu's aesthetic crafts, especially in the field of gardening [22]. Figure 6 shows a few data security threats to ancient aesthetic works like Li Yu.

Data Partitioning	Data Modification	Data Confinement	Ownership
• Cryptography based • Generative based	• Noise addition • Data addition • Data Perturbation • Randomization • Space transformation • Similarity based reduction • Dimentionality Reduction	• Blocking • Sanitizing • Hoslistic Data sharing • Partial data sharing • Pattern sharing	• Copyrights • Infrindgements

Figure 6. Data Security Threats to Ancient Works

2. Related Concepts

This section briefs a few important milestones in preserving aesthetic crafts using various contemporary techniques. The application of a Machine Learning (ML) algorithm that learns from its previous experiences in protecting the integrity of artistic works regarding the authorship claims is discussed [23]. This work comprehensively reviews the copyright laws based on the authorship of the literary works. A few expert opinions are also presented in this work with a futuristic ML model. The immutable nature of blockchain has opened new doors for preserving the integrity and data security of literary works. The authors can use blockchains to create quasi-immutable records depicting the ownership with special encoding in the form of smart contracts [24]. In addition to this, the work investigates the distinction between smart-contract-based ordering and copyright laws in the context of limitations and exceptions.

Widespread usage of Artificial Intelligence (AI) is connected with the term anthropocentrism or machine author. This has challenged the copyright law and necessitates legislative responses. This trend is more prevalent in China, where many disputes arise in the context of the originality and ownership of historic artefacts [25]. The work proposes a neighbouring rights scheme along with a digital signature for regularising the AI-generated textual content. Copyright volitions are not only confined to textual content but also to videos. To a great surprise, YouTubers do not necessarily fulfil the related rights or any Copyright Law [26].

Website contents are also subjected to Intellectual Property Rights (IPR) including copyrights. In addition to this, they also fall under the category of separate objects of civil rights. The correlative association between the website and the domain name is done through a comparative method [27]. The results show that both of them should be treated as independent objects. Research on the ownership of the Japanese comics industry that investigates the Manga business and its associated copyright law to explore the reasons for decentralized copywriting [28]. The work highlights the Manga market and Japanese publication right to show the success story of the comic work.

A detailed review of the capabilities and limitations of blockchains and smart contracts from the perspective of copyright is done [29]. Enforcement of copyrights and other Digital Rights Management is well preserved using his technology, which is discussed in this work. Not only does textual content copyright law also protect other artistic works like the Balinese weaving of Indonesia [30]. The sui-generis model facilitates the inventorying as well as proper documentation of the method as a way of protecting it as it still faces challenges as this traditional motive can be easily reproduced as an industrial fabric and commercialized in the digital era.

Music is an entity which is very difficult to protect. Especially the owner or composer of folk music is not one specific person but a local community. As the copyright acts do not support These challenges and possible solutions to the issues are discussed with a special mention to IPR [31]. A framework of copyright law is also proposed. It is very difficult to maintain a code of honour in ancient books as the writing did not have much commercial value, and it was technically not feasible to impart security to a monopoly work [32]. In the sixth century, the Theognis of Megara showed evidence of plagiarism as well as theft. This was the earliest idea of IPR obtained according to the literature. The development of AI big data has made it possible to digitize ancient books. Chaoxing

and Hualu Group [43], along with university digital libraries, has attempted to digitize ancient books as a part of the regenerative process to protect those books [33]. This is also seen as an act to inherit traditional culture. This work also discusses various organization styles along with automatic integration systems.

Thus, the brief literature shows that many attempts were made to secure and protect the integrity of ancient books and various art forms through contemporary digital technologies. However, there is no framework exists for finding the copying of aesthetic elements described in the textual forms as in the case of Li Yu's works. This article proposes a novel framework using natural language processing and a perturbation model that protects the integrity of Li Yu's work from being altered or modified in its form.

3. Methodology

In the digital era, identifying and protecting the aesthetics of ancient literary craftworks is a great concern and challenge due to the various computing techniques available to modify the artworks. However, the integrity and ownership of the aesthetic craft works mentioned in the ancient literature can be recognized using text feature recognition and classification to learn the significant features of the ancient works. Apart from learning the original features, there are fat chances that the work may have been reproduced in an altered form, which is very difficult to recognize through automatic means. Hence, this work used the geometric noise perturbation method to induce noise in the text forms and then find the feature vectors of the original text. The training data for the proposed framework shall comprise original data as well as the data that was perturbated to facilitate the model to learn all types of duplicate versions.

The author recognition happens in two phases, namely, the training phase and the classification phase. The primary operations of the training module include pre-processing the corpus, extracting keywords, generating similar text using vector semantics, generating noisy data and then the classifier. The classification phase includes a comparison of the altered text with the original ones to find whether they contain the aesthetics of Li Yu's craft. Figure 7 shows the training phase of the framework.
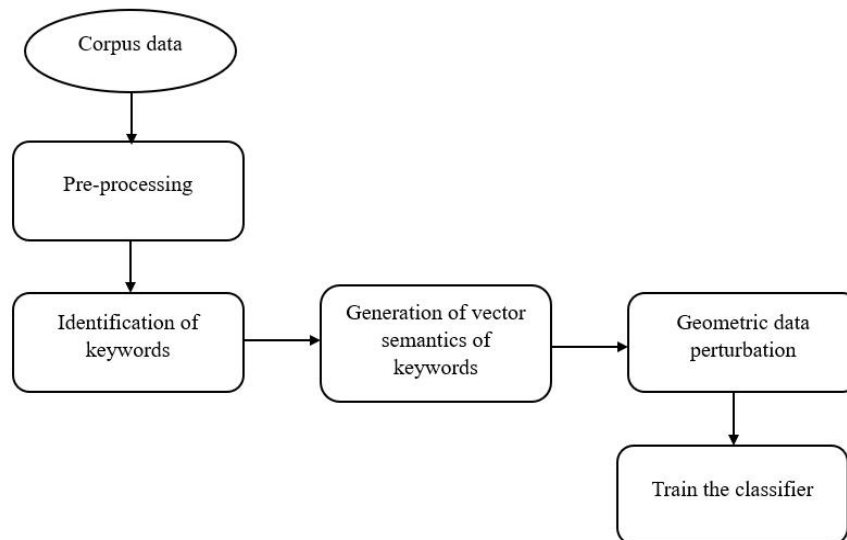

Figure 7. Training Phase of the Proposed Framework

3.1 Pre-processing Steps

The corpus data is pre-processed using various methods to extract the keywords or features in this work. Four pre-processing operations are done to extract the keywords from Li Yu's literary work, which depicts the aesthetics of his crafts. Figure 8 shows the reprocessing techniques used in this framework.
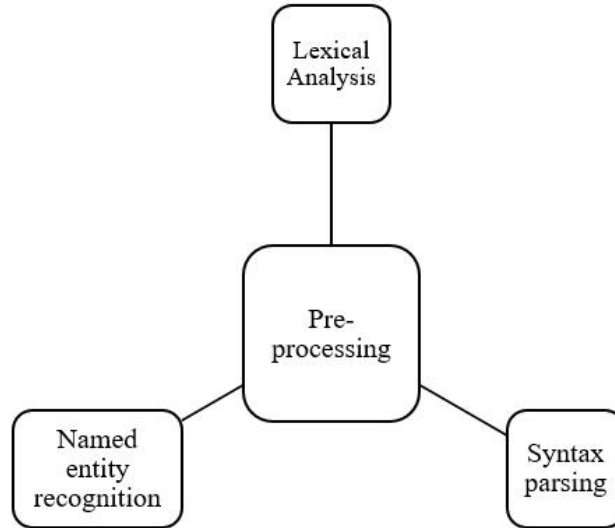
Figure 8. Preprocessing Phase

3.2 Syntax Parsing

Syntax parsing of Li Yu's literary work is done by analyzing the syntactic nature of the textual forms by analyzing its grammatical arrangement and the associations between the words [34]. The pos-tagger method, which is based on the Context Free Grammar (CFG), is used in this work to learn the structure of the texts.

3.3 ii) Recognition of Named Entities

Recognition of named entities is a way to extract information and has a crucial role in identifying keywords [35]. This work uses a conditional probability model [36] to identify the named entities in Chinese. This named entity recognition is done as follows: The features F-2, F-1, F0, F-2 F-1, F-1 F0, F0 F1 and F1 F2 are used where F0 is the current character, F-1 is the previous character and so on. The probabilistic model uses the basic features from F-2 to F2.

3.4 iii) Lexical Analysis

Each word in the text is tokenized based on the patterns observed in the Chinese language [37]. The Chinese lexicon is used to match the words apart from providing the syntactic information, which will be helpful to know the context.

3.5 Generation of Vector Semantics of Keywords

The vector semantics or embeddings indicate a word in any language in a multi-dimensional vector space. This is a defacto standard in NLP as this method can learn the words automatically from the underlying text in an unsupervised fashion. The work uses Term Frequency and inverse Document Frequency (TF-IDF) methods to generate word embeddings. This method is obtained as a product of TF as well as IDF. The former is the frequency of the keyword, while the latter assigns much higher weights to the keywords that rarely occur. These words play a significant role in discriminating Li Yu's aesthetics from others. The TF is downscaled by the log10 scale, as mentioned in Equation 1.

$$TF_{(t,d)} = \begin{cases} 1 + \log \text{count (t,d)} & \text{when freq(t,d)} > 0 \\ 0 & \text{when freq(t,d)} \leq 0 \end{cases} \qquad (1)$$

t indicates the frequency of the keyword occurring in the document d. The IDF is found according to Equation 2.

$$IDF_t = \log\left(\frac{\text{Count of documents considered}}{\text{Frequency of the keyword appeared}}\right) \qquad (2)$$

Estimate the weight according to Equation 3. This actually indicates the significance of a word in Li Yu's work to act as a major discriminative factor. Figure 9 shows a sample vector semantics.

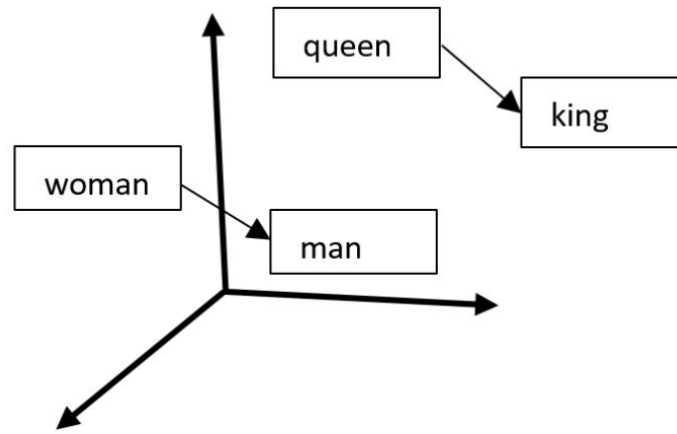$$Wt,d = TFt,f \cdot IDFt \qquad (3)$$

Figure 9. Sample Vector Semantics

3.6 Geometric Perturbation

The Geometric Data Perturbation (GDP) is done by rotating the perturbations along with random translation perturbation [38]. The noise is added as Y = R £ X. This method is more robust and yields better efficiency in combating integrity [39], [40]. The attribute is signified as G(X), and T indicates the translation. The random rotation is denoted as R, and D indicates Gaussian Noise. X is the data that was obtained after word embeddings. The calculation of G(X) is done using Equation 4.

$$G(X) = RX + D + T \tag{4}$$

The addition of noise D is based on Equation 5.

$$D = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-(x-\mu)^2}{2\sigma^2}} \tag{5}$$

The σ is the standard deviation, and μ is the mean of the words. R is the rotation of the word to 1800. Also, the translational matrix (T) is the summation of the keyword along with the mean value. The R preserves the original data through Euclidean distance apart from protecting the sensitive data through the distance. But this alone will not be sufficient to discriminate the data. Hence, the Translation conversion maintains the distance. The mean value of the keyword is added to the original value. But this method is more prone to attacks. Hence, this must be combined with Rotational perturbation with noise element to ascertain data discrimination.
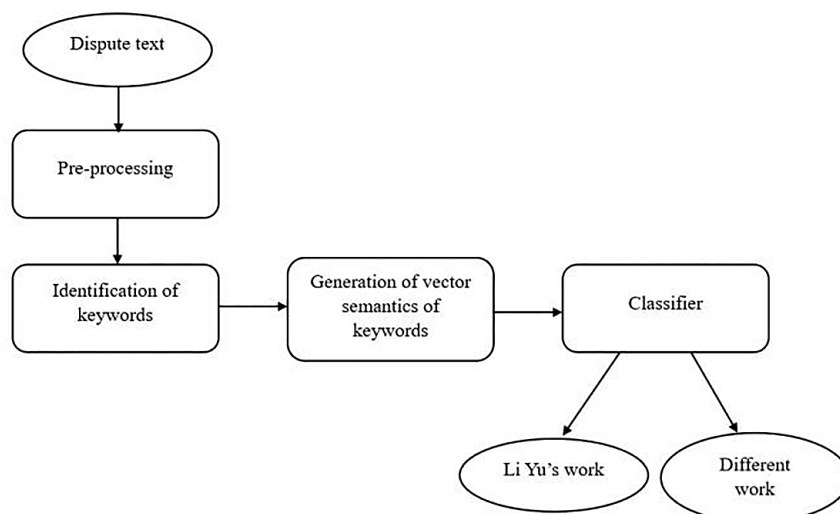
4. Classification of the Dispute Text

Figure 10. Framework for Protecting the Aesthetics of Li Yu's Craft

Figure 10 shows the framework that isolates Li Yu's work from others. The classifier mentioned in this framework can be a simple machine learning classifier like logistic regression, Support Vector Machines, Decision trees and homogeneous ensemble algorithms like random forest [44]. However, while choosing the classifier, the performance has to be validated by choosing the

one that best learns the usage of word patterns and language styles. This is similar to the training model, except the noise addition phase is not included. Thus, this framework takes the original Li Yu's text and extracts keywords from it. Sometimes, the copied crafts may use the contents by finding synonyms and antonyms of the keywords. Hence, they are generated using vector semantics, which generate all the similar and opposite words that may mimic the original aesthetic craftsmanship. The training is done by adding geometric perturbation by adding rotational and translational works. In addition to this, random noise is also added to impart versatility in training. The selection of a classifier is beyond the scope of this work. This framework is very generic, and hence any classifier can be used.

5. Conclusion and Future Work

The digitization of ancient Chinese literature work brings a new turn to the lifestyle by generating crafts and other artistic work. Streaming digital information has paved the way for easy modification, alteration and even reproduction in digital or physical means. This is a serious threat to the preservation of security aspects of the literary works. This work focuses on securing the aesthetics of the crafts as described by Li Yu's work by proposing a novel framework that integrates semantic vectors to generate word embeddings. These embeddings are then subjected to geometric perturbation which generates words which are induced with rotational and translational transformation and then adding random noise. This is done to impart versatility to the original corpus. The two phases of this framework are the training phase and the classification phase. The text with dispute is subjected to the classification phase which differs from the training phase as it does not have any addition of perturbations. This work can be used along with any type of classifier, thus making it more robust. As a future extension, the framework can be tested with various author's works.

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