Background

- Using deep learning to determine the genre of a painting
- X: painting image – Y: one of 44 genres

Data

- Kaggle’s dataset “Painters by numbers”
- 80000 images and their corresponding style, genre, artist, and date
- Gray-scale images repeated 3 times to match the RGB dimension
- 4th channel in RGBA images dropped to match the RGB dimension
- Manually downloading more images of rare genres

Models

Transfer Learning in tensorflow

- Input size (300,400,3)
- Adding a shallow (one or two layers) NN to the ‘avgpool5’ output of a pre-trained VGG19 model

ResNet-50 in Keras

- Input size (128,128,3)
- Training all layers

Transfer Learning in Keras using ResNet-50

- Input size (224,224,3)
- Adding a softmax layer

Result and Discussion

<table>
<thead>
<tr>
<th>Model</th>
<th>Train Acc (%)</th>
<th>Test Acc (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VGG-19 (transfer learning)</td>
<td>98 (%)</td>
<td>56 (%)</td>
</tr>
<tr>
<td>ResNet-50 (fully trained)</td>
<td>97 (%)</td>
<td>74 (%)</td>
</tr>
<tr>
<td>ResNet-50 (1. Keep top layer, add softmax)</td>
<td>51 (%)</td>
<td>31 (%)</td>
</tr>
<tr>
<td>ResNet-50 (2. Remove top layer, add softmax)</td>
<td>69 (%)</td>
<td>64 (%)</td>
</tr>
<tr>
<td>ResNet-50 (3. re-train last 24 layers + softmax)</td>
<td>98 (%)</td>
<td>62 (%)</td>
</tr>
</tbody>
</table>

- Models generally have high variance
- Variance problem due to data imbalance
- Confusion matrix show the imbalance in the data
- Some genres are more likely to get confused with each other and penalizing their misclassification more in the loss function could improve the model
- “genre-painting” image misclassified as “figurative”.
- “history” image misclassified as “landscape”.

Future Work

- Data augmentation script to increase number of images of rare genres
- More comprehensive hyperparameters search and trying different ways of regularization
- Using GAN to generate paintings of a particular genre

References

- Gan by example using keras on tensorflow backend. URL https://towardsdatascience.com/gan-by-example-using-keras-on-tensorflow-backend-1a6d515a60d0.
- URL https://github.com/solig/Painting-Genre-Classification.git.