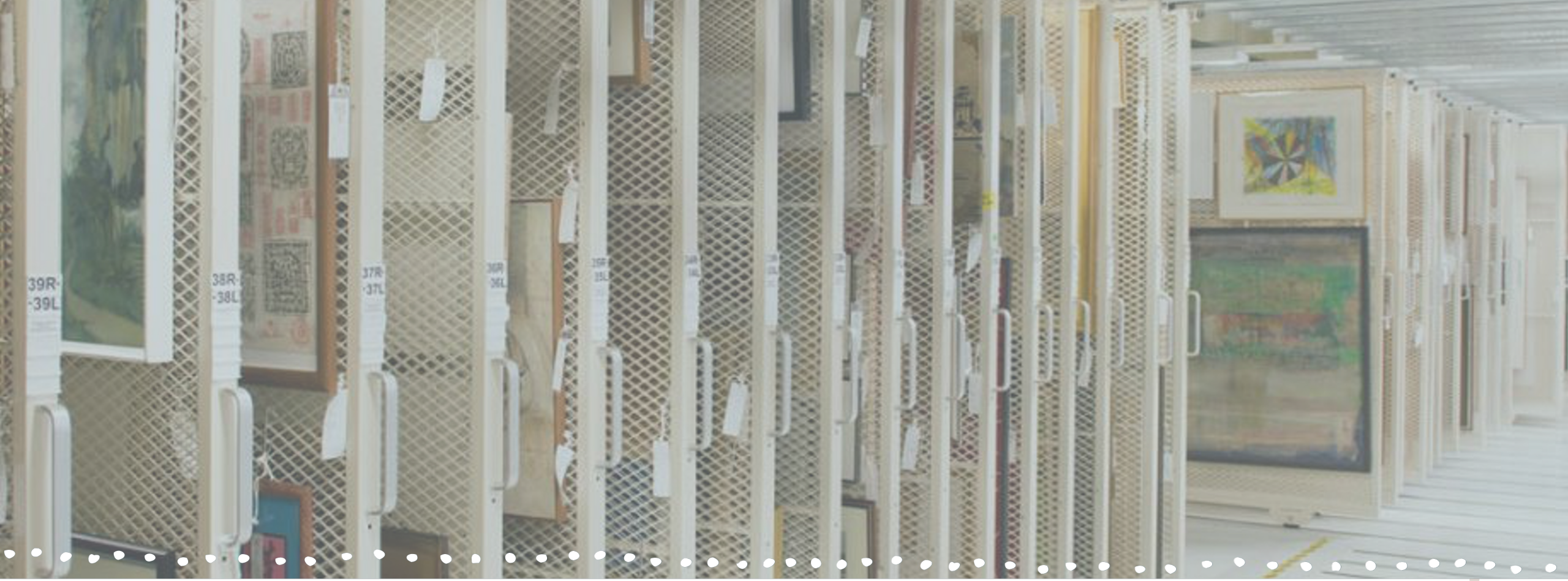


Classifying artefacts in the national collection

Presenter: Shuying Tan
27 Apr 2023

Agenda

- Background
- Pre-processing & Modelling
- Deployment
- Conclusion & Recommendation

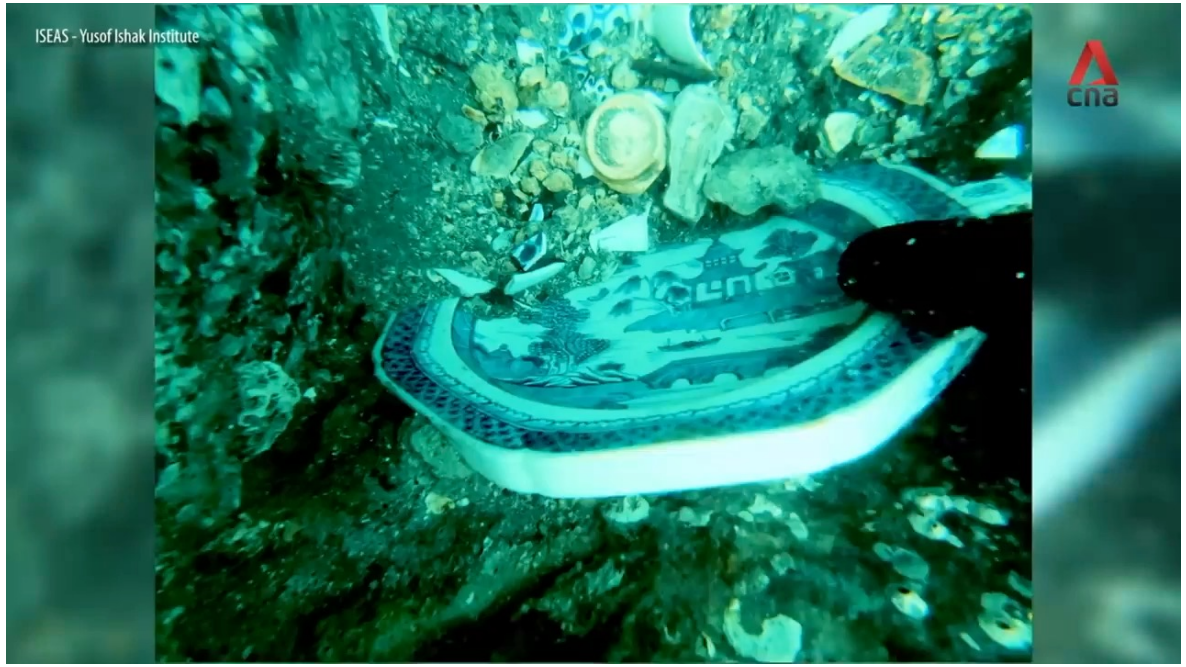
Background

Problem Statement

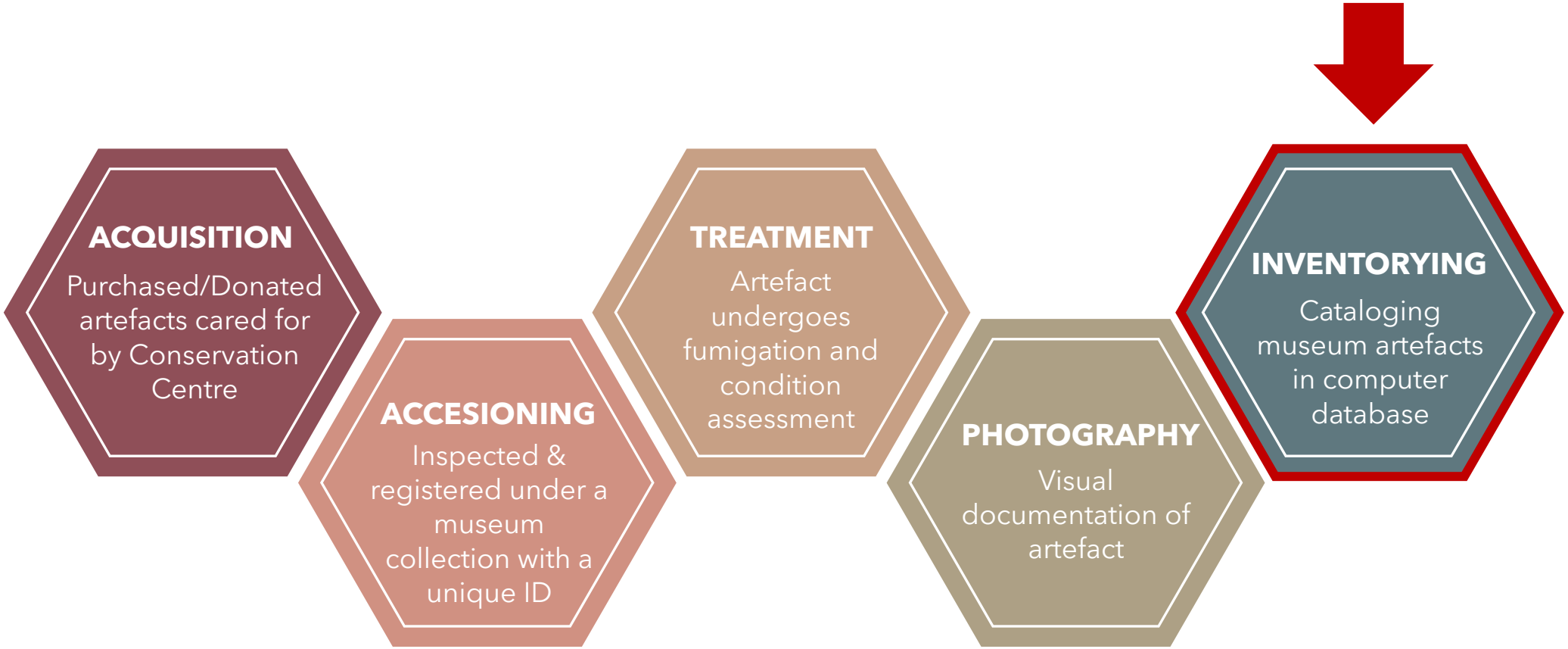
To develop an **image classification** system that accurately **predicts tags for artefacts** captured in the photographs, for more efficient cataloguing of Singapore's national treasures.

Success will be measured by the **accuracy** of the model in classifying the artefact.

Ever wondered??
Behind-the-scenes of museum artefact displays



Artefact conservation lifecycle

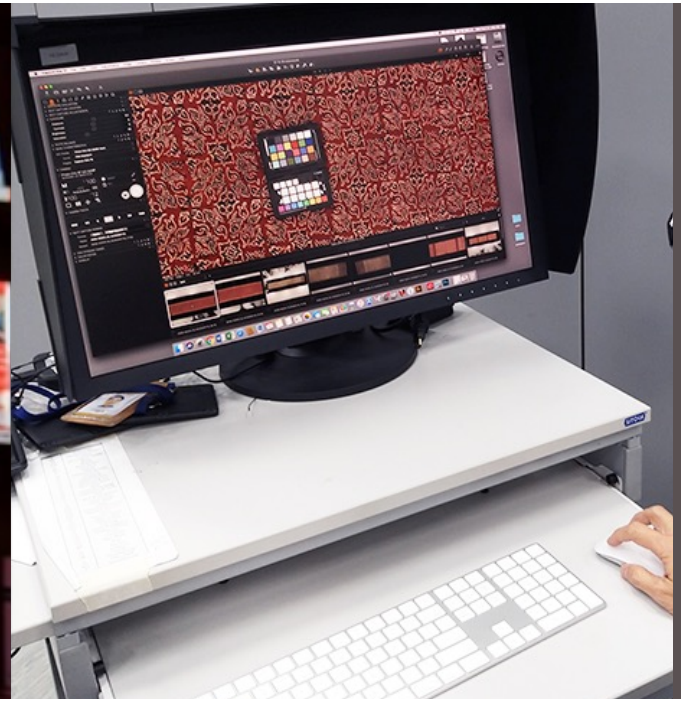


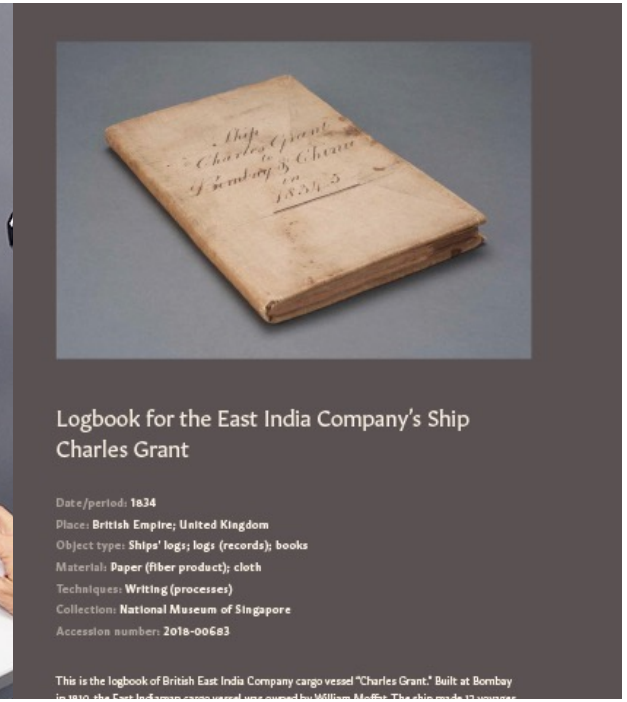
Heritage conservation centre

Heritage conservation centre

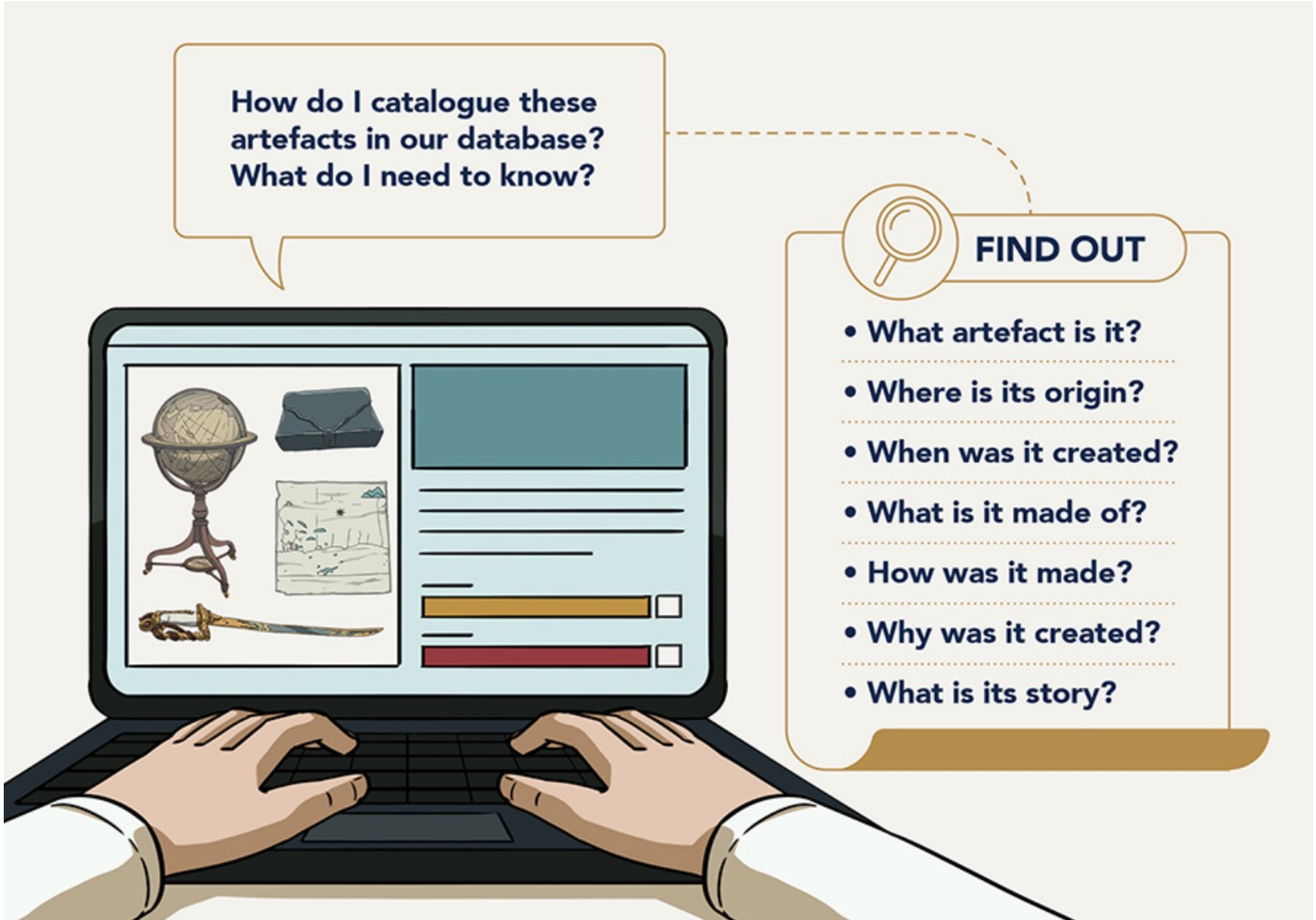
Dave – the photographer

AFIQAH – THE CATALOUGER



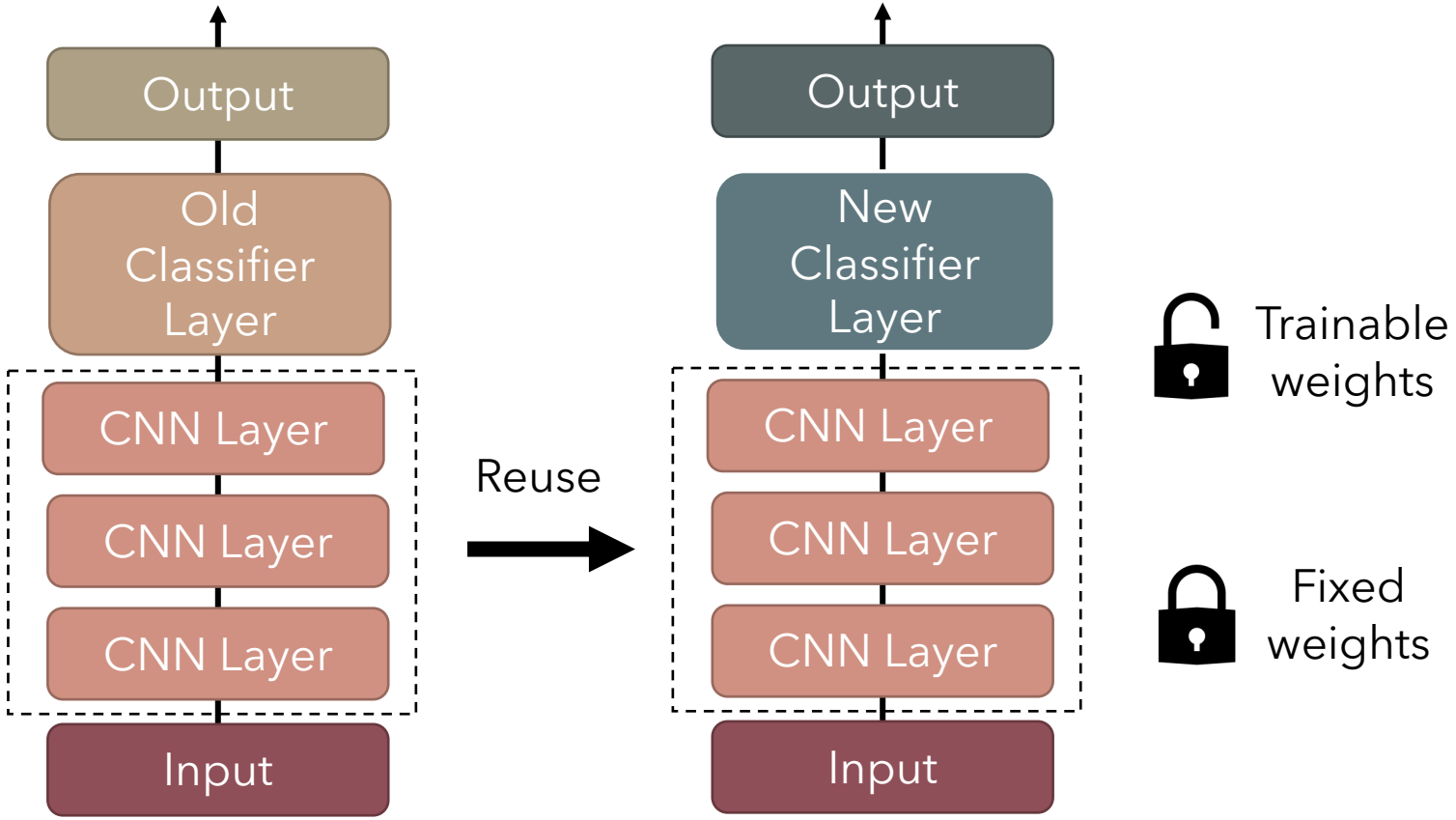


Cataloguing – How will this project help?



Project overview – How was the project done?

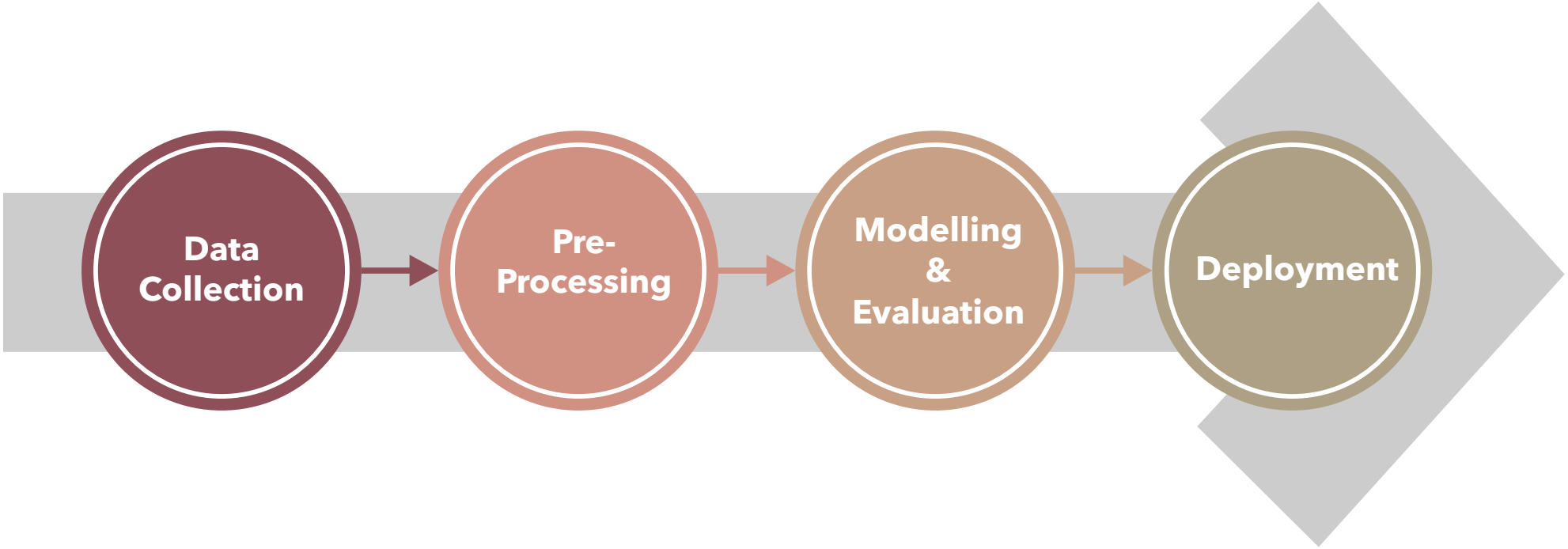
Transfer Learning and Convolutional Neural Networks (CNN)



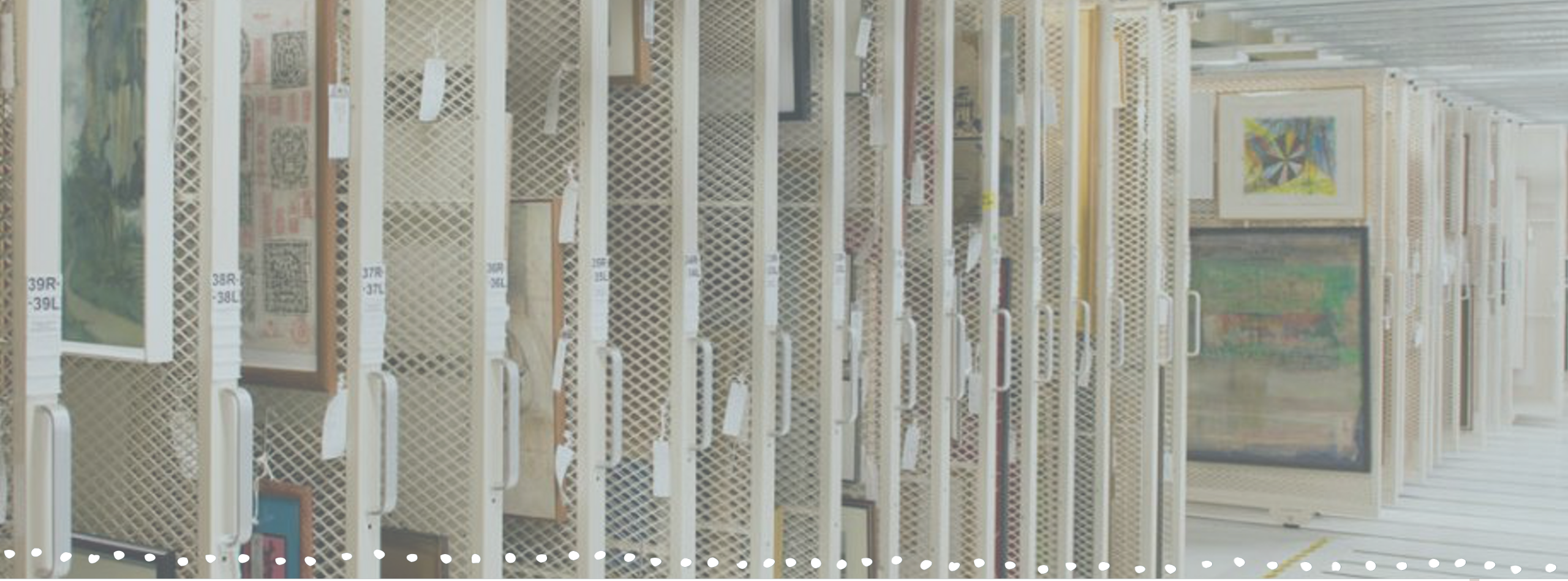
Existing CNN for Task A

New CNN for similar Task B

Project workflow



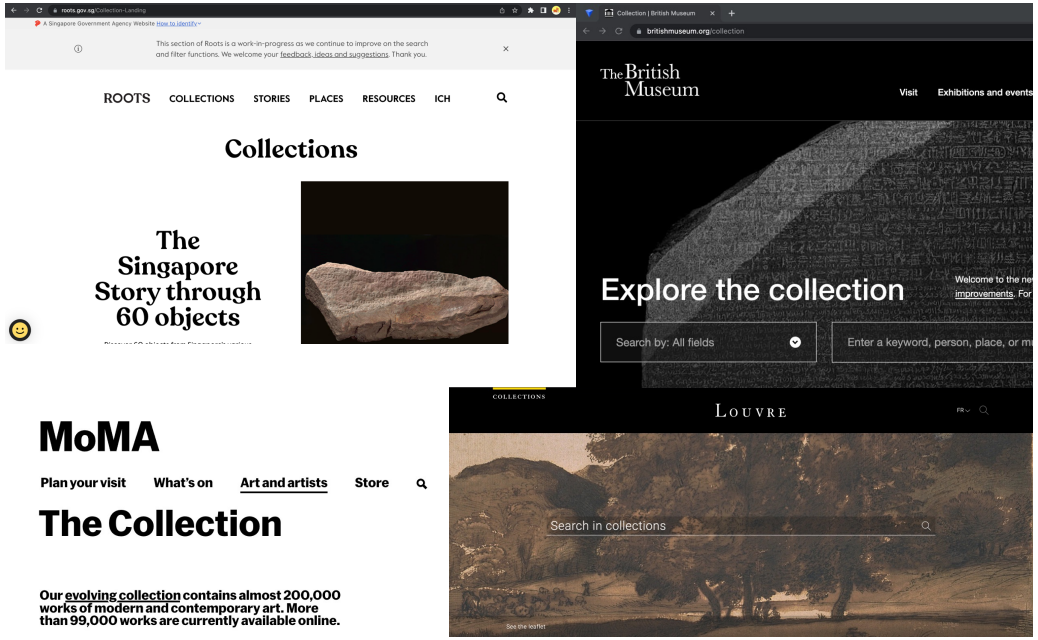
- Collect diverse, representative images. Consider data quality and quantity.
- Resize, normalize the images to ensure consistency in size & scale. Augmentation to increase size of dataset to improve model generalization.
- Use suitable pre-trained CNN model; Train the model; Monitor performance; Finetune the model.
- Deployment of the trained model for use



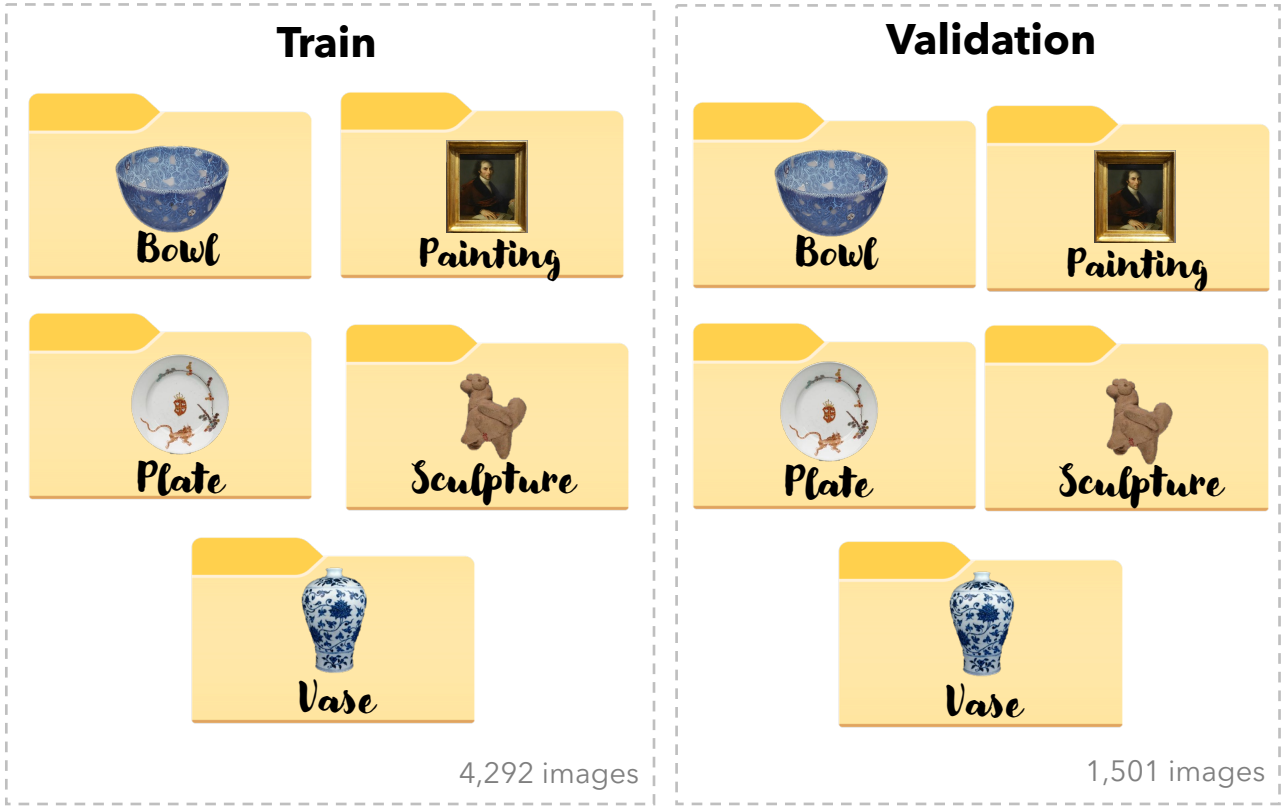
MODELLING

Data collection

- Online collections from various local and international museums

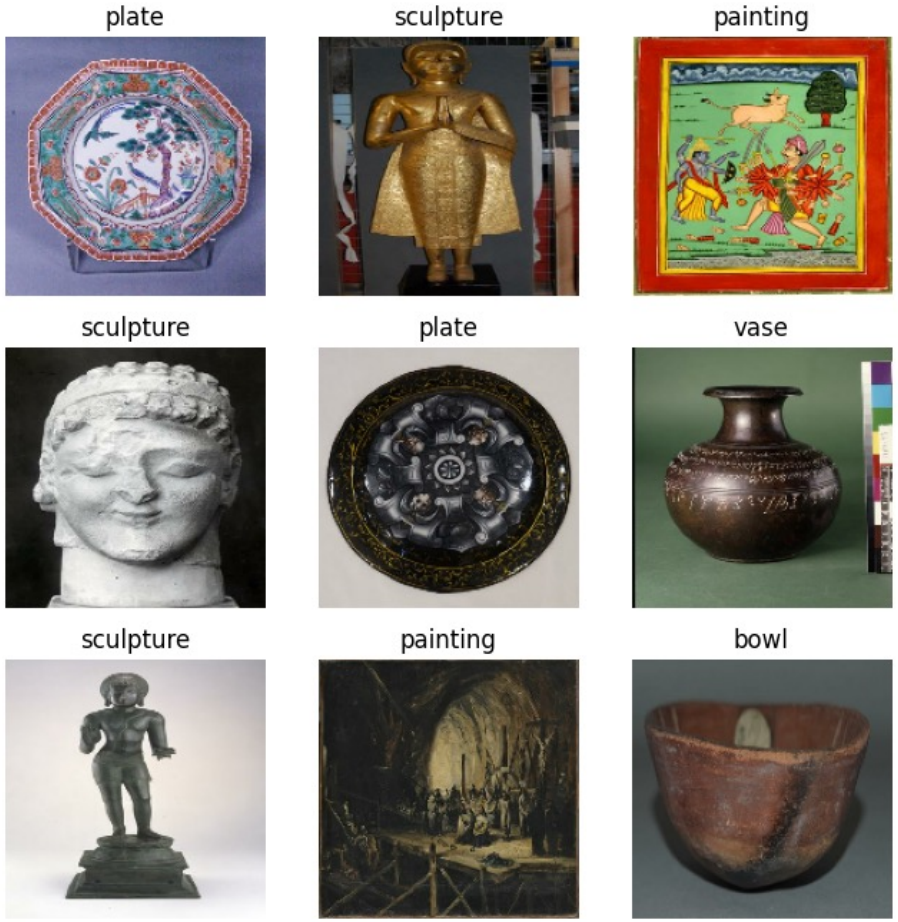


- **5 classes** of artefacts selected
- Close to **6k images** belonging to five classes

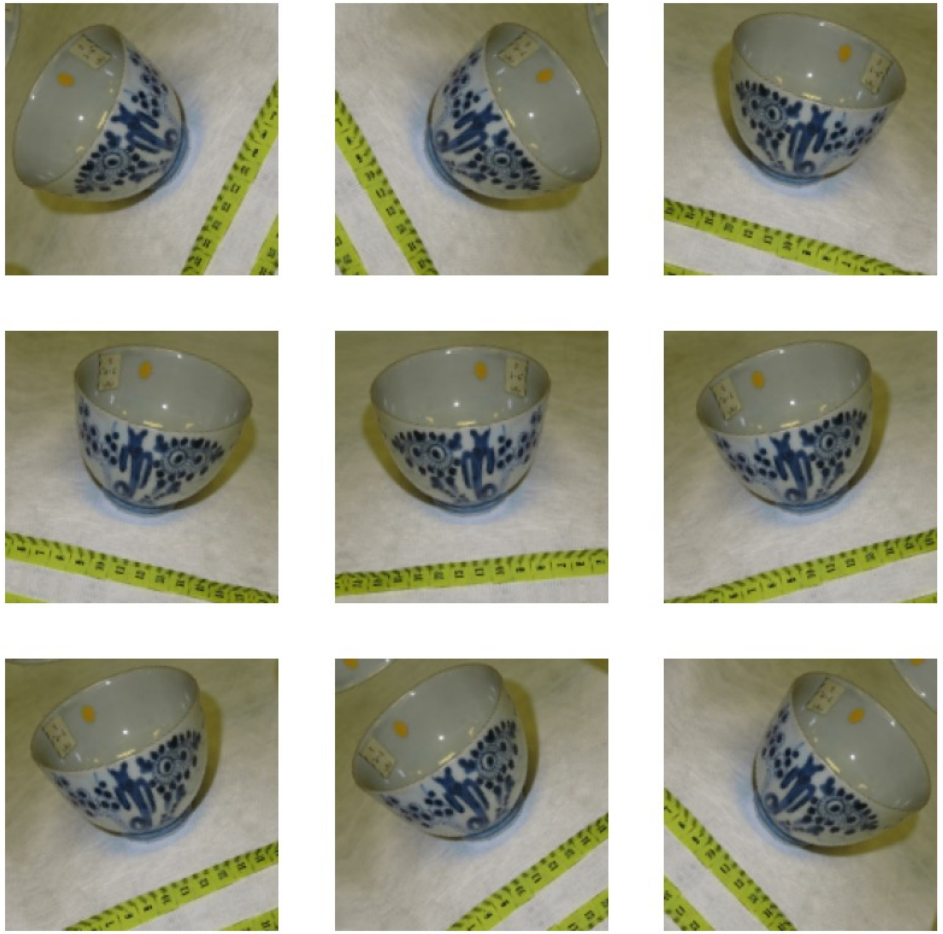


Pre-processing

- **Resize, crop, normalize images** to ensure consistency in size & scale



- **Image augmentation** (e.g., rotation, flipping..) to diversify the training images

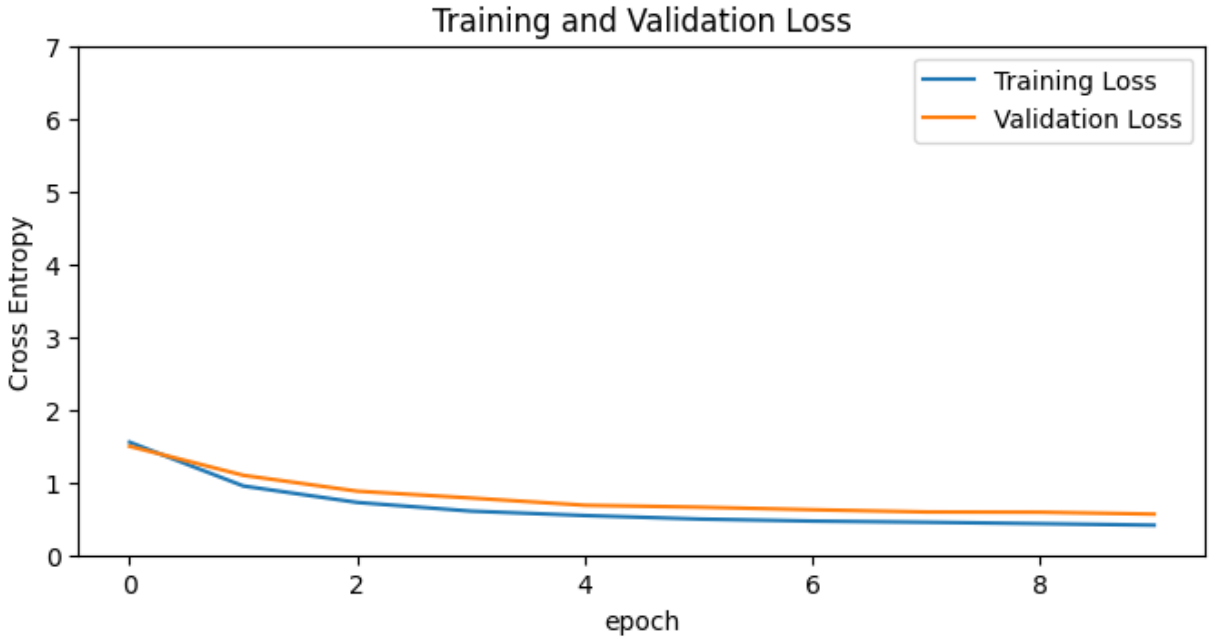


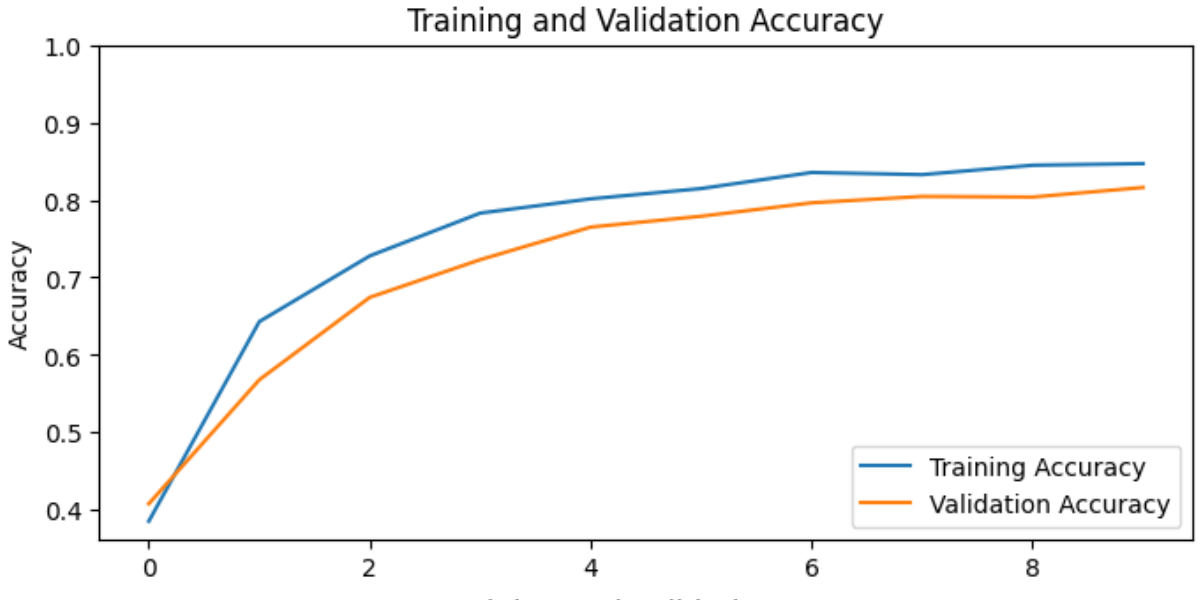
Multi-class classifier Using Mobilenet v2 model

Overall, the learning curves reflect that the model is learning & improving its performance over epochs.

- **Decreasing training loss**: Learning and fitting the training data better over time
- **Decreasing validation loss**: Generalizing well to the unseen validation data

- **Increasing training accuracy**: Reaches ~84.7% at last epoch
- **Increasing validation accuracy**: Reaches ~81.6% at the last epoch



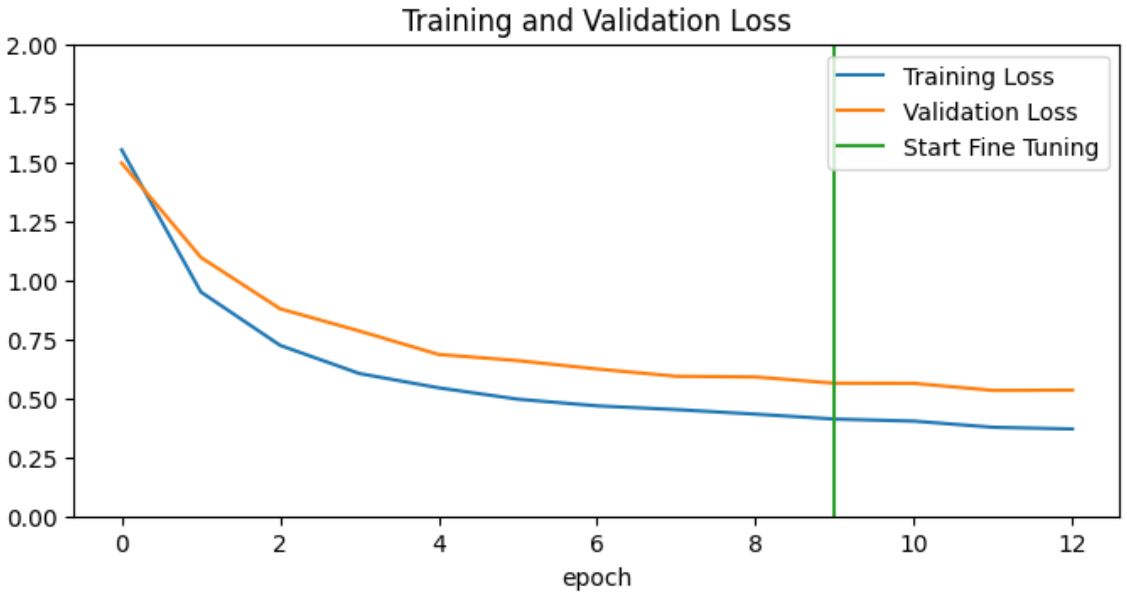


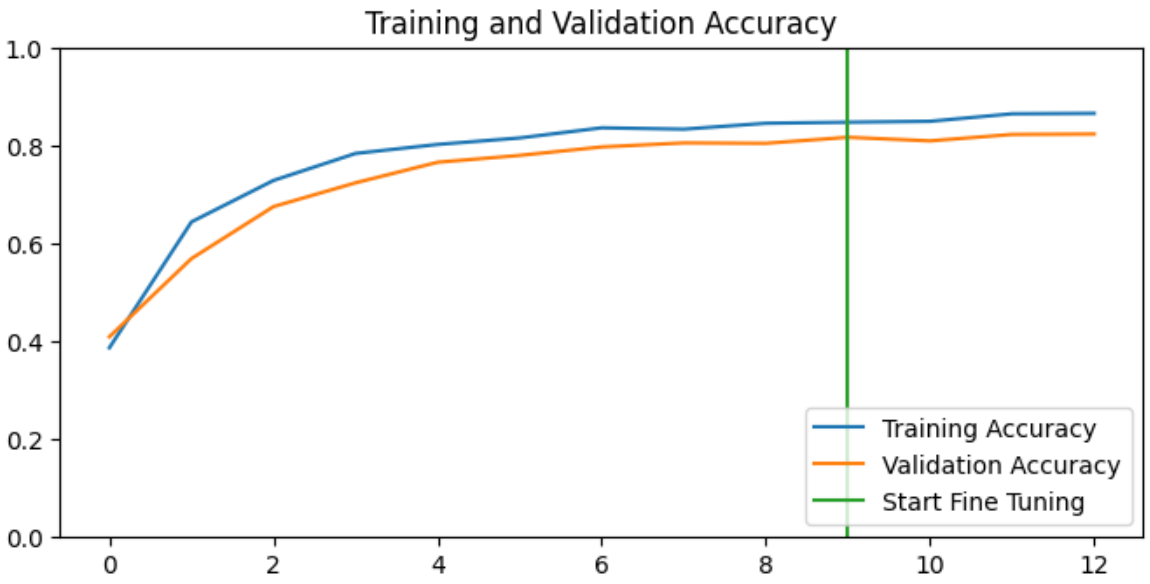
After finetuning

Overall improvement indicated by decreasing loss & increasing accuracy

- **Training loss decreased** from 0.4026 to 0.3695
- **Validation loss decreased** from 0.5626 to 0.5338

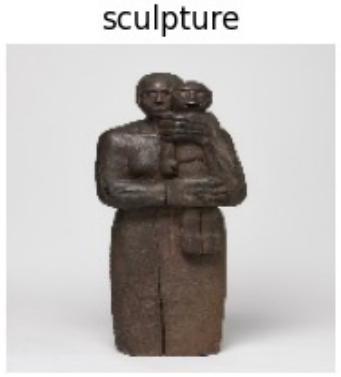
- **Training accuracy increased** from 0.8488 to 0.8651
- **Validation accuracy increased** from 0.8087 to 0.8228





Overall Model Performance

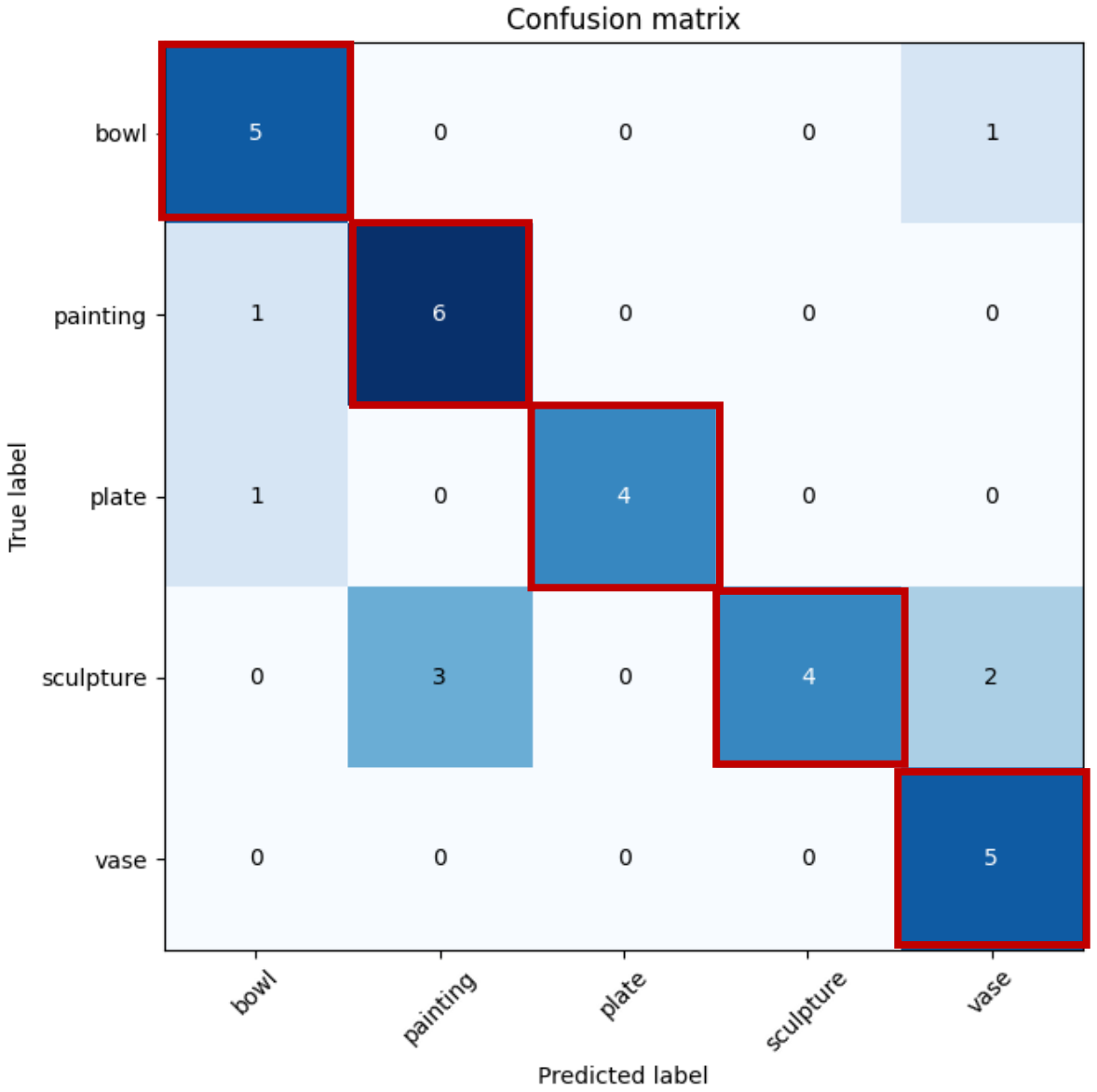
Oops.. Sculpture!



Oops.. Painting!

Accuracy 81%

Model Performed Fairly well across the different classes

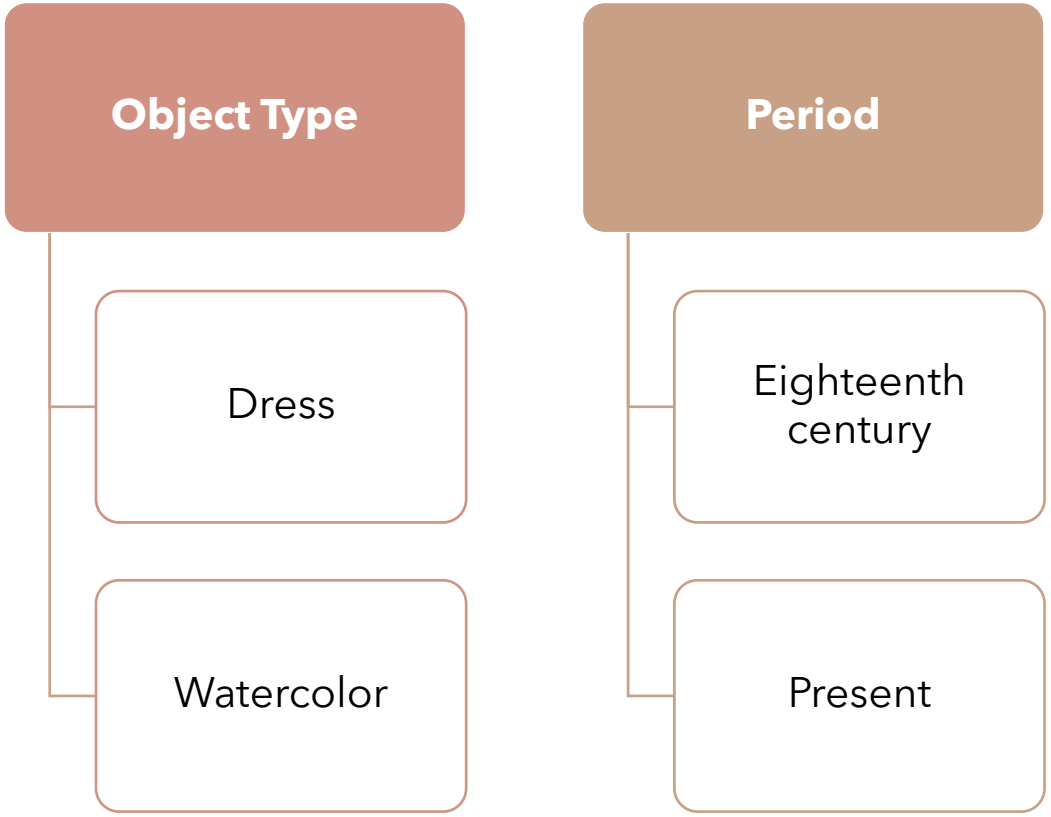


Room for improvement for sculptures

Exploring further!

Scratching the surface... Multi-labels required

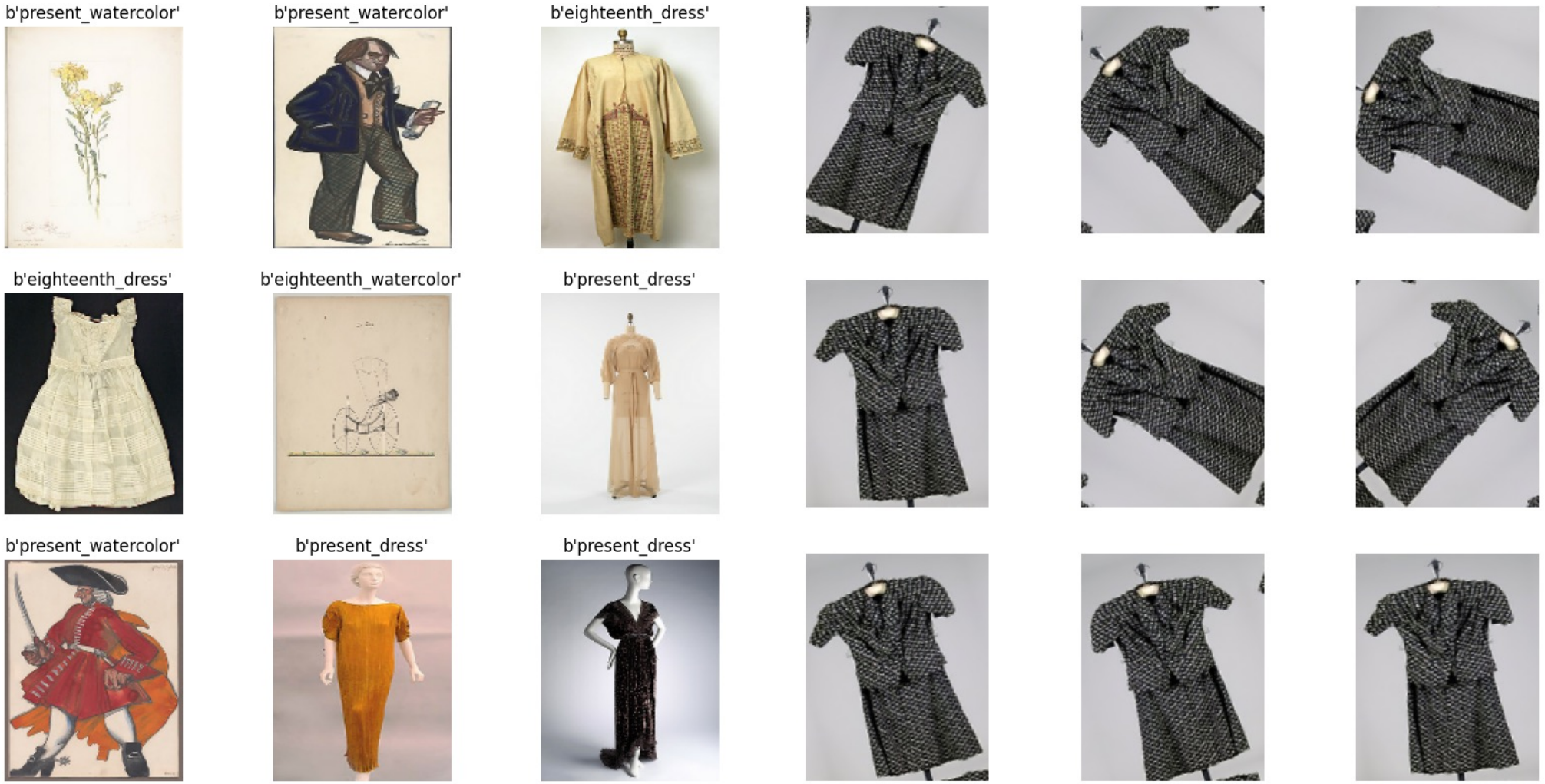
Conducted further exploration for the project on:



4,196 images across all labels

Pre-processing

- Similar processes of resizing, cropping, image augmentation, etc. were performed



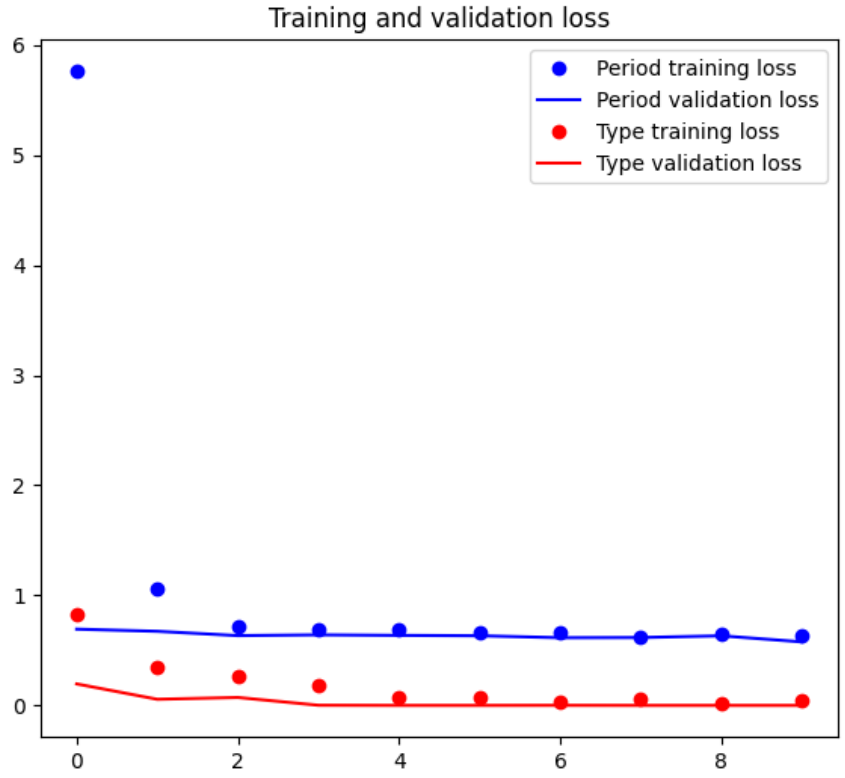
Multi-label Classifier using VGG16

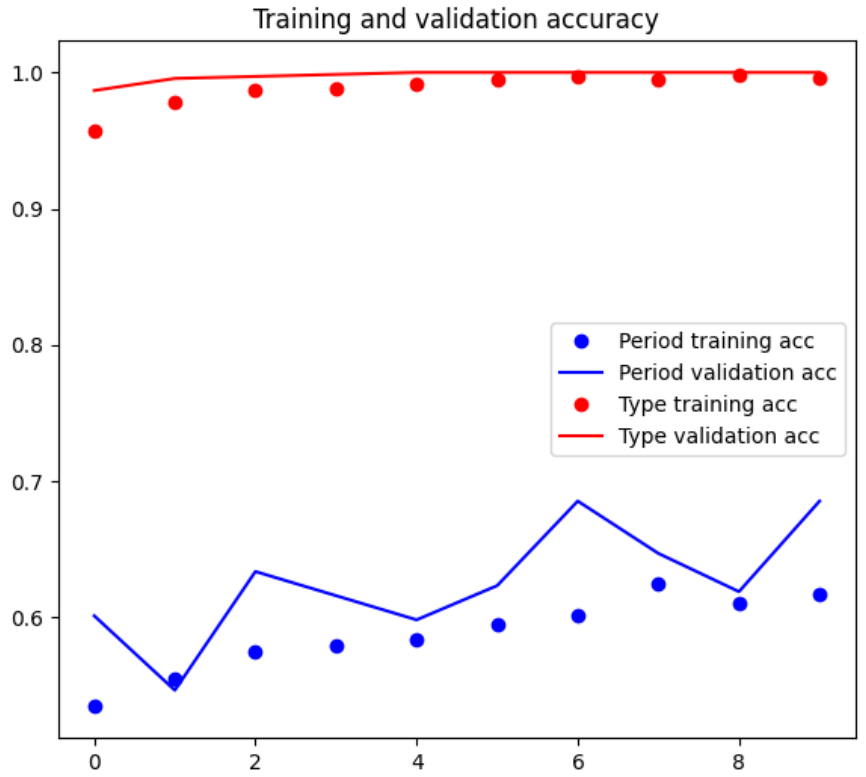
'Period':
- The training loss decreased from 5.76 to 0.69
- The validation loss decreased from 0.69 to 0.64

'Type':
- The training loss decreased from 0.83 to 0.18
- The validation loss decreased from 0. 20 to 0.001

'Period':
- The training accuracy increased from 0.53 to 0.58
- The validation accuracy increased from 0.60 to 0.64

'Type':
- The training accuracy increased from 0.96 to 0.99
- The validation accuracy increased from 0.99 to 1





Overall Model Performance

Oops..
Room for improvement
for period!

Accuracy
52%

label: b'present_watercolor'
prediction: b'eighteenth_watercolor'

label: b'present_watercolor'
prediction: b'eighteenth_watercolor'

label: b'eighteenth_watercolor'
prediction: b'eighteenth_watercolor'

label: b'present_watercolor'
prediction: b'eighteenth_watercolor'

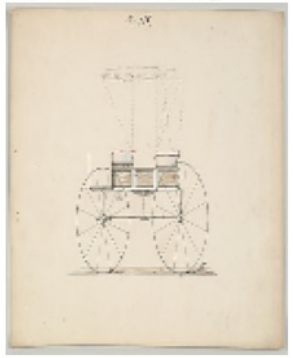
label: b'present_dress'
prediction: b'present_dress'

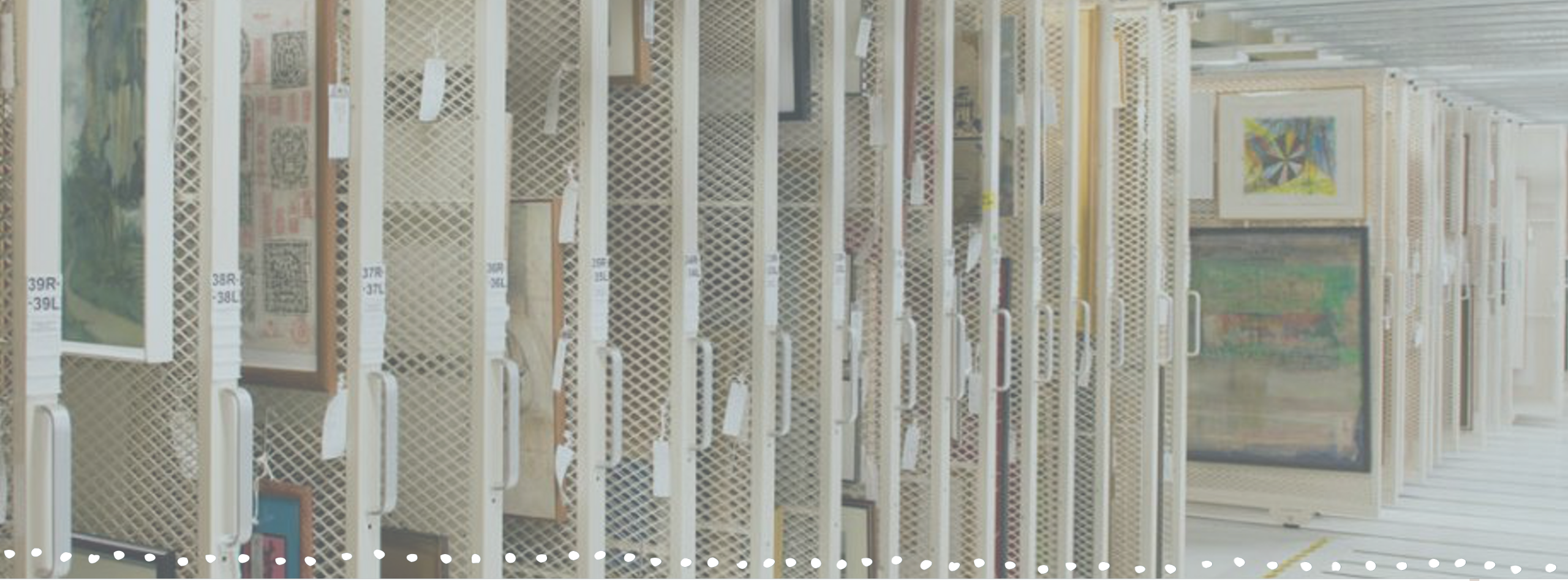
label: b'eighteenth_watercolor'
prediction: b'eighteenth_watercolor'

label: b'present_dress'
prediction: b'present_dress'

label: b'eighteenth_dress'
prediction: b'present_dress'

label: b'eighteenth_watercolor'
prediction: b'eighteenth_watercolor'



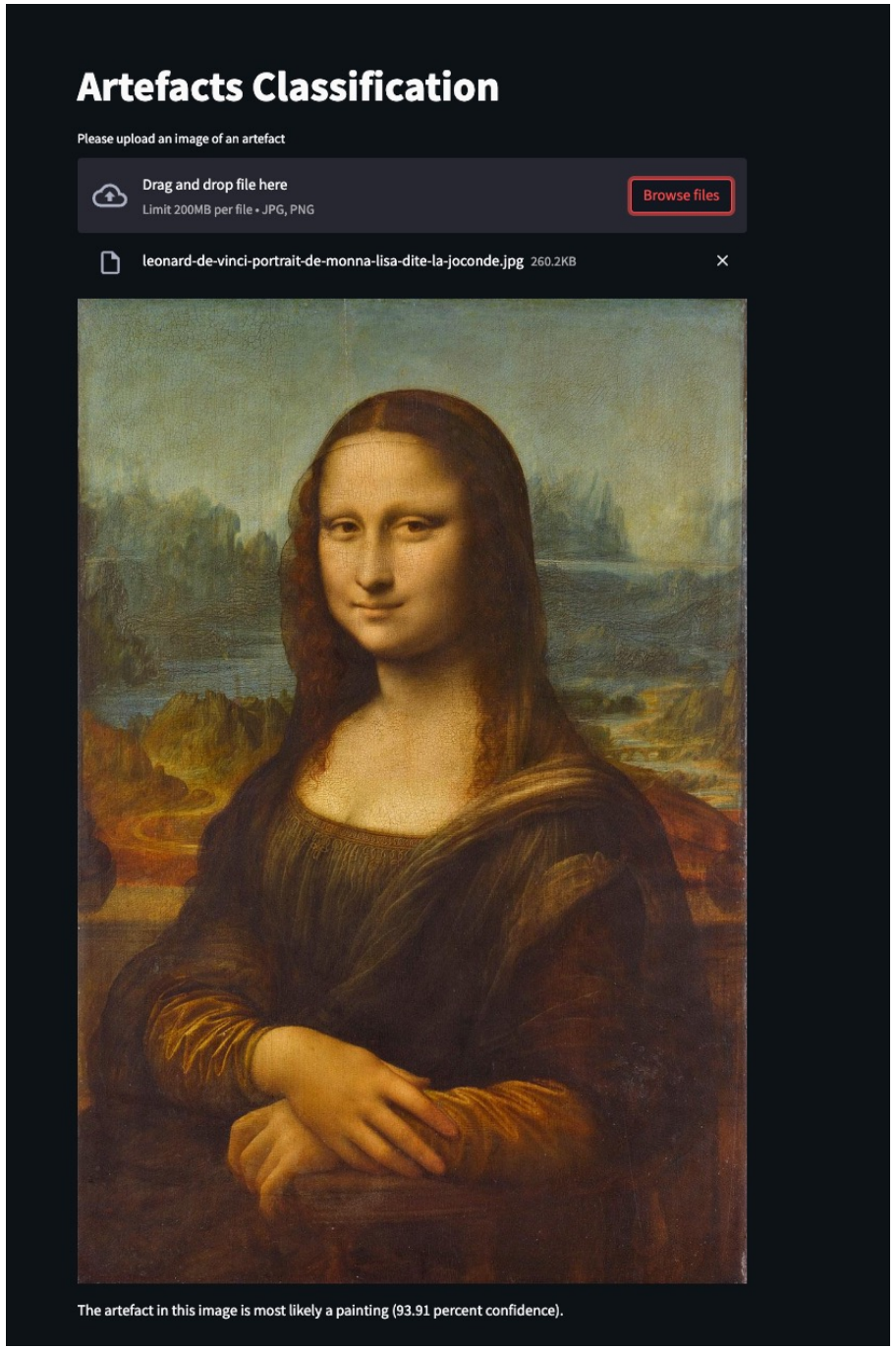


Deployment

Let's Try!

https://ab1a-34-68-110-175.ngrok-free.app/

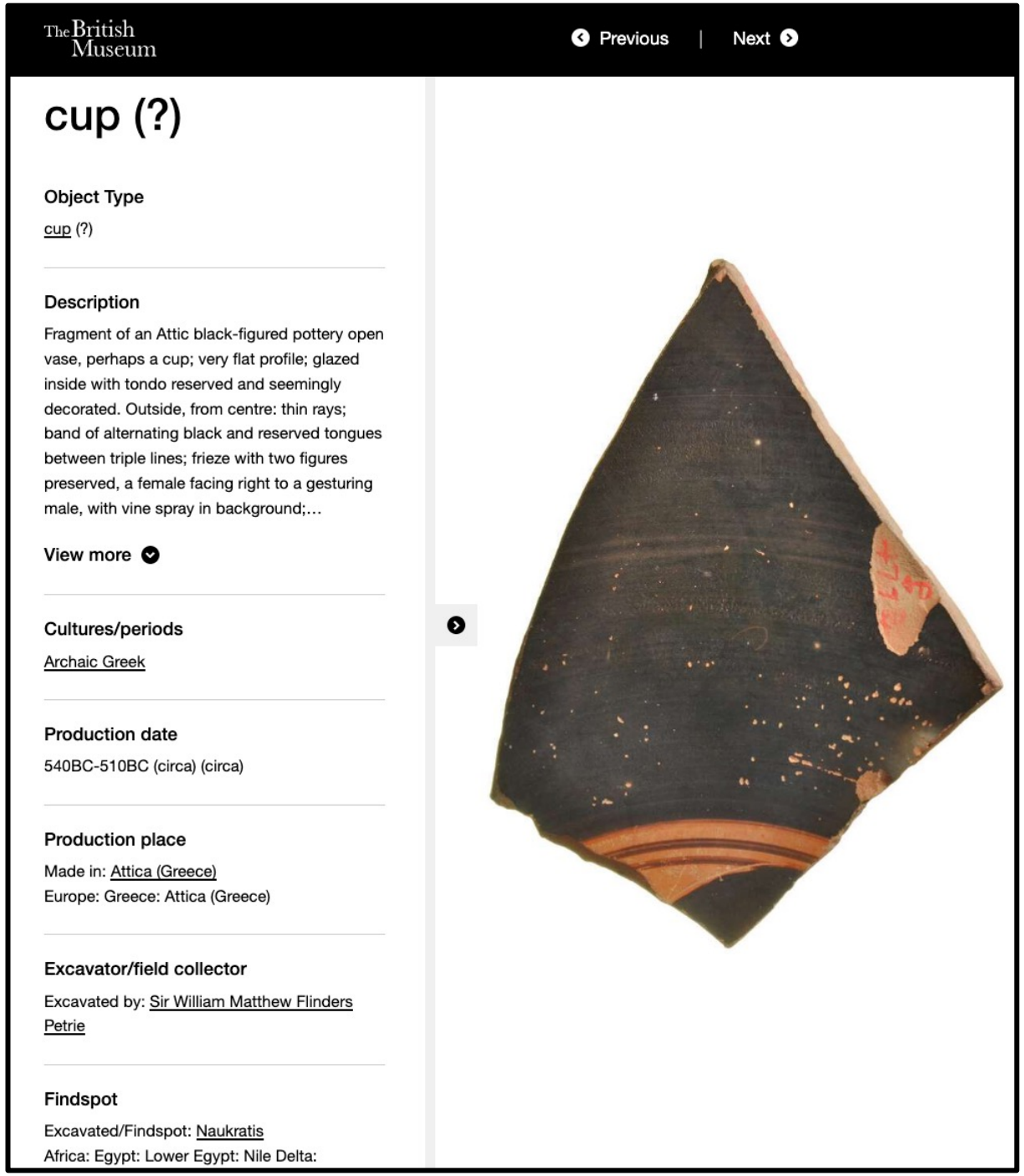
Interested in cataloguing? Scan Me!



Conclusion

Limitations & Challenges

- Limited dataset
- Lack of interpretability
- Complex systems in archaeology & cultural complexity

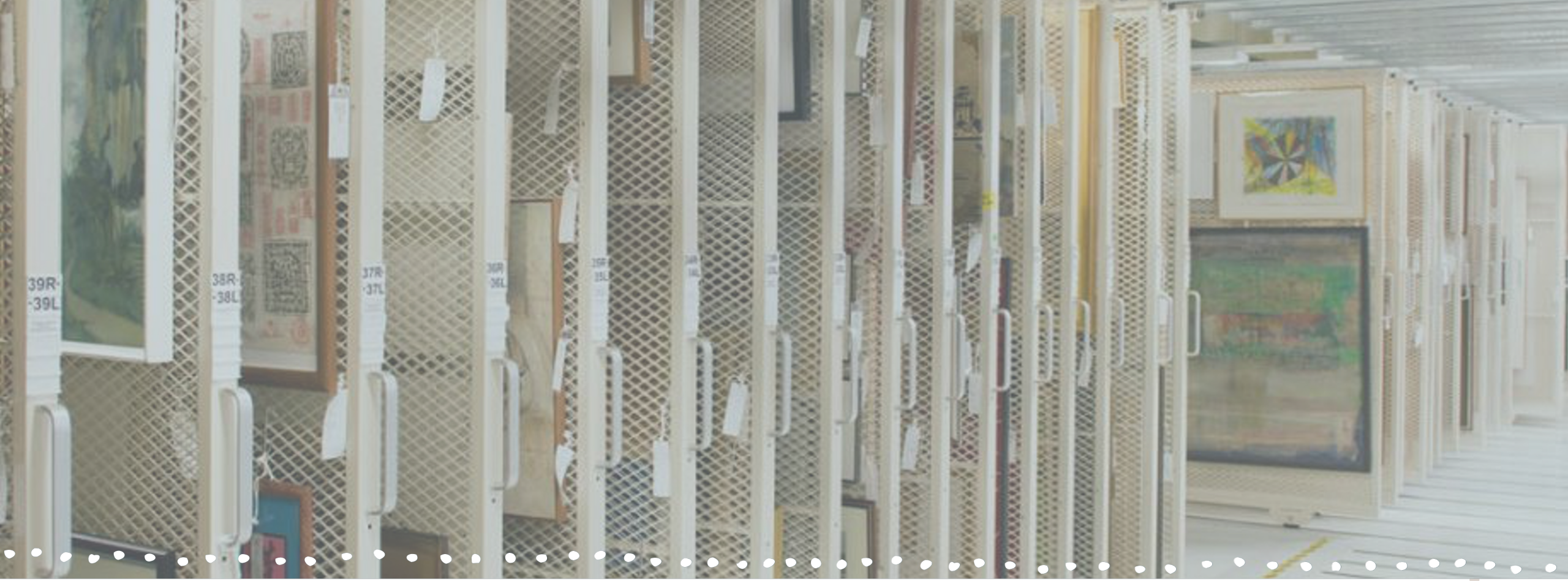


Conclusion

- **Results for the image classification system are promising**
  - 81% accuracy in predicting tags for the various artefacts (classes) for the multi-class system
  - Moderate accuracy for both ‘period’ and ‘type’ outputs for the multi-label system

- **Further improvements and fine-tuning** could be explored to optimize the model’s performance

- Results highlight the **potential of using image classification models for cataloguing** of artefacts for museums locally and internationally



Thank you!