Evaluating Lottery Tickets Under Distributional Shifts

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Lottery Tickets

**Introduction**

> Compression algorithm that finds small, sparse subnetworks within large, overparameterized networks

> Works using four simple steps:

1. **Initialize** a neural network with parameters drawn from a random distribution
   \[ f(x; \theta_0), \quad \theta_0 \sim \mathcal{N}(0, 1) \]

2. **Train** the network to convergence (e.g., several epochs or iterations)
   \[ \text{train } f(x; \theta_0) \rightarrow \theta_n \]

3. **Prune** the network using a heuristic to permanently remove the least important weights (e.g., least magnitude)
   \[ m \in \{0, 1\}^{|\theta|} \]

4. **Retrain** the pruned network using the original parameters before training
   \[ f(x; \theta_0 \odot m) \]

**Related Work**

Frankle and Carbin (2019)

Lottery tickets exist! Resetting network weights to their initial values is crucial.

Liu et al. (2019)

Actually, initial values are questionable. Randomly initialized tickets still perform well if the learning rate is tuned.

Morcos et al. (2019)

Lottery tickets obtained on ImageNet transferred to other datasets. Initial values seem to be important?

**Our Work**

> How well do lottery tickets generalize?

Figure 1: If a lottery ticket was obtained using New York Times samples, then how would it perform when trained with Twitter samples?

Figure 2: How important is it to reset models to their initial values? Can randomly initialized tickets generalize as well?

**Methodology**

**Cross-Domain Setup**

> In order to test generalizability, we must introduce domain shifts; we use multiple domains from the Amazon Reviews Dataset to set up a binary sentiment analysis task

Books  Electronics  CD  Movies  Home

20K Train  10K Validation  10K Test

**Testing Generalizability**

> Obtain a source domain lottery ticket and target domain lottery ticket; then, train variants of the source domain lottery ticket using target domain samples

**Experiments & Results**

> We find compelling evidence of source lottery ticket generalization ability. In addition, there is a phase transition point (~99.5%) where initialization matters.

> Sometimes, source lottery tickets perform on-par or even better than the target domain tickets. Future work can explore what makes source tickets more effective in a target domain.