Fine-Tuning Pre-Trained Models to Determine Model Superiority for Enhanced Medical Image Diagnosis

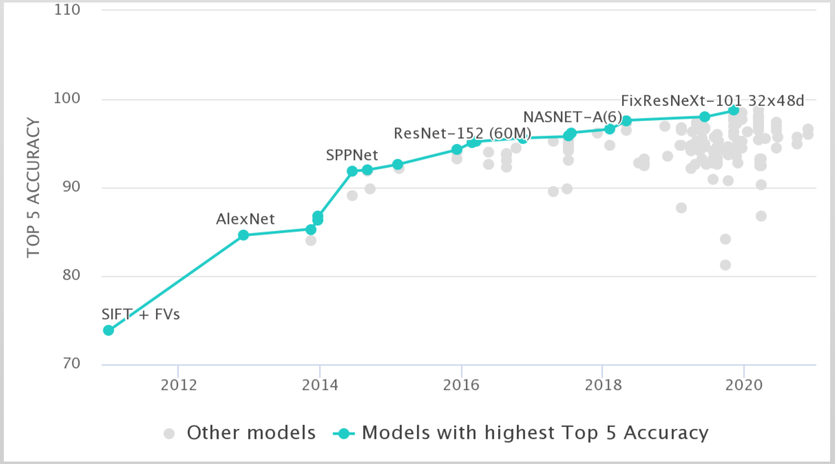
Daniella Asare, Biomedical Engineering (*M.S.*)
Mentor: Vincent Pizziconi, PhD.
School of Biological and Health Systems Engineering

Will fine-tuning pre-trained models to determine model superiority be effective in computer vision applications for enhanced medical image diagnosis?

INTRODUCTION

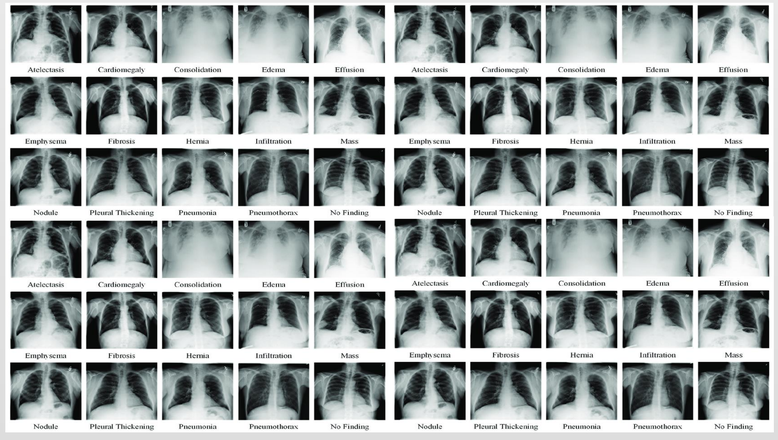
Computer vision as an evolving field has advanced tremendously in many fields, notable amongst them is the field of medical image diagnosis. The biggest challenge in this paradigm however remains the slow nature of the data annotation process. Many research works have been undertaken in self-supervised representation learning to get supervision from the unlabeled data themselves.

BACKGROUND



No large-scale evaluation has compared pre-trained models for medical image analysis. In this project, various pre-trained models from three main research streams are benchmarked to evaluate and determine their superiority for medical image diagnosis.

METHODOLOGY



Algorithms were trained on chest X-ray scans. Codes and models were submitted as jobs to ASU's Agave cluster.

RESULTS & DISCUSSION

Each image classification model was run 5 times in classifying 14 respiratory tract diseases namely Atelectasis, Cardiomegaly, Effusion, Infiltration, Mass, Nodule, Pneumonia, Edema, Pneumothorax, Consolidation, Emphysema , Fibrosis, Hernia and Pleural Thickening

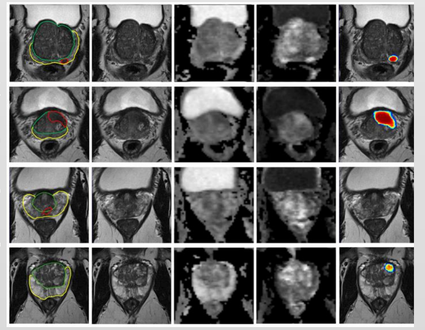
It was observed that outcomes were highest for Hernia detection.

Models	mAUC
DenseNet151	0.8158
ResNet50	0.8134
ResNet18	0.8115

CONCLUSION & DEDUCTION

The potential of this project extends beyond determining model strength for specific tasks rather, it looks to identify and give necessary recommendations for further work that could ultimately lead to an overall enhancement and efficiency in Machine Learning for Medical Image Diagnosis.

This will help complement Physician's decision and provide important information for planning biopsies and other procedures with accuracy.



FUTURE DIRECTION

With a surge in prostate cancer cases in the United States, the potential of fine-tuning pre-trained models to determine model superiority for prostate cancer diagnosis promises to be revolutionary considering the issue of large intrasubject variation.

REFERENCES

1. https://www.google.com/search?q=plot+of+imagenet+accuracy&ssxrf=APq-WBvwn--p0ZtxjFo-x503XlZnwrI7xg:1650441742935&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiqp73OlqL3AhW8I0QIHeMZBRwQ_AUoAXoECAEQAw&biw=1536&bih=714&dpr=1.25#imgrc=AsrKtIx1eOof94M
2. https://www.google.com/search?q=non+parameteric+prostate+cancer+mri+images&tbm=isch&ved=2ahUKEwiKStWGrqH3AhXsAjQIHYYNDOcQ2-cCegQIABAA&oq=non+parameteric+prostate+cancer+mri+images&gs_lcp=CgNpbWcQAzoHCCMQ7wMQJzoECAAQQzoFCAAQgAQ6BggAEAcQHjoGCAAQCBAeOggIABAIEAcQHlDUCliAPWCnP2gAcAB4AYAB_wOIAbgWkgEKNy4xMi4xLjUtMZgBAKABAaoBC2d3cy13aXotaW1nwAEB&sclient=img&ei=a1BfYsqEA-yF0PEPhpuwuA4&bih=714&biw=1536#imgrc=IEIc-qVVAbbh4M&imgdii=3OOEC7cXWbe3SM
3. https://www.google.com/search?q=chest+xray+scans&ssxrf=APq-WBuwv_rsjtn-Hl4HIwROBZQJ5pUF4A:1650412886257&source=lnms&tbm=isch&sa=X&ved=2ahUKEwjSusWOqfH3AhX4EQIHb7RCf4Q_AUoAXoECAIQAw&biw=1536&bih=714&dpr=1.25#imgrc=9Y3dqHS8tkfr3M&imgdii=1dPhJNW1-xEhUM
4. https://arxiv.org/pdf/2012.02706 | https://arxiv.org/pdf/2011.13377| https://arxiv.org/abs/2008.11702

MORE
Masters Opportunity for Research in Engineering

Ira A. Fulton Schools of Engineering
Arizona State University