Transfer Learning Study for fMRI Images

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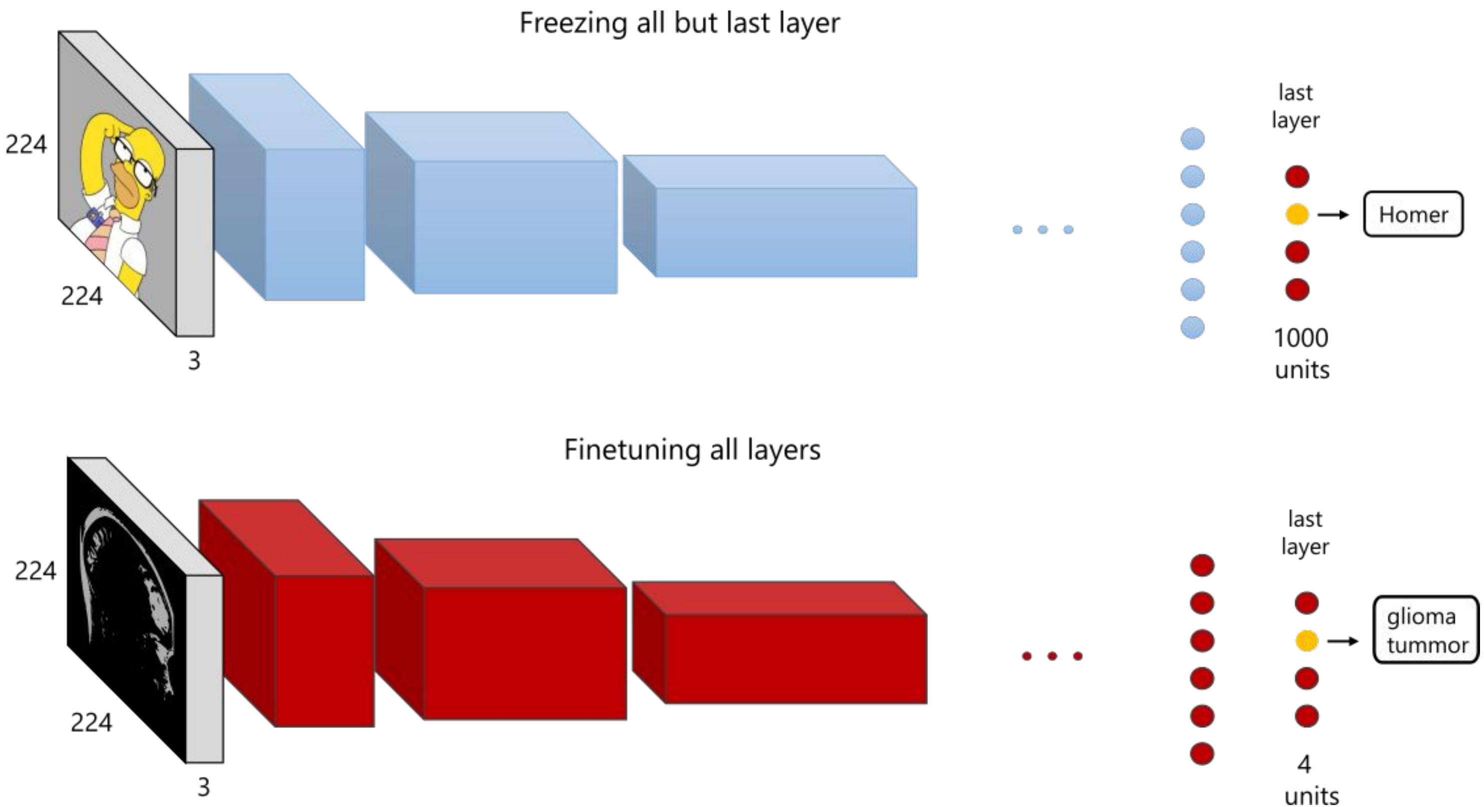
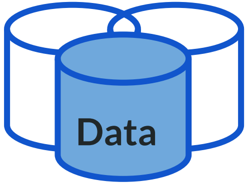
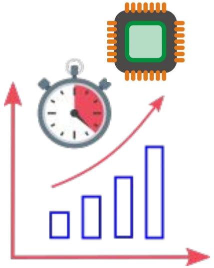
Transfer Learning



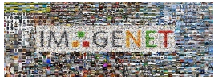
Motivation



LARGE
DATA



TIME AND
RESOURCE
CONSUMING



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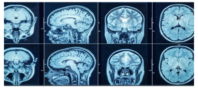
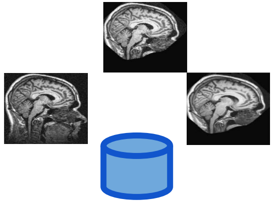
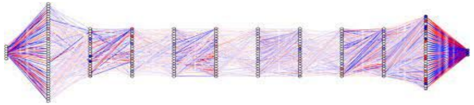


FEATURE
DIFFERENCE



SCARCITY OF
MEDICAL DATA



OVERPARAMETERIZATION

Research Question

NeurIPS 2019 paper “Transfusion: Understanding Transfer Learning for Medical Imaging" mentioned -

- Maithra Raghu et al, Google Brain

“transfer learning does not significantly affect performance on medical imaging tasks, with models trained from scratch performing nearly as well as standard ImageNet transferred models”

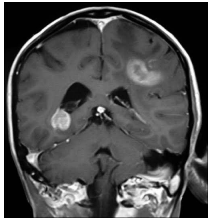
Whether we can optimally do knowledge transfer from natural images domain to a medical domain and maximize performance?

Knowing Data

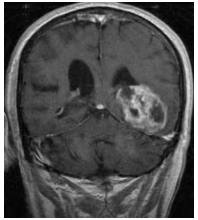
- Multiclass classification task
- Brain Tumor fMRI classification dataset, kaggle

- Brain T1-weighted CE-MRI dataset, figshare
- Images have an in-plane resolution of 512×512
- Collection of 3064 slices from 233 patients
- Contains 3 tumor classes namely meningioma, glioma, pituitary tumor and one no tumor class

Glioma Tumor

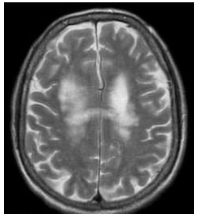


Meningioma Tumor



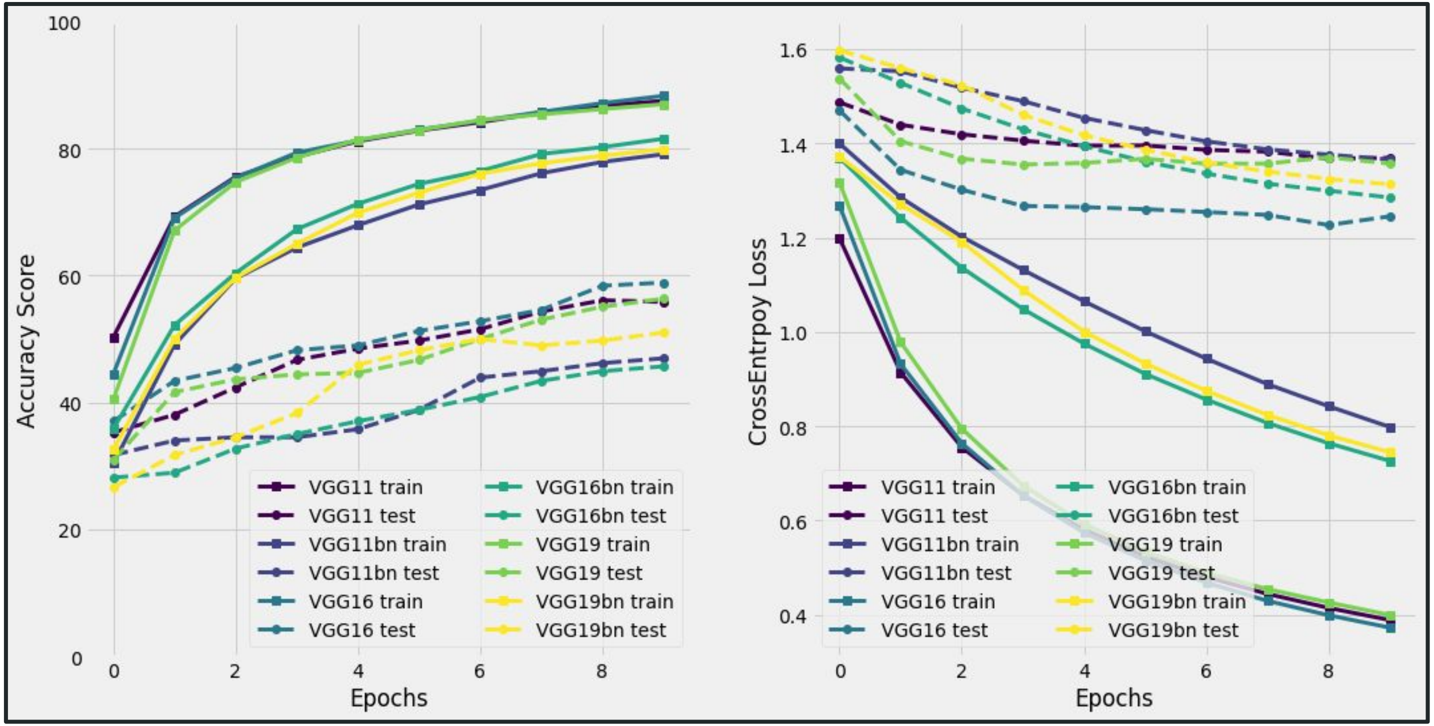
Pituitary Tumor

No Tumor



Architecture Comparison

bn - batch normalization



Hyperparameters

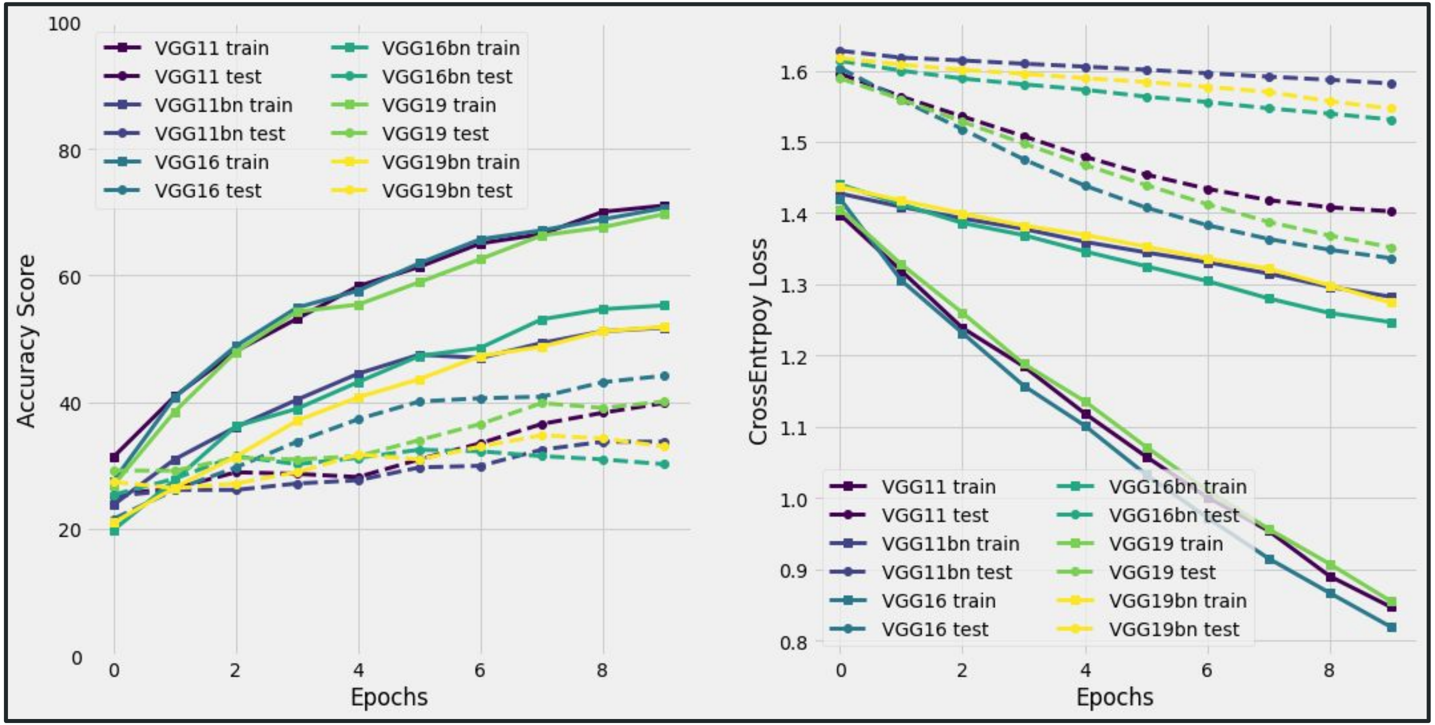
- SGD
- momentum 0.9
- lr: 1e-5
- weight_decay=1e-5
- Model architecture:

25088 -> 4

- batch_size = 64
- epochs = 10

Architecture Comparison

bn - batch normalization



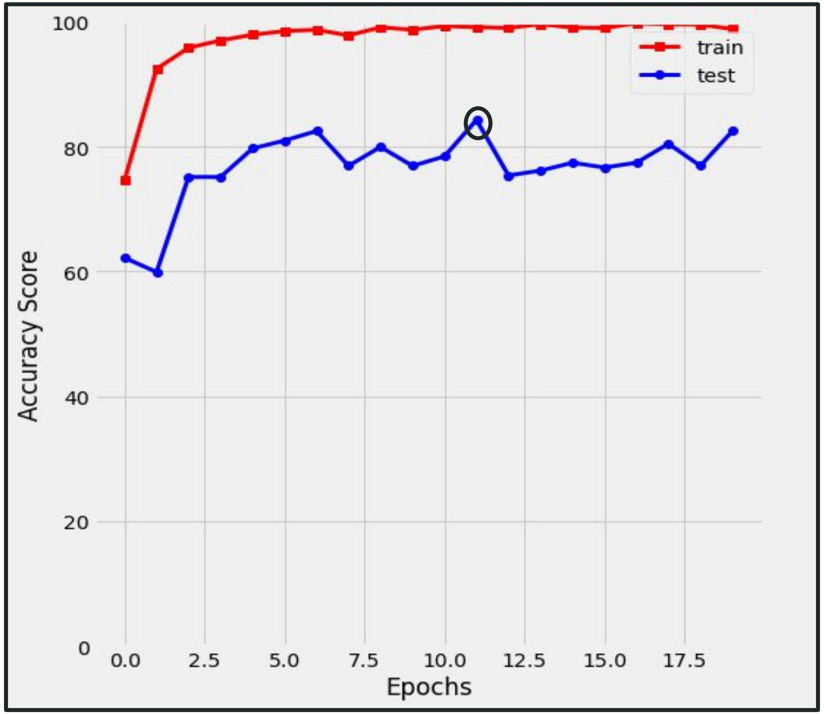
Hyperparameters

- SGD
- momentum 0.9
- lr: 1e-5
- weight_decay=1e-5
- Model architecture:

25088 -> 128 -> 4

- batch_size = 64
- epochs = 10

Best Result so far!



Hyperparameters

- Adam lr: 1e-4
- Model architecture: VGG11

25088 -> 2048 (Dropout-0.7) ->256 (Dropout-0.6) -> 4

- batch_size = 32
- epochs = 20
- Augmentation: RandomRotation(degrees = 30)

Accuracy: 84.26%

Precision: 92.01%

Recall: 84.26 %

F1-Score: 85.84 %

Conclusion and Further Study

- Accuracy above 80%
- The shallower, the better
- Challenging task for MRI images with different features
- Suggest a further study with a view to reduce the overfitting
- Better evaluation techniques