

Convolutional Neural Networks for Medical Image Analysis: Full Training or Fine Tuning?

Nima Tajbakhsh *et al.*

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1 Contribution

In this paper, we systematically study knowledge transfer to medical imaging applications, making the following contributions:

- We demonstrated how fine-tuning a pre-trained CNN in a layer-wise manner leads to incremental performance improvement.
- We analyzed how the availability of training samples influences the choice between pre-trained CNNs and CNNs trained from scratch.
- We compared the performance of pre-trained CNNs, not only against handcrafted approaches but also against CNNs trained from scratch using medical imaging data.
- We presented consistent results with conclusive outcomes for 4 distinct medical imaging applications involving classification, detection, and segmentation in 3 different medical imaging modalities.

2 Experiment Result

When using complete datasets,

$$\text{Deep fine-tuning} \geq \text{Scratch} > \text{Shallow fine-tuning}$$

When using reduced datasets,

$$\text{Deep fine-tuning} \gg \text{Scratch}$$

3 Conclusion

Deeply fine-tuned CNNs should always be the preferred option due to following reasons:

1. Better performance.
2. Tolerance to reduced dataset size.
3. Faster convergence.