Hi everyone, welcome to my presentation

My name is Ren and my topic is going to be about painting restoration using deep neural networks

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Historical artworks are fascinating not only because of their beauty, but they also contain invaluable cultural and historical information that can be extracted and studied.

Here is one of the most significant examples of artworks providing historical value. This is School of Athens by Raphael, showing some of the most famous ancient philosophers including Plato and Aristotle.

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Now, artworks tend to degrade over time. This can be due to a variety of reasons, such as temperature, humidity, light, pollution, and just physical deterioration of the materials that were used.

These factors can result in cracks, smears, smudges, or even whole regions of an artwork being destroyed.

Attempts to restore damaged paintings have started long before the modern period.

The process of restoring artworks, or filling in the missing parts, is called inpainting.

Traditional methods were all done by hand and required a trained art conservator who has studied the style and techniques of the original artist.

As you can imagine, this process was often laborious, time consuming, and prone to human error.

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Attempts at digital inpainting began in the mid 90s, and has since then garnered significant interest from machine vision researchers due to its diverse applications.

Early attempts at inpainting used propagation and sampling based approaches, where they would attempt to fill the gap by analysing surrounding textures.

This method would often fail to look at the whole artwork, and the result was often a blur and contained a lack distinctive features.

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Modern technological breakthroughs have allowed researchers to use deep neural networks to achieve very convincing results.

Without going too far into the technical aspects, one of the methods that they use is called the encoder-decoder model.

This is where an image is gradually mapped to lower feature spaces, before being expanded back to the size of the original image.

Depending on the model and the training, the results can be very realistic and accurately capture distinctive details.

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My primary goal for this project is to develop a model that can be used for artwork inpainting and restoration.

I will be utilizing the encoder-decoder model as previously described.

I’ve decided to focus on artworks from the period of the Italian Renaissance, due to it’s cultural significance and the large amounts of training data available.

For those who don’t know, the Italian Renaissance covers the 15th and 16th century, where there was a cultural and artistic flourishing. This period included artists such as Leonardo da Vinci, Donatello, Raphael, Michelangelo, etc

As a stretch goal I want my model to be transcribable to other data sets and not just artworks from a specific time period.

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Some of the biggest challenges so far includes learning PyTorch and general AI concepts, since I’ve had no previous experience.

Me and my supervisor decided to containerize the project on Docker, but the process has been time consuming and error prone.

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So far I’ve been in the process of setting up the infrastructure and gathering training data.

I’ve managed to successfully deploy a model using the MNIST dataset. This model takes in a handwritten number and tries to recreate it, in a process that is similar to the one I’ll be using.

I set up this model so I could familiarize myself with the process and use the experience to define my own model.

Here you can see the training results on my local machine, where the accuracy increases after every training epoch.

I’ve also gathered 5 GB of artworks from different artists from the Italian Renaissance.

Next steps would be to define my own model, and use the data that I’ve gathered to train it.

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And that’s all I had, any questions?