Identifying Artists

McGill Artificial Intelligence Society

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Problem Description

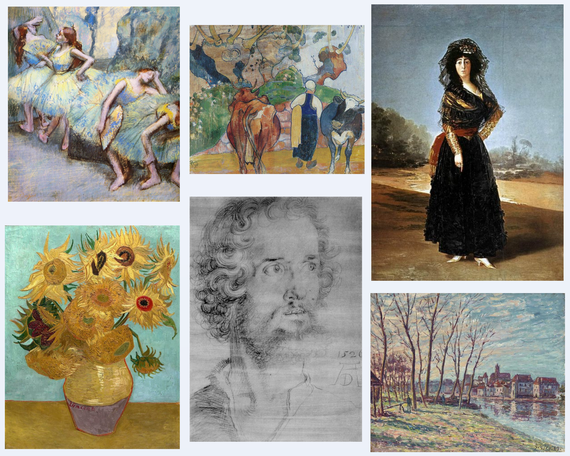
My goal was to design a model that could classify coloured mages of a 2-D art by artist. I simplified the problem to create a model that can distinguish images of only 10 famous artists.

Hypothesis

I hypothesized that by using a Convolutional Neural Network (CNN) I would be able to create a model that classified the images with a 70% accuracy without using pertained weights.

Data

- Data were chosen from the 10 artists with most images out of a dataset from resource [1]
- The number of images per artist varied greatly I had 250 image for some artist and 800 images for others
- The data also varied in size, so all images were centred and cropped to
- All images were cropped to be equal in length and width and then resized to 400x400
- 30 images from every artists were separated for testing
- The data was split as follows:
  - Train: 83%
  - Validation: 9.2%
  - Test: 8.0%
- The original labels for the images data were mapped to one dimensional vectors that would be used for the neural network



Implementation

- I used the Keras deep learning library to build my model
- After some experimentation with different prebuilt models, I decided to used the VGG-19 network as a base
- At the end of the base model, a global average pooling layer was added
- Then a dropout layer with a dropout rate of 0.2 was added to help prevent overfitting
- Because the data was very unbalanced class weight were added to prevent the model from learning to classify certain artists better than others
  - This addition significantly improved results
- The model used the relu activation map and cross-categorical entropy

Finetuning

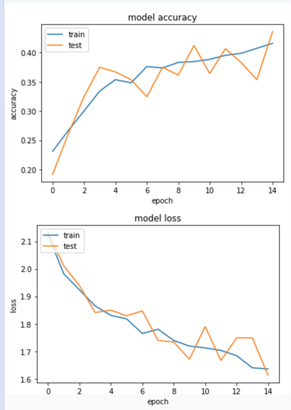
- I did initial testing on the 5 different optimizers to find the best one for training
- Validation accuracy after 1 epoch
  - SGD: 0.2660
  - Adam: 0.2048
  - RMSprop: 0.1543
  - Adagrad: 0.2048
  - Adadelta: 0.2048
- Based on the results the SGD optimizer was used

Training

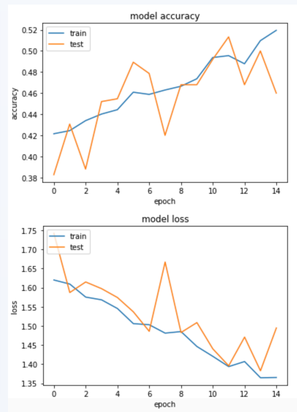
- The model was run through 4 rounds of 15 epochs
- The batch size was 18
- There was 10% validation split of the training data
- After the first 15 epochs the model had an accuracy of 36%
- After 30 epochs the model had an accuracy of 46%
- After 45 epochs the model had an accuracy of 50.3%
- After 60 epochs the model had an accuracy of 63%

Results

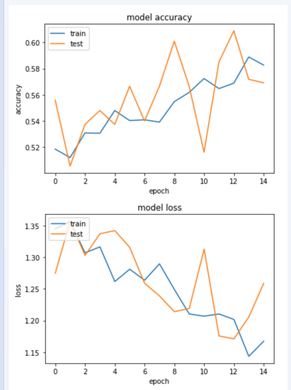
Epochs 1-15



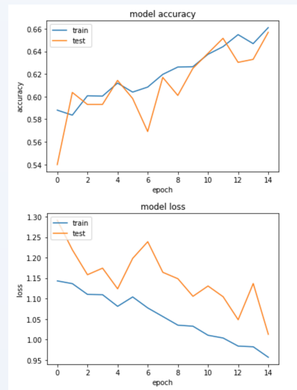
Epochs 16-30



Epochs 31-45



Epochs 46-60



- The final model had an accuracy of 63%

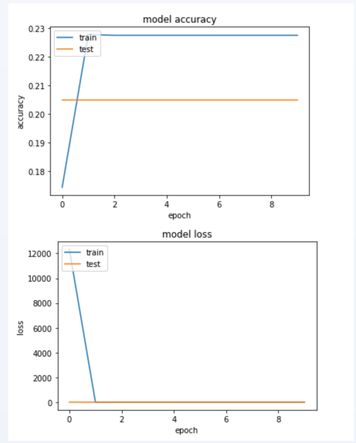
Confusion Matrix

	Degas	Durer	Gaugin	Goya	Picasso	Renoir	Sisely	Titian	Rembrandt	Van Gogh	Accuracy
Degas	18	0	1	0	0	7	0	1	2	1	0.60
Durer	0	26	0	1	0	0	0	0	0	3	0.87
Gaugin	2	0	23	1	0	1	0	0	0	3	0.77
Goya	4	1	2	9	1	0	0	5	3	5	0.30
Picasso	3	0	4	0	18	1	0	1	0	3	0.60
Renoir	6	0	4	0	2	15	0	1	0	2	0.50
Sisely	0	0	5	1	0	0	24	0	0	0	0.80
Titian	4	0	1	2	1	0	0	20	2	0	0.67
Rembrandt	4	0	0	0	0	0	0	5	20	1	0.67
Van Gogh	2	2	2	0	3	0	4	1	0	16	0.53

This matrix shows exactly how the model predicted each of the 300 test images. The column is the predicted artist and the row is the actual artist. The model's accuracy is reflected in the middle diagonal which is all of the images that were correctly identified.

Conclusion

- Though the goal of 70% accuracy was not reached, the model still performed well at 63% accuracy
- The model may have been slightly overfit as the final validation accuracy was 66%, which is higher than the test accuracy of 63%
- The model performed significantly better than the baseline
  - The baseline used was a simple neural network with only one dense layer
  - After 8 epochs of training the baseline performed with an accuracy of 10%



Next Steps

- The model could be further improved by using under sampling and over sampling
- The accuracy may be increased by using pretrained weights
- If more data could be collected one could expand the model to classify more artists.

References

- Best Art Work of All Time, Kaggle Competition: https://www.kaggle.com/ikarus777/best-artworks-of-all-time/kernels

Acknowledgments

- Rick Wu, Project Manager, MAIS executive
- Cheng Lin, MAIS executive