Guided Recommendation for Model Fine-tuning

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Model Selection
- Given a task and a large zoo of pre-trained models, Model Selection (MS) selects the top few models for the best fine-tuning performance, avoiding fine-tuning of all models.

Feature-based Model Selection
- Linearization Assumption
- Label-Feature Correlation (LFC)\(^1\)

Limitations
- Difficulty with heterogeneous models

PARC\(^2\) introduces heuristics of layer depth

\(S_{\text{PARC}} = \frac{\mu' - \mu}{\sigma} + \frac{f_{\text{PARC}}}{f_{\text{PARC}}}\)

Experiments: More Training Data Helps!

Datasets
- Aircrafts
- Caltech-101
- ImageNet
- LogME
- MNIST
- PASCAL
- Caltech-UCSD
- UCM
- CUB
- CIFAR-10
- CIFAR-100
- MNIST
- CIFAR-100
- STL-10
- SVHN
- Tiny-ImageNet
- ImageNet

Setting 1: MS learned with only ImageNet training history, 80% of the 409 models are sampled as training set. Our methods still get reasonable core scores even when models are randomly initialized.

Table: MS trained on 409 ImageNet training jobs. The ground-truth performance of 22 models. The best result is obtained.

Setting 2 & 3: Average Pearson Correlation of predicted performance and the ground-truth performance of 22 models. The ImageNet model is trained on 409 ImageNet training jobs. The LogME column denotes MS trained on ImageNet and LogME.

Setting 4: As an Upper Bound, MS trained on ImageNet and LogME.

Reference
\(^1\)PARC is a linearized framework and a new benchmark for model selection for fine-tuning. Deshpande et al, arXiv 2021
\(^2\)Studies Mixture Model Selection for Accessible Transfer Learning, Beane et al, NeurIPS 2021

Learning to Recommend Models
- We convert model selection as a model recommendation problem, which learns the model selection criteria from the past fine-tuning history.
- The goal is to predict performance on the target dataset for a given model.

Recommendation Models
- Linear Regression (LR)
- Factorization Machines (FM)

Features
- Domain-related features
- Model-related features
- Additional features

Empirical Results
- Linear regression
- Feature interactions

Aircrafts
- Linear Correlation
- Feature Correlation

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