昆山杜克大学
DUKE KUNSHAN UNIVERSITY

SIGNATURE WORK PROJECT PROPOSAL

Please complete every section of this form, including the relevant signatures. The project proposal should contain specific information about the project you will pursue. The SW project proposal form must be signed and approved by the SW mentor and SW co-mentor if applicable. **Any unsigned forms will be returned and not accepted**. All project proposals will be reviewed by the signature work faculty review committee before being accepted. SW project proposals not approved will be required to revise and re-submit. Submit this form by following the instructions on the SW Sakai portal for review. This will include filling out the Qualtrics survey and uploading the form.

STUDENT INFORMATION

Name:		Yantao Mei		Date (*m/d/y*):	11/29/2022
NetID:	ym174	Major:	Data Science	Graduation Date *(m/y)*:	05/2024
Email:			yantao.mei@dukekunshan.edu.cn		
SW Mentor:	Prof Benjamin Bacon			Division:	AH
	Email: benjamin.bacon@dukekunshan.edu.cn				
SW Co-Mentor If Applicable:				Division:	

Project Type:	Type:	Creative	☒ Individual	☐ Team-based

If team-based, list names/roles of members

Research Direction: Machine Learning, Media & Art

Individual Project Title: (*Notes: Please format your individual project title as the following "Discipline: Contextual SW Project title."*)

Discipline: Picturing Poetry: Translating Chinese Classics into Art

Team-based Project Title: (*Notes: Please format your team-based title as the following "Team Project: Contextual SW Project title."*)

Five Key Words (Required):

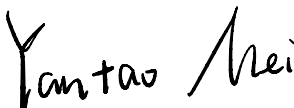AI Painting, Chinese Ancient Poem, Machine Learning, NLP

2

Provide a description of the proposed Signature Work. This should include any division- or discipline-specific instructions.

A. Rationale/purpose (500 Words)
(What is the importance, to you, of the project?)

As a practical project, "Picturing Poetry: Translating Chinese Classics into Art" (hereinafter called Picturing Poetry) has its importance on a technical level. Picturing Poetry is a project that uses a variety of machine learning methods and knowledge. Due to its technical feature, this project is a demonstration of learning outcomes for me as a Data Science major student. In this project, there will be NLP (Nature Language Processing), deep learning, artificial neural network, and other pieces of knowledge that are taught in statistics courses to be implemented to turn poems into pictures. Moreover, this project is also an opportunity to exercise and put knowledge into practice, which is vital for the data science major that is designed to be used in real life. In the process of achieving the project objectives, there will be not only

the accumulation of experience but also the tests for personal skills since this is an individual project. With the comparison between different models of AI drawing, this project will also set a standard for judging the quality of the outcomes of different AI drawers and find out which is the most suitable for turning Chinese poem prompt into graphical outputs.

Besides the technical meaning, Picturing Poetry also has its practical and educational meaning as an applicational project. By the end of this project, we will get the tools that can visualize Chinese poems, which can explore the diversification of understanding Chinese ancient poems. As a traditional Chinese cultural classic, the Chinese poem is known for its beautiful artistic conception (意境). However, it is also the difficulty for people who do not speak Chinese to understand the atmosphere created by a work of Chinese literature or sense the feeling that is designed to evoke in the viewer or reader. Having a graphical representation of Chinese poems can make people, who are interested in Chinese poems a detailed, more acceptable understanding instead of being confused by the language gaps. In another word, Picturing Poetry is positive for the propagation and inheritance of Chinese culture, which is highly related to its practical meaning and educational meaning. According to Qiu and Bai, the key for traditional culture to attract young people is experience and participation. Thus, the outcome of this project can provide a tool for young people to customize the visualization of Chinese poems by themselves, which provides sufficient amount of experience and participation that can support the development of Chinese poetry culture among young people. Nevertheless, this project can also be used as the educational tool in the process of teaching Chinese poem literature and other Chinese courses.

Also, by analyzing how AI try to imagine Chinese poem, which is translating references into objects in semiotics, we can figure out new perspectives to understand Chinese poem, and how AI and algorithms contribute to communication and semiotic theory.

For myself, Picturing Poetry is a personal reflection on the process of learning Chinese. When I was in high school, I did very poorly in Chinese class, especially in classical prose and poetry. At that time, the barren knowledge of ancient Chinese and my poor imagination makes me suffer. This provides me the motivation to create Picturing Poetry to help people understand Chinese poems better and make up for my regrets at high school.

B. Project Objectives (500 Words)
(What are the key goals of the project?)
Picturing Poetry's goals are separated into two parts, implementation, and products. The implementation part is all about codes and implementations of the whole process to visualize Chinese poems. For the product's part, it is about the application of this tool. In this way, the key goals are separated into several phased goals for this project: 1. build a machine learning model that turns Chinese poem into text prompts that fits the standard of AI drawers; 2. compare the outcomes of different AI drawers; 3. sum everything up to build a usable tool for the visualization of Chinese poems; 4. generate an image based Chinese poetry graphic novel.

To be more specific, in Phase 1, the key goal is training a machine learning model using a Chinese poem database and other resources that can take Chinese poem as input and change it through neuro network and other models to make a text-based prompt in English, which can be read in popular AI drawers or self-trained AI drawers. For Phase 1, the condition of success is to have a majority of Chinese poems successfully and fully "understand" by the AI drawer, that is to say, most of the imagery object (意象) shows up in the prompts. For Phase 2, we need to compare different outcomes of different AI drawers, which means that for the same Chinese poem prompt we input, there will be a standard to distinguish the qualities of image outputs. As an example, we can use questionnaires to implement double-blind tests for people on the Internet to grade different outputs for the same poem. In Phase 3, which is basically the combination of the result of Phase 1 and 2, the key goal is to have a graphical user interface that can take Chinese poems as input and directly output the image to the user. In this Phase, the importance is to connect the machine learning model and AI drawer by a front-end machine, which will be the last phase related to codes. In Phase 4, which is the phase about the application of this tool, we can get an image-based Chinese poetry graphic. In this novel, there will be selected outputs from the previous phase and presented in the form of a combination of texts and images. Nevertheless, by analyzing how AI "translates" text into images from semiotic and communication theory's point of view, we might have a new way to understand the ontology of sign, language, image, and AI.

In sum, the goals of Picturing Poetry combine machine learning knowledge implementation, the

practice of building software, Chinese poem analysis, media theory, and visual products. The goals will present the purpose of this project, which is the examination of machine learning techniques and practical influences on Chinese poems' inheritance and development.

C. Project outcomes? (300 Words)
(Describe what information or knowledge you expect to generate from the project. Include any non-written deliverables such as codes, exhibitions, etc).

Like the importance of Picturing Poetry, this project has diversified outcomes. The outcomes of this project can be divided into two parts: analysis and products. The Analysis part focuses on the discussion of the process of implementation and project results, which will be shown in the comparison between different AI drawing models and the research paper. In the comparison between different AI drawing models, we hope to build a grading standard for the image outputs which can help to quantify the quality of the image output. This grading standard is not limited to judging Chinese poem input, however, the various AI drawing in the form of input text and output image. In the research paper, the detailed methodology and machine model training process will be involved in the discussion. During the process of this project, there will be difficulties and problems with statistics, computer science, machine learning, and Chinese literacy, which will also be recorded and analyzed in a research paper. In the part of the product, there will be two major outcomes: the Chinese poetry analysis model, the software of Picturing Poetry, and an image-based Chinese poetry graphic novel. As the by-product of this program, the Chinese poetry analysis model can turn Chinese poems into English prompts, which provide an interface for other applications related to Chinese poems. This by-product has strong scalability that can be used in Chinese poems' translation and other statistical analysis and computer science or data science application. The software of Picturing Poetry as one of the major products of this project will be a mature tool for visualizing Chinese poems and can be customized with the output via adjustable settings. This tool can be used in education, cultural creation, and other perspectives. As an exhibition of the result of the project, the Chinese poetry graphic novel will include several Chinese poems and its image generated by AI.

D. Methodology (750 Words – 1000 Words)
(How do you intend to accomplish the project

Phase 1: In the process of turning a Chinese poem into an English prompt, we plan to use NLP (Natural Language Processing) process in python using "jieba" library. With the customized Chinese poem thesaurus, we can split Chinese words accurately for the latent semantic analysis (LSA). LSA can analyze the relationship between different words and conjecture the meaning behind these words, for example, the combination of wind and moon in a Chinese poem usually refers to the poet's homesickness LSA can be trained to fit this kind of connection between imagery and the feeling. Having the meaning and feelings of the poem, we can add these words to the text prompt to adjust the image to be more empathetic. Also, we need to filter the objects or imageries to simplify the text prompt for two reasons. First, the common AI drawers usually have a word limit to control the number of text vectors in order to increase the accuracy of the image line process. Moreover, overwhelming objects in small-scale images that AI may disturb viewers to understand the meaning of the image, after all, this image is to help people understand the artistic conception in poems. Thus, we need to use NLP to filter out the main objects that have a strong relationship with the theme.

Phase 2: In this part, we need to use AI drawers to take the text prompt that we produce and turn it into an image. This process acquires denoising diffusion probabilistic models and Variational Autoencoder to encode text prompt, generate a rough, low-resolution image, and diffuse this rough image into the delicate image. The denoising diffusion probabilistic models are constructed by multiple layers of the neural network, which include generation networks and extension networks. In each round of diffusion, the image will be added as noise and then be input in the generation networks where text prompt will impact the process of denoising. If we need to extend the size of the image, after denoising, the image will be extended through the extension network. With every round, the image will be detailed and fixed. That is to say, with the first few rounds of production, the objects in the image and the composition will be fixed, while the rest of the process is to polish and beautify the image.

Phase 3: In this part, we plan to build a UI to connect the NLP process and AI drawer in the form of a website or applications on the computer. Though the detailed implementation of UI is not decided, the function should be the same, which is to have basically a text bar to input Chinese poems, and an image window to show the result. To make the output more adjustable, we can also add more input that

corresponds to the variables in the AI drawers like strength, noise, random seed, and other parameters. Also, we will add the output of the text prompt to analyze different poems' image accuracy and provide a way to debug. With these functions, the UI should be able to test and publish. However, there are more functions like historical records, recommended settings, and other things that we can add to UI later. To achieve these functions, the UI needs to have the ability to create communications with the python program of the NLP model and other websites or applications to run AI drawers.

Phase 4: At the end of the project, this part is focusing on the analysis and comparison of AI's performance. With thousands of Chinese poems and different settings, we will get a sufficient amount of image output to analyze. First, we need to grade different images depending on their completion of content, composition, detail, and the expression of the theme. Then we need to compare different AI drawers according to the grades we get. During this process, we can select some representative, beautiful, or interesting images and make them visual image-based Chinese poetry graphic novels. On the other hand, it is also worth discussing the meaning of using AI to turn Chinese poems into images. Turning a Chinese poem into an image is different from turning a straightforward description into an image. Comparing to the latter, a Chinese poem contain sets of objects, for example, bamboo and wind, moon and river. These objects not only represent themselves but also represent the emotion and other things that poets want to express. However, AI does not have feelings, either intelligence. Thus, the process for AI to turn poems into Images is actually making connections using the data in the database, solving math equations, and executing the code – the semiotic transformation became a math problem.

E. Project timeline (No Word Limit)
(How do you see the completion of the project unfolding?)

- Preparation (January to June): 1. Find the database of Chinese poems; 2. Choose the lists of AI drawer models; 3. Have a prototype of the NLP process; 4. Design the UI to connect NLP model and AI drawer.

- Implementation (June to September): 1. Polish the NLP model; 2. Implement the connection between NLP model and AI drawers; 3. Getting the image output; 4. Having some rough analysis.

- Analysis and Summary (September to December): 1. Having an analysis report and discuss the meaning of the project and the outcome; 2. Finish the image-based Chinese poetry graphic novel.

F. Bibliography (No Word Limit)
(Use the appropriate style for your discipline.)

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