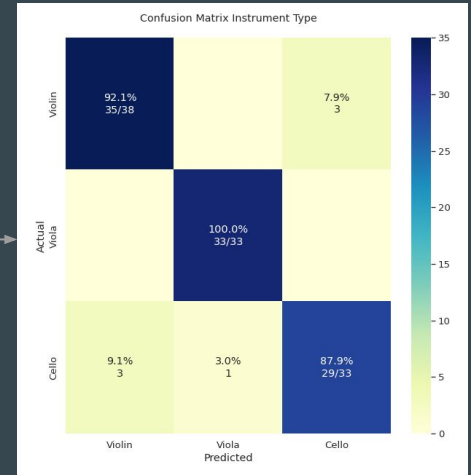
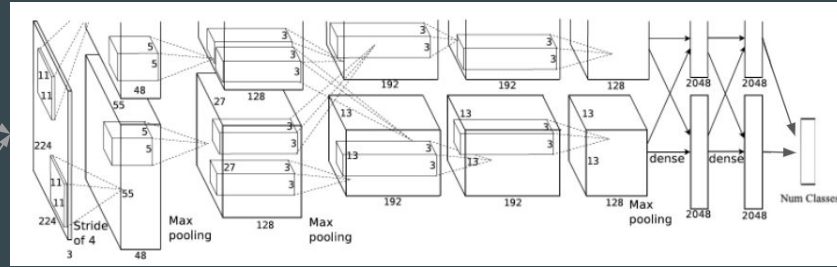
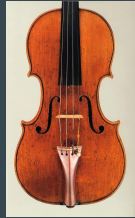


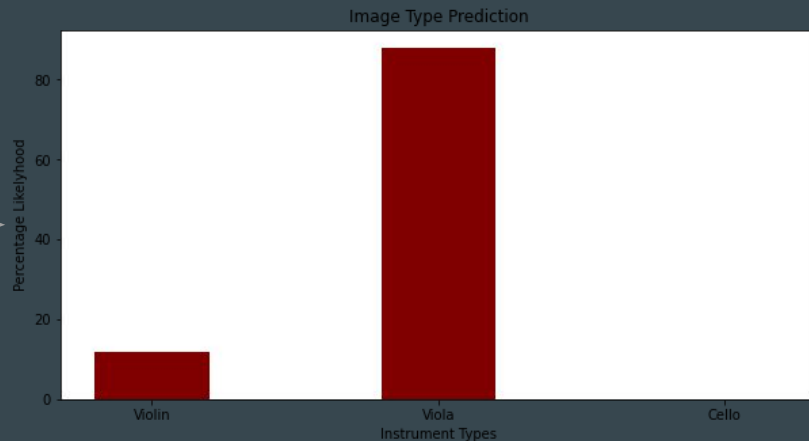
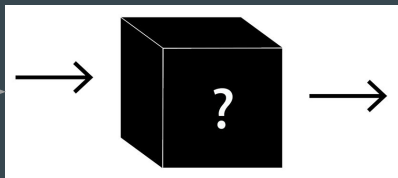
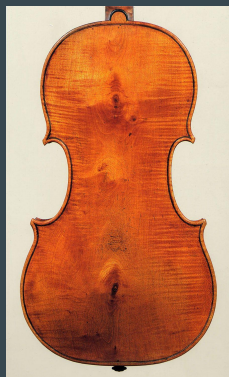
Using Transfer Learning for Musical Instrument Classification



By Alex Chandler

The Goal

- Create models that can classify instruments
 - Classify by type (violin, viola, cello)
 - Classify by view (front or back)
 - Classify by country made (Italy, Germany, USA, France, Holland, Austria, etc.)
- Input: Image of instrument, output: predicted category of instrument



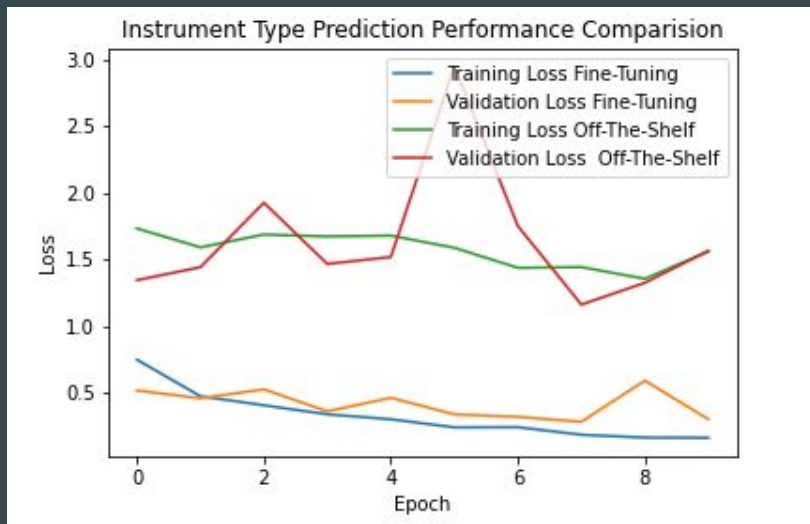
The Dataset and Image Processing

- 15,000 rows
- Extremely Unbalanced Data
- Missing Data

image_top	maker_name	country_made	city_made	year_made	instrument_type	year_sold	sale_price_USD	image_back
[[[255, 255, 255], [255, 255, 255], [255, 255,...]]]	Robert Clemens	United States	Chicago	NaN	Violin	2005.0	3738.0	[[[183, 183, 183], [183, 183, 183], [183, 183,...]]]
[[[254, 254, 254], [254, 254, 254], [254, 254,...]]]	John Frederick Lott II	United Kingdom	London	1840.0	Violin	NaN	NaN	[[[255, 255, 255], [255, 255, 255], [255, 255,...]]]
[[[239, 239, 239], [239, 239, 239], [239, 239,...]]]	John Frederick Lott II	United Kingdom	London	1840.0	Violin	NaN	NaN	[[[233, 233, 233], [233, 233, 233], [233, 233,...]]]
[[[244, 244, 244], [244, 244, 244], [244, 244,...]]]	John Frederick Lott II	United Kingdom	London	1850.0	Violin	NaN	NaN	[[[248, 248, 248], [248, 248, 248], [248, 248,...]]]

Model Creation and Training

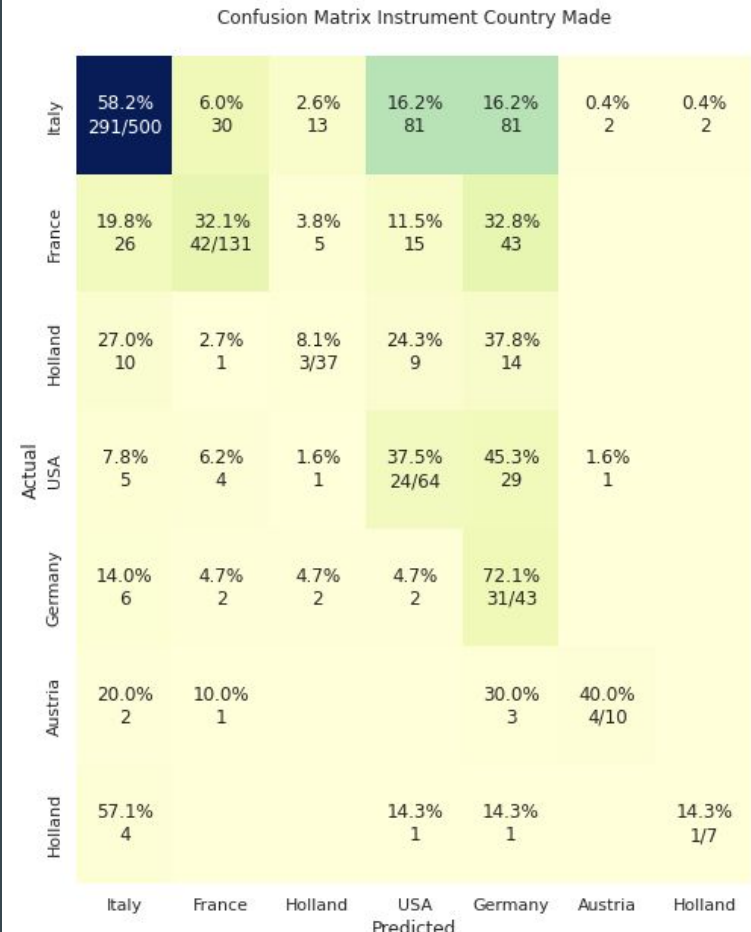
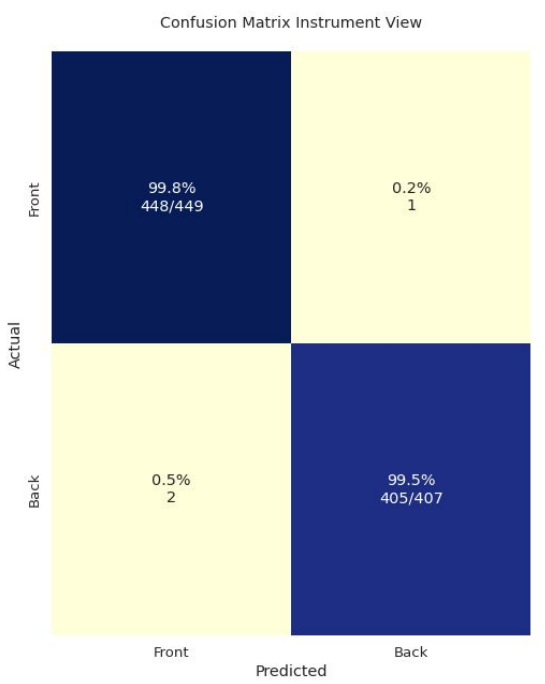
- Load pre-trained AlexNet (and other models)
- Replace final layer with a new linear layer that outputs number of desired classes
OR add linear layer to model that outputs number of desired classes
- Fine-Tune model OR Freeze Pre-trained layers
- Balance dataset (by removing frequent classes) OR use weighted loss for each class



Computational Experiments

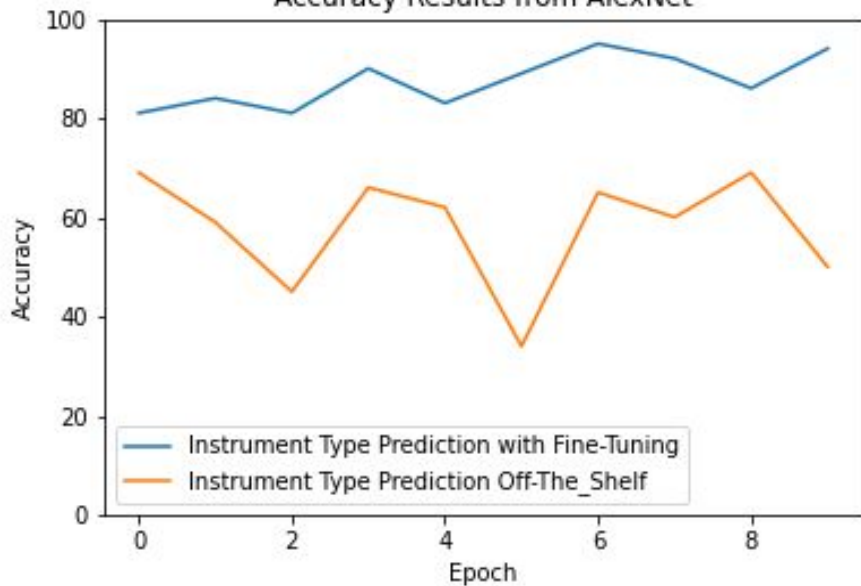
1. Balanced Dataset versus Weighted Loss
2. Image Normalization
3. Off-the-Shelf versus Fine-Tuning
4. Testing Different Models
5. Creating Class Saliency Map to Detect Important Features

Testing and Results

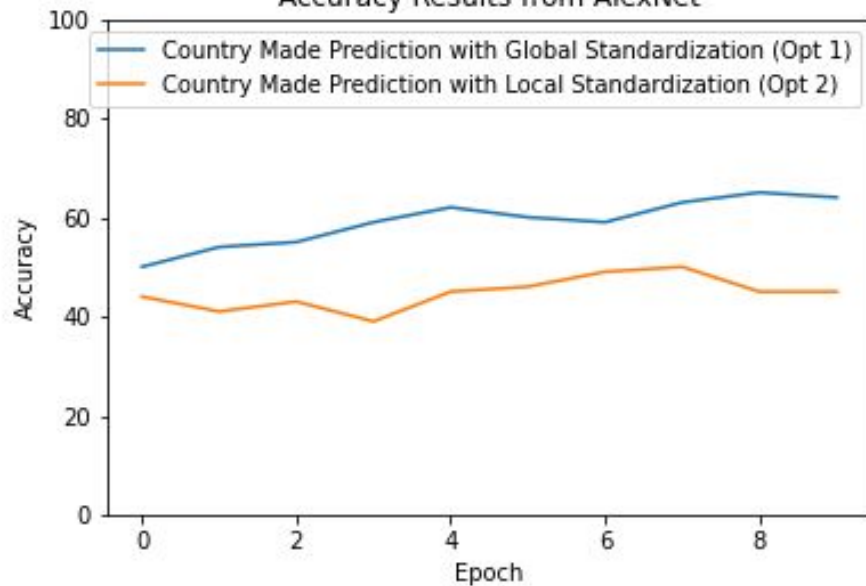


Accuracy Plots from Two Computational Tests

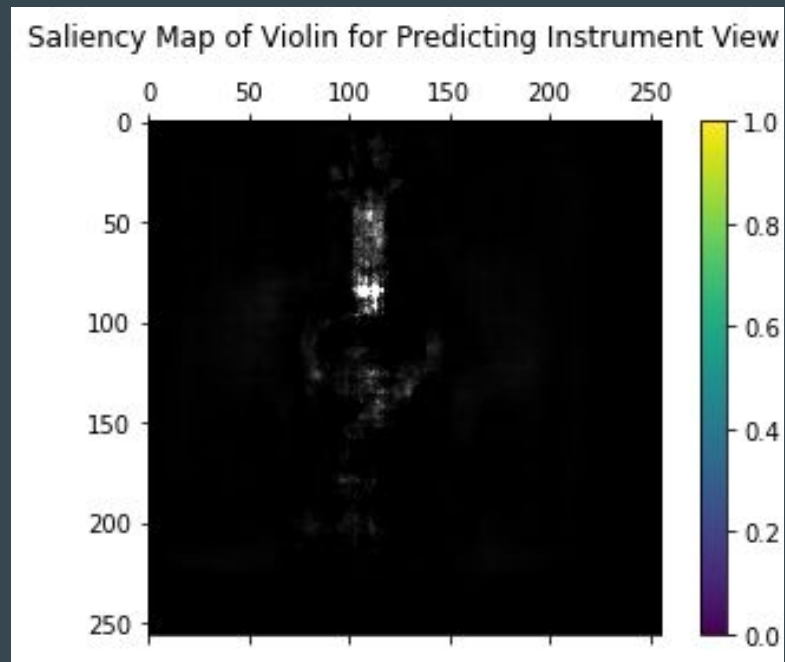
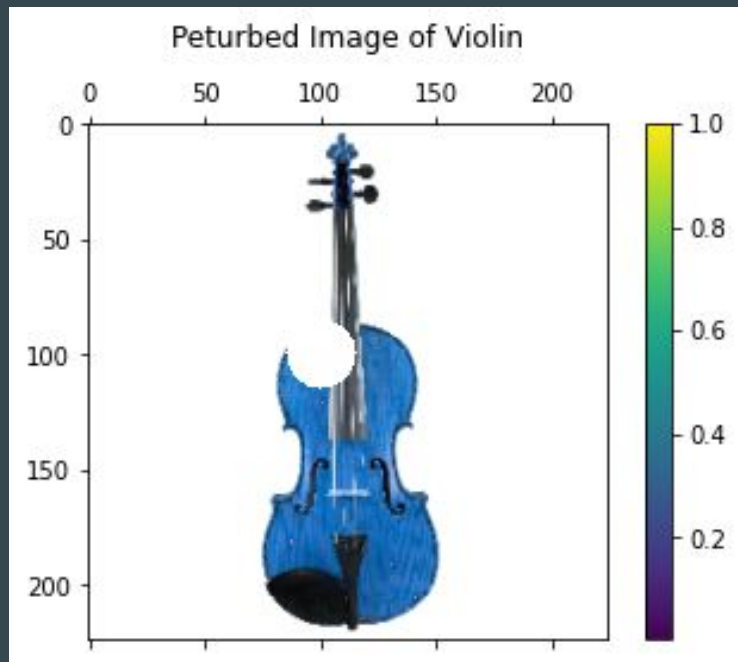
Accuracy Results from AlexNet



Accuracy Results from AlexNet



Class Saliency Maps



Conclusion

- CNNs perform well on classifying instrument type and view
- AlexNet struggled to predict country made
- Neck of instrument important for classification

Future Work

- Try transformers
- Feed multiple views of instrument into model
- Improve image processing
- Gather larger database