Deep Architecture

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Outline

1. Data Preprocessing
2. Data Augmentation
3. Handling Class Imbalance
4. Modeling
5. Model Performance and Results

Objective

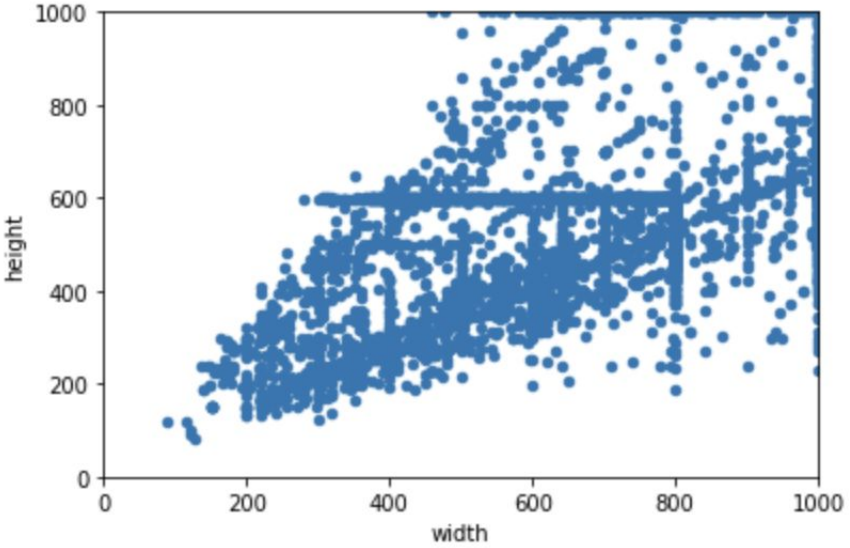
Given an image of a building, predict its **architectural style**

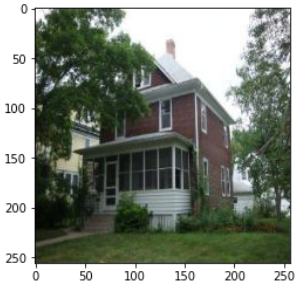
Data

Kaggle Architectural Styles: 10,113 Images of buildings. 25 class labels for style

Preprocessing

- Only true preprocessing was to scale all of the images to the same dimensions (256 x 256)
- 600 x 800 is most common and around the 50th percentile





Training Issues

Class Imbalance

- class_weights = tensor([1.2831, 1.2880, 0.8039, 1.1788, 0.7397])
- nn.CrossEntropyLoss(weight=class_weights)

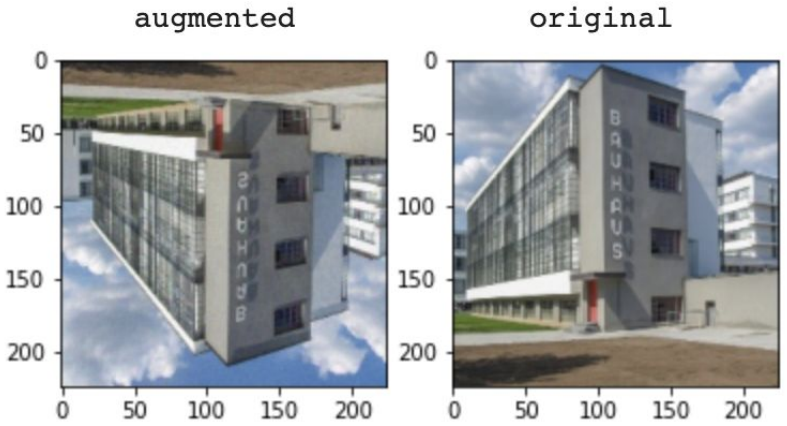
Number of Classes

- Started with full 25 classes but training took a long time since there's more data
- After a 5 epochs accuracy was ~ 50%

	class_index	class_label	N	Proportion
0	0	Gothic architecture	331	0.159
1	1	Byzantine architecture	313	0.150
2	2	Greek Revival architecture	523	0.251
3	3	Russian Revival architecture	352	0.169
4	4	Art Deco architecture	566	0.271

Data Augmentation

- RandomCrop (CenterCrop for validation)
  - Standard ResNet dims (224, 224)
- Flips - Vertical / Horizontal
- GaussNoise
- Normalize() (train and valid)
  - Standard ImageNet Normalization



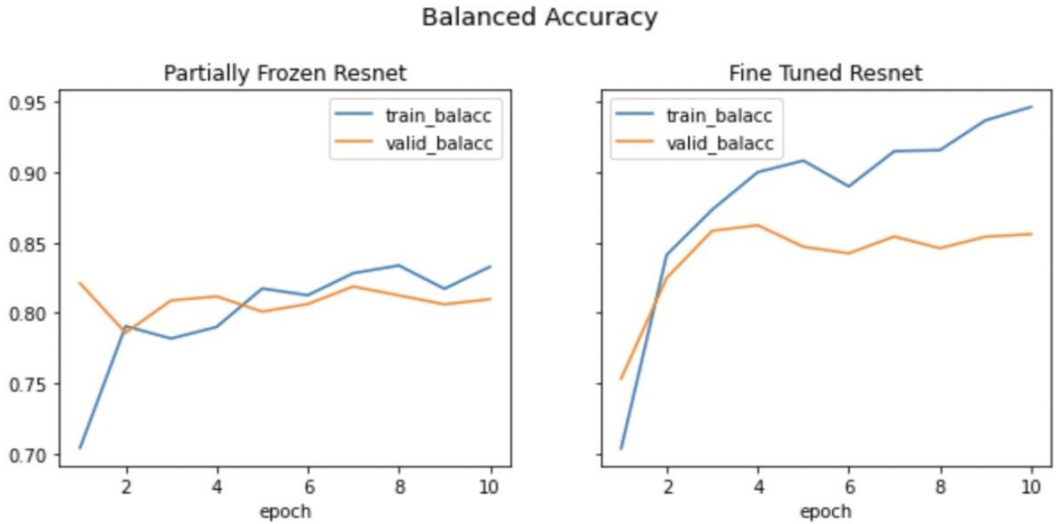
Models

- No “from-scratch” approach
  - Time-Consuming
  - Unlikely to perform better than fine-tuned approach

- ResNet-18 CNN
  - Pretrained on ImageNet
  - Tried partially frozen - just updating the last layer
  - Fine-tuning - update all parameters.

Performance - Accuracy

Accuracy vs epoch count



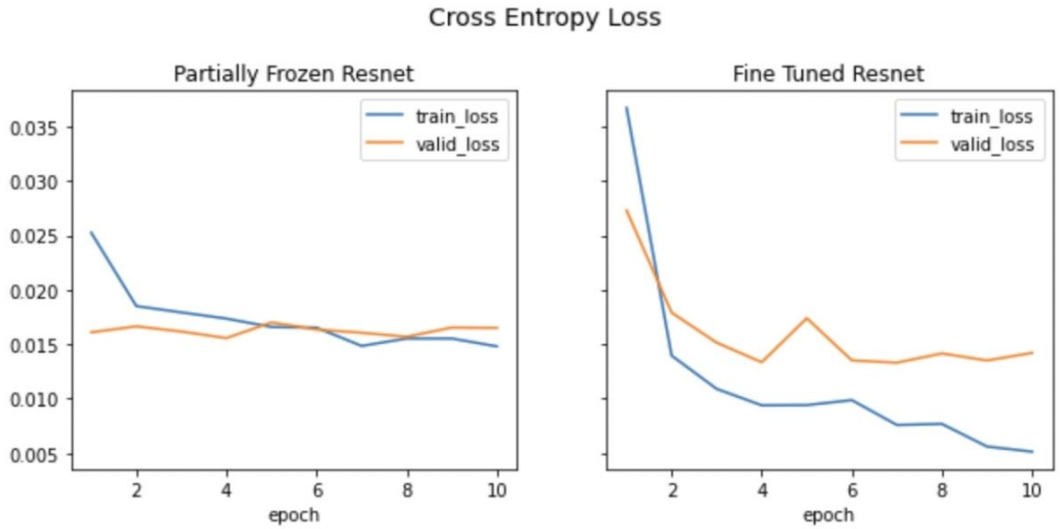
Partially frozen - 82%

Fine Tune - 86%

Excellent accuracy for small scale multi-class classification problem. Showing potential for larger scale problem.

Performance - Cross Entropy

Training Loss vs epoch count



Partially frozen - 0.016

Fine Tune - 0.013

Excellent loss for small scale multi-class classification problem. Showing potential for larger scale problem.

Conclusion

- Best model has 86% validation accuracy on a subset of the classes
- With more time and more complicated architectures, we could likely achieve better results on the full 25 classes
- Experimentation
  - More data
  - Augmentations
  - Image sizing/scaling
  - Different Architectures

Thanks for listening!