Transfer Learning-Based CNNs vs Independently Designed CNN for the Classification of Chest X-Ray Images

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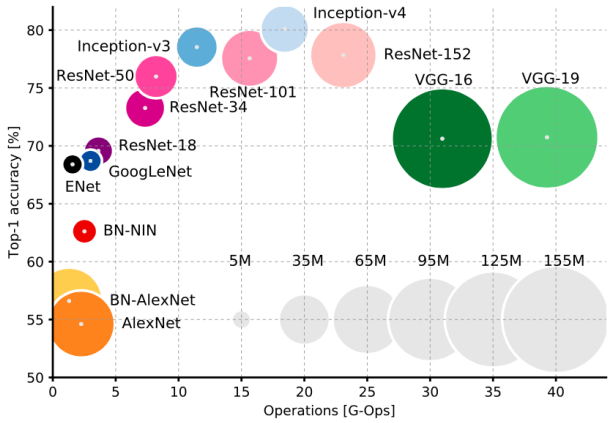
Transfer Learning: a technique in which one model trained for one task is reused for a second task

- Allows for rapid architecture design and implementation
- Pretrained models exist for image classification:
  - Google Inception models
  - Oxford VGG models
  - Microsoft ResNet models
- Use architecture only
- Use weights and architecture



Inspiration: *Identifying Medical Diagnoses and Treatable Diseases by Image-Based Deep Learning*[1]

- Used transfer learning (Inception) based architecture trained on both their own x-ray images and imagenet to classify multiple medical images, including chest x-ray images labeled as having pneumonia or not.
- Results:
  - Accuracy: 92.8%
  - Sensitivity: 93.2%
  - Specificity: 90.1%
  - AUC: 96.8%

Dataset:

Training set: 1349 “normal” images and 3883 “pneumonia” images.

Testing set: 234 “normal” images and 390 “pneumonia” images

1. Kermany, D. S., Goldbaum, M., Cai, W., Lewis, M. A., Xia, H., & Zhang, K. (2018). Identifying Medical Diagnoses and Treatable Diseases by Image-Based Deep Learning. Cell,172, 1122-1131. doi:https://doi.org/10.1016/j.cell.2018.02.010

Question: is a transfer learning based approach truly ideal for the classification of medical images?
Approach: Build independent CNN to classify chest x-ray images and compare classification results to that of a established architecture with pretrained weights to determine differences in performance.

FINAL RESULTS

Model	Recall	Precision	F1 Score	AUC	Accuracy
Arch 1	0.8153	0.8641	0.8391	0.8008	0.8045
Arch 2	0.8974	0.8537	0.875	0.8205	0.8397
Arch 3	0.8615	0.8773	0.8693	0.8303	0.8381
Arch 4	0.8487	0.8531	0.851	0.8026	0.8141
Arch 5	0.8282	0.8411	0.8346	0.7838	0.7949
Arch 6	0.9872	0.7026	0.821	0.7581	0.731
IncV3-NW	0.9179	0.792	0.8503	0.7581	0.7981
IncV3-W	0.9795	0.71	0.8233	0.6564	0.7372
VGG16-NW	1	0.625	0.7692	0.5	0.625
VGG16-W	1	0.625	0.7692	0.5	0.625