

# Improving on Classification of Architectural Heritage Images with Transfer Learning

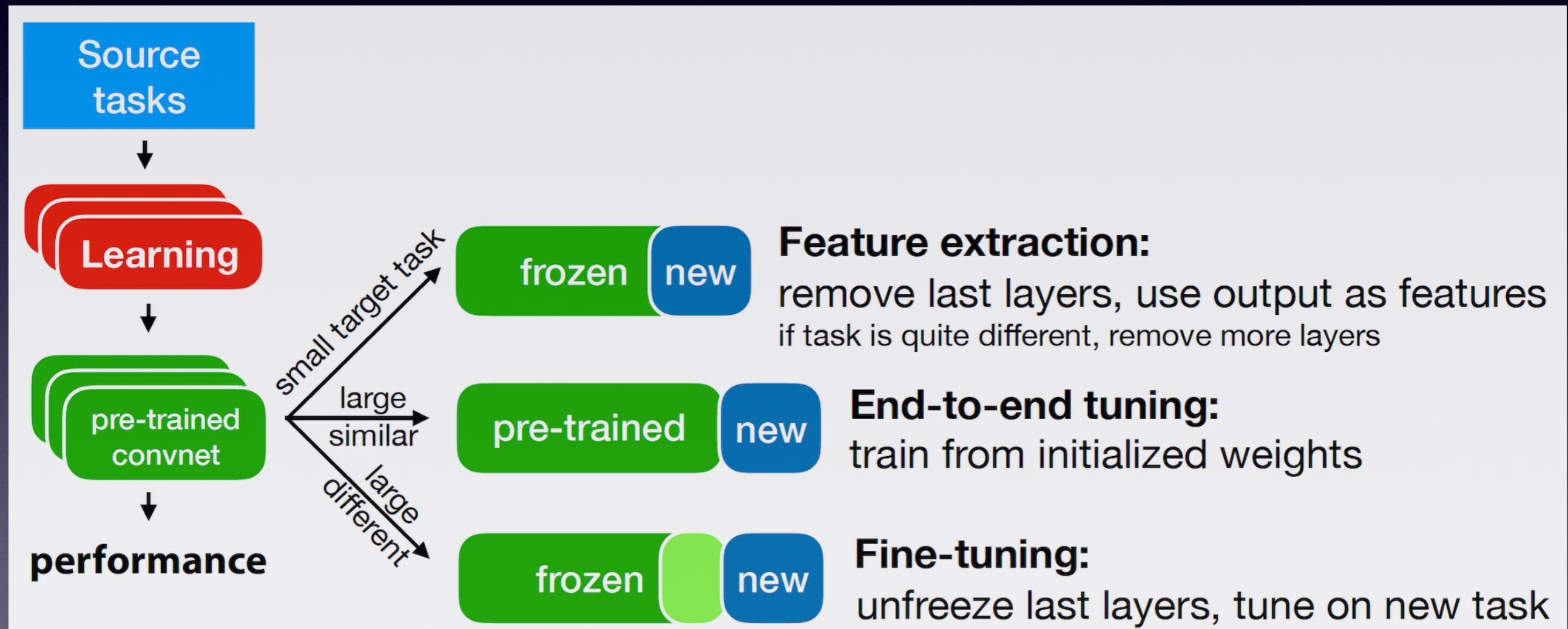
Applied Deep Learning - WS 2019

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The Task  
10235 Training Images  
1404 Test Images  
80/20 Train/Validation Split  
10 Classes



# Transfer Learning in a Nutshell



Hutter F., Vanschoren J.: Learning to Learn -  
NeurIPS 2018 Tutorial on Automatic Machine Learning

# Score to Beat

Full Transfer Learning with Resnet:

| Measure  | Altar | Apse  | Bell Tower | Column | Dome Inner | Dome Outer | Flying Buttress | Gargoyle | Stained Glass | Vault |
|----------|-------|-------|------------|--------|------------|------------|-----------------|----------|---------------|-------|
| F1 score | 0.906 | 0.874 | 0.903      | 0.953  | 0.967      | 0.937      | 0.805           | 0.923    | 0.990         | 0.925 |

# The Good: Results

| model                   | altar         | apse          | bell tower    | column | dome(inner) | dome(outer) | flying buttress | gargoyle      | stained glass | vault         | performance |
|-------------------------|---------------|---------------|---------------|--------|-------------|-------------|-----------------|---------------|---------------|---------------|-------------|
| <b>baseline</b>         | 0.906         | 0.874         | 0.903         | 0.953  | 0.967       | 0.937       | 0.805           | 0.923         | 0.990         | 0.925         | +/-0        |
| <b>hrnet v1 small</b>   | <b>0.9353</b> | 0.713         | 0.8521        | 0.866  | 0.922       | 0.9043      | <b>0.8442</b>   | <b>0.9437</b> | 0.9728        | <b>0.9254</b> | -2          |
| <b>resnet 18</b>        | <b>0.942</b>  | 0.6602        | 0.8629        | 0.8427 | 0.9078      | 0.8762      | 0.766           | <b>0.9536</b> | <b>0.9622</b> | <b>0.9298</b> | -2          |
| <b>resnet 152</b>       | <b>0.96</b>   | 0.8738        | <b>0.9193</b> | 0.9448 | 0.9014      | 0.9356      | <b>0.9262</b>   | <b>0.9853</b> | 0.9547        | <b>0.9446</b> | +/-0        |
| <b>hrnet v2 largest</b> | <b>0.9373</b> | <b>0.9091</b> | <b>0.944</b>  | 0.9458 | 0.9489      | 0.936       | <b>0.9396</b>   | <b>0.9787</b> | 0.966         | <b>0.9364</b> | +2          |

App Demo...

# The Bad

- Python Dependencies: Windows/Linux/OSX
- Dataset Loading: Ensure that you have more than 1 worker
- HRNet Project Structure: Python Files included at runtime -> breaks Linter

# More Learnings

- **Cuda:** When to use GPU, when to use CPU?
- **Flask:** Flask-Upload Component is complex  
(would not use it again)
- **Debugging:** Visual Studio Code with Inspection  
and Debug Console
- **Testing:** Torchtest is nice but better suited for  
models from scratch

Thanks!

# Resources

- [https://www.researchgate.net/publication/320052364 Classification of Architectural Heritage Images Using Deep Learning Techniques](https://www.researchgate.net/publication/320052364_Classification_of_Architectural_Heritage_Images_Using_Deep_Learning_Techniques) Paper
- [https://pytorch.org/tutorials/beginner/transfer\\_learning\\_tutorial.html](https://pytorch.org/tutorials/beginner/transfer_learning_tutorial.html) Transfer Learning with Pytorch
- <https://github.com/HRNet/HRNet-Image-Classification> HRNet
- <https://github.com/laszlokiraly/DS-Applied-Deep-Learning> Repository - Transfer Learning & Web App & Docker